Vision 1990

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The University of Montana consists of Western Montana College at Dillon and, on its Missoula campus, the College of Arts and Sciences and professional schools of Business Administration, Education, Fine Arts, Forestry, Journalism, Law, and Pharmacy and Allied Health Sciences. In addition, we maintain twenty-six research units, including specialized laboratories, institutes and centers. Off-campus facilities include the Flathead Lake Biological Station at Yellow Bay in northwestern Montana; the Lubrecht Forest and Bandy Ranch, which are experimental facilities for the School of Forestry located east of Missoula; and the Geology Field Station in southwestern Montana. The university offers a master’s degree in administrative sciences at Malmstrom Air Force Base in Great Falls and a master’s degree in business administration at Eastern Montana College in Billings. Our faculty consists of about 540 scholars working with more than 10,000 undergraduate and graduate students.

This publication illustrates examples of current research and creative activities at the university. These examples contain a strong unifying thread of service to the people of Montana, in addition to individual contributions to various scholarly disciplines.

Service to the state and the region through encouraging economic development has become one of UM’s major missions. Working with Montana State University, we have been designated the lead institution in biotechnology. The Montana Science and Technology Alliance has named us the lead institution in entrepreneurial business assistance, working with MSU and Eastern Montana College. Technology, technological transfer and assistance in developing businesses in the state provide the framework for our efforts in this area.

The reorganization of our life science programs into one division emphasizes the importance the university places on the life sciences and its role in economic development and research. We have established mutually supported, cooperative relations with a number of Montana biotechnology firms, including Ribi ImmunoChem, ChromatoChem, Basic Bio Systems and Skyland Scientific. These relations involve research, shared equipment, company employees involved in cooperative instruction and research, and opportunities for graduate students to use the company research facilities.

Our Montana University Affiliated Rural Institute on Disabilities has emerged as a leading facility in the state for research, demonstration and outreach. In developing this program we have created cooperative relations with Missoula Community Medical Center and engineering programs at MSU. Most important, we are creating a joint clinical facility with MCMC that will be a model for the region.

Our wildlife program continues to expand with studies throughout the world. The Boone and Crockett Club, the national organization founded by Teddy Roosevelt 100 years ago and dedicated to conservation and the publication of North American big game statistics, has provided us with a ranch on the Rocky Mountain front and is establishing a professorship for wildlife studies. In addition, our research on wildlife management in the People’s Republic of China has been greatly strengthened by the establishment of the Robert M. Lee awards for research on sustained-yield management of wildlife.

Grant and contract awards to UM faculty and staff continue to grow at about 10 percent a year, with each year bringing a new all-time record. Our success in recruiting outstanding faculty members—many bringing funded research upon arrival—will help to ensure the scholarly productivity of the university and its ability to contribute to economic development and service to Montana.

Raymond C. Murray
Associate Vice President for Research and Dean of the Graduate School
Recognizing that the vitality of a university depends upon the quality of its research and other creative work, the University of Montana treasures its outstanding scholars and artists. Each year, the Distinguished Scholar Award for achievement in research and creative ability is awarded. First given in 1980, the award carries a $1,000 honorarium from the UM Foundation. Recipients are selected by the University Research and Creative Activities Committee from faculty nominated by their schools and departments.


Recent recipients are:

1990: Geoffrey Richards
Professor of Chemistry

Geoffrey Richards came to Montana in 1985 as a teacher and director of the University of Montana Wood Chemistry Laboratory. Within three years after his arrival at UM, he had published 20 research papers and one book chapter, and drawn $782,000 in grant and contract funding. His research aims to increase the utility and value of renewable resources such as sugar, wood and wood byproducts. He is a member of the Sugar Association’s Sucrochemistry Advisory Council and has served as a consultant for Eastman Kodak and other companies. Before coming to UM, he headed the chemistry and biochemistry department at James Cook University of North Queensland in Australia.

1990: Steve Running
Professor of Forestry

Steve Running has taught forest ecophysiology at UM since 1973 and is one of 24 scientists worldwide selected for a research team on NASA’s Earth Observing System. (See pages 20-21.) In 1989, he received a nearly $7 million, 11-year grant to build satellite monitoring tools for NASA to study vegetation responses to the greenhouse effect. He is also working with the U.S. Forest Service to research the use of remote sensing and digital image analysis for assessing wild land fire severity. In 1986-87, he spent six months on sabbatical with the Division of Forest Research in Canberra, Australia. He is widely published and serves on numerous national and international committees.

1989: Bart O’Gara
Leader of the Montana Cooperative Wildlife Research Unit

Since 1978, Bart O’Gara has led the Montana Cooperative Wildlife Research Unit, where he researches wildlife problems, directs the training of graduate students in wildlife science and advises agencies about managing wildlife. He is overseeing the doctoral research of two students in China studying musk deer and wild yak; a student working on a management plan for wild artiodactyls in the Northwest Frontier Province of Pakistan; and a student studying the muntjac, a small deer, in Taiwan. In 1987, O’Gara won the Interior Department’s Meritorious Service Award and in 1988 was cited by the U.S. Fish and Wildlife Service for his work as leader of the Northern Rocky Mountain Wolf Recovery Team.
UM's animal facility accredited

The UM Laboratory Animal Facility is entering the nineties with full accreditation by the prestigious American Association for the Accreditation of Laboratory Animal Care (AAALAC) and a major National Institutes of Health equipment grant.

"They found our level of care and quality of facilities to be among the best in the country," says Phil Bowman, animal facilities manager. The NIH grant will improve the facility even further.

Accreditation means more than a pat on the back for Bowman, who was hired in 1987 to manage the UM animal facility. AAALAC's praise was something of a comeback for UM.

"AAALAC had placed UM on probation in 1986, mainly because there wasn't a centralized facility for animals here," Bowman says. Animal-care personnel were funded, hired and supervised by the departments that required laboratory animals for research and teaching.

"Every policy regarding animal care came about on a case-by-case basis," he says, "and the system wasn't standardized from department to department." The faculty and staff took good care of the animals, he adds, but it was an outdated system.

Establishing a centralized facility was an investment the university had to make, says Associate Vice President for Research Raymond Murray. Last year, UM received more than $3 million in external research funds to support research involving animals. Biomedical researchers at UM use animals to study devastating ailments such as influenza, gonorrhea, asthma and AIDS. Other UM faculty members study the behavior, ecology and physiology of fish, birds and mammals using animals housed in the animal facility or in their natural habitats.

New federal regulations address overall maintenance of the facility and every detail of life in it, requiring strict temperature, light and humidity control for each species and meticulous cleanliness. Housed separately, each species is fed and cared for according to detailed guidelines. A local committee of scientists and community members, chaired by a veterinarian, regularly inspects the facility as a part of the committee's responsibility to monitor all use of animals in research on campus. Government inspectors drop in unannounced several times a year to ensure that UM is upholding federal standards of care.

"It's my personal conviction that the animals should be treated well. We owe them the best conditions that we can give them."

— Phil Bowman

While accountability to the law is a constant concern, the facility staff members agree that there is no substitute for tender, loving care. They continue to look for ways to improve their animals' care. Last year, Bowman worked with psychology Professor Dave Strobel to design and build a primate playroom. Now, two dozen rhesus monkeys cavort in the toy-lined room when they are not playing a video game Strobel uses in his research.

"It's my personal conviction that the animals should be treated well," says Bowman. "We owe them the best conditions that we can give them."

Animals play an important role in the education of future scientists, says Don Jenni, a zoologist and head of the Division of Biological Sciences. Hundreds of students a year study biological and pharmacological sciences at UM in courses that involve animals. In addition to the technical experience they gain from working with animals, Jenni says students learn a new respect for the animals by handling them.

"We continue to reduce the numbers of animals we use in research and teaching, but we are so far from knowing everything we need to know about nature that we will never completely do without them," Jenni says. "Our commitment to maintaining a humane animal facility is a commitment to good scientific research and training. We all stand to benefit."
Anthropologist probes natives' past by reading stones and buffalo bones

"I keep looking for this manual 'How to Kill Buffalo'; I can't find one," jokes Associate Professor of Anthropology Tom Foor, discussing his research on prehistoric buffalo jumps.

Instead, he reads bones, charcoal dust and arrowheads at sites such as the Jordan Buffalo Jump in Garfield County. By learning what took place, Foor gains insight into how the prehistoric people of Montana lived.

"We talk about prehistoric groups as being ancestors of living groups, and in a very broad sense they are," he explains. "I'm interested in sharpening that. How closely related to living people are those people who left archaeological sites?"

Foor examines their tools and technology to find an answer. "I study how ethnicity is reflected in the tools," he says. With the help of ten students and two professors, Foor excavated areas of the Jordan site in June 1989. The research is a cooperative effort with the Bureau of Land Management, which administers the site.

"The bison jump is a unique way to look at ethnicity," he says in describing an area were Plains Indians herded buffalo, also called bison, over a cliff to their deaths. He explains that anthropologists have been arguing for years whether these kills were done by tribes or groups that just happened to come together to hunt. "That's what these sites will help us understand."

Plains tribes used everything from buffalo tongue to dung. They ate the meat raw, boiled, roasted or dried. They transformed the skins into lodging, clothes, food containers, quivers and medicine bags. Sinew became thread, bowstrings and rope. Horns converted to spoons, chisels, hide fleshers, scrapers and paint brushes. Hair was made into yarn, bags, belts, necklaces, ropes and leggings. Dung was used for fuel.

The Jordan site was used only once as a buffalo jump when a bison herd fortuitously presented itself, Foor says. The day of the kill, the bison were probably grazing on two knolls near the buffalo jump, he says.

At the Jordan site the grasslands flowing south of the Big Dry River end abruptly at the jump, a twenty-five-foot sandstone drop-off. That grayish-pink cliff is one bank of a dry ravine. Looking north up the ravine, a series of terraces and fire hearths extend, where the buffalo were cooked and processed.

Foor describes the jump's events this way: physically resembling the Plains Indians of today, hunters approached the herd on foot and chased the animals along a previously marked path leading to the lip of the bluff; women and children hid behind brush or other temporary screens and jumped out, yelling and waving things to scare the buffalo and keep them on course.

They drove about fifty bison over the cliff, he says. Hunters rushed in
UM anthropology student Glenn Walter draws a soil profile of an excavation in a bone bed at the Jordan Buffalo Jump site. UM anthropology Professor Tom Foor and several students excavated the site in June 1989.

Excavations revealed only one layer of buffalo bones, indicating the jump was used just this once. However, groups probably occupied the campsites several times, Foor says. Perhaps, he adds, the Jordan spot was a good stopping place for travelers on some prehistoric trail between the Missouri and Yellowstone rivers.

Foor will send the collected charcoal to a lab for radiocarbon dating, which will reveal more specific information about the dates the site was used. He'll also be reading the arrowheads for clues. The arrowheads should have distinctive characteristics that would link them to specific Plains tribes.

"If these kills were done by groups that came together, I should find a wide variety of these arrowheads because each group would have its own style," he explains. "There should be less variability if the hunters all came from the same group."

A site like the Jordan Buffalo Jump can also help anthropologists determine whether these people stayed on the move or had a home range. He suspects they stayed within familiar territory.

"It's not a very satisfying solution to follow a herd," Foor says. "When I look at the records of living hunters and gatherers, it's hard to envision prehistoric groups moving long distances. I would think the premium would be placed on knowing one area very well and knowing all of the resources available in that one area."

The Jordan site isn't unique to Montana, which has more than four hundred buffalo jump sites. Eight such sites are in Garfield County. Since the Jordan jump lacks good public access, Foor doesn't recommend developing it for visitors. However, he says, it merits listing on the National Register of Historic Places. He'd also like to see an exhibit developed for the Garfield County Museum that would display some of the artifacts and explain what happened at the site.

Among the frantic and injured animals and slaughtered them with bow and arrow. If the first ones over the cliff survived the fall, they likely died when the rest of the herd fell on them.

"They were butchered right there where they died, and then they were dragged away to be cooked," he says. He bases these descriptions on historic eyewitness accounts of buffalo Kills in the 1800s. "It's common sense that prehistoric jumps couldn't have been that much different."

Little smudges of charcoal and some chipped stones were the only visible evidence of the ancient cooking hearths. Using pointed trowels and dental picking tools, the researchers carefully removed soil to reveal charcoal and discarded tools. Arrowheads and bones were found in one area; scrapers and hearths were found in another. "We want a careful record of where things were found," Foor says. "My goal, in the end, is to reconstruct the whole site."
AIDS treatment: Cats’ virus may solve Puzzle

In the fight against AIDS, cats may hold the key. And University of Montana scientist Tom North hopes to use that key to unlock the puzzle of how to cure, or at least curtail, the deadly virus.

North, an associate professor of biological sciences, is conducting a federally funded study to find an effective way to fight AIDS through antiviral drugs. His goal is to identify a drug or drugs that can stop AIDS in cats, assuming that what works on the feline virus will have an identical impact on its human counterpart.

Acquired Immune Deficiency Syndrome, declared “Public Health Enemy Number One” by former President Ronald Reagan, is incurable, invariably fatal and spreading through the population at an alarming pace. Scientists throughout the world are struggling to change that grim picture, and North thinks he has found an ideal means toward that end.

Feline Immunodeficiency Virus (FIV), which causes the immune-system breakdown in cats, is nearly identical in makeup and symptoms to its human counterpart, HIV, North says. Cats spread the disease among themselves by fighting and biting, he adds, but people cannot catch the feline disease. So FIV is like HIV in many ways that benefit researchers, but not in the way that endangers them.

“We're very fortunate that the feline AIDS virus is so similar to the human AIDS virus in the disease it causes and in the drugs you use to treat it,” North says. “And it's safe to work with in the lab...I couldn't really think of anything that I could have done to make it a better model.”

The similarity of the feline and human viruses works in both species' favor. Just as progress toward an HIV breakthrough can be hastened by using an animal model, the urgency of finding a cure for human AIDS gives a big boost to feline virus research. The potential benefit to human patients makes FIV a high-priority research topic, qualifying for grant funds that would not be available if the work would only benefit animals, North says.

The prospect of helping to stop a modern plague makes North’s work extremely exciting, he says. And Peggy Johnston of the National Institute of Allergy and Infectious
Diseases (NIAID), which is funding North's research, says his FIV work is promising.

If North fully develops FIV as a reliable model for testing AIDS drugs on animals, that would provide "one of the things that has really been lacking and that has hindered our progress in finding new therapies for AIDS," says Johnston, chief of the developmental therapeutics branch of the NIAID's AIDS division.

"Tom is one of the few people in the country who is...geared toward development of a model for drug evaluation," she says. "He has considerable history with antiviral drugs and antiviral metabolism and, I think, is in a unique position to combine his past expertise with this particular model."

North, who came to UM in 1988 from Tufts University, was recruited into the AIDS battle by the NIAID because of his successful antiviral work on herpes viruses. He was among a relatively small group of scientists who developed a way to suppress herpes symptoms with drugs, laying the groundwork for all subsequent antiviral research.

Before that herpes breakthrough, North says, it was generally believed that chemotherapy would not work on viruses, tiny particles that grow by infiltrating the cells of the organisms they infect.

"Because most of the metabolism it uses is the cell's metabolism," he says, "it was thought that anything you would do to inhibit virus replication would kill the cell."

Now herpes can be controlled safely with drugs that hit the virus without damaging the host cell, North says, adding, "Our challenge now is to do that for AIDS and then...for other viruses."

North's strategy for fighting AIDS centers on an enzyme, reverse transcriptase, that is crucial to the viral replication process in both FIV and HIV.

"When the virus infects a human cell...the very first step in this process is carried out by this enzyme," North says. "So the rationale here is that if you inhibit this enzyme, you prevent everything that the virus can do."

North is in the third year of a three-year, $360,000 NIAID grant to study FIV as a model for AIDS chemotherapy. He's confident that funding will be extended and says "within five years we should know whether these approaches will work."

Another likely source of funding is North's collaboration with Burroughs Wellcome, manufacturer of the widely used AIDS drug AZT. He hopes to expand his anti-AIDS efforts considerably this fall with the help of an anticipated grant from Burroughs Wellcome.

The work in North's lab is strictly in vitro, using cell cultures, not animals. He works closely with scientists at the University of California at Davis who do in vivo research with laboratory animals.

Antiviral research is currently the hot prospect in the fight against AIDS, North says, although early hopes focused on finding a vaccine.

While chemotherapy fights the virus after it has infected a patient, he says, a vaccine would be the ideal weapon against AIDS because it would prevent infection, teaching the immune system to kill the virus on contact. But for a vaccine to work, the immune system has to recognize the exterior of the virus, and the AIDS virus changes so quickly that an immune response that recognizes one strain of the virus won't work against the others, he says.

"It's the same problem we have with cold viruses," North says.

"That's why there's no vaccine for colds."

North's antiviral approach attacks an interior part of the virus, the enzyme reverse transcriptase, which remains the same in all variations of the virus, he says. So it presents a stable target for anti-AIDS medication.

Even if a vaccine were developed, North adds, work toward an effective antiviral drug would still be essential because a vaccine couldn't help the millions who have already been infected by HIV.

North was the first scientist to study FIV as a model for AIDS antiviral work and, in June 1989, he was the first to publish a paper on the topic. Since then, he says, the feline model has gained broad acceptance, attracting other scientists to FIV work.

He believes FIV research stands a good chance of producing an AIDS breakthrough, making it a disease people can live with even if an absolute cure cannot be found.

"Ultimately what we would like to do is develop something that would eliminate the virus," North says. "I don't know if that's possible. But I would be willing to at least initially settle for a treatment, something that would suppress the virus replication enough so that as long as the patient takes the drug they don't have any problems.

"I'd call that a cure."

"We're very fortunate that the feline AIDS virus is so similar to the human AIDS virus in the disease it causes and in the drugs you use to treat it. And it's safe to work with in the lab....I couldn't really think of anything that I could have done to make it a better model."

—Tom North
Research on the wing:

Professor looks at flight

“Cautions! Mad Birds Flying Down the Hallway.”

They’re not really mad, admits Ken Dial, assistant professor of biology. But the sign stops night visitors from opening the door and scaring the birds. Behind the door, floodlights shine on pigeons flying down a hallway, each feathery flap recorded by whirring cameras and tape recorders.

This isn’t the set of “Revenge of the Killer Pigeons,” but rather the scene of novel research that is yielding unexpected findings on bird flight.

“People have been terribly interested since before Aristotle about how birds fly,” says Dial, whose own fascination with flight started as a child. “I’m interested in how the nervous system controls different kinds of movement.

“What we’ve been able to do, just in the last four or five years, is peek inside the bird and look at when a muscle turns on and how the skeleton moves during flight. It’s much different than studying a specimen that’s been pickled in formaldehyde and then is moved around manually. We’ve had hundreds of years of that.”

To study wing beats that are just a blur and flutter to the human eye, Dial uses high-speed film and then slows it down frame by frame.

Another research hurdle is bird training. Pigeons, after several months of tutelage, prove adept at flying down hallways and landing on a variety of perches. However, they don’t take to the sixteen-foot-long metal and Plexiglas wind tunnel that Dial uses.

The wind tunnel allows Dial to observe and film a bird in level flight at different speeds, determined by the wind velocity in the tunnel. By slowing the film, Dial can study the component movements of flight.

“You can see individual wing beats are very beautiful, very fluid,” he says as he shows a film of a starling. “The feathers open up like a deck of cards being fanned in your hands.”

High-speed X-ray film shot from above and below the flying bird shows that the wing bones and shoulder move in a breast-stroke motion, while the body moves like bellows. The film reveals that the bird’s skeleton is more than a coat hanger for muscles to be draped on.

“The skeleton is an essential entity in both supporting and complementing the muscles,” Dial explains. The skeleton bends, twists and in other ways aids muscular movement in flight. In some birds, the wishbone, or fused collarbone, acts as a spring. “It seems to absorb a certain amount of energy during a given part of the wing-beat cycle—the downstroke—and release back that energy during the upstroke.”

Wishbone movements may also help birds breathe, he says.

In another study, Dial inserts hair-thin wires with a hypodermic needle into individual wing muscles of...
“People have been terribly interested since before Aristotle about how birds fly. I’m interested in how the nervous system controls different kinds of movement... We can learn how we move by studying a bird.”

—Ken Dial

pigeons. These wires detect the electrical potential of the muscles as they are activated by nerve impulses. When the pigeons take off, fly down the hall and land, amplifiers blast out the burst of muscle activity, “bwwwk, bwwwk.”

High-speed film is synchronized with the recording of each sound. Tiny strain gauges on the wing bones measure the time and magnitude of force generated by an individual muscle. Measurements of up to eight muscles are recorded at once and entered onto the tape recorder and computer. Dial matches the nerve impulse with the exact wing position during flight, thus learning when series of muscles are turned on and off.

Dial has received more than $200,000 in grant money from the National Science Foundation and several University of Montana research grants to finance the research. Introduced to this line of study by Farish A. Jenkins, a Harvard paleontologist, and G.E. Goslow Jr., a Brown University neurophysiologist, Dial has collaborated with them on previous research projects.

In the future, Dial will look at how wing design varies between groups such as falcons and woodpeckers and how the wing differs within a specific family. “I’m particularly interested in why birds are designed the way they are and how they evolved to move the way they do,” he says. He also wants to know how habitat influences bird behavior and wing design.

The research will provide insight into the evolution of birds and other four-limbed creatures, including human beings, over the past 150 million years.

“We can learn how we move by studying a bird,” he explains. The human arm and hand correspond almost muscle for muscle and bone for bone with the wings of birds. While humans evolved for greater forearm dexterity and hand movement, birds followed a design for greater wing muscle speed and force.

By understanding the mechanics of locomotion, researchers can surmise how extinct animals may have moved. Other research areas that may benefit from these studies are medical science, aerospace engineering, veterinary science and the design of robotics and prosthetics.

While applications and results are the thrilling part of the project, Dial doesn’t claim any immediate applications from his research. He likens the effects of his research to that of botanists: “They don’t go out to cure people from a given disease, yet botanical science has contributed a tremendous amount to our pharmaceutical world.”

There’s also the not-so-thrilling aspect of the project—data analysis. A few seconds of flight will take Dial days to analyze. He admits this is so tedious that he often wonders why he left musical studies or his biological fieldwork in Kenya.

“I have tens of thousands of frames of film and thousands of signals from muscles, and I’m trying to find a pattern that makes sense,” he explains. “Looking at this data is very much like looking at sheet music for an orchestra.

“Each instrument is playing not only its own rhythm but its own intensity. And how the instruments interact becomes important when you are trying to look for harmony in the orchestra. Well, there also has to be some harmony involved in how you move a limb. It’s not haphazard; it’s done with exquisite and fine control.”

As his fingers fan through stacks of computer printouts, he says, “We now have several lifetimes of work before us. I won’t be able to answer one-tenth of the questions I am interested in.”

Despite these frustrations, Dial emanates enthusiasm.

“If you keep at this long enough and keep trying to improve each time you do an experiment, you are probably going to find out something that no one has ever found out before in history,” he says. “And that is the payback. It’s terribly exciting to see it come to fruition because most of the time it’s numerous stumbling blocks.

“I’m a little kid who is interested in how birds fly—period. I hide under the cloak of being a scientist. My interests are the same as that of my little son when he says, ‘Daddy, how do birds fly?’ and I say, ‘Son, give me a few years. We’re looking into it.’ ”
Entrepreneurs may not know it yet, but Montana is full of people and programs geared to helping them get started. Business students at the University of Montana will help a fledgling enterprise develop a business plan. The University Technical Assistance Program at Montana State University offers engineering expertise in developing products for market. The small business incubator in Butte can provide office space and secretarial help for a reasonable cost. Development groups like the Missoula Economic Development Corporation stand ready to search for venture capital.

Still, entrepreneurs looking for help have had difficulty finding the resources they need.

No longer. The Montana Entrepreneurship Center, which opened this summer, now serves as a one-stop information broker for people interested in starting or developing businesses in Montana. Its goal is to use the strengths of the Montana University System to build the infrastructure necessary to encourage and support entrepreneurship and small business development.

The center provides information on special resources and equipment available to entrepreneurs, including faculty expertise and student outreach programs. "We link clients with information they really need to have," says Kay Lutz-Ritzheimer, the center’s director.

Funded by the Montana Science and Technology Alliance, the center is a cooperative effort of the University of Montana, Montana State University and Eastern Montana College, with offices on each campus. "We are so geographically dispersed in this state that one office can’t serve everyone efficiently," Lutz-Ritzheimer says. UM houses the central office, the director, a database manager and a full-time secretary. Half-time directors work at the other two campuses.

Under the initial grant in 1988, research teams from the three schools surveyed entrepreneurs and business groups to confirm the need for coordinated business services, both for Montanans starting businesses and for companies coming into the state. They learned how much help is available in the state and what a difference good facilities and programs can make for a company hoping to do business in Montana.
“We have incredible expertise and resources in this state. For biotech companies, having research facilities available might make the difference between coming to Montana or going elsewhere.”

—Kay Lutz-Ritzheimer

For the past year, the staff has been developing an exhaustive data base that describes hundreds of programs in the university system and in the public and private sectors, plus faculty members with particular expertise and special facilities available to business. For each facility or service listed, the data base includes a brief description, who’s eligible, any fees and the name and telephone number of a contact person.

By surveying faculty members, the center’s staff members have identified areas of expertise that might be useful to new businesses. “We link clients with the expertise they need,” Lutz-Ritzheimer says.

The center’s UM office occupies former classrooms on the second floor of McGill Hall. With oak woodwork and blue-gray carpet, the center includes a reception area, conference room, office for the director and a large computer/data base/resource room. Special wiring permits staff members to operate the computer equipment in every room for special demonstrations.

When a potential client calls the office, Lutz-Ritzheimer schedules an interview to determine the company’s needs. What is the product or service? Does it need further development before it’s marketed? Does the client have a business plan or need help putting one together? Does the company need to use university laboratories for research? Does the client have enough money to pay for services? Is there a need for funding?

With the needs identified, the director offers written materials that might help or refers to the computerized data base to match the client with other resources in the state. Key words allow the computer operator to identify resources of a particular type. The client may also specify a particular county or university. In time, the center will also provide access to 300 other data bases from all over the world.

Although the data base is housed and continuously updated at UM, directors at the other two centers have access to the data base, can retrieve information and print it for their clients.

“We’re taking advantage of the most up-to-date telecommunications technology there is,” says Keith Larson, data base manager. Larson explains that in addition to the data base services, the center can use a Unix conferencing system to put entrepreneurs in touch electronically with thousands of other business people and computer experts, to help them solve problems or discuss ideas. This will permit Montana businesses to benefit from the experience and expertise of other companies worldwide.

Another conferencing possibility would be enabling people with home-based businesses—of which there are many in Montana—to communicate with each other through a special electronic network, Lutz-Ritzheimer says. Entrepreneurs could ask each other about taxes, computer programs and other common business problems.

“This is the only entrepreneurship data base in the world that’s on a PC,” Larson says, noting that most similar data bases use expensive mainframe computers. The setup also allows clients to use the conferencing system from their place of business, no matter what kind of computer they have. “We haven’t alienated any users,” he says.

Although the center will be available to all entrepreneurs, with access to the data base for a modest fee, directors will pay particular attention to ventures with the potential to create jobs and affect the state’s economy. “We’ll probably only identify two or three clients of that kind in each office per year,” Lutz-Ritzheimer says. Directors will nurture these companies on their way, helping them find financing, develop management skills and market their products. “We’ll do whatever it takes to get these ventures operational,” she says.

A member of the business school faculty since 1983, Lutz-Ritzheimer brings personal entrepreneurial experience to her position as the center’s director. In 1983, she established Lutz-Ritzheimer Consulting to provide feasibility analysis services to businesses, professional organizations and public agencies throughout the Northwest. The following year she founded Northwest Survey Research to provide research services to businesses and non-profit organizations nationwide. She served as president and chief executive officer of both companies before accepting the directorship of the center.
Native cures offer hope for migraine sufferers

For centuries, people have been complaining about headaches. Aristotle wrote about them. John Calvin, Leo Tolstoi and Ulysses S. Grant suffered from them.

In fact, up to one-fifth of the world’s population suffers from chronic, recurrent, incapacitating headaches known as migraines, according to a December 1987 article in *Smithsonian.* This type of painful headache accounts for five million lost work days and $1 billion spent on painkillers each year, the article says.

While migraines remain poorly understood and difficult to treat, Keith Parker, a chemistry professor at Western Montana College of the University of Montana at Dillon, has been studying remedies traditionally used by Native Americans.

“We’ve searched Native American literature and the Rocky Mountain region’s folklore for their treatment of headaches and discovered that Native Americans used buckwheat frequently as a medicinal tea for headache treatments.”

—Keith Parker
If the migraine research project succeeds, Parker believes it could lead to the production of a marketable migraine-alleviating drug with few serious side effects. None of the treatments now used to cure migraines are universally successful, Parker says, and some carry sizeable risks, such as nausea, vomiting, circulatory problems and non-migraine rebound headaches.

The buckwheat research also will help scientists better understand the pathology of migraines, leading to new ways of correcting the underlying problems that cause them. Parker explains.

“Our project’s purpose is quite simple,” Parker says. “We’d like to develop a more effective, less dangerous drug from natural sources that will treat migraine headaches. Techniques from pharmaceutical chemistry can then be used to modify the natural drug structures to improve their activity. By combining natural products with technological advances, we’ll finally be able to treat a severe human affliction.”

Although twentieth century synthetics are touted as wonder drugs and cure-alls, most drugs historically have come from natural products, Parker says.

A Billings native and a Western faculty member since 1981, Parker graduated from Montana State University in 1972 with a major in psychology. He earned his doctorate in pharmacology from the University of California in San Francisco in 1977 and spent four years as a post-doctoral fellow at the University of Colorado’s Health Science Center. Later, he served as a research associate in the chemistry department at the University of Denver.

For almost a decade, Parker has been involved in researching natural products for their useful application in neuropharmacology, the study of effects of drugs on the nervous system.

“I originally majored in pharmacology during my doctorate,” Parker said, “but I decided to branch out into pharmacognosy—the study of natural products in medicine—because I wanted to return to Montana to do research with plants of local interest. For over twenty years my overriding interests have been with the nervous system, and all my studies have involved nervous tissue in some fashion. I’m a neuropharmacologist with related interests in neurochemistry and neurotoxicology.”

In addition to migraine headache research, Parker is involved in another neurological research project—studying the activity of cancerous brain cells. This project, funded in part through the American Cancer Society, focuses on both the aging process and biological transformation of specific brain cells.
What's water worth?

When economics Professor John Duffield traveled to the Norwegian valley where his grandmother grew up, he planned to fish in the nearby Laerdal River, famous for its Atlantic salmon. However, “the river was leased till 1992 to Monsieur Something-or-Other from France,” he recalls.

So he journeyed to northern Norway to fish but was priced out of the market at $120 a day. Six people per mile could fish along the rivers during certain hours; the rest of the time fishing rights were reserved for the landowners.

This 1983 trip heightened Duffield's interest in an area of economics known as non-market valuation—the value of natural resources not traded in markets.

Duffield, who grew up near Mystic Lake in the Beartooth Mountains and in Thompson Falls, credits his interest in natural resource economics to his Montana upbringing and what he calls “a lifelong fascination with the out-of-doors.”

While some economists look at a river and consider kilowatts of energy produced or dollars of crops irrigated, Duffield sees the river as also having economic value when it's used by people “to produce themselves a good time,” he says.

To understand how Duffield does his research, it's helpful to look at some of his previous studies.

In 1983 a local electric cooperative proposed building a dam on the Kootenai River near Libby that would have diminished the fishing and aesthetic values of popular Kootenai Falls and China Rapids. Duffield received a small grant from the state to estimate the recreational value of the site with and without the dam.

He surveyed recreational users of the river and Lincoln County residents through a mail survey. Recreational users were asked about their travel costs and amount of time spent reaching the falls and their willingness to pay a hypothetical entry fee. Duffield estimated the annual recreational value of the site at $8 million.

The hearing examiner cited Duffield's study as one of the key reasons for turning down the proposed dam. “It's just amazing to some people that the falls is actually more valuable for aesthetic and future purposes than to produce electricity,” Duffield says.

The typical method Duffield uses in his various research projects is to set up a hypothetical situation for the respondent, such as an entry fee or payment into a trust fund. “You pose a hypothetical market situation like the situation in Norway and ask them how they would respond,” he explains. The respondents then state their willingness to pay for a
recreational activity, such as fishing, hunting or observing wildlife. Duffield validates these economic values by comparing the estimates to actual fees paid in similar situations.

In a study on the value of Montana fishing, Duffield and researchers John Loomis of the University of California at Davis and Rob Brooks of the Montana Department of Fish, Wildlife and Parks surveyed licensed anglers. They established that Montana lake fishing is worth $70 a day, and stream fishing is worth $100 a day. These values, Duffield says, are in the range of daily fees paid at fee fisheries.

Daily fishing values varied from $37 on the Kootenai River to $160 on the Madison River. These differences result because certain rivers attract a greater share of non-resident anglers, who actually spent an average of $536 for their fishing trip and traveled about 1,500 miles round trip, he says.

Like destination ski areas, some Montana rivers are destination fisheries, that is, the main destination of their fishing vacation, he says. The study found that Montana lake and stream fisheries are worth $215 million annually.

Duffield also worked on a study of Montana hunting, in which 2,000 licensed hunters were interviewed. The study found that elk hunting was worth $66 a day; deer hunting, $55; and pronghorn (antelope) hunting, $62. These figures represent how much hunters valued the experience over and above their actual expenses, he explains. The total hunting value in Montana for all three species was $95 million a year.

Recent research by Duffield has formed the basis of the state's decision to acquire additional elk wintering range near Gardiner for the northern Yellowstone herd.

In a current study with funding from the Environmental Protection Agency, Duffield is looking at situations in which water rights are leased from irrigators to increase rivers' instream flows. Specifically, he's trying to determine how much people are willing to pay to maintain instream flows. The water leasing could benefit key spawning tributaries for Yellowstone cutthroat trout and the Arctic grayling, two species of special concern in Montana because of declining population.

Done in cooperation with The Nature Conservancy, Duffield's work may help implement a 1989 water-leasing bill that allows the Montana Department of Fish, Wildlife and Parks to lease water for fish and wildlife habitat. He also directs a study on proposed wolf recovery in Yellowstone National Park.

Duffield hopes that his economic research brings new insights to resource policy and management decisions. For instance, the U.S. Forest Service has based its management decisions on "fish and wildlife values that underestimate the full value of these resources," Duffield says.

The Forest Service in Region 1, which includes Montana, northern Idaho and North Dakota, values hunting at $13.60 a day, a quarter of the value Duffield found. Likewise the USFS bases land-management decisions in Region 1 on fishing values of $3.22 a day for lake and stream fishing, or about 3 to 5 percent of the values Duffield and his co-workers estimated for Montana waters.

Many people may not want to profane such recreational activities as fly fishing or elk hunting by discussing them in terms of money, Duffield says. He even sympathizes with them. However, he points out, alternative land and water uses compete with fisheries and wildlife resources. Hydroelectric projects and agricultural irrigation are two such competitors with obvious market values.

"The natural environments we have in Montana and the fisheries and wildlife they support are getting scarce because the rest of the country has developed so much. When things get scarce, they get valuable."

—John Duffield

He sees his work as a way of giving voice to concerns that people may not know how to articulate. Economics may also be a way for people to find common ground when discussing the best management for a resource, he says.

Balancing alternative uses of natural resources will be a continuing problem, he says.

"The natural environments we have in Montana and the fisheries and wildlife they support are getting scarce because the rest of the country has developed so much," Duffield says. "When things get scarce, they get valuable."
Greg Pape returned to northern Arizona in summer 1989 to seek the seeds of poems. The area, rich in Indian history, had proved fertile before, yielding a number of poems for his recently completed book, *Storm Pattern*.

"I'm interested in contemporary life but also in the way it's affected by the past," says Pape, an associate professor of English who teaches poetry at the University of Montana. "You can't really understand the present unless you have a sense of the past. When you walk in it and you live in it, you can't ignore it."

Supported by a UM research grant, he spent a month exploring Indian ruins, keeping a journal and studying Arizona's prehistory at the Museum of Northern Arizona in Flagstaff.

Besides coming up with ideas for new poems, he revised the ones in *Storm Pattern* that were inspired by earlier stays in Arizona. Most of his revised poems will be published in *The Morning Horse* by Confluence Press of Lewiston, Idaho.

Pape's home base in Arizona, an old lava rock ranch house on the eastern fringe of Flagstaff, lay in the shadow of the San Francisco Peaks and on the edge of the huge Navajo Indian Reservation. During the long, hot days of July, he visited ancient Indian ruins with magical-sounding Hopi names: Wupatki, Wukoki, Lomaki, Nalakihu. He sought inspiration from prehistoric rock carvings, underground ceremonial rooms called kivas and ancient dwellings known as pit houses.

His two major trips were to Arizona's Canyon de Chelly and New Mexico's Chaco Canyon, which he says holds the most extensive ruins in the United States. The largest of them is Pueblo Bonita, a semicircle of kivas built around A.D. 919.

Walking among the ruins sparked
his imagination about the Indians who, centuries ago, left traces of their civilization. "It's wonderful to walk out there in the desert and try to dream up those lives," he says.

Researching and reflecting on the lives of Indians have instilled in Pape a sense of kinship with them. That bond comes through in poems like "Blue Bowl" and "Making a Great Space Small," in which he disdains the U.S. bombers that shatter the calm with training flights over the desert, intruding upon the traditional lives of Indians.

Similarly, in "After Anger Breaks Up the Song," Pape makes no secret of his disgust over the polluted water of the Rio de Flag. And in "Storm Pattern," the title poem of his book, he shares the heartbreaking of a Navajo woman forced by the government to leave her ancestral home.

"You can't really be any kind of writer without touching on social responsibility and political questions because our lives are political," Pape says. "Everything we do is connected to everything else we do."

His concern with social and political issues in Arizona has deep roots. He spent some of his childhood in Tucson, where he later earned a master's degree in creative writing and taught at the University of Arizona and was an instructor at Pima Community College. He also was a visiting assistant professor at Northern Arizona University in Flagstaff.

He traces his fascination with Indian culture to the time he taught creative writing in Indian communities as an employee of the Arizona Commission on the Arts and Humanities. "I didn't want to go into Indian communities and presume to teach the kids without knowing about them," Pape recalls. "I started studying."

Pape takes a similar approach to poetry, getting to know as much as he can about his surroundings before writing about them. "I work a lot with memory and place," he says.

Clarity also characterizes his poetry. "See, I think poetry should be somehow demystified," he says. "People say, 'Oh, poetry,' and they think of something that is absolutely beyond their reach. My own thing has been to write as clearly as I could in the hopes that lots of people would understand."

Today many poets write clearly about complex matters, Pape says. Two of his favorites are Philip Levine, under whom he studied at California State University, and Elizabeth Bishop.

Pape acknowledges that some poets still take pride in producing hard-to-follow poems, in the tradition of T.S. Eliot. "Eliot was a good poet, but he was a difficult poet," he says. "He didn't write 'The Wasteland' for your average Joe to pick up and say, 'Hey, this is an all-right poem.'"

Pape, in writing more about history and the land, is moving away from what he calls a tight use of language. "I think I'm giving myself more slack because I realize you have to try new things in order to make new discoveries," he says. "It's not good to align yourself so much with a certain style. Your style is part of you, and it's going to show through."

"It's not good to align yourself so much with a certain style. Your style is part of you, and it's going to show through."

—Greg Pape

Working in both free verse and traditional forms, Pape is also beginning to explore his spiritual side in his poetry. "It's kind of taking a risk," he says. "It's easy to write poorly and abstractly when you start working with things like spiritual ideas."

But taking risks is necessary to growing as a poet. "You have to write what's real to you, what's important to you," Pape says. "If you're committed as a writer...you've got to believe in your work....If I get a book rejected, that's certainly not going to stop me from writing. I tell my students not to be in it for immediate rewards but for the long haul."

Pape speaks from long experience as a poet and teacher. The author of the books Black Branches, Border Crossings and Little America, he's placed his poems in literary magazines such as Northwest Review, Quarterly West and The Missouri Review.

Besides teaching at UM and schools in Arizona, he's taught at the University of Missouri, Hollins College and California State University. He's also been a visiting writer at the University of Louisville and University of Alabama and landed a number of awards and fellowships.

His honors include two National Endowment for the Arts Creative Writing Fellowships and a fellowship to the Fine Arts Work Center in Provincetown, Mass.

In addition to urging his students to focus more on their writing than on getting published, he tells them that the art of writing is rewriting. "You have to work on stuff," he says. "You have to compose it. You have to make your discoveries. It's a process."

He sees his role not as teaching students to write poetry but as helping them and giving them real, honest responses to their work. He encourages them to experiment, to convey ideas through recalled experiences.

"We're given a certain amount of experience in our lives: where we live, what we do, whom we come in contact with, what happens to us," he says. "If we're writers or artists, that's what we work with."
The vision of a united Europe captured the world's imagination long before the Iron Curtain came tumbling down. In 1988, when UM foreign languages and literatures Professor Gerald Fetz and five other scholars formed a traveling seminar in West Germany on the first forty years of the Federal Republic of Germany, they couldn't keep people on the subject. "After about five minutes, the topic shifted to Europe as a whole," he says. "That's what these people were interested in."

"You're talking about the free flow of people and goods. You don't have to be a Marxist to understand that the direction the economy goes affects other areas of life. It could lead in time to a United States of Europe."

—Gerald Fetz

A united Europe is now closer to becoming a reality than ever before. The twelve Western European countries in the European Community have agreed to remove all trade barriers in 1992, forming a single European market. Once the borders are down, people will be able to migrate freely between countries. Reciprocal agreements will allow doctors, engineers and other licensed professionals to practice anywhere they wish.

"What I see developing is a federation of states," Fetz says, relaxing in his office in the Liberal Arts Building. Surrounded by shelves of German books and walls covered with German maps and posters, he leans back in his chair and describes the scope of the changes. "You're talking about the free flow of people and goods," he says. "You don't have to be a Marxist to understand that the direction the economy goes affects other areas of life. It could lead in time to a United States of Europe."

In a region torn for centuries by cultural clashes and wars of conquest, plans for that kind of cooperation are startling, Fetz says. "What was going on even a year ago was profoundly revolutionary," he says. "Here we have twelve sovereign states deciding voluntarily to relinquish a great deal of their sovereignty for mutual gains, even at
an economic cost to themselves.” For example, Germany, the richest and strongest nation by far and Fetz’s special interest, will have to bear the burden of poorer countries such as Portugal, he says.

Plans for a united Europe—that is, for a united Western Europe—were clicking along full steam when the democratic revolutions in Eastern Europe late in 1989 effectively tossed a wrench into the works.

“Throwing Eastern Europe in complicates everything,” Fetz says. “Germany is right in the middle of it, economically, culturally and politically.” Now Austria, Poland and Czechoslovakia have expressed interest in being included in the new economic federation, even though they don’t belong to NATO. “It’s hard to say how the EC will take shape,” he says.

With the Berlin Wall down, the leaders of East and West Germany brought about reunification. At first some feared that Germany’s reunification would turn West Germany’s attention away from the efforts to unite Western Europe, Fetz says. However, he says, the two Germanys’ push for rapid reunification was in part designed to foster a united European Community.

Whatever happens in Western Europe’s unification endeavors, the United States won’t play a leading role. “We’re very much in the dark about what’s going on, how it affects them and what they expect to happen.”

From these interviews Fetz concludes that until recently national rivalries prevented most Europeans from even conceiving of such thoroughgoing teamwork. But the development of an international corporate economy has become a powerful force for cooperation.

“This is a quiet revolution that’s supported in the boardrooms,” he says, explaining that while national corporations could manage despite international tensions, international corporations can’t live with conflict. With the globalization of business, nationalism can lead to economic disaster. No longer can Europeans afford to look at each other as military or even economic enemies, he says.

Cultural changes, also, have moved toward unity, Fetz says. For example, he says, the mass media provide instantaneous coverage of events around the globe; prosperity permits widespread travel and student exchanges, which nurture international understanding; and while artists and intellectuals have long been able to live without borders, an increasing number of people of all kinds consider themselves citizens of the world.

For Fetz, the most fascinating aspect of the change is neither economic nor political but cultural. Although a united Europe has not been feasible until recently, visionaries have seen it coming for a century or more. “I don’t think history moves forward without precedents,” Fetz says. His research includes digging into German literature, art and poetry for expressions of the unity theme, which he’s found in the works of Goethe, Nietzsche, Heinrich Mann and others.

“I’m intrigued to see what will come out in literature,” he says. So far, the themes that crop up in German literature and art have dealt with the split between east and west. When east and west come together and borders become practically meaningless, he asks, what will the cultural fabric look like? How will future historians recast the developments of the past few centuries to explain the events of today?

Students at UM already benefit from Fetz’s research. In spring 1990, he taught a course on German culture from 1900 to the present examining the role of Germany in a divided Europe. Another course, taught in German, looked at cultural reflections on the division of Germany in contemporary German literature. In June 1990 he presented a seminar on campus for Montana school teachers titled “Europe Without Borders,” focusing on cultural expressions of European unity. The following month he returned to Germany to celebrate the launching of the reunited country.

“This is all very exciting stuff,” says Fetz. “There can be no doubt that we are witnessing history in the making.”

Gerald Fetz
Forestry

NASA taps UM researcher for global-watch project

University of Montana forestry Professor Steve Running has the right stuff and a projected $7 million, eleven-year grant to build satellite monitoring tools for NASA to study future vegetation responses to the "greenhouse effect."

The greenhouse effect is the widely publicized consequence of increasing atmospheric carbon dioxide in which scientists expect the Earth's temperature to increase seven degrees in the next century. This may cause widespread drought, the melting of polar icecaps and rising sea levels. The greenhouse effect and other global environmental concerns are focal points for NASA's primary research project for the 1990s.

Running is part of that project as one of twenty-four scientists selected for an international team working on the Moderate Resolution Imaging Spectrometer (MODIS) of NASA's satellite Earth Observing System (EOS). With Running's project, UM has the only forestry program in the nation with a team member on MODIS.

Running's proposal for MODIS stems from his idea that satellite data coupled with computer models can calculate surface vegetation health and activity. Since 1982, with NASA research grants exceeding $1 million, Running and UM researchers have developed a specialty for using satellite data and computer simulation for studying forest ecosystems and forecasting their future. That's what landed UM on the MODIS team in 1989.

MODIS is one of many satellite sensors scheduled to go into orbit in 1997 with the launch of EOS, NASA's multi-mission observation system to study changes in Earth's environment. With an estimated price tag of $20 billion, EOS is "the biggest project ever attempted by NASA—bigger even than going to the moon," Running says. "Even by NASA standards, this is a big operation."

"When you go down the list of global environmental problems, the greenhouse effect and pollution and ozone holes and so on, the EOS project is really the centerpiece global-change-research effort for the whole United States."

EOS will continuously monitor Earth, including its land, atmosphere and oceans, using the most sophisticated satellite technology in the world. More satellite Earth observation data will be collected in EOS' first week in space than has been gathered in the past decade, Running says. The data will be stored on computer tape and laser disks, not paper.

Seven research assistants will help Running develop a system for using MODIS. His NASA funding is projected through the year 2001, he says, but it will likely be extended throughout the sensor's fifteen-year operating life. So, he says, if the launch goes according to schedule in 1997, the project should continue through 2012.

By 1999 he will submit weekly maps of the entire North American continent’s photosynthesis using EOS satellite images enhanced by computer simulation in his UM lab. Photosynthesis, the conversion of sunlight into plant growth, is the first step in the food chain that supports all life.

"If we can make that calculation and monitor the photosynthetic activity of the entire world, then we can monitor whether a deterioration of photosynthetic activity is occurring," Running says. "Of course, there's nothing more fundamental to the habitability of the world than photosynthesis. That's the beginning of all food chains."

NASA will use Running's photosynthesis maps to help monitor the influence of regional drought, pollution and other global climate changes related to Earth's habitability.

"The basic theories to execute this project we can do and have done," he says of his UM research team. "But to take that capability to an entire continent and do it every week is not trivial. That system's development is what we're in for in the next decade."

Before 1980, interest in the health of the global environment stayed at the scientific-curiosity level, Running says. But more recently, reports on acid rain, global warming, ozone holes and other factors potentially jeopardizing Earth's habitability have moved out of scientific journals and into the public media, he says.

Until the EOS project with its satellites and computer simulation,
Steve Running is one of twenty-four scientists on NASA's international team to study future vegetation responses to the “greenhouse effect.” The computer screen shows the Swan Valley's forest cover as represented by the Landsat satellite.

most biological research was conducted on a small scale. In trying to understand the intricacies of the global environment, Running says, scientists had to grapple with the question: How do we study the whole world?

“We didn’t even need the equipment so much yet as we needed a logical thought process of how to attack the problem,” he says. “It was a perfect example of being given a problem that was so much bigger than had ever been addressed that you absolutely had to throw out the window all your original preconceptions of how to do your work.”

The shift from a local scale to a global scale remains difficult for scientists, especially biologists, says Running, the only terrestrial biologist on the MODIS team. Scientists’ reluctance to make that mental adjustment, he says, is a major problem hampering global ecology research.

But why study global ecology? Why not take action now?

“The solutions to these problems are so cataclysmic to society, they will cost so much money and they would change the way society operates so dramatically,” Running says, “that we have to have near 100 percent probability of understanding what’s going on.

“If this was something that a few billion dollars would fix, they’d say let’s fix it. But global-scale problems don’t fix that easily, and because of that we have to be much more accurate in our understanding of what’s happening.”

Much of scientists’ understanding of Earth’s environmental health is based on computer simulation models from the world’s top researchers, Running says. But many global-scale problems, such as deforestation, have never actually been measured, he says. Before scientists can suggest solutions to those problems, he says, they need a survey of the current status of the Earth and the capability to monitor what’s changing.

“The difference between computer simulations and theories and hard-measured facts is one of the major issues at hand,” Running says. By continuously monitoring and measuring all aspects of Earth’s environment, EOS will separate facts from theories, he says.

While mission EOS is under way, Running will be working on three other NASA projects and two National Science Foundation projects, all related to his MODIS work. The two new projects sponsored by the EPA Global Change Program are scheduled to start soon. In addition, he sits on the global hydrology panel for the International Geosphere Biosphere Program centered in Stockholm, Sweden. His global hydrology work paired with his NASA project might gain him a place on other international research teams and bring more research money to UM.

“This gives us national and international credibility in global ecology,” he says, “and I think that’s what is the real significance of this project to the state of Montana.”

Besides his NASA work, Running is involved in other major research efforts. He has a U.S. Forest Service grant to research the use of remote sensing and digital image analysis for assessing wild land fire severity. And he is working with scientists at UM’s Flathead Lake Biological Station under a two-year, $190,141 National Science Foundation grant to study how non-native species affect the food chain in Flathead and similar lakes. Such projects indicate UM’s standing as a scientific research facility, Running says.

“We think we have facilities that are world class and capabilities that are world class and ideas that are as good as any in the country,” he says.
Visitors to Montana were surprised last year when UM researchers approached them at airports, questioned them at rest stops and flagged them down on remote highways. Before long, 10,000 people had agreed to complete a seven-page survey of why they came to Montana, what they did, who they traveled with, how much they spent and how they liked it.

The survey is part of the research conducted by UM's Institute for Tourism and Recreation Research, a component of the School of Forestry.

"We're laying the groundwork for strengthening the tourism industry," says Steve McCool, a forestry professor and the director of the institute. McCool notes that Montana's other major industries, such as timber and mining, rely on a solid foundation of basic research. But, he says, "This is the first time Montana has had a strong, continuing program in tourism research."

The Board of Regents for the Montana University System created the institute in June 1987, as mandated by the Montana Legislature earlier that year. Two and a half percent of the money collected through Montana's new tax on overnight accommodations goes to the institute for studies of statewide significance. Particular regions, counties, agencies or businesses also contract with the institute for specialized studies.

For instance, the U.S. Forest Service commissioned a study of recreational facilities in the Lincoln area, and the U.S. Park Service funded a study of the number of people using Glacier National Park's backcountry. With funding from The Montana Power Co., the institute studied the recreational use of reservoirs and with funds from the Idaho Department of Fish & Game investigated the way hunters' strategies affect elk populations.

Logan Pass is a frequent stopping point for thousands of out-of-state visitors who come each year to Glacier National Park, in northwest Montana. Among other tourism-related requests from the private and public sector, UM's Institute for Tourism and Recreation Research received funding to determine the number of people using Glacier's backcountry.
In addition to McCool and Assistant Professor Mike Yuan, the institute employs three research specialists, six graduate students and nearly a dozen work-study students who conduct telephone interviews and enter data.

If anyone doubted the importance of tourism in Montana’s economy, a quick look at the institute’s “1988 Non-Resident Travel in Montana and Economic Report” would lay those thoughts to rest. In 1988 non-resident travelers spent $658 million in Montana, resulting in $1.45 billion in total economic impact.

Non-resident travel alone accounted for 22,500 jobs in Montana, creating the fifth largest industry in the state. When the results are in on current studies of motorcoach tours and resident travel, McCool expects the tourism industry will prove to be nearly equal in size to the wood products industry.

“This provides a basis for measuring our efforts to increase tourism.” McCool says. “It also gives the tourism industry a little more cohesiveness.”

One of the first steps toward increasing tourism was a study of advertising effectiveness. In one study, done in cooperation with Travel Alberta, the institute mailed a questionnaire to everyone who requested information about Montana after reading a magazine tourism ad. It asked whether they visited Montana and how much they spent. The study showed that 22 percent of those who received a travel planner packet actually visited Montana, bringing in $7 million. The advertisements and travel planners that piqued their interest cost $66,000. “Our estimate is that for every dollar spent on advertising, we generate $100,” McCool says.

In another study, the institute engaged researchers at Montana State University to telephone residents of Denver, Seattle and Minneapolis-St. Paul asking whether they could recall television commercials on Montana shown in their area. “The data show that people recalled it—it was a very strong commercial,” McCool says, describing the vivid images of Montana’s scenic beauty and opportunities for family adventures. People who said they could recall the commercial reported they were more likely to visit Montana because of it.

The image—or lack of image—that out-of-state residents hold of Montana concerns McCool.

“People feel there’s not much to do here—that it’s a big empty spot,” he says. “People also think Montana is terribly backward.”

“In my experience, people have no reference point,” says Research Specialist Neal Christensen. “If I say something about Montana, five minutes later they think I said Wyoming.”

The ads produced by Travel Montana, a state agency that works closely with the institute, are designed to build a positive image for the state. “We’re trying to say this is a very special place, with spectacular scenery, abundant wildlife and many things for families to do.” McCool says.

![How the Non-Resident Travel Dollar is Spent](image)

Marketing isn’t the only requirement for expanding tourism, McCool says. “If you’re going to have tourism development, you have to think about having enough hotels, restaurants and resorts.” he says, noting that any resistance to tourism comes from Montanans who’ve gone to their favorite places and found too many people. “If we increase too quickly, we’ll overload these resources.”

Montanans’ friendliness is a vital tourism resource that McCool hopes never spoils. Hundreds of respondents mentioned it spontaneously in the non-resident travel survey. Describing bad experiences with rude service station attendants in California, he notes that people tell friends and neighbors about bad impressions even more quickly than they do good ones. “We don’t want that to happen in Montana,” he says.

Although friendliness seems to be natural for Montanans, the state may want to try to ensure it doesn’t disappear, McCool says. Special training programs could help hotel personnel, service station attendants, store clerks and others who deal with travelers to understand the importance of a warm smile and congenial conversation.

Another critical resource is made-in-Montana products. “People are really interested in high-quality goods,” McCool says, adding that he’s received numerous requests for Montana huckleberry chocolates from out-of-state relatives and friends. “If we had more things for people to spend their money on, there’d be a tremendous economic impact,” he says. When the money travelers spend goes to Montanans, who turn around and spend it in Montana, there’s less leakage in the economy, he explains.

The other side of the coin, McCool says, is that while tourism contributes impressively to the state’s economy, other economic players can affect tourism. “We have to think about water quality, fishery management and what these landscapes look like,” he contends, adding that people come to Big Sky Country to enjoy the beauty of its openness, mountains and forests.

“If we can establish that tourism is significant, we may have to change the way we get the logs out, or sometimes not take the logs out.” he says, advocating a holistic managerial approach that would benefit everyone. “There’s no intrinsic incompatibility between logging, mining and tourism development, but it may mean changing the way we do things.

“If there really is a Montana mystique, how do we protect that? If Montana begins to look like every other state, why would anyone come here?”
Thanksgiving morning found Assistant Professor of Geology Nancy Hinman in the lab testing a batch of water samples for radon. The test she was running would help determine how much radon is in specific wells in the Helena Valley. Since radon breaks down quickly and totally disappears within three weeks, there's no time to let the samples sit—even on holidays.

Radon, a breakdown product of uranium, is a colorless, odorless, tasteless gas that has been linked with increased risk of lung cancer. Rainwater, coming in contact with uranium in rock such as granite, picks up radon and carries it to the groundwater. Radon in the earth and groundwater has led to high concentrations of the gas in some basements and homes, particularly in more air-tight, energy-efficient homes.

The samples Hinman tested that morning were just a few of the 150 samples that Helena Capital High School student Jodi Briggs had collected and sent to Hinman over several months. Hinman says the research probably will show that few wells in the Helena Valley have harmful radon levels.

While Briggs and the U.S. Geological Survey, which is cooperating on the research, are looking at the health aspects of radon, Hinman is studying it for other reasons as well.

"I got interested in radon because I wanted to find a naturally occurring tool to act as a tracer to measure the rate at which groundwater moves," Hinman says.

The radon, acting as little radioactive "flags" or markers on water molecules, could be tracked and used to measure rates of water transfer and velocity. This information could explain not only how radon moves through the soil above the groundwater, but also how pollutants enter and move through the groundwater.

"If radon works for tracking, you'll know exactly where that water molecule hits and moves through the vadose zone (the layer of soil above the groundwater) and then when it hits groundwater," she says. "You can tell the age of the water. That's phenomenal!"
The saturated zone of the earth above the groundwater holds water like a giant sponge, but it's made of different earth materials. “The substance in the aquifer determines how your groundwater moves,” she explains. “You can imagine a roomful of sand, or a roomful of marbles, versus a roomful of bowling balls, and that water moves through these all at different rates.”

Hinman plans to use the data from this research to set up computer models over the next two to three years that will help predict how pollutants move with water to the aquifer and the rate and extent of groundwater contamination.

Briggs’ part of the research has earned her a tie for first place in the Intermountain Junior Science and Humanities Symposium. She has gone on to compete nationally.

Hinman likes the idea of students’ getting hands-on experience doing research. As a result of this commitment and her research interests, she manages an ambitious research schedule. She and graduate student A. Cam Stringer are working with Burlington Northern Railroad to clean up diesel fuel at its former fueling site in Missoula. Stringer is monitoring the extent of the spill, the water table elevation and the rate and direction of groundwater flow to predict the fuel’s migration.

By knowing rates and patterns of groundwater flow, the railroad’s consultants are able to design ways to pump out the diesel fuel. “The fuel’s just sitting on top of the water in a sort of congealed area, a kind of lens right on top of the water table,” Hinman said. She described the site as a sponge filled with oil instead of a sponge filled with water. The railroad has already recovered some of the diesel fuel.

“They should be able to reduce the amount down to a sheen,” she said. “I think it’s just super that Burlington Northern has said, ‘We need to take care of this.’ It’s really good for us to be involved in the project and to train a student. It’s a super opportunity. The student is helping with the research and also getting to interact with the consultants and industry.”

Another student, Kevin Armstrong, is working with Hinman and geologist William Woessner in measuring the extent of perchloroethylene (PCE) contamination in the Missoula aquifer. PCE is a chemical used in dry cleaning.

The UM researchers, cooperating with the Montana Department of Health and Environmental Sciences, the Water Quality Bureau, and the Missoula City/County Health Department, sample and measure PCE amounts in well water and map the chemical’s movement and concentration in the groundwater. The agencies use this information to track down the pollutant’s source.

Hinman is also investigating contamination from mining wastes in the Warm Springs ponds, near Anaconda, and the Milltown Reservoir, near Missoula. This work could lead to an understanding of how metals migrate in water and soil. This research could also have implications for cleaning up the wastes, since any attempt to remove the wastes could mobilize the metals.

Besides environmental benefits, this research could help Hinman gain insights into the earth’s geological history. Knowing how the metals formed may aid in understanding how similar ore deposits formed elsewhere in the world.

Hinman is also studying spring flows at Lost Trail Pass. Lost Trail Hot Springs Resort relies on hot-springs water, she explains. The Federal Highway Administration is planning to improve the road over the pass, which could disrupt spring flows. That agency must ensure no loss of quantity or quality of water, she says. A student will sample the water monthly and will probably develop a master’s thesis from the research, she adds.

Another of Hinman’s research projects is giving a student summer employment, scientific training and a good tan. Hinman jokes that she has been searching for the perfect rock to test her hypothesis that organic carbon affects in specific ways the rate at which certain rocks become petroleum-bearing. She seeks to explain how a rock that is dusty brown and feels as light as papier-mâche becomes heavy and rich with petroleum.

This summer she took her quest to a California beach that is part of the Monterey Formation, a major oil-producing deposit in California. There she and a student from Oberlin College endured the terrible fate of combing beaches for the perfect rock.
Welcome to

The age of sports injury lawsuits

Not all sports contests are on the playing field or in the gym. More than ever, they’re taking place in the courtroom.

A California teacher won $14.7 million in a lawsuit against the maker of gym equipment involved in an accident that left him a quadriplegic. Two Texas students hurt in a school game of tug-of-war successfully sued their school district and ten of its employees for $10.9 million. A Columbia Falls man injured in a snowmobile accident received more than $2.5 million from the Montana Department of Fish, Wildlife and Parks.

“The increase in sports injury lawsuits has been phenomenal,” says Gary Nygaard, professor of health and physical education at UM. Ron Baron, executive director of the Center for Sports Law and Risk Management in Dallas, dates the increase to 1981 or 1982.

One indication of the proliferation of sports injury lawsuits can be found in the recently released second edition of Law for Physical Educators and Coaches, a book Nygaard wrote with Missoula lawyer Tom Boone. The book is more than double the length of their 1981 edition, with new cases and recommendations accounting for much of the increased length. And the cases they include in their book are only reported ones.

“You have to realize that most lawsuits aren’t reported,” Boone says. “It’s usually only the ones that are tried and appealed. Probably 5 to 10 percent are tried, and then a small percent of those are appealed.”

Sports injury lawsuits are an American phenomenon, Nygaard and other experts in the area say, and courses on the subject—unavailable twenty years ago—are now required for anyone in the country wishing to become an exercise professional.

Americans’ increasing awareness of their legal rights partly accounts for the growing number of lawsuits against coaches, physical educators and other exercise professionals, Nygaard says.

Another explanation, Nygaard and Boone say, is that most states have passed laws allowing people to sue governmental institutions. By contrast, in the 1920s a football player blinded in one eye and seriously injured in the other by lime on a football field was prevented by governmental immunity from suing the Minnesota high school responsible for his condition.

Montana legislators dispensed with governmental immunity in 1972, Nygaard says. In 1976 they limited settlements against governmental agencies to $300,000 per person or $1 million per incident, and then a few years ago the state Supreme Court threw out those limits. In the past year, the Montana Supreme Court has restored some immunity to governmental agencies and their employees, he notes.

Nygaard says states like Montana have also switched from a contributory negligence to a comparative negligence theory in lawsuits, giving rise to more litigation.

Under the old theory, still in effect in the early 1970s, a person couldn’t recover any money in a lawsuit if his negligence contributed to his injury. Now—as long as he’s less than 50 percent negligent—he’ll be compensated for his injury if he can prove the defendant was more than 50 percent negligent. For example, if a plaintiff were 40 percent negligent and the defendant 60 percent, the plaintiff’s award would be reduced by 40 percent.

In addition, since the 1970s, courts have held exercise professionals to
what Nygaard calls “a higher standard of care.” At one time the professionals had to prove only that they’d acted as reasonable and prudent people; now they must show they’ve acted as reasonable and prudent professionals.

Dallas’ Ron Baron adds that courts have eroded the doctrine of assumption of risk. That doctrine states that if people expose themselves to certain kinds of known dangers, they can’t collect damages if they’re injured.

“We probably don’t have any more injury cases than we’ve had in the past,” says sports management Professor Herb Appenzeller of North Carolina’s Guilford College, who’s written seven books on sports injury cases and works with the Center for Sports Law and Risk Management.

“I think what we’ve really done is added more litigation to the area,” Appenzeller says. Examples include cases involving defamation of character or the lack of due process, such as when a coach is fired or an athlete suspended.

Americans have also begun suing far more people related to an injury than in the past, he adds, among them trainers, officials and doctors. “We’re trying to sue everybody we can sue with the hope that somebody’s insurance will get involved and that there’ll be money available.”

“I’m very sympathetic to people who think that people are getting money (for their injuries) for no reason,” says Libby lawyer Ann German, who helped Libby High School student Becky Puckett collect $100,000 from her school district when she received a concussion during a “powderpuff football” game.

But German stresses that juries, a “real conservative, very representative cross section of society,” vote only for awards they’re satisfied a plaintiff deserves. And such awards serve another purpose besides taking care of the injured person’s financial needs.

“The theory that I have generally about tort (civil) law is that the whole purpose of the law should be not necessarily to recover damages for the individual plaintiff who’s injured but should be aimed at trying to change the behavior of the person who caused the injury,” she says.

Insurance companies could reduce the number of lawsuits through risk assessment, German adds, rather than “just paying the occasional settlement and hoping that everybody doesn’t get hurt in the meanwhile.”

The rising number of sports injury lawsuits, coupled with changes in sports law, have dramatically altered the way exercise professionals do business in this country, Nygaard says.

“The old stereotype of a coach was of a demagogue, a dictator,” he says. “You don’t dare be a dictator anymore.” Ethics aside, a coach can no longer afford to tease a student or call him a wimp or hypochondriac to get him to play a sport. He cites the case of a man convicted of misdemeanor assault for grabbing a twelve-year-old Roundup baseball player and trying to hypnotize him into becoming a better pitcher.

“There’s even some question whether you should use words like ‘aggressively’ anymore,” Nygaard continues. “Maybe you should tell your players to play ‘assertively’ because in sports psychology, ‘aggression’ implies an intent to injure.”

In addition, a coach can no longer—without fear of lawsuits—simply warn his players their sport is risky. Since 1978, Nygaard says, courts across the country have held that a coach must make sure his athletes know, understand and appreciate the inherent risks of their sport.

“It’s no longer sufficient to tell your players that each year maybe ten to fifteen football players are paralyzed nationally,” he says. “You have to somehow get across to them the impact being paralyzed would have on their lives.”

One way to do that is showing a movie like “Warning: It Could Happen to You,” which focuses on the life of Seattle’s Chris Thompson, paralyzed in a high school football game.

Other signs of the times include the removal of trampolines from schools because many companies won’t insure schools against the injuries they cause. Nygaard knows of no Montana schools where powderpuff football has been played by junior and senior high school girls since the Puckett case in Libby.

In addition, a coach or teacher doesn’t dare let his students play games called things like “Kill” or “Jungle Rules.” “You can still play those games, but you have to change their names so they don’t imply survival of the fittest,” Nygaard says.

Exercise professionals not only face a high risk of being sued these days but also must pay insurance premiums that have skyrocketed over the past four to six years, Nygaard says. His own payments have tripled, for example.

Nygaard, author of Sport Litigation: A Casebook and co-author with Tom Boone of Coaches’ Guide to Sport Law, has consulted or been a witness

“The old stereotype of a coach was of a demagogue, a dictator. You don’t dare be a dictator anymore.”

—Gary Nygaard

in about twelve sports injury lawsuits around the country. “I try to work for defendants usually because I think exercise programs are valuable, and I hate to see activities stopped,” he says.

He also developed and teaches the course “Legal Issues in Physical Education and Sport.” “The common reaction to my course is ‘I don’t know if I want to coach,’” he says. At least his students can make informed career decisions by the time they finish his class, he adds.

To his students, as prospective exercise professionals, and to people already in the field he offers this advice: “Know what your legal duties are and how to fulfill them, and make sure that you have at least $1 million of liability insurance and that it covers you for everything you do.”

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Using the past to understand the present is the historian's stock in trade. And UM history Professor Linda Frey is looking through the lens of the past to examine diplomatic immunity, a contemporary problem with ancient roots.

The centuries-old controversy centers on this basic dilemma: To protect its representatives on foreign soil, a nation must offer similar protection to visiting foreign representatives; and a policy that is broad enough to protect envoys from unfair harassment also protects them from fair enforcement of the host nation's laws. So, diplomats and members of their entourages can literally get away with murder.

Such incidents, combined with a general public aversion to any policy that arbitrarily grants special treatment, have made diplomatic immunity wildly unpopular. But the practice persists, Frey says, because it is necessary: It enables nations with conflicting interests to interact under the mutual assurance that their envoys will not become political pawns.

"The problems are immense, but it's hard to think of an alternative," she says. "What's intriguing about diplomatic immunity is that you can't have an international community without it. You've got to have some safety for both representatives."

Frey shares her fascination with immunity—and most other things—with her identical twin and fellow history professor, Marsha Frey, who teaches at Kansas State University. The twins have co-written eight books and are now working on their most ambitious project: a study of the evolution of diplomatic immunity from primitive times to the present.

The book will be the first scholarly work on the history and practice of diplomatic immunity and is intended to bring an understanding of immunity to a broad audience.

"It helps to illumine the problem if you see where it was before," Frey says. "It's a good example of how history can cast a different light on questions than can, say, the approach of a lawyer."

The sisters have been working on the project for three years, traveling frequently to gain access to international collections and archives.
They hope to have it ready for publication by 1991 or 1992. Generally, Frey says, they work on two or three books at a time, but this project is so comprehensive and involving that it requires all of their available time.

"It's a great topic," she says. "It's just full of interesting things. Every time you look at it you see things in a different way. And that's the virtue of it."

Frey, who has taught at UM since 1971, specializes in early modern Europe, from the 1550s to 1789. During that period, she says, European governments began to face the issue of what kind of privileges and immunities should be accorded representatives permanently stationed in a country.

"That issue, then, led me to the idea that I should trace the question backwards in time to find out how we had gotten to where we were in the early modern period," she says, "and at the same time try to trace it forward in time because...the privileges and immunity that exist today are considerably different than those that existed in the 1600s. So it's kind of a genetic approach to a contemporary issue."

Diplomatic immunity has its roots in early religious sanctions that granted safe passage to tribal priests and messengers and has evolved into the complex international system that exists today. The Freys' study traces that evolution, placing particular emphasis on three pivotal points: the formation of permanent embassies in the thirteenth or fourteenth century, the sixteenth-century Protestant Reformation and the 1789 French Revolution.

Before permanent embassies were established, diplomatic exchange was transitory: Representatives of rival nations conducted their business then departed. But embassies established a perpetual foreign presence, forcing nations to cope with the concept of "the enemy within," she says.

That concept grew more threatening during the Protestant Reformation, when religious intolerance clashed with international exchange, causing diplomatic circles to contract. Frey explains. The presence of Catholic ambassadors in Protestant countries, or vice versa, raised tricky questions that often proved impossible to ignore, she says. Officials worried that such envoys might use their positions to advance their religious cause within the host country or protect members of their faith, she says. And chapels within embassies created a distinct problem, she adds: "If you really thought those were rites of the devil, how could you allow them to continue simply because they were behind embassy walls?" The initial response to such problems was to close the troubling embassies, she says.

Another major turning point for diplomatic immunity came during the French Revolution, which epitomized a disdain for privilege that has continued to the present day, Frey says. To the oppressed citizens who overthrew the French aristocracy, she says, "diplomacy smacked of the ancien regime." It was too closely allied with the royal court, she explains, so those who ejected the ruling class also rejected the trappings of diplomacy.

To the revolutionaries, she says, diplomatic exemption from the law was not immunity, but impunity. "It violated the demands of justice for anyone to be immune from anything," she says, noting that those feelings ran so deep that "even the word 'privilege' was banned as a noun. You couldn't even talk about it."

The egalitarian spirit and distrust of privilege that fueled the French Revolution are gaining headway in today's society, Frey says, and "diplomatic immunity has come under a lot of fire lately." Dramatic increases in the number of diplomats and others covered by immunity have aggravated the situation, she says, adding "in the United States alone there are something like 50,000 people who qualify for diplomatic immunity."

Another complicating factor in the contemporary crisis over immunity is the integration of non-European communities into what is essentially a European system," she says. Although the diplomatic community is now truly global, the existing system goes by Western rules, causing misunderstanding and resentment, she explains.

One aspect of diplomatic immunity that prompts heated debate is its vague parameters, she says. For example, should diplomatic immunity also cover diplomats' employees and family members and, if so, to what extent?

In the early modern period, Frey says, a distinction was drawn between acts that were evil in themselves and those that were evil by prohibition. "There was a feeling that everyone belonged to one community and you didn't violate certain natural laws—the laws of God—such as the prohibition of murder. Nothing could exempt you from that." But after the French Revolution, that distinction faded, she says, and now it has disappeared in law as well as in practice. Diplomatic immunity covers offenses ranging from speeding and parking violations to rape and murder.

"It came to be the practice, partially because of functional necessity, that in effect that distinction doesn't exist anymore," she says. "If you're immune, you're immune, even if you commit an atrocious crime."

Controversy over blanket immunity, paired with the volatile nature of international relations, ensures that the practice of diplomatic immunity will continue to evolve.

"It hasn't stopped changing yet," Frey notes. "Maybe that's what makes it such a fascinating topic." 

Indian Law Clinic serves tribal courts

Of the many endeavors of the School of Law, one of the most truly Montanan is the Indian Law Clinic, dedicated to providing law students with experience in working with tribal governments and justice systems.

About 41,000 Indians live in Montana, many on the state’s seven reservations, which together cover a sixth of the state’s land mass. Although Congress has the authority to regulate tribal status, each tribe or tribal confederation is an independent entity with inherent powers of self-government.

"Indian law places an additional dimension in conventional concepts of American federalism," says law Professor Margery Brown, clinic director. Federalism, a basic concept in American government, divides sovereign power among state and federal governments, she explains. But because Indian tribal governments exercise sovereign power as well, jurisdictions often overlap. “People generally don’t recognize the complexity of the federal-tribal relationship and Indian law.”

Law Assistant Professor Brenda Desmond, the part-time supervising attorney for the clinic since 1985, explains that traditional tribal law was rooted in longstanding custom, interpreted through the wisdom of the elders.

Because of its official goal during the 1880s of breaking up Indian tribes and assimilating them into the larger society, the U.S. government undermined traditional tribal law. A principal means was to impose federally created “tribal courts” on traditional dispute-resolution systems.

In the Indian Reorganization Act of 1934, Congress reversed that agenda by recognizing and reaffirming tribal authority to adopt constitutions, elect tribal councils and enact codes of law. Subsequently, Desmond says, the Bureau of Indian Affairs’ implementation of the act caused tribes to adopt variants of a model constitution and a brief code of civil and criminal law produced in Washington, D.C.

"As tribal governments have grown in complexity, these 1930s codes have been seen as inadequate.” Brown says. Within the past two decades, tribal governments all over the country have been revising their legal codes to create legal systems that reflect Indian traditions while enabling tribal governments to conduct their operations in modern times. For technical assistance in revising the codes, judges and officials of several tribes in Montana have called on the Indian Law Clinic at UM.

Founded in 1980 at the request of Indian and non-Indian students who planned to work in the field, the clinic gives students an opportunity to work on problems facing tribal governments and tribal justice systems. Although at the outset a few students represented clients in tribal courts, the clinic now primarily provides research and technical assistance to tribal justice systems and to tribes in constitutional and code development.

“Students can learn trial practice somewhere else, but they can’t learn how the reservations operate and the needs of the tribal justice system” in other programs, Desmond says. Under the supervision of Brown and Desmond, students meet with tribal committees, research various tribal codes, participate in public hearings, summarize code sections and work with tribes to draft new laws.

“We’ve been cautious in the School of Law not to be producing codes of law for these tribes,” Brown says. “We’ve done everything on their invitation.” Tribal leaders develop their own policies and decide what they’d like their laws to accomplish. Then they consult with the Indian Law Clinic on ways to do it.

For instance, the U.S. Supreme Court has ruled that tribal courts do not have the authority to bring criminal charges against non-Indians for offenses such as speeding on highways that pass through reservations. So when the police in nearby towns were not controlling speeders, several tribes imposed civil penalties for traffic offenses. “They had a practical problem and wanted to know if there was a legal solution,” she says.

The clinic’s first efforts in tribal code revision, funded by a series of grants from the BIA and other tribes,
In November 1935, U.S. Secretary of the Interior Harold Le Clair Ickes, seated, and members of the Confederated Salish and Kootenai Tribes of the Flathead Reservation, in Montana, signed the first tribal constitution under the 1934 Indian Reorganization Act.

have focused on criminal procedure, civil procedure, family law and probate. The clinic has also worked on natural resource and regulatory code provisions reflecting the interests of various tribes.

Although the law school has proposed many revisions in Montana’s code, tribal code work involves special challenges because for so many years the codes were unwritten.

“It’s difficult to integrate written codes that may inherently reflect Anglo-American values with traditional Indian values,” Desmond says. Drafting a new code might include hearing testimony from tribal elders on established tradition in a particular area, such as the importance of a convicted criminal repaying the injured party.

In addition to tribal code revision, the Indian Law Clinic helps tribal judges and personnel in professional development.

“Typically, tribal judges are not lawyers yet work in an ever-changing, highly complex field and often don’t have very large libraries,” Desmond says.

In 1986 a group of tribal judges formed the Montana-Wyoming Tribal Court Judges Association, which meets a minimum of three times a year. At least one session is held at UM’s law school. BIA grants cover expenses. UM law faculty and students often speak at these meetings, as do staff people from the tribal courts. Law students have also presented mock trials. Judges request particular topics such as extradition or legal research. After each presentation, the judges comment from their own experience.

“Although we prepare intensively for our presentations to the judges, we recognize that a great deal of the education they receive is from each other,” Desmond says. “They believe that interaction with their peers and additional knowledge will help them make better decisions.”

Tribal courts are under a lot of political pressure both on and off the reservation, she says. Because judges are sometimes appointed by the tribal council, they may face council opposition if their decisions are unpopular.

“To the degree they see themselves as part of a larger group of tribal judges, they believe they will be better able to resist that pressure,” Desmond says. Many tribal judges advocate an intertribal appellate court that they say would support their autonomy. In September 1988 the judges’ association received a BIA grant to study the feasibility of an appellate court, essentially an Indian supreme court for Montana and Wyoming. The judges contracted with the Indian Law Clinic to conduct the study. While clinic students researched Indian appellate court systems in other areas of the country, Brown and Desmond met with tribal councils to explore the issues involved.

“We learned that tribal governments take their tribal courts very seriously as an essential part of tribal sovereignty,” Desmond says. “They’re more supportive of tribal court autonomy than the public believes.”

Still, she says, the venture will be extremely complex because of the distance between reservations and the differing needs of each tribe.

Under a new BIA grant, the clinic will work with the judges’ association to refine plans for the court.

“In its ten years of existence, the Indian Law Clinic has provided a service to Indian tribes in Montana,” Desmond says. “However, in the long run we believe that our students and the law school receive the greater benefit.”
You can set your watch by John Ellis. Just before noon he climbs the fifty-three steps to the third floor of Main Hall, passes through an office that once was a classroom, and walks down a small corridor into another small storage room in the tower where time seems to have stood still.

A narrow flight of worn wooden steps rises almost vertically to a hidden chamber above. The native fir newel post, dating back to 1897, has been polished to a high shine by countless hands. In this room, now hazy with dust, one can almost hear echoes from the past.

It’s easy to imagine the mischief that must have gone on when zealous freshmen would break through the locked door and ring the Victory Bell way beyond the one-hour limit. And if you look up at the ceiling to the left of the stairs, you can still see the hole where the rope used to hang.

Today, the Victory Bell is long gone. Installed in 1903 at the authorization of the Legislature, the old bell was lowered from the tower in 1953 to make way for the Memorial Carillon. So now, rounding the corner at the top of the precipitous stairs, you no longer see a bell, but a clavier, an elevated console that looks much like an organ attached to a metal loom. Instead of black and white keys, the clavier has projecting pegs that are struck by the hands and feet. These
keys connect to rods running up through the ceiling to the bells, reached by climbing a ladder through a trap door. The bells do not swing; only the clappers, linked by the rods to the console, move.

Four days a week Ellis climbs to the tower to play the carillon. Most people, he says, don’t know that the noon-hour concerts are live. “If you took a poll, at least a third would think it’s a tape or mechanical,” he says.

In 1953 the forty-seven-bell carillon, a gift from alumni and friends, was installed with much fanfare as a memorial to former students who died in World War II and the Korean Conflict and in memory of other individuals and groups. Kamiel Lefevere, the bell master at New York City’s Riverside Church, which still boasts the world’s largest carillon, played the first concert on Homecoming Sunday to a 3,000-plus audience.

UM’s bells were forged in Holland by the Royal van Bergen Bellfoundries. The largest bell, the 2,000-pound Alumni Bell, measures four feet in diameter; the smallest is a twenty-pound, eight-inch bell. Like all true carillon bells, they are made of pure bronze—four-fifths copper and one-fifth tin. Their luster comes not from polishing, since polishing can damage the tuning by changing the weight, but from sandblasting. Each bell is beautifully inscribed and bears the university’s seal. Even though the carillon weighs a hefty nine tons, it is considered a light carillon, with a range of four octaves. On Ellis’ wish list are D-sharp and C-sharp bells, the heaviest and most costly bells that were omitted to save money.

The bells were shipped from Holland through the Panama Canal to Seattle, a six-week journey, and then trucked to Missoula in time to be installed for the Homecoming dedication.

Curiously, the Main Hall tower almost seems to have been built for a carillon, although Ellis says that’s unlikely. Carillons were not in vogue in this country until after 1925, when John D. Rockefeller presented a carillon to Riverside Church in memory of his mother. The Main Hall tower stands on its own foundation, which is three feet thick at the base. Its walls are nearly two feet thick at the third story. The bells are mounted on a box-like steel frame. They occupy a twelve- by fourteen-foot room above the clavier and, due to space limitations, are not arranged by size.

When Ellis came to UM in 1969, students had stopped playing the carillon because no money had been put into maintenance and repair. The carillon was, in Ellis’ words, “bubble-gummed and Scotch-taped together” and in such bad repair that the bells were unplayable. “I worked for a few years to get some interest going in rebuilding the carillon,” Ellis said. But it wasn’t until Richard Bowers became UM’s president, in 1974, that progress was made. Bowers had come from the University of Michigan, famous for its carillon, and he wanted to know why the UM carillon wasn’t being played.

In 1977 a $21,122 console and transmission system were installed thanks to the generosity of Bill Gallagher of Missoula, the Oakley Coffee Memorial Fund and others. The bells have been ringing ever since.

Ellis, who is low-keyed about his role as UM’s carillonneur, has been nationally recognized for excellence as a teacher and musician. At the 1989 commencement, Ellis received the first School of Fine Arts Outstanding Faculty Member award, which carries a prize of $500. In 1988 he received the University of California-Berkeley Medal for “distinguished service to the carillon,” and in 1989 the Montana Arts Council awarded him an artist’s fellowship. He has been invited to play carillon recitals throughout the United States, Canada and Europe. In 1986 he played at the House of Parliament in Ottawa.

A native of North Dakota, Ellis holds both bachelor’s and master’s degrees in music from the University of Michigan and a doctoral degree in musical arts with honors from the University of Kansas. He first became interested in the carillon at the University of Michigan after being invited to pull ropes for English change ringing, in which peals of bells are rung in set combinations. Ellis then became interested in the carillon and studied the instrument for three years while at Michigan.

He originally came to UM to teach organ for a professor who was taking a year’s leave of absence. He stayed and taught piano before moving back into the organ department in 1972. He teaches organ, harpsichord and music theory. Usually one or two of his students each quarter study the carillon.

He is also the organist for the Holy Spirit Episcopal Church, a harpsichordist with the Montana Baroque Ensemble and a frequent guest organist with the Missoula Symphony Orchestra. Active in the Guild of Carillonneurs of North America, he is serving a three-year appointment on the Student Advancement Committee, which auditions and approves student guild members.
Most children view the world as a friendly place where trust and emotional ties come naturally. Others learn very early to be distrustful and wary of attachments because no one seems to care about them; they often end up in foster homes.

But University of Montana psychology Professor Jim Walsh and his wife, Roberta, do care—so much so that they spent seven years researching ways to help foster children form long-term, trusting relationships. Their book, *Quality Care for Tough Kids*, is about youngsters like Alice and Louis, who have been so damaged that they have little chance of leading normal adolescent and adult lives.

Alice is an undersized, immature sixteen-year-old with a remote look about her. Born on a ranch in Wyoming to a poor, almost illiterate fundamentalist Christian family, she was half-starved, beaten, overworked and brainwashed by both parents and sexually abused by her father. She was almost psychotic when the state removed her, at age eleven, from her parents. After living in a series of custodial homes, Alice was placed in foster care when she was thirteen.

Louis, an intelligent, handsome fourteen-year-old, was deserted by his mother shortly after birth and adopted by a couple who were unable to have children. By the time he was nine, both parents had become alcoholic. They divorced, and neither would provide a home for him. By that time, the uncertainties of his life had made Louis suspicious and a habitual liar. His first placement with a family broke down because of his lying and inability to form emotional attachments. He’s now in foster care in a group home.

Alice and Louis are two of the fifty Montana children in the Casey Family Program, a private foster care program that uses its substantial resources to help the most needy kids.

Typically the children have had five to twenty placements before entering the Casey program. Walsh says. Many have been battered, neglected, psychologically abused, deserted and institutionalized. They’ve learned to trust no one. They may be withdrawn, surly, manipulative, delinquent or aggressive. They may fail in school or run away from home. Their behavior has a lot to do with the breakdown of previous placements: but each time they move, they continue a cycle of rejection.

The children need stability, Walsh says. If they can stay in one foster family through grade school, high school and beyond, he says, they’ll have a better chance in life.

As a scientist and psychologist, Walsh knew the importance of finding the answers to two important questions: What factors are most important in achieving long-term, stable relationships between the children and their foster families? What can caseworkers and foster parents do to encourage youngsters to establish emotional ties and trust?

The Casey program is an ideal source of data, since it keeps meticulous records and serves children from dysfunctional families to which they have no realistic hope of returning. When Walsh proposed his research, Casey
administrators were eager to cooperate.

Jim Casey, founder of the Casey Family Program, had a hard youth himself. When he was eleven, he had to leave school and work as a messenger boy for $2.50 a month to help support his sick father, mother and three younger siblings. By the time he was nineteen, he started his own messenger service, which became United Parcel Service. After retirement, he established a $700 million endowment for a foster care program for the toughest cases.

The Casey program searches out strong families, pays them to provide a supportive, long-term environment and pays allowances for the foster child's clothing, school expenses, health care, psychotherapy, tutoring and such extras as music or art lessons. Financial aid continues through apprenticeship, vocational school or college, up to a doctorate.

Because of its extraordinary resources, the Casey program has an excellent chance for success, Walsh says. Its caseworkers are highly trained, have reasonable caseloads and are available to counsel parents and children and help solve problems. The generous financial package provides a measure of material comfort for the foster family and child. But children with enormous problems stretch the resources of foster families to the limit, and there are failures.

Casey program records provided the Walshes with detailed information about the background, biological parents, extended family, placement history, personality and development of each child. Social workers kept copious monthly records on each foster child and family. With plenty of data, the Walshes decided to look closely at 282 factors to find which ones predicted placement success.

Their research indicated three areas that seemed most relevant: specific characteristics of the foster family, some characteristics of the child's natural family and some characteristics of the child's developmental history.

The best foster families have a mother with strong emotional stability and a father who presents a confident, masculine role model. Walsh says. The foster parents are good at problem solving, communicating under stress and handling anger. Their home is child-centered. A nurturing, even smothering, environment is preferable, probably because the child has been so deprived of attention in the past. "Veteran couples, those married twenty years or more, provide very good foster families," Walsh says.

The researchers found that natural relatives who are willing to stay in touch with the children, remember their birthdays, take them on picnics or have them stay for a week or two have a positive effect on placement stability. However, if the natural father becomes too involved, he can give the child unreasonable expectations for reuniting the biological family.

Rejection by the natural mother is a negative factor in placement success, and so are multiple foster placements, Walsh says. The child who's bounced from home to home has a harder time settling in one place. Institutionalization, whether in an orphanage, in-patient mental health facility or hospital, also has a negative effect on placement success, he adds.

On the positive side, Walsh found that children who have hobbies or athletic and musical interests are more likely to make a good adjustment. Also, those who seek attention and help from adults, take scolding and punishment without undue submissiveness or rancor, express emotions and demonstrate appropriate heterosexual behavior have better prospects for stability.

Walsh's research reaffirms that foster parents have a complex and taxing job. Here's some advice he'd give them:

- Foster parents should be aware that the child is not going to fit into the family easily or immediately. He or she is "carrying a lot of baggage" into the home. They should be patient.
- The family should be child-centered.
- The mother should feel emotionally very secure. The father should feel confident as a man and as a father.
- The father and mother should be prepared to be deeply involved emotionally with the child.
- They should encourage the child to develop hobbies, musical ability or take part in athletics, if feasible.
- Foster parents should strengthen relationships with whatever natural family the child might have.
- They should help the child feel comfortable about close emotional ties with members of the natural family and foster family.
- They should teach children to laugh, including at themselves, and feel confident in heterosexual relationships.

UM psychology Professor Jim Walsh and his wife, Roberta, spent seven years researching ways to help foster children form long-term, trusting relationships. Their effort culminated in the book Quality Care for Tough Kids.

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UM researcher tackles duck decline

When Joe Ball began studying wildlife biology, he learned that controlling hunting was the key to maintaining the duck population. Now, after eleven years at the University of Montana, the assistant leader of the Montana Cooperative Wildlife Research Unit knows better.

The country’s duck population is taking a nosedive, some wildlife managers fear it may never pull out of, and it’s clear to Ball and other scientists that hunters aren’t the main culprits.

“We have about the same rate of hunting mortality we had back in the fifties and sixties,” he says.

Hunting, it turns out, is less a factor in ducks’ decline than habitat loss and drought. In areas like western Montana’s Mission Valley, predation is also a significant problem. Through research funded by the U.S. Fish and Wildlife Service, Ducks Unlimited and the Confederated Salish and Kootenai Tribes, Ball is gaining new understanding of duck population dynamics that he hopes can be used to help reverse decades of decreasing waterfowl populations.

U.S. Fish and Wildlife Service statistics are startling: There were about 6.1 million mallards in 1989, compared with 10.3 million in 1955. Northern pintails hit another record low in 1989: 2.5 million, down from 9.3 million in 1955.

What’s caused the drastic reduction in duck numbers? “Recruitment (birth) rates have clearly changed a great deal,” says Ball, who for five years has researched the importance of recruitment to the duck population in the Ninepipe area, southwest of Ronan. Assisting him are wildlife biology graduate students Nathan Hall and Denise Pengeroth.

Ducks Unlimited, a non-profit organization dedicated to conserving wetlands for waterfowl and other wildlife, agrees with Ball’s assessment of the cause of the decline. “Years of scientific study and evidence from banding programs (point) to reduced recruitment as the reason for today’s duck population skid,” Managing Editor Mike Beno writes in the fall 1989 issue of DU’s magazine.

UM’s Ball says once biologists shifted their attention from hunting mortality to birth rates, they discovered a disturbing fact: “In many places—in fact, throughout most of the prairie potholes—duck recruitment is in big trouble.”

The pothole region, historically the continent’s most productive duck-nesting habitat, lies in northeastern and north-central Montana; the Dakotas; and southern Alberta, Saskatchewan and Manitoba. A treeless stretch of rolling plains, it’s dotted with depressions formed by glaciers that gather spring runoff and hold it through the summer. The area is the breeding ground for more than half the continent’s ducks, says DU Research Director Bruce Batt.

Ducks flourish with 50 percent nest success, measured by the number of nests in which at least one egg hatches. They do well with even less. But in the potholes, it’s not unusual to have a 10 or even 5 or 4 percent success rate, Ball says. He adds, “Fifteen percent is about what it takes just to barely keep the population stable. They can’t do it at 10 or 5 or 4.”

Each May and June, Ball and his assistants monitor nest success. By dragging a chain between two parallel Jeeps, they’re able to flush nesting hens and examine the nests. Although the chain passes over the nests, damage to eggs or nests is rare because the structures are slightly sunken into the earth and surrounded by vegetation. Damage caused by the vehicles is also uncommon, Ball says.

What the researchers have learned is that despite good habitat—dense, tall grass—recruitment has been poor to marginal in their research area, and the main reason is that skunks have been devouring duck eggs at an alarming rate. Elsewhere, predators include raccoons, which eat eggs, and red foxes, which eat eggs and hens. Losses due to predation by these animals appear to be minor in the Ninepipe area, partly because a few resident coyotes seem to exclude other predators, Ball says.

“Wildlife biologists have always said, ‘If you have good habitat, then you don’t have to worry about predation,’” Ball says. But “what happens is when you create an island of habitat that’s good for ducks, it’s also very good for skunks and other things.”

Small mammalian predators are far more prevalent in the Northwest than they once were. They’ve adapted well to man’s encroachment on wild areas, taking advantage of dumps, culverts, buildings and grain fields.

“In terms of habitat, we’ve improved it for skunks and made it worse for ducks,” Ball says. “It’s a game of hide and seek, and (ducks have) less and less habitat to hide in, and they’ve got more and more things looking for them.”

Indeed, conservationists say man
has destroyed more than half the original wetlands in this country. Even more harmed than small wetlands is the upland cover relied upon by ground-nesting ducks, DU says in a report on the duck depression of the 1980s.

"We need to maintain the habitat that we have and, where possible, secure more habitat," Ball says. He notes that FWS recently bought 1,548 acres of uplands and wetlands around Ninepipe and that many similar opportunities exist in the area.

Besides habitat loss and an increase in predation, drought has played a major role in the decline in the duck population over the past ten years, DU's Batt says. Pintails, for example, breed largely in agricultural areas in shallow puddles called sheet water. For the past few years, there hasn't been any, Ball says.

Ball's research focuses on how the duck population is affected by predation by skunks. His research assistants reduce the skunk population by about twelve skunks per square mile. They then examine the skunks' reproductive tracts to see whether the creatures are producing more young to offset the reduction in their population, a phenomenon common among predators.

Like Ball, DU views predator control as effective on a small scale but prohibitively expensive on a large one. As Batt says, "The solution ultimately has to be to change land use."

In an effort to boost the duck population, Ball's research team has also placed fiberglass and concrete nests above the water that offer hens a safe spot to incubate their eggs. In some cases, ducks also nest in hay bales the researchers have installed mostly for use by Canada geese.

"We're trying to come up with ways (to raise the duck population) that are economically acceptable, aesthetically acceptable and biologically effective," Ball says. Future possibilities include surrounding duck habitat with a low fence to keep out skunks and razing unused buildings in which those creatures seek refuge.

Ball's goal is to double the duck population around Ninepipe over five years. "I think we could do it," he says. "There's little doubt in my mind."

He has reason for optimism, having played a key role in a recent study that nearly doubled the Canada goose population along the Flathead River over five years. The primary tactic was increasing nest success by erecting artificial nests.

So far, Ball's efforts seem to be paying off: Duck nest success in his study area jumped from 20 percent in 1986-1988 to 44 percent in 1989. "If we could hold onto 44 percent, you wouldn't know that valley," he says.

Some people might argue that by limiting duck predation Ball is interfering with nature. But he maintains that man has already interfered with nature by destroying duck habitat and supporting unnaturally high densities of egg-eating predators.

"We've modified the habitat so much that we're simply going to have to manage some areas to favor some species, or we're going to lose them," he says.

Ball's research has drawn praise from wildlife managers, among them Don Childress, wildlife division administrator for Montana's Department of Fish, Wildlife and Parks. Childress commends Ball for his careful documentation and ability to put established facts into perspective.

"Joe has a very good handle on what the needs are in terms of management and how as a researcher he can help pursue the types of information you're going to need," Childress says. "In a state like Montana, where we have lots of opportunities to manage wildlife, that's a key ingredient we need for the future."
Front cover: UM Professor Steve Running and research assistants produced these computer images of the Flathead Lake area, in western Montana. The "control" image represents the area's forest productivity in its current climate. The "2xCO2" image represents the area's forest productivity in a climate with doubled atmospheric carbon dioxide, the so-called "greenhouse effect" that most scientists predict will happen within the next century. Running and his assistants are part of NASA's team to build satellite monitoring tools for studying vegetation responses to the greenhouse effect. (See pages 20-21.) Back cover: This schematic diagram of the Flathead Lake study area shows variations in elevations and precipitation.