Dog Days,
Raven Nights

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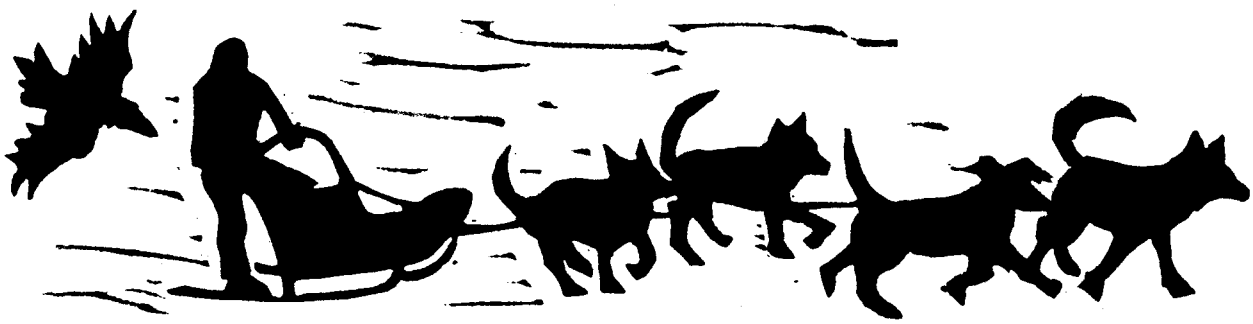
Dog Days, Raven Nights

John M. Marzluff and Colleen Marzluff

Original Linocut Illustrations by Evon Zerbetz

Foreword by Bernd Heinrich



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For Topper, Sitka, Brodie, Kenai, Sky, Buster, and Granite, forever together as a team over the "rainbow bridge." They carried heavy loads with quick feet and happy hearts.

And

For Zoe and Danika, who are shaped in part by our experiences.

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Contents

Foreword

Bernd Heinrich

There are few endeavors fraught with more tension, expectations, joys, and sometimes disappointments than a young researcher starting his or her career, or an older one fearing that his is petering out and suddenly finding a new direction. They generate dreams and spawn adventures that affect lifetimes and that will later be remembered, savored, and finally appreciated. You never know at the beginning what your labors will bring, but you knew back then that you *have* to go the mile or suffer the anticipated pain of possible regret. I believe John and Colleen Marzluff knew that when they left Arizona to join me in Maine at Camp Believe It. We were all captivated by an extremely charismatic bird, the raven, and working in the romantic backdrop of the Maine woods with colorful characters, human and other, living there. What we experienced is, I think, a surprise to all of us. It was at least for me far beyond expectations. It turned into the adventure of a lifetime that went beyond the discoveries we made and that revealed unexpected secrets in the lifestyle of a mysterious animal.

I have been a closet ornithologist probably since I was eight years old, but in my university positions, I had been a practicing insect physiologist. I had "made" my career on the study of the behavior and ecology of bees with reference to their evolution and their energy economy and the physiological mechanisms of exercise and body temperature regulation. But since childhood I have had a love affair with corvid birds and at various times have

enjoyed the intimate companionship of free-flying but hand-raised tame crows, jays, magpies, and ravens. The idea that I could make scientific discoveries from these birds was beyond my ken since I presumed everything worth knowing had already been discovered.

By the 1980s I was starting to run out of steam with my insect work; I had answered the questions I had set out to solve and felt I had mined the major nuggets from my field. I could not see any looming enigma but sensed that there were many small, perhaps mostly repetitive, questions instead, most of which I felt could be solved by rote. But in fall 1984, I was attracted to a moose carcass in the woods near my camp by the noisy calls of ravens, calls I had never heard before. Having worked with bees who recruit colony mates to rich food resources, I was instantly intrigued, because ravens "shouldn't" give away the location of a rich food resource. Ravens are not social like bees. I knew of the raven pair that had nested for at least a decade in a pine tree at the nearby Hills Pond, but I had never heard these calls. Here, in part because of my ignorance as well as my knowledge of social behavior, I knew there was something extremely interesting going on. Could there be sharing behavior by proximally selfish individuals? This would not be a problem like my insect work, where at this point I usually already had a good hypothesis of what was going on at the beginning. Here I didn't have a clue. This mystery was to me irresistible, and I jumped in with everything I had.

It turned into an adventure, and it was the most physically demanding one I have ever encountered. Recently I had run ultramarathons but having had enough of them, I now had energy to burn while seeing the bright light of a potential exciting discovery ahead. After spending part of every week at my camp for four winters, then spending a sabbatical year there (with my tame raven Jack), I felt I had finally found an answer to the enigma. It was pieced together from a large patchwork of observations, "experiments," and inferences from theory and comparative behavior. It was sufficient for a publication. Ordinarily that would have been the end of it. Except there remained the troubling question: although the "yell" calls given at food did attract others,

they could not account for the large numbers of ravens that usually arrived as a group from one direction in the dawn or even predawn. These ravens were nonterritorial vagrant birds that came from communal roosts. But how were they recruited from there, and from how far and by whom? Did the carcass discoverer do the equivalent of the waggle dance that bees did in the hive? Impossible! Here was another looming enigma, but one I doubted that could, practically, be solved.

Serendipitously, Con Slobodchikoff (an insect behaviorist interested in social behavior) invited me to a symposium he had organized in Flagstaff, Arizona. I presume he had asked me because of my work with bumblebees, since that was all I was known for. Instead I talked about my raven work because it involved recruitment, and I knew so little and felt there was much to learn; I needed a sounding board with the corvid researchers based there at Northern Arizona University. There I met John Marzluff. He had attended my talk and had apparently also mined out his area of research, the social biology of Pinyon Jays. Like me, he was captivated by corvids and excited by a good question. I stayed with John and Colleen Marzluff at their home, and I was much captivated by their interest, energy, and enthusiasm. I knew that if anyone could or would solve the recruitment problem it would be they. I think we were so enthused that we were able to "think big"—to talk of making a huge aviary where we would simulate wild conditions suitable to experiments of recruitment from a communal roost. This would be a big project, one I could not do alone especially as I was based in Vermont, where I was tied to teaching duties at the University of Vermont. The logical place to mount this project was in Maine, at my camp, Camp Believe It, where I owned the land and where we could chop down a patch of forest to build an aviary, since the only way to continue was with experiments with captive birds. This project required a huge commitment and a constant presence; John and Colleen, as postdoctoral researchers could and needed to be there with the birds full time. They had now a "perfect" question to try to solve, and it would be theirs.

One of the marks of good research is, I think, that it can be somewhat

predictable but not too much so. As John describes in the pages that follow, we built a huge aviary (the late Eberhard Gwinner, a pioneer raven researcher in Germany, declared it the biggest he had ever seen when he came to visit). The aviary had a large central compartment from which radiated two long corridors ending in smaller side aviaries. We could house a territorial pair of ravens in one side aviary and could hide food with them or in the undefended side aviary for the captive young ravens to find. We made roosting sheds where the birds had perches under protective roofs for use at night. We equipped these communal roost sheds with viewing platforms in the back so that we could observe the birds through one-way mirrored windows. We thus hoped to determine how the food-discovering birds were able to recruit others into and down the long aviary corridors to the food hidden in side aviaries. Unfortunately, this, which I felt was *the* prime experiment of the project, proved to be impractical in the aviary setting. This should not have been too surprising to us as we knew that the aviary context was not guaranteed to be the best platform for seeing natural behavior of all kinds, although it was the only context in which to critically observe and test behaviors. In previous projects, I often ended up doing experiments other than the ones I had originally proposed. This was usually good because it meant that I had to be open to what the results suggested, not tied to my expectations. John and Colleen, by being enterprising and innovative, made the same discovery.

Despite our inability to witness recruitment from the roost within the confines of the aviary, it proved to be an extraordinary tool and a tremendous success. The wild-caught ravens, the shyest and most secretive birds I knew, tamed down quickly, far beyond what I expected, and they could then be observed up close and intimately, while at the same time we could manipulate conditions and, more important, also know the experiences of the individually marked birds. None of this would have been possible without the aviary setting. It was a golden opportunity to conduct many tests, something we did not anticipate at the beginning of our research. I was taken aback when John and Colleen started to "test" what I thought I already "knew." In retrospect, I

should have known better. Almost every experiment led to another one that would divulge something new and unexpected, something that would not have been thought of or conceived were it not for the experiment that preceded it. I was pleasantly surprised and impressed with the cleverness of their experiments and how they revealed the intentions and motivations (mind) of the raven.

Previously I had worked only with wild ravens. I had enjoyed the help and company of numerous volunteers, people who were in it for the adventure but not the science per se, but John and Colleen and I had come together from different scientific directions, and so we complemented each other both in the work and with stimulating discussions. I, having studied insect behavior, had been concerned with the mechanics and function of that behavior; there was never any thought in my mind of an insect acting out of a proximate motivation *to consciously* do something for a purpose. Similarly, I felt the ravens recruited "to" overpower the defenders of food bonanzas as a shorthand, meaning there was adaptive significance to that behavior, which we could demonstrate with a benefit. I did not mean to imply any specific intention whatsoever. The yell calls could simply be a reflex of hungry birds to some stimulus associated with a situation where there was food and where there was a possibility that the presence of others might aid in gaining or maintaining access to it. Indeed, to me the *significance* of the raven recruitment was as a system of sharing based on selfishness. It was proximally based on the selfishness of nonterritorial birds and was ultimately a tactic functioning to circumvent the selfishness of others. To the contrary, however, some people presumed instead that I was proposing that ravens were kind-hearted selfless creatures willing to give up for the benefit of others. I felt it was nearly impossible to know what the proximate psychological reason for ravens to recruit was. John and Colleen, having previously worked with jays and squirrels, and not being dyed-in-the-wool believers that intentions are a taboo topic, were more open to and interested in the proximate reasons for the ravens' sharing. For this level of investigation, the aviary was ideal testing ground, and the new lever that they

applied to the problem was the objectively derived dominance relationships among groups of birds. Ironically, because of the work with the ravens enclosed in the aviary I was later converted; I was led to experiments of perhaps the most proximate reasons of all—not just reflex responses to otherwise arbitrary stimuli, but also behavior in response to what was happening in their heads, such as "insight" and "intelligence." At this point the raven baton has now been passed on, primarily to another postdoc, Thomas Bugnyar, who came to Vermont from Austria, also with his family, and who stayed for three years to work with other groups of tame ravens in another aviary and who is now a professor at the University of Vienna.

The three years that John, Colleen, and I worked together to solve a raven mystery is recounted here in *Dog Days, Raven Nights*. As I read their accounting of our time together, I came to understand and appreciate much more about their personal adventure and unique experiences, not only with ravens but also with the dogs that shared their lives. The good times and often challenging times are laid bare. My love of a good joke and the feel of Maine culture and some of my closest friends since childhood are revealed with fresh eyes. The discoveries and the frustrations of a newly minted Ph.D. and a seasoned professor, the dynamic of a husband-and-wife research team, unique insights into the summer world of blackflies and the winter world of ravens and raven handling, as well as that of dogs and dog mushing, are here recounted. As I reminisce about that time, two decades ago, I see it as one of the great adventures of my life. It is brought back here in often-vivid detail, detail that at the time vacillated between the seeming routine and the still mostly hidden but sublime.

Preface

In 1988 we packed our belongings, bid farewell to the familiar, and headed with our two dogs, Sitka and Topper, from Arizona to a far corner of the northeastern United States. We were embarking on a three-year study of the winter ecology of ravens. The experience taught us much about biology and even more about rural lifestyles, strong friendships, career paths, dogsledding, and each other. Here we weave these themes together as we experienced life in a small cabin in the lightly settled mountains of western Maine. Ours is not a story of wilderness. It is a celebration of scientific research in a remote setting that fully involves, and critically depends on, the local people.

We wrote this book to share our perceptions and discoveries with a wide audience. We hope to motivate young scientists, who like us are following an unknown and tortuous career path, to persevere. We offer this motivation from the viewpoint of a young married couple who worked together to learn. In addition, we aim to teach the interested layperson about an often-misunderstood bird, the common raven, from our unique and personal view of their mysterious lives. For those who love dogs or are fascinated by working dogs and arctic travel, we introduce you to the work ethic of modern sled dogs and allow you to learn with us how to integrate a life-long companion into your work and recreation. Finally, as outsiders who were immediately and warmly

welcomed into a large, extended Maine family, we share with you our understanding of rural life and character. The people of Maine who shared their lives with us are among the most resilient and resourceful people we have ever known. In today's uncertain world, they have much to teach.

Our perspective draws on our years in Maine from 1988 to 1991 and on the two decades since then, after we returned to our native western United States. Our story of those years remains a fresh and accurate picture of a recently married couple just out of graduate school, seeking permanent employment, before children. In writing this book, we draw on the extensive personal journal that Colleen kept and on John's detailed research notes. We clarified impressions and blurry details during a visit to our former abode in August 2008.

Much of the basic biological knowledge that we gained has been published in the scientific literature, and some of the adventure and discovery of our work has been published for the layperson in the books written by our partner in this research, Bernd Heinrich. Here we build on these past efforts by more fully exploring the daily insights we gained into the lives of captive and wild ravens. Our view as young, recently married scientists with an uncertain future and undeveloped connection to the people of Maine complements Heinrich's view as a well-established, single scientist and Mainer. We hope our fresh eyes provide new insights into ravens, the adventure that is field science, and partnerships.

In this book we explore three distinct partnerships: student-mentor, husband-wife, and human-dog. Each has taught us much. The student-mentor relationship is creative but tense, and we illustrate how both of these aspects made us better scientists. The husband-wife relationship is supportive but stressful in tight quarters and demanding work conditions. This personal relationship allowed us to succeed and grow. The human-dog relationship is simply fantastic. Our dogs lightened our workload and our lives by hauling supplies and providing a social, recreational, and humorous outlet.

We write in our personal voice so that you can more fully share our excitement, successes, and failures. To aid in knowing who the "I" is, we include each other in our opening statements and preface transitions to John's voice with a raven icon and to Colleen's voice with a dog icon.

Our adventure and this book would not have been possible without the support of our families, friends, and colleagues who came to visit to see what we were doing and to lend a hand. Tom, Zetta, Jenn, Hilary, Josh, Brodie, Sky, and Jocko Wojcik shared their home and lives with us, making our stay in Maine possible and enjoyable. Henry and Leona DiSotto, Billy and Butch Adams, and their extended family supported us as one of their own. They also were quick to help with our construction, observation, and raven-raising projects. Dave Lidstone was steadfast in his field support and enthusiasm for learning about nature. Stan and Jim Roth, Jim Parker, Rick Ashton, Harry Wycoff, and Wendy and Steve Freschette gave freely of their time to aid our field research. Bernd Heinrich encouraged and supported our research, mentored us as developing scientists, and provided the research and logistical network that was the basis for our work. Although we did not always see eye to eye on the daily grind of science, we remain respectful friends and valued colleagues. Bernd read the entire manuscript of this book and provided thoughtful, timely, and stimulating comments. The U.S. National Science Foundation supported our original raven research and the School of Forest Resources, University of Washington, provided the intellectual and physical space needed to write. Evon Zerbetz enlivened our work with her beautiful linocut illustrations. She sees ravens for all their fun, mischievous, and wonderful selves. Our current students and postdocs, Barbara Clucas, Heather Cornell, Jack DeLap, Laura Farwell, Ben Shyrock, Lauren Seckel, and Steven Walters, as well as Clara Burnett and Joanne Bartkoski, constructively critiqued our manuscripts. Jack DeLap did double duty, also illustrating appendix 1 with a scientist's eye

and artist's skill. Eliza Childs edited our manuscript with a New Englander's eye. Jean Thomson Black at Yale University Press encouraged and improved our writing and thinking, literally helping us to see the book in our story.

John and Colleen Marzluff
Maltby, Washington

Cast Of Characters, Lay of the Land

Our story refers to many people, places, dogs, and ravens. To help readers keep track of our friends and land, we here provide a brief overview. The landscape we traversed in pursuit of ravens and their roosts, as well as in dog races, is mapped. Landmarks to which we often refer are placed on the map for quick reference. We illustrate the groups of ravens we captured, held in the aviary, and eventually released to the wild during three years of research in appendix 1.

People

Russ Balda, professor at Northern Arizona University, pioneered research into the mental abilities of corvids. He advised John's graduate work and employed Colleen as a research technician.

Frank and Don Castonguay, father and son butchers in North Livermore, Maine, supplied an offal lot of what the ravens ate.

Dwight Cram and *Mike Pratt,* state of Maine game and fish wardens, relayed the locations of road-killed animals for raven research and pitched in with construction and field work when needed.

Margaret Cook, a school teacher and sled racer from Boston, bred Siberian Huskies (kennel name Teeco) and mentored Colleen.

Henry and Lee DiSotto, husband and wife who lived in Jay, Maine, adopted John and Colleen into their extended family. They and Lee's three sons, *Butch (Vernon) Adams, Billy (Clifford) Adams,* and *Jimmy (Floyd) Adams* were indispensable research assistants and ambassadors to the Maine culture. Butch was an electrician married to *Nancy,* and together they had two daughters, *Monica and Lindsey*. Billy was a shoe pattern maker married to *Lili,* and they had a son, *Aaron,* and a daughter, *Kathleen.* Billy was deeply involved in all aspects of the raven project, including raising a brood of young ravens in 1989.

Peggy Grant, an early and influential Siberian Husky breeder, owned Marlytuk kennels.

Eberhard (Ebo) Gwinner, a raven expert from Germany, visited Maine.

Ed Hathaway, student of John's in Arizona, close friend of John and Colleen, and Boston native, spent extended stays in Maine helping us finish the aviary and aiding research.

Bernd Heinrich, professor of biology at the University of Vermont, initiated the raven project in western Maine where he was raised. He owned Camp Believe It atop York Hill. *Hilda,* his mother, lived nearby in Jay, Maine. Bernd, who was recently divorced, was often accompanied on raven research trips and visits to Maine by his young son, *Stuart,* and his nephew, *Charlie*.

Dave Karkos was a local newspaper reporter.

David Lidstone was a logger, wildlife photographer, expert woodsman, and volunteer raven researcher.

Carol Nash, a nurse and sled racer from New Hampshire, bred Siberian Huskies (kennel name Canaan) and mentored Colleen.

Jim Parker, John's former scoutmaster from Kansas and an ornithologist specializing in raptors, just so happened to live outside Farmington, Maine, and he helped with trapping and tagging ravens.

Dr. Robert Patterson was veterinarian to John and Colleen's sled dogs.

Patty Parker Rabenold and *Richard Knight,* ornithologists specializing in social foraging, vultures, and ravens, advised us on laporotomies (Patty) and field work (Rick).

Larry Wattles, Anne Moody, and *Buster Nutting* lived near the New Vineyard roost.

Tom and Zetta Wojcik, landlords of John and Colleen, owned Hills Pond Associates and parented *Jennifer, Hilary,* and *Joshua*. All five participated in and supported the sledding and research addictions of John and Colleen.

Harry Wycoff, a local resident who supplied wood for a racing sled, raised a brood of baby ravens in 1989.

Animals

Boo, a sleek black Labrador mix owned by Henry and Lee.

Brodie, a rotund smooth-coated Border Collie of the Wojciks turned sled dog.

Granite and *Buster* were pure-bred Siberian Husky racing dogs adopted by John and Colleen.

Jocko, a noisy African Gray Parrot who lived with the Wojciks.

Kenai and *Sky,* the Siberian Husky pups owned by Colleen and John and the Wojciks, respectively.

Phoebe, Butch and Nancy Adams's boxer dog.

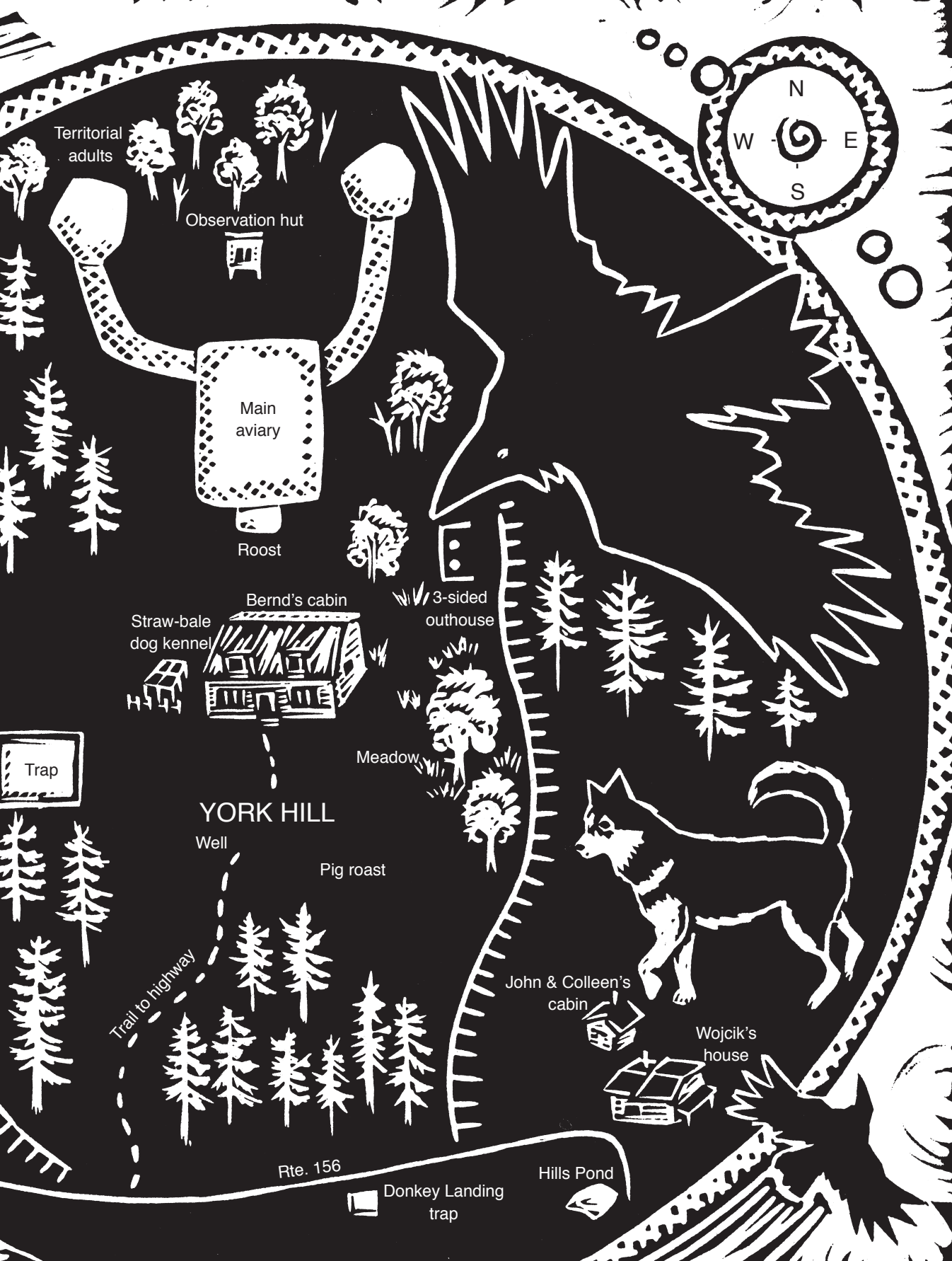
Sitka, John's dog, a smart mix of Siberian Husky and shepherd.

Topper, Colleen's dog, a mutt of various sheepdogs from the Navajo reservation who was prone to wander.

Woody and *Tilly* were pure-bred Siberian Husky racing dogs that John and Colleen often borrowed from Margaret Cook.

Following pages: Western Maine where we conducted our research. Important local landmarks, towns, villages, and research sites are indicated for orientation.


MAINE
Taylor
Hill
roost
New
Vineyard dump
Strong
New Vineyard
Weld dump
Lake Webb
York
Hill
Rte. 156
Bald
Mountain
Wilton
Farmington


N
W
E
S
Territorial adults
Observation hut
Main aviary
Roost
Bernd's cabin
Straw-bale dog kennel
3-sided outhouse
Meadow
Trap
YORK HILL
Well
Pig roast
Trail to highway
John & Colleen's cabin
Wojcik's house
Rte. 156
Donkey Landing trap
Hills Pond

one

Can You Make a Living from a Love of Natural Science?

Our future was visible, if blurry, as we crossed the Lemon Fair River in the verdant forests of Vermont. With meager savings, two good dogs, and new friends, we would apply our life's training to understand a new world. A safety net of friends and family who hosted us as we traveled east from Arizona faded to the southwest. Ahead were the Maine woods, a small cabin, and the secrets of hardy people and crafty birds. Our savings would get us through the winter, and with luck, pending grant proposals would provide support for the next three years. But presently there were no guarantees. We had only hope, hunches, and a deep longing to learn. How did New England's nature work? What were the people like? Can you make a living from a love of natural science?

It was late summer 1988. We were approaching the western mountains of Maine intent on studying the winter behavior of a wild bird. The Common Raven is an often reviled, jet-black scavenger. Its large size, dark eyes, and sable dress suit it well for tending nature's morgue. Provocative, funereal, wonderful, and mysterious, it lives around the globe from arctic to desert regions and temperate to tropical climates. The raven's influence on humanity's language, art, religion, and popular culture is unmatched in the animal world. Despite being familiar and influential, ravens were just yielding to scientific scrutiny, and we wanted to join the hunt to learn more. In the past months we had been consumed by preparation. We developed, proposed, and

tested new ways to study wild ravens. We sorted our possessions, packed those deemed useful in remote field settings, and planned a route across the United States that would enable us to visit friends and sleep cheaply. Finally, our wish for an adventure in a new land with new people and wild nature was upon us. We were convinced that our savings and professional standing were worth gambling. As we drove, reality melted away and adventure began. We were fully in the raven's grip.

Years of study and serendipity had made this trip possible. Colleen and I had met six years earlier as graduate students at Northern Arizona University in Flagstaff. Only three years ago we had married. As a student, Colleen had followed radio-tagged Abert's squirrels around the pine forests to decipher their ranging and feeding habits, gaining experience with this relatively new technology. And she knew animal behavior. As a professional research technician with my graduate mentor Russ Balda, she had investigated the incredible spatial memories of jays and nutcrackers. These small birds consistently outperformed graduate students on standardized tests, remembering the locations of thousands of stashed pine seeds each year. I had just finished seven years of research for my Ph.D. on the behavior and ecology of the Pinyon Jay, a unique bird that lives in large flocks. It was this careful study of a close relative to the raven that brought us to a unique intersection. While arranging a meeting on advances in the study of animal social behavior at Northern Arizona University, we had read an intriguing story about raven societies by Bernd Heinrich. Bernd was known for his work on bumblebees, but his new raven interest fit well with the theme of the meeting. Con Slobodchikoff, who was organizing the meeting, agreed, and we invited Bernd to the meeting. He came and stayed with us. He arrived in summer 1987, looking much like a raven—lean, inquisitive, and carrying far too little for a weeklong stay. He was a professor at the University of Vermont, but he spent as much time as he could at his "camp" in the mountains of western Maine, where he had grown up and where he had become fixated on ravens. During his stay we hit it off

immediately. On long runs in the Arizona pine forest and at home over drinks and meals, we talked with Bernd about ravens and science. We were captivated by his stories of Maine and its rural character. It took little time to convince us that we had to move to Maine to study ravens with Bernd.[1]

Postdoctoral study (or a postdoc) is not uncommon in our field. Few newly anointed Ph.D.'s get real jobs. Instead they flit from lab to lab working with seasoned pros in a sort of apprenticeship. During this time, productivity, especially in grantsmanship and publication, is key. A postdoc may do some teaching, but research is more common. Without the distractions of students and committees, postdocs are free to immerse themselves in a new research environment. This time is not all bliss; old research must be published, new papers must be written, and one's future is anything but settled. Freedom is wonderful, but job security is purposefully absent. Although stimulating, a postdoc is also stressful because one must always be looking for permanent employment while simultaneously proving research ability in a new venue. Postdocs are usually financed with grant money, for which I started applying a year or more before we crossed the Lemon Fair. I wrote grants to study jays in Arizona and Florida, which ultimately were not funded. Bernd and I wrote three proposals to the U.S. National Science Foundation for support that would fund the research and pay our salaries. As is usual for any new idea in science, we were roundly criticized but also encouraged to revise our ideas and try again. Bernd had enough money to gather preliminary observations, get me to Maine for reconnaissance, and provide basic support for the start of our work. From this small beginning and with little assurance of long-term support, I started my postdoc on raven winter behavior.

As little was known about the winter habits of wild ravens, we proposed a combination of field observations and aviary experiments that would build on Bernd's solid foundation. What Bernd saw, but could not fully explain, was quite simple. Usually large animal carcasses or other bonanzas of food left in the snowy Maine woods would be quickly discovered by just one or two

ravens. Often these were mated pairs, and they vigorously defended their valuable finds from others intruding on their territory. But a group, often numbering more than fifty birds, eventually gathered to share the food with the territorial pair. Bernd's meticulous observations suggested that unpaired ravens formed loose aggregations, or "gangs," at foods, which allowed them to overpower the fierce defenses put up by the resident pair of adults. But how did these gangs of vagrants form? Did they actually recruit each other by giving *yells* at the food, as Bernd's playbacks of recorded raven noises suggested? Or were they more like bees, somehow dancing and calling at their communal night roosts to give directions to newly found foods? Why did they share information as apparently valuable as the location of a dead animal that might keep them well fed through the winter? We reasoned with Bernd that if we could catch vagrant ravens, house them in a huge cage, and control their access to food bonanzas, some of which were defended by adults, then we could answer these questions. As we brainstormed over proposals, we converged on the idea of building some sort of cage within which we could have a modicum of control over the actions of our study subjects. But ravens are big, weighing nearly three pounds apiece, and groups of ravens would need considerable space. If we hoped to learn anything remotely relevant to the actions of ravens in nature, we would need a super-sized cage. In it, with controlled experiments and supplemental observations of free-roaming wild birds, we could learn how and why young nomadic ravens share valuable winter meals. Our enthusiasm was endless and our hand-drawn plans fit easily into our proposal, but we were suggesting enclosing an area the size of a city block in wire. Just getting the materials to the site would be difficult. Actually raising the cage might not be possible. But we never considered this. Bernd did not know failure.[2]

Others, however, would require more than faith before they would fully invest. Proving that our concept was sound was essential. To the academic skeptics, Bernd was better known for his work on insect physiology than his

work on bird behavior. But his detailed research on bumblebees in the field easily spilled over to experimental work on birds. He liked to manipulate nature to learn her secrets, punching holes in leaves, for example, to see if chickadees used the damage as a cue to the location of an insect meal. He had also manipulated what he could to learn about ravens. This involved moving dead animals here and there to determine which ravens discovered them, then cataloging the events that followed. I was also hooked on experiments and on using a combination of wild and captive animals to fully understand their behaviors. It was only natural that Bernd and I would build our research approach on a strong experimental foundation. Though an unproven young Ph.D., I had expertise in bird behavior. Colleen's experience with the new technology of radio telemetry and diverse training in animal behavior rounded out our skills. Our expertise and Bernd's experience made a good research team. But we had to show others that we could work together and accomplish what we proposed. We got that chance in 1987 after Bernd convinced the National Science Foundation to seed the project with just enough money to build part of the aviary and test it.[3]

On August 26, 1987, I began to turn our paper plans into reality. I flew to Vermont to meet Bernd and drive to his Camp Believe It in Maine. This trip was my first time with Bernd in the Maine woods, or to state it more accurately, cutting and clearing what seemed to be a significant portion of the Maine woods. We started to work in earnest the minute we pulled off Route 156 (also known as "the Weld Road") at the base of York Hill. We hauled gear and basic necessities, including a fresh-killed sheep for a party the following day, uphill a half mile to Bernd's cabin. The cabin had been unoccupied for several weeks and was musty and dank. We opened the doors to let in fresh air, and gathered wood and started a fire in the old cook stove to dry out the cabin. An old stone well, hand dug decades earlier, was nearby. I dropped a bucket into the well and retrieved it, hand over hand, to fill our water container. As camp life energized the cabin, we began to survey the aviary site.

We pushed our way through underbrush thick as a wolf's winter coat, over rough ground, and around a half-mile-wide grove of young maple and beech behind the cabin. Peering through the dense foliage of hundreds of trees, we could imagine a great cage rising up from the undergrowth. We fired up the chain saw and started felling, delimbing, hauling, piling, and clearing. With Bernd's friend Alice Calaprice and his young son, Stuart, we worked through steaming rain until dark. Coming from an elevation of 7,000 feet in the dry western United States, I wasn't used to the heat and humidity. Progress was slow but visible. The day's work made the bonfire in front of the cabin extra special, and the hard labor softened the scattered logs we sat upon. We were famished and eyed the sheep hanging in the birch tree just beyond the front door. The main carcass was off limits tonight. As a raven first goes for the entrails of a newly found carcass, tonight we would eat only the internal delicacies. Bernd and Alice cooked and shared the liver. Not having an appetite for organ meat, I cut out the tongue. A sheep tongue is not very big, but when skewered with a green maple twig and roasted over a crackling fire it sure is tasty. But it wasn't much, and with no other food in sight, I collapsed in my sleeping bag with a growling stomach and an important lesson learned. One should *never* go into the woods with Bernd without bringing food.

An enthusiastic army of volunteers woke us the next morning. In this part of Maine, friendships are strong and eager to be strengthened with manual labor. Bernd's relatives, former neighbors, and lifelong friends trekked up York Hill, and the work party grew to nearly fifteen. Now we had jeeps and an old military amphibious craft, known as the "coot," hidden for decades in a Maine barn, to do the heavy hauling of wire, nails, and tools up the hill. We had Lee DiSotto's homemade doughnuts, carefully packaged in wax bags habitually recycled from cereal boxes, to soak up the coffee. And we had muscle and skill, from a crew that ranged in age from six to nearly seventy, to clear the forest and construct a unique research facility. It rained all day, but as it grew

darker we saw more clearly. Our work had shaved the ground clean, raised a four-foot-tall base wall of stout wire, or "hardware cloth," that we stapled to the perimeter trees, and perched a first-class observation hut at the height of the land. Supported by strong maples and stout granite, the hut would offer a commanding view of the cage.

Now it was time for a real Maine party. Wired to a sapling, the sheep had been roasting above a wood fire most of the day, carefully rotated above the smoke and fire by Charlie, Bernd's nephew. It smelled heavenly. The beer was cold and plentiful. Our knives were sharp. When the sheep was laid whole on the picnic table, we all rushed in to cut off a hunk. In this research, we may not have been able to eat our study species, but we sure did eat like them. Sitting on logs with the sun setting, we ate, drank, and told stories. Jack Daniels and Johnny Walker made an appearance, but it was the friendship that kept us warm. This was truly the social fabric of the Mainers I met: hard work, honesty, support, and celebration.

We spread our sleeping bags across the cabin floor and slept deeply. The cabin rocked with the gas and snoring fueled by the sheep and beer. The following morning we nearly finished the observation hut and secured flexible "chicken wire" above the hardware cloth base to create fifteen-foot-tall walls around most of the main aviary. By midday, the Mainers returned to their homes, and Bernd headed back to Vermont. I was able to stay a few more days and finish up a few tasks on the aviary and hut. Sunday was warm and sunny, and I enjoyed a dip in Alder Brook in between hanging tarpaper on the hut and unrolling wire for the cage roof. Just readying the roof for the next gathering—unrolling and arranging the springy chicken wire on the forest floor—took me more than a full day. The Ruffed Grouse were constant companions, and I began to explore the orchards and woods around the cabin. As I prepared to leave on Wednesday, September 2, the first corvids (the family of birds that includes crows and ravens) inspected the aviary. Not ravens, but Blue Jays. As they perched along the new forest edge they called in apparent

disgust. I hoped they would understand. I went back to Arizona already longing to return to Camp Believe It in the Maine woods.

Bernd followed up on our first week of work by organizing two more cage-building parties during autumn 1987. By the time winter frosted the wire, a sealed aviary was ready to be tested. I flew to a snowy Portland, Maine, for three weeks in February of 1988. Colleen remained behind in Arizona, where she ran our dogs in their first dogsled race. Practicing my skills as an absent-minded professor, I left my driver's license in Arizona. As a result, the rental car I had reserved was unobtainable. Thankfully, Henry and Lee DiSotto answered my phone call and were more than happy to brave the winter and drive eighty miles to meet me at the airport. We figured Henry could rent the car and we would be off. But to rent a car one needs a driver's license and a credit card held by the same person. Henry, who lived within his means and not his credit, had the license, but he did not use credit cards. After hopeful negotiations with the rental car attendant failed, we figured I didn't really need a car after all. Henry and Lee would just take me to the cabin and three weeks later take me back to the airport. They would happily provide any other support during the research visit as well.

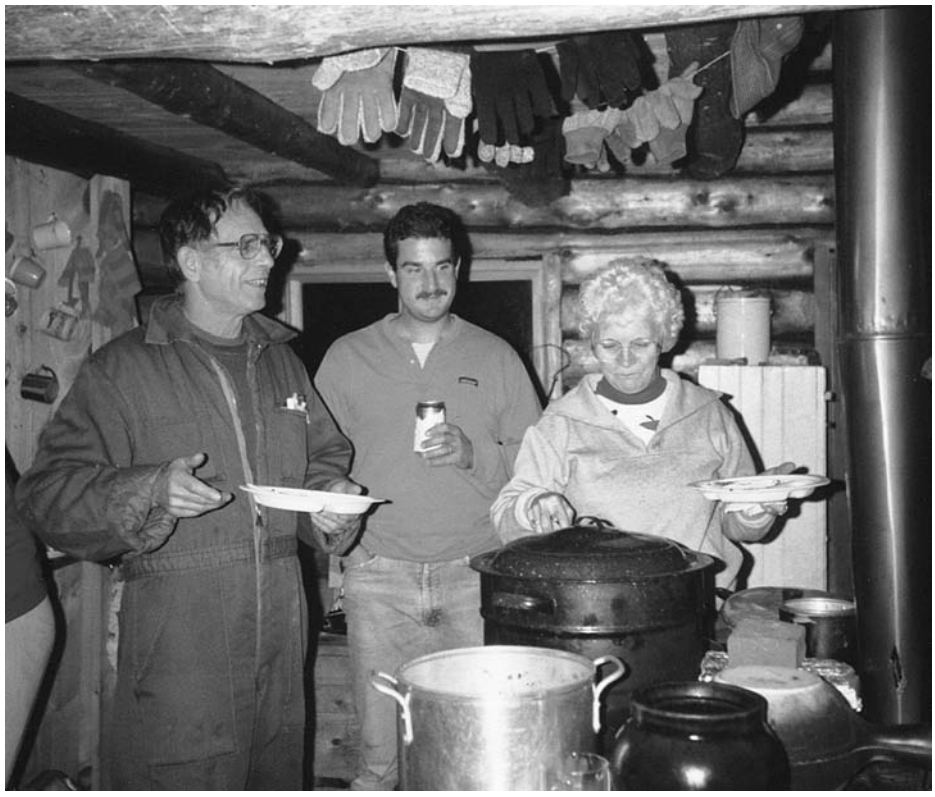
Although they had met me only briefly the previous summer, Henry and Leona (Lee) DiSotto treated me like a long lost son. Driving in the dark from the airport, we decided that I should stay the night at their house and go to the cabin early the next morning. Henry and Lee lived appropriately enough in Jay, Maine, seventeen miles from the cabin. Their house was a typical New England–style home, sprawling, with all parts connected together, even the barn (now a garage). Between the house and barn was the "summer kitchen," with many windows so air could flow through on warm summer days when Lee would do her canning. There was a black iron pump handle that drew water from a century-old, hand-dug well right inside the house. When they first moved in, the two-story, four-hole outhouse was still standing. It was now long gone, but the hand-hewn, wide pine flooring and ceiling planks of the

house date to the original construction, finished nearly two centuries earlier in 1793. The upstairs was like a museum. Lee had collected antiques over the years and furnished the rooms as they would have been in 1859 when the town of Jay used it as the "poor farm," allowing four families to survive their struggles within its sturdy frame and fertile acres.

Lee was the matriarch of a very extended family, which grew by one that night. With white hair, a soft smile, and twinkling blue eyes, Lee was the ever-ready hostess, always eager to expand her family with newcomers. When Bernd Heinrich's family settled in Maine in the 1940s, Lee and her first husband, Floyd Adams, welcomed and nurtured them. A young Bernd was befriended by the Adams boys and quickly became a fourth son. Eventually, Bernd bought York (aka Adams) Hill from Floyd. Lee and Floyd had divorced decades earlier, leaving Lee to raise three young boys alone.[4]

Henry had married Lee and adopted her boys nearly thirty years before we came to know him. Times were challenging for a single mother of three, and Henry made sure the boys had presents under the Christmas tree even before the marriage. He worked for International Paper in the mill's warehouse in Jay. His demeanor was a product of hard work and service to his country during the Korean conflict. As a boy he had cut lake ice for refrigerators, and he spent his early years wrestling cordwood from railcars to the International Paper pulping vats. Working his way up to his current position as a crew boss in charge of loading finished paper onto trucks, Henry was union, and the union was now on strike. It had been for eight months (since June 1987). Between puffs on his cigarette, Henry was always joking. But his humor was only a thin cover for a deep concern over America's growing corporate greed. He knew the importance of the common, working American and would tell all listeners his views. As the strike raged, the union hall became his workplace. But whenever we called, he lent his wiry frame to the cause of science.

During that first winter visit, research went well. Bernd and I practiced catching and handling large groups of ravens in the trap just east of his cabin.



Henry (left), John, and Lee gather around the cook stove in Bernd's cabin for a hot dinner after a day of construction on the raven cage. Wet gloves dry above the stove.

We tested the aviary, which worked beautifully. Twenty ravens shared some of their secrets with us during that time. They fed as a tenuously cooperative group. Fights broke out, but only rarely because a strict pecking order guided their actions. Like barnyard chickens, ravens have dominance hierarchies that allow valuable resources to be shared without repeated, and potentially harmful, bickering. I observed and easily measured dominance status as one bird excluded another from choice food or a central feeding spot. Just as my larger dog, Sitka, would exercise her dominance over Colleen's smaller dog, Topper, with a growl, snarl, or stare, a dominant raven's sharp jab of the beak or direct

gaze to a subordinate reinforced its claim and caused the weaker bird to cower, fluff its feathers, and back away.[5]

We were able to peer deeply into raven life. We began to decode basic signals, for example, the sharp loud calls that sounded like *yack,* which signaled that a subordinate was displaced. By observing the situation, or context, associated with the variety of calls given by our captives, we might come to understand the meaning of the hoots, yells, quorks, woops, kaws, knocks, gurgles, barks, clucks, rattles, and drips that filled the air wherever ravens roamed. Even behaviors rarely seen in nature were common in the aviary. After eating their fill, the ravens frequently rolled in the snow to bathe and played tug-of-war with sticks. These aspects of raven social life reminded me of our dogs and of young wolves that endlessly chase, tug, wrestle, and roll in the snow.

Two of the adults we had captured, apparently an established pair, were in constant contact, grooming each other like monkeys, calling in duet fashion, and defending food as an efficient team. Many of the younger nonbreeders in the cage, especially the most dominant ones, also seemed paired up. They often courted and preened one another. Rather than fight for dominance status at food, these paired birds appeared to have a joint status. Was the male's status conferred to the female or did females have their own hierarchy? Perhaps our observations could refine views of bird social relationships, much like detailed observations of individuals within wolf packs were refining our understanding of pack structure. No longer do wolf biologists describe wolf packs as simple organizations where an alpha male sits atop a chain of subordinates from the alpha female to the omega pup. Modern descriptions characterize packs as extended families co-led by a dominant, mated pair and several of their offspring, with flexible status relationships among themselves and with their parents. In the aviary, we would be able to determine the relative influence of individual character and the character of one's associates on a raven's status.[6]