Greater Yellowstone

On Hopeful Geographies and Whole Ecosystems

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The Tetons and the Snake River (1942) Ansel Adams. Photo Courtesy of the National Archives and Records Administration, Records of the National Park Service.

The night of autumn equinox, under a full moon, a friend and I drove out to the edge of the Teton Range, an abrupt juncture where the mountains drop to meet the Snake River valley. We rolled down the car windows and followed the calls of bull elk to a meadow, where the outlines of their dark shapes moved among the night shades of gray. I turned the car off and zipped my coat up to my chin as we listened to the elk sift through the grasses, stopping to lift their necks and release that other-worldly bugle. We could not see their antlers hit, but heard them crack in the night.

This time of year as the world swings us into the dark, we find ourselves alongside these mountains because the cool air expands us, the animals remind us we're animal, and because hope can still be found in geologic time. A Shoshone friend once showed me a fasting spot positioned atop an impossible cliff in these peaks, which makes me think that these mountains have struck us in similar ways for a long, long time.

I am not alone in this sentiment. The names "Yellowstone" and "Grand Tetons" conjure up images of grizzly bears and geysers, great jagged mountains pushing still upward, glacial lakes reflecting their grandeur. In popular American geographical imagination, this part of the world is one reserved for wild, untrammeled lands. An advocate for wilderness, Wallace Stegner wrote, "We simply need that wild country available to us, even if we never do more than drive to its edge and look in. For it can be a means of reassuring ourselves of our sanity as creatures, a part of the geography of hope".[1]

A patchwork of national park, national forest, designated wilderness, tribal, and private lands, the Greater Yellowstone Ecosystem is one of the largest nearly intact ecosystems in the lower 48 United States of America. More conservative ecosystem boundaries (originally defined as the range of *Arcto arcturis*, the grizzly bear, and later expanded) estimate its size as 73,000 km^2, slightly smaller than Scotland[2]. More generous boundaries, or jurisdictional boundaries defined by county lines, scale the ecosystem up to 145,635 km^2, a size larger than England[3]. Either way, its coverage is substantial, extending outward from its hubs: Grand Teton and Yellowstone National Parks.

Yet the ecosystem exists outside of popular imagination. It is *not* just a place where "man himself is a visitor and does not remain" [4] as the Eastern Shoshone and Northern Arapaho tribes well know, along with the 30,000 residents of the city of Bozeman. It is inhabited, managed, explored, and has been for as long as Shoshones positioned themselves on these peaks, perhaps longer.

Two friends of mine, filmmakers who work for National Geographic, admit they spend hours editing out roads, telephone lines, and human structures from their films on Greater Yellowstone. I suspect most tourists, in their digital snapshots, aim away from the roads. Are we honest with ourselves? Is our romanticism (as "absolutely American" as our national parks[5]) overshadowing our ability to see the ecosystem in its full complexity? In its breadth of human and environmental relationships?

Is it still enough to drive to its edge and look in?

Greater Yellowstone, a Peopled Place

My own early memories of the region are commonplace. I drove north from Denver with my family on summer vacation, 1982, tallying up the number of Wyoming's antelope to pass the time on the great sage plains, watching the oil wells impatiently pull up and down on their black metal ropes. Train cars, which I counted, looked the same and went on forever, just like everything else, and I ranked Wyoming somewhere between the Texas panhandle and Kansas cornfields on the boredom scale. But then we drove over Togwotee Pass and the jagged Tetons appeared over the Continental Divide. As we were descending toward the Snake River, I saw the first moose of my life: a great black bull with algae hanging from its antlers. Dad pulled the car off the road and my sister and I reached for our new Kodak cameras, as did everyone else in the pile up of cars. When, two weeks later, we drove the same roads back to Denver, I'd filled three rolls of film and was sporting a new Yellowstone t-shirt with a little black bear on the front. I'd photographed bears, moose, mudpots, my family next to Grotto Geyser; and best of all, my sister peeling a leach from her thigh.

As mysterious and wild as we imagine it to be, Yellowstone is anything but unknown. Over 3.3 million summer visitors took similar trips between April and August of 2010[6]. Yellowstone's summer visitation exceeded twice the population of Idaho, more than three times the resident population of Montana and six times the population of Wyoming[7]. With an average of just over 26,000 visitors a day in July, people were the second most abundant large mammal in Yellowstone outnumbered by 30,000 elk (wolves number just 100, black bears 500, and bison 4700) [8].

Certainly parts of Yellowstone deserve their remote, untrammeled status, and this remoteness is essential in maintaining populations of, for example, wolves and grizzly bears. Most visitors do not wander far from the main loop roads. Yet the sheer numbers of people, *increasing numbers* of people in the park point out the obvious: this is a peopled place. And here our geographical imagination splits from pure physical geography. Is our relationship with the park what we imagine it to be?

Behind every film on Yellowstone is a film crew filming it; wolf statistics are collected and analyzed by a research crew. Home values tip the scales along the boundaries of public lands; suburbs creep into lodgepole pine forests, which we *know* will burn. As bison that wander out of Yellowstone Park are killed because of conflicting livestock interests, as we struggle between three states to manage sustainable populations of wolves, as rural residential development increased 350% between 1970 and 1999 (and overall population increased 58%)[9] we must consider: is it possible to manage this ecosystem effectively and still imagine it without people in it? Does our inability to reconcile wildness and humanness threaten the ecosystem itself?

And what if we consider the human spirit? What is our world if we imagine it to be pockets of wonder in a known world? What if, like Yellowstone's wolves and bison and bears, we wander beyond our map of ourselves?
Have we drawn our boundaries too small?

Greater Yellowstone, a Laboratory

Researchers, and particularly ecologists, biologists, and geologists do their fair share of wearing tire troughs into the endlessly heaving, cracking, constantly deteriorating roads of the national parks. Each summer researchers flock to Yellowstone to better understand its nature. In a quick search of Web of Science, over 1200 articles with the topic "Yellowstone" appear between the years 2005 and 2010 and cover everything from bison to hybridizing cutthroat trout, hydrothermal fluids and blister rust in western trees. Yellowstone is

one of the best places to study the way the natural world behaves without human influence, which becomes increasingly valuable through the repetition of our measurements.

At age 25, I became a member of this cadre of scientists. As a field assistant for a fire ecology research team, I spent a summer field season studying the mosaic of fire across this landscape. Our crew would awaken at five in the morning (to beat the traffic into Yellowstone), eat a fast breakfast as we caught glimpses of the double image of the Tetons and their reflection turning lavender on Jackson Lake, load our equipment, and drive to our research sites, which were sometimes up to three hours away, and still in the parks.

The days were full of measuring, collecting, and counting: the diameter of trees at breast height or identification and coverage estimates of understory. Yet some days stand out: the bear cub following us to the car or the bull bison wandering in and settling down on the far end of our transect, thereby delaying our work. (We drove to Old Faithful, bought a "Moose Tracks" ice cream and watched tourists creep way too near a bison for a photograph: a spectator sport.) I still occasionally dream about a night when I was assigned an all night shift with the infrared gas analyzer. In my dreams, as I recall that night, some lumbering animal comes in closer and closer as I sit there alone in the dark.

That summer was my first real research field experience and I struggled to connect how counting a 50 meter transect of new trees in burned fire stands helped us understand concepts like dynamic equilibrium. Why, exactly, did it matter whether each lodgepole pine tree had open cones or closed cones, and did we *really* need to count so many thousands of them? It is only now, ten years later, and after research of my own that I fully appreciate that work, not for the excitement of bears or bison in our plots, but for the concepts our research directors tried to understand. Monica Turner and Bill Romme, the principal investigators of our research team, were (and still are) central to the American landscape ecology movement (a movement that started in Europe) that complicated the ecological narrative of ecosystem function. Alongside many other scholars, they studied large landscapes and repositioned nonlinearity and threshold dynamics as central to ecosystem process. Ecosystems did not evolve to a certain steady climax; they burned, flooded and heaved. The 1988 fires were, perhaps, not as unusual as they seemed, though they scorched a third of the park. Ecosystems, they found, were dynamic and heterogeneous across a landscape, behaving differently on different scales. Bill Romme went so far as to suggest that equilibrium may never have existed in the fire mosaic of forests in Yellowstone. Despite the human tendency to believe in increasing order, these forests may be part of a nonsteady-state system, fire serving as a repeated, transformative force of change.

This idea was an uncomfortable one. The wilderness of the Rocky Mountains had become my refuge from a world that was too mad and too much. It represented, for me, an unhuman order where even the violence of a wolf devouring an elk calf made sense and maintained a kind of balance. This no longer felt true. The world now struck me as more creative than balanced, and organisms interacted to co-create an uncertain future. Perhaps, in stepping over Stegners edge, I had sacrificed my own equilibrium.

Greater Yellowstone, a Home

Despite my delight in discovering *Vaccinium scoparium* (or, perhaps more accurately, its delicious grouse whortleberries), and discerning the size of the tiny tooth of a leaf that distinguishes *Fragaria vesca* from *Frageria virginiana*, I did not find Dorn's 24 ways to describe the hairs on a plant as riveting as my colleagues (not to confuse strigose with strigillose, tomentose with tomentulose). Creighton trained to be a botanist, Tania a landscape ecologist, but I took a different turn.

A year later, and as part of my masters degree at Schumacher College in the U.K., I returned to Greater Yellowstone for a different research project. I was hired as an intern to conduct initial research for an initiative at Montana State University intended to build water education programs in tribal

communities of the Missouri River Basin. My assignment was to spend the summer with Beau Mitchell, a Chippewa-Cree, as we traveled to American Indian reservations interviewing tribal members about water: what did they want their young people to know. I remember the first long silence of our summer. Beau and I were driving across the sage plains toward the Fort Peck Reservation. He asked me, from the passenger's seat, "So, do you have any Indian friends?" I shook my head and said no. I asked, "Do you have any white friends?" He said, "Not really." I looked back through the windshield at the long two lane road.

On our last trip together that summer, after merging a strong friendship traversing the north of the state, Beau and I followed the well worn roads through Yellowstone and Grand Teton National Parks southward into Wyoming, this time not to photograph or measure attributes of the parks, but to use their roads as a conduit. The same road I took over Togwotee Pass as a child, where we spotted the Tetons and photographed a moose, drops on the Continental Divide's eastern flank and runs through the Wind River Indian Reservation. With Beau, I experienced my first childhood trip in reverse, climbing from the Tetons over the Continental Divide, and winding down through white bark pine and spruce-fir forests into the arid badlands, where the Wind River runs a green ribbon of vegetation through red eroding soils and those same great sage uplands I thought would never end.

The interviews we conducted at Wind River were similar to others that summer, though specifics certainly differed between tribes, among them Blackfeet, Sioux, Assiniboine, Crow, Northern Cheyenne, Gros Ventre, Chippewa-Cree, and (at Wind River) Eastern Shoshone and Northern Arapaho. Despite the growing number of interviews behind us, I was not accustomed to them. Beau and I had watched people cry as they remembered valuable river bottomlands flooded for hydropower by the government in the 1940s and 1950s. We heard, "Water is a gift, not a right," referring to the convoluted water law of the West. But most unsettling to me were the juxtapositions: people would express their concern over the health effects of groundwater contaminated by uranium tailings, and then tell us about the dangers of swimming near water spirits. For the first time in my life in the United States, I stopped at a gas station and asked if I could drink the tap water. The attendant said no, and motioned toward the bottled water. I was astonished. And paranoid. Where, exactly, did the water monsters live?

Flora Crazythunder, Northern Arapaho, photographs the Wind River Basin through her windshield.

An Implicate Order?

At the end of the summer, I loaded my car and drove back southward to Denver, where I would catch a plane back overseas. I stopped in to see my old fire ecology research crew on Jackson Lake the week of the Perseid Meteor shower as I drove south. Dan took out his guitar and we all gathered on the dock as the sun set. His music drifted over the still water of the darkening lake and meteors began to streak their trails of light across the sky. I did not talk much about my summer. Though the Wind River Reservation is located just over one mountain range to the east, the paired research experiences were worlds apart.

As I lay in my sleeping bag outside that night, my discomfort left me sleepless. Why could anyone drink out of a water fountain at Old Faithful but not Fort Washakie? Did the water spirits live only on the east side of the Wind River Range? I'd picked up a brochure at the health clinic on the reservation that said life expectancy that year was 49. Could that possibly be true? Forty-five percent of the community of Arapahoe lived below

the poverty line, and 43 percent in Ft. Washakie, the main Shoshone community[10]. The grizzlies and wolves wandered the whole region, but was this really one ecosystem? How could this be one place?

I had been reading Brian Goodwin and Lynn Margulis, but the words of physicist David Bohm comforted me that night, "True unity in the individual and between man and nature, as well as between man and man can arise only in a form of action that does not attempt to fragment the whole of reality." I would spend the next ten years trying to pull these fibers together.

Selective Complexity

Unbeknownst to me that summer, I was to spend the next decade working on the Wind River Reservation and with the tribes. The National Science Foundation fully funded the Native Waters program the next year, and my summer internship of 2000 became an assistant directorship and extended through 2005. I eventually left that program to conduct my own PhD research, an investigation of riparian vegetation along the Wind River. It is only looking back that I realize this research combined those two enormously influential summers of 1999 and 2000: vegetation and water, culture and ecology.

The philosophical questions I grappled with during those summers of 1999 and 2000 are still the ones I struggle with now though I like to think the questions are better articulated. Much has happened in the last decade as I work alongside many, many others to understand the role of people and their unique relationships with place in ecosystem change (or "linked human-ecological systems"). The National Science Foundation now funds several "Native Science" initiatives, recognizing that tribes' ways of investigating their world are different than those of traditional science and just as valid. Conversely, "Traditional Ecological Knowledge" investigations incorporate traditional ways of understanding the environment into Western, more mainstream, ecology. I like to think the two worlds are reaching toward the best of one another.

Ecologists and economists began to publish articles on human-environmental systems and their dynamics of the Greater Yellowstone in the 1990s, finding that private lands in Greater Yellowstone are particularly vulnerable to growth and development. They found that the most significant reasons for locating in these areas were "the environmental and ecological amenities, the scenery, outdoor recreation, and the pace of life" [11]. Proximity to airports and the education level of the general population were also found to be significant, attracting retirees, wealthy young adults and professionals in service industries. [12] "Nothing symbolizes the new West more than a mountain valley formerly used for livestock pasture and/or irrigated hay production, now punctuated with massive log homes perched upon the upper hillsides on parcels ranging anywhere between 10 and 160 acres," write Jackson and Kuhlken[13]. Ecologists have found that the patterns of this amenity migration threaten ecosystem function, since certain populations (from grizzlies to yellow warblers) and disturbance dynamics (for example, fires) extend beyond boundaries of parks and protected areas. Land use change outside protected public lands may "rescale" the ecosystem, decreasing biodiversity and altering ecosystem processes. [14]

This research is essential, and offers a critical analysis of an enormously important component of the ecosystem: ecosystem-wide growth since 1970 (when Landsat imagery became available). This research acknowledges ecological complexity: threshold dynamics, disturbance, the "rescaling" of ecosystems, but social complexity is oversimplified. For example, cited recent human growth patterns are not at all evident on tribal lands, which cover the same area as Yellowstone National Park[15]. Moreover, the tribes regulate hunting differently on their 2.2 million acres of land, managed for just 1000 hunters; they maintain an area declared roadless years before the U.S. Wilderness Act was passed in 1964 and currently pursue free roaming bison herds on tribal lands, in direct contrast to state policy[16]. Surely several cultures, lifestyles and preferences exist in a land area the size of Scotland or England, and perhaps their diversity is what's preserved the wildlands and wildlife of this place.

A Hopeful Geography?

Sometimes I think that roaming grizzlies and the prized wildlands and wildlife they represent, may be one of the few things connecting this ecosystem, aside from the roads. Greater Yellowstone is deeply fragmented in our minds and across the land. Its public lands (68 percent of the ecosystem) are managed by the National

Park Service, the Forest Service, and three different states; its private lands are urban and rural, ranches and ranchettes that cover almost one third of this place[17]. Even tribal lands can be divided into allotted, tribal and fee. Economically, regions remain distinct, an extreme affluence and extreme poverty of which the grizzly is unaware.

We recognize complexity in ecological systems. We core trees to their center and reconstruct the dynamics of fire. We sense that, on some scales, equilibrium never existed. Yet we fail to recognize that cultural dynamics may operate with their own thresholds, heterogeneity, and disequilibria that must shape ecosystems in the same dynamic way. We are of this world. We are products of ecosystems.

That influential summer of 1999, when I worked with my fire ecology crew in Yellowstone, I drove to a gear store near the base of the Tetons to buy long underwear. On the wall, above the cash register, again was that well-known Wallace Stegner quote attached to a mountainous picture, "We simply need that wild country available to us, even if we never do more than drive to its edge and look in. For it can be a means of reassuring ourselves of our sanity as creatures, a part of the geography of hope." I memorized the quote on the spot, and still keep it nearby in my memory's cache. (Stegner's wilderness letter is a treasure.) But it is not enough. First, protected areas do not provide enough land to sustain many wild populations. Second, they alone do not support the breadth of the human spirit, in which we relate to our world as "part of the environment of trees and rocks and soil, brother to the other animals, part of the natural world and competent to belong in it." [18] In addition to wilderness, where we should not remain, we need to perceive ecosystems as sustainable homes. We cannot live in extreme fragments of reality and strive for an inhabitable future.

Earlier this summer, a friend and I stood in a meadow of Red Rocks Lakes National Wildlife Refuge in the northern part of the ecosystem. In the place where trumpeter swans were saved from extinction, we watched a family of short eared owls in the shadow of a storm growing in the west. The patches of shade cast by the clouds on the mountains were changing, instead, to windows of shrinking light as we watched the owls fly low over the blowing grasses, hunting rodents. An owlet tried to balance on a thistle head as it bobbed in the wind, toppling and regaining equilibrium.

I remembered to myself the Shoshone word for Burrowing owl (din-zy-daysh) "prairie dog's brother in law", a word that indicates that the split between social and ecological is not a given (kingfisher is "water's big brother", sandpiper "coyote's son in law") [19]. If, as Bohm writes, "both observer and observed are merging and interpenetrating aspects of one whole reality, which is indivisible and unanalysable," shouldn't we value perspectives that exemplify these social-ecological links? Shouldn't we, for example and at all costs, ensure the survival of the Shoshone and Arapaho languages as we did the trumpeter swan and grizzly bear in our ecosystem? With less than 150 speakers, Arapaho is expected to disappear from the world in less than 15 years, and Shoshone from the ecosystem.

As we watched the owls, in mid-July, the Arapaho Sundance was taking place, the sacred start of the tribe's new year. I thought of the special summer reservation hunt reserved for Sun Dance meat and contrasted it with the controversy of whether hunting should be allowed at all on the Red Rocks Lakes National Wildlife Refuge. Do we really know the land if our ethic is leave no trace? Do we know land through our photographs? Do we know land if we look at it? Or if we eat it and hunt in it? Really, what's more sacred, dry meat or a Polaroid? How must we touch our world to know our god(s)?

We cannot envision ourselves separate from nature or separate from one another. Even an ecosystem as large as Greater Yellowstone cannot survive with such severe, and false, distinctions. While certainly parts of the ecosystem must be reserved for wildlife alone, these boundaries, statistically, are not enough. As Michael Pollan writes, "…we need, and now more than ever, to learn how to use nature without damaging it. That probably cannot be done as long as we continue to think of nature and culture simply as antagonists." [20] We *can* touch our surroundings without destroying them. As Yi-Fu Tuan succinctly writes, "The human presence, contrary to the message of the more hysterical environmental literature, has not always and everywhere impoverished the earth." [21] We can co-create a future, among wolves and hunters, immigrants and residents, English and Arapaho, water spirits and fishing holes, bison *and* cows, as long as we

recognize and touch one another, difficult and controversial as this may be, dynamically merging and interpenetrating. There may be no predictable future, no single equilibrium.
Isn't this a geography of hope?

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