Saguaro and the octopus: Exploring natural history through personal essays and illustrations.

Beth Peluso

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The Saguaro and the Octopus: 
Exploring Natural History Through Personal Essays and Illustrations

By

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Presented in partial fulfillment of the requirements
for the degree of Master of Science

The University of Montana
Spring, 2002

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5-31-02
Date
Scientific research into biology and geology and other -ologies often contains fascinating stories, such as how the Missouri found its current bed, or why buffalo gnats bite. But the stories, more often than not, stay sealed in scientific journals and language. Only a few people hear them, which is a sad fate for a good story.

This collection of four essays and eight paintings intertwines natural history with personal narrative in an effort to make natural history accessible and relevant on an individual level. The concentration and patience required for observing the natural world, both artistically and scientifically, can serve as a tool to make people more aware of a sense of place. In turn, this sense of place can lead to questions about how humans relate to the world around them. These essays are connected by the thread of exploring the natural history of new places and the personal reflections those explorations generate. The paintings represent a different method of exploration of landscapes and their inhabitants. Instead of gradually revealing a place over the duration of a written story, they present images that can be comprehended in an instant, mirroring the impact of seeing a place first-hand. These two methods complement each other to give a fuller vision of the landscapes I explore than would be possible separately.

In the end, I hope to stir up curiosity with paintings and writings such as these. At least enough curiosity for people, if not to run out and start snooping around the natural world on their own, to think more deliberately, observe more carefully, and to realize that when you start erasing the details, the whole picture becomes that much more faded.
Acknowledgments

This project represents a shift in the focus of my life, and I would like to thank my committee members Donald Snow, Hank Harrington, and Marilyn Bruya for their knowledge and talents. Hank introduced me to the world of natural history literature before I knew I wanted to be a part of it. Don has been a sensitive and excellent editor for the past several years, finding themes and ideas in my writing I didn't know existed, and encouraging me to risk bringing those ideas to light. Marilyn helped me dust off the principles of painting I had forgotten I knew, with the result that I feel I've made enormous steps in handling the difficult and sometimes cantankerous medium of watercolors.

I would like to thank my parents, Tom and Linda, and my siblings, Karen and John, for their support and confidence in my talents, even though they were never quite clear on what exactly "environmental studies" entailed. Thanks also to Rebecca Lawrence and Deborah McArthur for their enthusiasm and laughter in our many adventures through the terrain of graduate school and Montana. And thanks to Brett Walker for keeping me afloat in these final months of writing when I wasn't sure I would make it.

Parts of my graduate studies were funded by an Erasmus Scholarship from the Philosophy Department, by a Ron and Nancy Erickson Scholarship from the Environmental Studies Department, and by helping to organize the Environmental Writing Institute.
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Introduction:

Observing Like a Painter

I came to graduate school because of a quotation book. Well, more like one quotation book too many. I worked at a book publisher after college, one of the few people I knew employed in the same field as her Bachelor's degree. Of course, studying literature didn't prepare me for thinking in picas instead of inches, or writing book specs, or schmoozing with sales reps. (We actually published a book about schmoozing, written by the man who was the original Ronald McDonald. I didn't read much of it.) The company booklist fell across a variety of genres: self-help, parenting, a series of romance guides (written, ironically, by the most self-absorbed, egotistical man I have ever met), a cookbook, corporate inspiration. This last category contained a book called *The Wisdom of Wolves*, written by an author who may have watched a nature program once upon a time. He was signed to do a whole series, which never materialized, including a book called *The Wisdom of Eagles*. I always wondered if he realized bald eagles are mostly scavengers that pirate food whenever they can. An appropriate metaphor for the business world, but hardly inspirational. And they published quotation books. Witty quotes from women, quotes about how to have a happy office life, quotes about cats, and my personal favorite, quotes from Dan Quayle.

After working about a year, I began volunteering at a prairie restoration site. Once a month we ventured out onto several acres of forest preserve district land to pull invasive weeds or collect native seeds. I looked forward to those Sunday mornings, donning gardening gloves and pulling garlic mustard out by the roots, or hacksawing down European buckthorns. The buckthorns were remnants of an old farm, planted as hedges but now gone feral, reaching girths of six or seven inches and heights of fifteen feet. They grew in thick coppices, blocking out native hawthorns and oaks. Late that summer and
into fall, while autumn brown rustled the grasses, I learned the names of prairie plants as we collected seeds. Compass plant, which turns its one broad leaf to face north-south to minimize water loss. Big bluestem, also called turkey foot, the state grass of Illinois, that grew higher than my head. Little bluestem, boneset, rattlesnake master, mountain mint, and blazing star with its shoulder-high sprays of violet flowers.

Some of my clearest memories of working at the publisher were of leaving the office. When it was warm enough, I would walk a few blocks to the small Des Plains River (it was the Midwest, so you pronounce all the S’s) that flowed through the center of the suburb and read on the banks. My favorite route to the river led past a rose garden. I made a point of passing it nearly every day, especially in the spring when the buds first appeared. Trite but true, domestic roses are one of my favorite flowers—I like the complex nesting of the petals, the way the buds unspiral as they open. The plants grew lush and tall, blooming all summer, cloud white, blood red, scarlet-tinted peach, pale yellow. Sometimes the gardener would be out snipping twigs or pulling weeds. She told me she had planted the two isolated bushes at one end of the garden the day each of her granddaughters was born. The oldest girl was talking now, and would demand to see her rose whenever she visited.

One drizzly spring afternoon, after visiting the roses, I heard the faint, far-off trumpeting of sandhill cranes. I stopped in the middle of the sidewalk, scanning the gray clouds until I could see, just barely, the thin black brushstrokes of the cranes. They flew under the clouds, a V of six or seven, their course unwavering, pulling spring behind them. I watched as long as I could, and then listened a little longer. I wondered where they were headed and how long they had been in the air that morning. My coworkers were uninterested in these sorts of things. The mediocre books I worked on were more of an exercise in marketing than good writing. Those books had nothing to do with the world of grass and cranes, and that was increasingly where I wanted to be.
These essays and paintings are my way of shaking off the last cobwebs of three years in a place where packaging, not craftsmanship, mattered. My way of thumbing my nose at the people in my past who said my only worth was how much unpaid overtime I was willing to donate for another collection of things people had already said.

These are stories about looking for the content of places, about being engaged with the natural world and using that engagement generate reflection. On the surface, the topics of the essays seem as far from each other as the Rockies are from the sea: the fish of the Great Barrier Reef, glaciers in the Canadian Rockies, saguaros in the Sonoran Desert, swallows in the Missouri Breaks. What binds the essays together is the form—exploring new landscapes through natural history and science, and then looping that information back into questions exploring what I envision as internal landscapes, questions about being human.

Scientific research into biology and geology and other -ologies often contains fascinating stories, such as how the Missouri found its current bed, or why pronghorns can run twice as fast as anything alive that wants to eat them. But the stories, more often than not, stay sealed in scientific journals and language. Only a few people hear them, which is a sad fate for a good story.

I find that the way I come to know a place is to lean close, examine as many parts as I can, and learn the science behind why the details work the way they do. When I step back again, the whole landscape has a depth and character that it didn't before. I learned the process from painting—where you break everything down into shards of color and line, marking the interplay of light and shadow and how they express texture. When you're finished, you step back and see the whole scene again but not in the same way. You know that the brown of the river actually contains purple and green, and you've studied the shape of that shadow so minutely you know every inlet and peninsula well enough to draw a topo map. Those examinations still resonate when you view the whole again.
Taking the time to sit still and observe, to be open to color and form, to learn from and question the workings of a landscape, those are the subtle tools of natural history. Learning how to apply these tools externally easily slips into examining less concrete places. Letting questions well up about where water hides in the desert or the childhood of the Rockies, I find myself also wandering the cliffs and canyons of my mind, trying to figure out how I fit into what surrounds me. What course do I really want my life to take? How do we perceive time? How do life and death interact on a sunken ship? This is the true value of studying natural history: trying to understand the rocks and plants and animals stirs up questions about what it means to be human, and more importantly, a human situated in a specific place.

I do not claim to be wise, just curious. Curiosity leads to poking under rocks and sneaking up on birds and watching shadows melt in the morning sun. It means asking questions and learning to know a place, to investing some of yourself in it. Tangling your psyche up with a place generates concern about what happens there, how other people choose to interact with it. I had never heard of the Missouri Breaks before canoeing through them. Now the name draws my attention whenever it appears in a newspaper or on the radio, like learning a new word that suddenly pops up in everything you read. My hope is that, by painting and writing pieces like these, I stir up curiosity. At least enough for people, if not to run out and start snooping around the natural world on their own, to think more deliberately, observe more carefully, and to realize that when you start erasing the details, the whole picture becomes just that much more faded.
Diving the Yongala

There are no landmarks in midwater. I'm glad for the security of the descent rope, even though it prickles my fingers as my hand slides down it. The current pulls the columns of bubbles I exhale slantwise as they shimmy to the surface. In a free descent, the current could tease me off course, and with visibility at twenty-five feet, I wouldn't know until I reached bottom. The wreck of the S.S. Yongala slowly gathers itself into a shadow below my fins. I begin to catch darts of yellow from below as we near the wreck. We reach the top edge of the Yongala about forty-five feet below the surface, then sink to the sand at ninety feet, the deepest dive I've ever done. Ribbons of small fish twist up and over the ship's surface, flowing to the other side. Overhead, schools of larger fish, tuna perhaps, circle the wreck. A stingray ripples along the sand. Over the years, the metal hull of the boat has grown multicolored flesh of soft coral, anemones, and whip coral. It is the most exquisite tomb I've ever seen.

In her life above water, the Yongala chugged up and down the eastern coast of Australia, shuttling cargo and passengers from Melbourne to Cairns (pronounced "cans"). An elegant, modern steamer, she could carry two hundred first- or second-class passengers, who could wander among smoking rooms, staterooms, drawing rooms, and dining rooms awash with electric lighting. She boasted three engines, able to muscle her 350-foot-long bulk up to a speed of fifteen knots. But she carried no radio.

On March 23, 1911, the Yongala headed out of port just ahead of a cyclone (Australian for hurricane) warning. As the sea grew increasingly rough, the captain had two choices: either stay in the shipping lane sheltered by the Great Barrier Reef, which required precise navigation even in calm waters, or head seaward and ride out the storm...
in the full fury of the open ocean. The lighthouse keeper on Dent Island was the last person to see the Yongala as she steamed directly for Townsville, battling roiling hills of seawater.

For several days after the Yongala failed to arrive at her scheduled port, relatives of the crew and passengers hoped the ship was simply holed up in a cove, perhaps patching up some minor damage. Then debris began washing ashore—chairs, a traveling trunk of women’s clothing, the bloated and shark-eaten body of a prize racehorse that had been tethered on deck. Boats fanned out along the coast in one of the most extensive searches in Australian marine history. After several weeks of searching, increasingly for remains instead of survivors, the boats reluctantly returned home. The relatives of one hundred twenty-one people had to be satisfied with the epitaph "lost at sea."

The Yongala rests on one side, so the deck looms as a nearly vertical wall above where I kneel in the white sand. Life covers the entire surface: antlers of hard coral, brilliant blue starfish, entire beds of gently waving crimson sea anemones. For a moment, I don't move, spellbound. I try to slow my breathing, to feel the cool oxygen/nitrogen mix fill my lungs at each breath, so my tank will last longer. Everything around me is in motion, but all I can hear is the hiss of inhaling, the burble of exhaling that is as much a tingling of my lips and teeth as a sound. I fiddle with my buoyancy vest until I hover just above the sand, slightly rising and falling with each breath. I look up to see my sister Karen and cousin Julie also adjusting their buoyancy, knees barely kissing the bottom, their long dark ponytails swaying to the same rhythm as the anemones. This is the first wreck dive for all of us, so the divemaster will play tourguide and make sure everything goes smoothly. It seems odd, that we pay to be underwater tourists at a place where people died. At the same time, the sea life flourishes so thickly and brightly here, it blurs the sharpness of that decades-old tragedy.
Resurfacing
The fourth diver in our group is taking the advanced diving class on the ship, and we wait for the divemaster to finish a brief skills test with him. Back on the deck of the diving boat, the student had to guess what pressure would do to an egg at ninety feet. As the divemaster breaks an egg into the water, I hear the cigarette-roughened voice of my dive instructor back in Iowa—add another atmosphere of pressure for every thirty-three feet of water. Instead of the egg spreading out, the weight of the water holds it in a small globe. This intrigues a large, mottled-brown grouper. The divemaster cracks another egg in front of the fish. After a moment, it opens its thick, fleshy lips and sucks in the egg. Both of my fists would fit in its mouth, with room to spare. When no more eggs appear, it turns and paddles leisurely into the distance.

Karen and Julie drift to the wreck to peer at the coral. I float up a little to get a closer view of a clam. Its shell is open, exposing frilly purple insides as it feeds. I pass my hand over it, and it snaps shut. I hesitate to touch anything—the coral looks too delicate and I don't know which anemones leave painful stings. The divemaster has almost finished administering the test when an olive sea snake undulates towards us. I'm a little surprised to see one this deep, since they have to surface to breathe every ten to twenty minutes. This doesn't seem to concern the sea snake. Unhurried, it twines around the divemaster's ankle, just above the bone, flicking its tongue against his skin. I'm a little jealous of such close contact with the snake, wondering how smooth the scales are and if the diver can even feel the snake's tongue, but also relieved. Sea snakes are among the most venomous creatures in the world. They are also near-sighted and curious, which means they have a habit of twining around a diver's leg or arm or air hose. Usually non-aggressive, when they do bite, they can choose not to release any venom—just a warning nip. I don't find this the least bit comforting. I'm still not at ease with my position somewhere around the middle of the food chain in these tropical waters. The snake decides the divemaster isn't food or another snake and glides away.
For nearly forty years after she sank, the *Yongala* slowly clothed herself with coral and fish. During World War II, she briefly ghosted across the radar screen of a Royal Australian Navy minesweeper clearing the shipping lane. They labeled the object a shoal, not entirely a misnomer by then, and continued on their way. In 1947, the shoal was reclassified as a nameless wreck. Finally, in 1958, a Queensland underwater research group, using SCUBA for the first time, raised a safe and identified the wreck as the *Yongala*. After squabbles in the 1970s about scavenging rights, the *Yongala* gradually became domesticated by pleasure divers. The reward for decades of anonymity is a set of buoys anchored to the bow and stern, permanently marking her position. The Australian Historic Shipwreck Act now protects her from further souvenir hunters. My divemaster succinctly summed up the rule, "People died in there, so be respectful and don't go inside."

The divemaster motions us forward, and we begin our tour with slow, strong kicks. I clasp my hands near my waist in standard diving posture, as much to avoid the temptation to swim with my arms as to streamline myself. After a few flailing attempts to steer with my arms on the first dive of the trip, I learned to change direction by flexing or arching my back. It isn't a quick way to turn—usually it takes a few kickstrokes to reorient—but definitely more efficient than breaststroke. And efficient motion means using less air, which means longer bottom time. Julie swims past with the same slow deliberateness and clasped hands, putting me in mind of a nun on a meditative stroll in a flower garden. Except the nun wears a neoprene wetsuit and the flowers refuse to stay still. Little half-yellow, half-violet fish—royal dottybacks I think—catch my attention as they wander just above the coral. When I swim too close to one, it seems to teleport to safety: one moment it's above the miniature forest, the next it's peering out from behind a coral branch. It isn't even breathing hard. The dotty's speed reminds me I'm a tourist here—I can't even snap my fingers that fast underwater.
The hatch covering the cargo hold is gone, allowing me to steal a look inside. In one corner rests a bathtub covered with a rime of coral and shellfish. A butterfly fish with yellow fins and a black spot near its tail swims below, at a right angle to what I've been thinking of as vertical. I wonder how far it ventured into the belly of the ship. Maybe it wandered its cockeyed way through a corridor of staterooms, picked at the detritus covering the hairbrush and hand mirror of a long ago passenger. Perhaps they belonged to the middle-aged woman I read about in a book from the dive ship's library, who boarded the Yongala the day it sank, on a trip to see her grown children up north. What would that woman think now, watching a fish nuzzling her belongings? Would it have made her last thoughts any easier, knowing how much life the sinking ship would come to hold?

The Yongala bedded down eleven miles offshore of Cape Bowling Green, and about twice that distance from the Great Barrier Reef. Many reef species are homebodies as adults. So how did the coral and fish cross the distance to the wreck? Hard corals usually reproduce by cloning. However, one night out of every year, in late spring, the corals of the Great Barrier Reef release pink clouds of eggs and sperm into the water. The whole mass floats to the surface, where the fertilized eggs become mobile larvae. After a few weeks of drifting, they settle onto the ocean floor and begin new coral communities on any open surface, such as a newly sunken ship. Many other species, including fish, also have a plankton-sized larval stage that drifts to a new home on the ocean currents. In this way the Yongala became a self-sustaining reef, even though it rests miles from the nearest outcropping of the Great Barrier Reef. This isolation allows easy access for open water creatures, resulting in a riotous concentration of species from both habitats that draws divers like a lodestone. Eagle rays and sea turtles mingle with clams and parrotfish. In comparison, the reef display in the Townsville aquarium looks like a desert.
As we pass a carpet of scarlet sea anemones, the divemaster brushes his hand across it, leaving a swath of white where the anemone blanches in distress. He pauses over a little nook, the sort an anchor chain may have passed through, and motions us closer. He feints a poke at the creature inside, and it takes me a moment to realize it's an octopus. It writhes in displeasure, flushed an irate carmine, rows of fingertip-size suckers appearing and disappearing. Karen and I grin at each other around our mouthpieces and clap our hands, our own personal sign language for "isn't that amazing?" Intrinsically, diving carries an odd sort of isolation: you can't talk underwater. I find it almost unbearable when something spectacular swims past and my dive partners are just out of fin-tugging or shoulder-tapping distance. Even smiling or laughing with SCUBA gear takes practice. After a few mouthfuls of saltwater, I learned to shift my grip on the mouthpiece from my lips to my teeth when I smile, and to laugh with my lips pressed to the rubber. Karen, Julie, and I all memorized the standard diving hand signals: thumbs up, swim surfaceward; thumbs down, swim bottomward; hand palm down, rotated side to side followed by pointing at your ear means you're having trouble adjusting your ears to the pressure. Functional, but hardly expressive. We've developed our own system of signs and charades over the past few days. "What in the world is that fish doing?" (point and shrug). "Look at how gracefully that sea fan moves" (point and mimic the swaying with your hand). "Sea snake!" (point and slither your arm in the water). But anything more than simple observation has to wait until we return to the world of air.

I roll onto my back a moment, watch my bubbles rise toward the silhouetted schools of fish tracing circles against the surface light. They seem so far away. Did the woman in the stateroom see a school of fish swirling above her, backlit by the Yongala's fizzling electric lights, the moment before she drowned? Was there one instant when she saw even a sliver of the vibrant world I see now? My chest suddenly feels too small for the air I didn't know I was holding. I exhale hard, breathe deep. Once. Twice. I turn rightside-up, force a few strong kicks from my legs to catch up with the others.
Flustered (Octopus)
Julie looks back at me, then points at a moon wrasse, her favorite fish. Before this trip, I didn't know fish came in day-glo colors. The football-sized moon wrasse nosing among the coral sports a bright, watermelon pink on its belly, fading to vivid purple near its back. Narrow chartreuse stripes run from mouth to tail along its sides, topped by a broader stripe along its spine. It allows me close enough to see the fine turquoise stripes on its bottom lip, the same color as its fins.

I try to approach fish watching as I do bird watching, noting stripes and spots, color and size. However, reef fish biology is bizarre enough to satisfy the most outlandish science fiction writer, and visual cues are anything but straightforward. At first, it seems simple enough: male and female wrasses, like many fish on coral reefs, are different colors. This is also common in birds. But birds don't change sex. For many reef fish, such as wrasses, parrotfish, and angelfish, changing sex is a normal part of their life cycle. Some species change from female to male, others from male to female. For some, like parrotfish, it's simply a stage of maturation—when they reach a certain size, they change color and sex. Occasionally, though, an individual will only change color, a sort of piscine cross-dresser. For other species, behavioral cues trigger the change. In one species of cleaner wrasse, a male has a harem of females, one of which is dominant. When the male is removed, the dominant female changes sex and is able to spawn as a male within fourteen days. So Julie's brightly male-colored moon wrasse may actually still be a female, at least for another week or two. The vocabulary of coloration isn't limited to once-in-a-lifetime change. Some fish shift into breeding colors, which can be different for males and females, only when they're ready to spawn. Others even change color if they're communicating aggression, fear, or submission. To add to the bewilderment, many reef fish have completely different juvenile colors, sometimes even body shapes, than they will as adults. In some cases, juveniles and adults of the same species were mislabeled for decades as separate species. So I admire the moon wrasse as it dawdles away, marveling
that the sense I rely on underwater, sight, isn't very reliable at all, and can in fact be as misleading as judging distance in midwater.

We round the bow to swim along the exposed flank of the wreck. Someone has carefully cut all of the sea growth from the letters of the ship's name, the only bare surface I've seen. Diving superstition says it's good luck to touch the letters. All of them, or it doesn't count. I wonder if this is true for all wrecks, or just this one. There's no sign language for that question. I dutifully line up single file behind Karen and Julie as the divemaster leads us through the ritual.

Y. As I brush my fingers over the old, smooth paint, I realize it's the first thing I've touched since leaving the descent line.

O. What an odd course this ship has steered: transportation machine, fish house, tourist attraction.

N. How can it be good luck, touching the name of a drowned ship? It almost seems like a child's dare, to touch the name on a tomb and flee back home to light and warmth.

G. Yet this grave holds more permutations of life per square foot than I have seen anywhere else. Angelfish the size of my thumbprint, groupers the size of Samsonite suitcases, and everything in between. And the colors, lemon yellow, turquoise, scarlet, violet, royal blue, it's like swimming through a shattered prism.

A. Does it wrong the memory of the dead, being brimful of awe at the non-human life of this place? Is the reef worth the cost of one hundred twenty-one souls swallowed in a storm?

L. My visit will leave no impression on the creatures here. At the most, they spent a few fin-twitches moving out of my way. They do not know that the walls and crevices of their home were once filled with air and human voices. It is a world they cannot imagine, as the people who died here could not imagine the world under the waves.
A. It is only an accident of time and technology that I am able to return to the surface after kneeling on the ocean floor. But maybe, like the fish-namers, I'm looking too much at the shape and color of the place, missing the true nature. Splitting into categories what shouldn't be split, creating species out of stages by trying to pool my allegiance only with the dead or the living, the human or the non-human. The wreck rests here because humans gambled on technology, the strength of a few engines, to save them from the raw screaming power of a storm; a risk I share on a smaller, gentler scale, with my bottled air and valves and hoses. We try to protect ourselves with fragile gadgets in an element not meant for humans. The ocean creatures transmuted human loss into a gamble of their own, whose thriving results have drawn me on a pilgrimage into an alien element. It was an accident, that loss of human life, and the only reason I consider it ill luck is because it was an accident in human proportions, one I echo by slipping beneath the waves. If I could, I would take the hand of the woman from the stateroom and guide her to the ascent rope, bring her back from lost. Maybe that is the best I can give them, the one hundred twenty-one dead: a shadow of remembrance on the face of joy ninety feet down, that I will lift to the surface with me when I return to where the breeze brushes my skin.
Works Consulted


My first afternoon in the Sonoran Desert of southwestern Arizona, I forget to bring water. Actually, I choose not to bring it, partly because unearthing my backpack would involve unpacking the entire backseat, and partly because I'm curious about what will happen. I won't be going more than a mile away from the car, and it's spring, still a mild eighty degrees. It just doesn't seem worth the effort. After driving twenty-two hours straight from Missoula to where Organ Pipe Cactus National Monument hugs the Mexican border, I can't stand another minute near the car. My traveling companions are two of the twelve Field Ecology classmates I barely know. They seem pleasant enough, just not given to extended conversations. At the moment, we don't seem to have anything but car space in common. It was a very long twenty-two hours. Hiking sounds splendid.

The three of us strike out across the pebbled ground, between the fluted columns of saguaros, stopping when something catches our fancy. I have to keep catching up after being distracted by a spider web in the elbow of a cholla cactus, or the mysterious pipings of birds in a palo verde. I start getting thirsty after a half hour—I don't feel particularly hot, maybe a little sunburned around the edges, but the dry air draws the water through my skin without my noticing. An afternoon breeze kicks up, delighting me by playing different songs on the thorns of each plant species. The saguaros sigh long whispers. The sprays of ocotillo, tipped with orange flowers, plink as their hidden thorns catch on each other. I stride over to my classmates, excited to tell them how the thorns sound, but they're engrossed in a discussion about the Latin name of a small shrub. I can't imagine the sound of the wind being a useful tool to categorize plants. I keep the thorns to myself. Standing next to a poster-worthy saguaro with two perfectly curved arms, I crane my neck and watch the trunk and limbs wave ever so slightly. It seems odd that such a massive
plant moves at all in the faint wind. I can easily imagine one of the arms snapping off in a 
high wind, or the whole cactus thudding to the ground in a storm. After two hours, the 
back of my throat feels like dry wood and a dull headache has lodged in my temples. My 
fellow hikers stop at regular intervals for a conscientious sip of water. I'm too stubborn to 
 beg a drink from one of them. Back at the parking lot, I gratefully drain half a liter of car-
heated water. All right, I think to the desert, lesson one learned. Water is always worth the 
effort.

Driving to our campsite, I can't help but interpret the fantastic saguaro shapes in 
terms of other things, like you do with clouds: a sprinter, a madcap octopus, a ship's mast, 
a nuclear family of mother and father looming over a child. But my anthropomorphizing 
only overlays my amazement at what they have accomplished strictly in plant-terms: 
many of them tower three times my height in a climate where the average rainfall is nine 
inches a year. After we set up our tents, I dive into my A Natural History of the Sonoran 
Desert and a few of the other reference books in camp. Unlike me, saguaros don't have to 
worry about forgetting their water bottle. They, like all cacti, cope with water scarcity by 
storing it in their tissues—a strategy called succulence. Their pleated sides expand to hold 
water, rounding out when full. A large, saturated saguaro can weigh up to eighty pounds 
per foot and consist of 90 percent water. With so much water, why don't they simply flop 
to the ground like large green earthworms? Near our campsite, I saw something I'd never 
thought about before: a saguaro skeleton. It was still upright, a cylindrical arrangement of 
close-fitting, inch-wide slats of wood. The remains of the saguaro's flesh slouched around 
the base like a stretched-out black sock. In a living plant, thirteen to twenty of these 
woody ribs are embedded near the center of the stem, providing the support it needs to 
reach its ponderous weight forty feet into the sky. Sometimes the ribs remain, revealed to 
the world at last, long after the softer parts of the saguaro disintegrate.

The first night in camp the full moon repaints everyone in shades of silver and 
black, throws stark shadows under the tables and behind the saguaros. Only the brightest
constellations successfully fight their way through the flood, Orion, the Big Dipper, Cassiopeia. The Milky Way washes away; even the Little Dipper struggles to shine through the moon's torrent of light. The sun set at 6 p.m., folding its warmth away and tucking it below the horizon. I'd half jokingly packed long underwear, and now am thankful for another layer. We finished dinner at dusk, cleaned up, and I listen to the chatter, occasionally tossing in a comment or two. As the moon distances itself from the horizon, I spend more time looking out over the solitary towers of the saguaros on the hills. There is something soothing about the space between them. Eventually, even the four students who have been entertaining us all evening with their banter falter, and everyone drifts off to their tents.

I lie awake for a little while, skimming the events of the day in my mind. The song in the thorns. A few of the dinnertime biology jokes whose humor escaped me. I feel like I'm here under false pretenses. My background is in writing and painting. I knew when I signed up for the class that the sole purpose was to complete a field study and then write a scientific paper. I convinced myself that it would be good to write in a different discipline, would help me to understand the scientific mind. But really, all I wanted was to see a desert for the first time.

I wake up just before sunrise. The dawn chorus of birds is just getting underway. First I hear the two note whistle of curve-billed thrashers, like someone calling a disobedient dog. Not long after comes the soft "what?...what?" of the phainopepla nesting behind my tent. Soon all the birds chime in: the liquid notes of black-throated sparrows, the quarrelsome laughter of gila woodpeckers, the whika-whika of Gilded Flickers, the locust-like chirring of cactus wrens. Between nine hours of sleep and the avian commotion, I decide to shuck my sleeping bag and go for a run.

I head down the road toward the visitor's center, then break off onto the gravel surface of Puerto Blanco scenic drive. I only enjoy running if the scenery is distracting enough, and this qualifies. The air still feels cool, with hints of dampness in the hollows
of the road. The sun infuses the hill crests with rich oranges and reds, as if trying to make up for the monochromatic night. I've just turned around for the return leg of my run when I see a red-tailed hawk perched on top of a saguaro. It's the palest hawk I've seen, with a white stomach and only faintly rusty tail. The two-inch saguaro spines don't seem to bother him at all, the perks of having scaled feet. He watches me with the piercing intensity peculiar to birds of prey. When I come still closer, he flies leisurely away, two or three wingbeats, then a glide, two or three wingbeats, glide.

The birdsong begins to die away by the time I reach the main road again. Suddenly a large creosote bush heaves violently and I stop dead, wondering if it's a javelina, the local species of peccary, late in bedding down. Instead, four Gambel's quail scurry out, black apostrophe feathers wobbling madly on their foreheads. They run crazy zigzag patterns and disappear back into the bush. I kick into my running stride again for the last stretch back to camp. The sun is fully up now, the rosy light gone. My fellow students are just starting breakfast; I'm glad to have had a little time to myself, where I'm not working on my project or trying to become familiar with twelve other people. There are four experienced birders on the trip; they're constantly trying to identify whatever flies or sings nearby. I'm constantly asking them what some song or another is. It almost seems involuntary the way they try to mimic the bird sounds near camp. Something will call from the brush, and at least one of the birders will whistle back, trying to get the bird to answer them or maybe show itself. I find myself starting to pick up the habit, usually under my breath. For me it's more of a way to remember the sound than trying to enter a conversation. When I'm by myself, I prefer to sit quietly or to sneak up on a singing bird, trying for a close look. It's amazing how near birds will come if they think you're part of the scenery. Many of the species I find are quite common, but are either new to me or strike me as strange in the context of a cactus landscape. Red-tailed hawks range across the U.S. Yet seeing one perched on a saguaro made it seem slightly exotic. The quail, I'm told, scurry everywhere in this part of Arizona. But that morning they scurried across the
The Morning Watch (Red-Tailed Hawk)
same path I took. I mention the two species I saw to the birders at breakfast, and get 
polite nods. I don't try to convey the wonder of a hawk perched in the red morning sun, 
holding still, watching me watch it. I cannot limit my observations to species name and 
what it was doing at 7:02 a.m. After years of mixing paints to achieve exactly the right 
colors, I automatically note the light and shadows, lines and textures of what I see. It's not 
extactly a quantitative way to observe, so I hold the images of the hawk and the quail 
tightly in my mind like small semi-precious stones.

After a breakfast of fruit and cereal, I head out into the field to gather more data. My project involves measuring the girth and the pleats of saguaros to calculate how full of water they are. I spend most of the day moving slowly, trying to be aware of how close every part of my body is to those long, stiff spines. Even so, tiny broken thorn tips freckle the backs of my hands and my legs are roadmaps of scratches. The thorns grow in clusters on the peaks of the pleats. The sides of the pleats are smooth to the touch, like green skin. I start noticing the unique scars on individual saguaros, mostly caused by frost damage. The downcurved saguaro limb that reminded me of a sprinter's trailing arm didn't grow that way, it wilted after a frost. Other times frost leaves cinched-in places along saguaro stems, or gray, scabbed-over notches that look like a horse-sized kangaroo rat took a chomp. Storing large amounts of water serves as a buffer against cold temperatures in addition to ensuring the plant has enough moisture to last until the next rains. Desert temperatures fluctuate widely from day to night, as I found that first night. The water-rich tissue in saguaros serves as a literal wet suit, warming slowly during the day and radiating heat at night, evening out the plant's internal temperatures, keeping it warmer longer on chilly nights.

As I walk my (albeit crooked) transect, I slither down into a wide wash, the trail of where water flows in the wet season. The plant life is denser here. I wish I was here when water coursed the bed of the wash, to catch the brief moment before all the moisture was locked away in plant cells. What a sight that would be, running water at the feet of these
desert plants. Actually, the desert should be starting to bloom now, but it's been a dry
year. Instead of crowns of yellow flowers, the brittlebushes sport thin, dry stems. Only the
ocotillos are putting out flowers at the moment. The more measurements I take, the more
I'm beginning to admire the saguaro's ability to hold onto water. It doesn't really have
anything to do with centimeters and circumferences. It's more an appreciation of how
finely tuned they are to their harsh environment. I drink nearly a liter during the day and
am thirsty when I return to camp at night. The saguaros drink twice a year, during the
summer and winter rains. But they don't keep all the water they store to themselves: juicy
saguaro fruit drops from the plants in late June. Birds, insects, and mammals, including
humans, relish the red fruits. Each one can contain up to 2,000 tiny seeds, and some
saguaros may produce 200 fruits. They grow on the tips of the saguaro's main stem and
arms, and making them look like someone draped lumpy red hats on them.

I come across a saguaro skeleton stretched out along the ground like the forensic
outline of a body. Near the top is an object roughly the size and shape of a ski boot. The
saguaro "boot" is another type of scarring; when woodpeckers drill into a saguaro's flesh,
the plant heals itself by forming a hard callous around the injury. I rap on it with my
knuckles—it's about the consistency of the cast my sister had when she broke her arm.
Because the callous is so dense, it lasts long after the softer plant tissues decompose. I
hear a the sharp *pip* of a gila woodpecker nearby, so I take a break from sticking my
hands into saguaro thorns to track it down. I spot a female on top of a column-shaped
saguaro. Suddenly she drops to the side of another giant cactus, *pips* a few more times
and disappears. Startled, I scramble around to the other side of the cactus to find a nest
hole carved into the saguaro's armpit. I don't think I would have spotted it if she hadn't
climbed inside. I wait for perhaps five minutes, but she doesn't reappear. I make a mental
note of the location and go back to taking measurements. Many of the saguaros I come
across have woodpecker holes in them, but no occupants, at least that I can see.

Woodpeckers are the developers of saguaro real estate. Several other species that can't
excavate for themselves use abandoned woodpecker holes: American kestrels, ferruginous pygmy owls, elf owls, purple martins, Bewick's wrens. None of them choose to put in an appearance, though.

When I return to camp that evening, it takes me half an hour to shift from absorbing as many details as I can from the landscape to making small talk. Maybe it would be different if I felt comfortable discussing the saguaros in something other than growth rate and water conservation. I read a few sections in my *Natural History* book, trying to keep the quiet space of the day wrapped around me a little longer. A side comment in one of the articles catches my imagination. One of the native peoples of the area, the Tohono O'odham, have several myths that involve humans turning into saguaros. I look at the hillsides around us. The tall silhouettes throw their arms to the sky, pontificate with one arm, shrug with three arms drooping toward the ground. In the fading light, it's easy to imagine them holding a slow, silent debate on the habits of woodrats or the deplorable weather this past decade. It's strange: the more I learn about saguaro physiology, about the intricate interactions they have with their environment, the more fascinating they become. Yet no matter how many dry facts and physiological processes I research, I can't shake a growing fondness for them. It has nothing to do with mechanisms for coping with frostbite or bird habitat. Something about the landscape they inhabit fills a space in me that craves light and color and open space. I can't measure or quantify it, so I don't discuss it with my science-oriented classmates. I treasure my morning runs more every day, and begin to feel like I understand why Georgia O'Keefe lived in the Southwest.

Over the next few days I keep an eye out for a saguaro blown down by the wind, to get a look at the root system, but the closest I come are the exposed roots of a saguaro growing on the edge of a road embankment. Except for an anchoring taproot, a saguaro's roots usually grow within four inches of the ground surface, with water-collecting rootlets within the top half-inch of soil. They generally spread as wide as the cactus is tall, to
capture as much moisture as possible from brief summer and winter rains. Once the
cactus collects the water, the next trick is to keep it. The first line of defense against the
evaporating effects of the dry air involves thorns instead of leaves and a waxy, nearly
waterproof cuticle, or skin. The thorns serve the dual purpose of dissuading herbivores
and shading the saguaro's surface. The cuticle involves one of the more intriguing
saguaro adaptations, one that isn't even visible. You would have to taste it to when it
happens.

The cuticle is waterproof when the saguaro's gas-exchanging pores, the stomates,
are closed. This is intimately connected to the alternate form of photosynthesis that cacti
use, called Crassulacean Acid Metabolism, CAM for short. What that mouthful means is
that saguaros hold their breath during the day. At night, the stomates open to allow the
plant to take in carbon dioxide, which it stores as an acid. Less water evaporates in the
cooler night air. During the day, the stomates seal up to prevent water loss. The saguaro
breaks down the acid to use the stored CO₂ for photosynthesis. Saguaro fruit harvested in
the morning tastes sour, but later in the day, when more of the acid has been used, it is
more palatable. By using CAM photosynthesis, saguaros lose about one tenth as much
water as most other plants. They also have the option of dropping into an "idling" mode.
When water is extremely scarce, the plant keeps the stomates closed even at night, stops
growing and sheds its water permeable rootlets. Inside, it keeps up a low level of
respiration, which is the process of using the sugars created through photosynthesis.
Respiration releases CO₂, which can then be used in photosynthesis. Photosynthesis, in
turn releases oxygen that can be used in respiration. By bouncing the gasses back and
forth between the two chemical cycles, the plant can keep its stomates closed longer,
reducing moisture loss to a minimum. It can also return to its normal CAM cycle and
begin growing again within twenty-four to forty-eight hours after a rain. The drawback to
the CAM method overall is that it's a slower process than regular C₃ photosynthesis (the
kind used by 90 percent of the plant world), so saguaros grow more slowly than other
plants. However, since most saguaros don't start flowering until they're about fifty years old, it's a minor setback at best.

I continue reading biological texts. The facts researchers have discovered about the giant cacti lend an added level of intimacy I couldn't achieve by just wandering around. The irony is that the more I learn about the minute details of saguaros' interactions with their environment, their sensitivity, the more parallels I draw with my own unscientific way of observing the world. Saguaros are mostly self-contained in the times between rains. Yet they remain attuned to their surroundings, and within the space of a day or two, can completely re-engage with the world around them to absorb as much water as they can. Even a quarter inch of rain suffices. On the surface, I've been collecting data and jotting down numbers for the past few days. But underneath, I watch and touch and draw in the texture of the world. Different sizes of saguaro thorns sound different notes when I brush against them. Some of the broken rocks on the ground are shaded from orange to purple, like sunsets. When I take a break from measuring and recording, to watch a lizard scuttle away and lash his tail at me, or cloud shadows glide across the valley, those are the times when I feel open and vulnerable to the scenes before me. I cannot measure what it is about the blue of the sky, so intense it almost thrums in the space between sunset and darkness, that makes my breath catch in my throat.

Water is never far from my consciousness. It is the common thread I have with every life in this place, the reoccurring theme in all that I see. Everything in the desert obliquely refers to it through shape or behavior. One cactus wren is quite blatant about the matter. One morning, I'm the last person in camp after breakfast. I hear the rush of wings, and look up to see a cactus wren perched on the grill. After a brief survey, he flits to the table where we prepared our meal, explores the canyons between the pots and pans. When he reaches the end of the table, he cocks his head to look down at the water jug. The plastic cube rests on the bench with the spigot pointing at the ground. The wren drops onto the bench next to the jug and eyes the spigot just out of reach. He flutters to the other side,
leans out over the edge of the bench for a better angle. I feel like I'm watching some Southwestern version of an Aesop's fable in action. He hops to the ground and looks up at the jug. How did he learn water is supposed to come out of there? Did some camper have a leaky water jug once and now he checks all of them as a matter of principle? Or did he make his own observations and conclusions from watching people get drinks of water? After a few more circuits from side to side to ground, he pecks at the damp ground where the spigot leaked, perhaps checking if there's any moisture he can lap up. Then he streaks off to attend other business.

Saguaro seedlings are especially susceptible to other creatures' search for moisture. First, only an estimated 1 in 1000 seeds actually survive long enough even to become seedlings. After that, the odds hardly improve. The average life expectancy of a seedling first sprouting is only six weeks. Consisting of about 90 percent water, it often falls prey to insects or rodents. Also, since it takes twelve to fourteen months to establish a firm root system, birds often knock them over when foraging for insects. The seedlings that do survive tend to do so in the shadow of a rock or another plant, most commonly palo verde or desert ironwood trees. These "nurse plants" shelter the seedling from direct sunlight and frost damage. The litter of fallen leaves below the nurse provide cover that may mean the difference between being eaten and surviving. All in all, only about 1 percent of saguaro seedlings see their second year. With the incredible odds against new plant survival, it takes a year of exceptionally good conditions, especially rainfall, to produce more than just a smattering new saguaros. That's why looking out over the landscape I can pick out age cohorts by height. Not that the plants necessarily grow near one another, just that I see a number that are my height and a number that are twice that tall, with hardly any in between.

Halfway through the week we visit the desert fish. Rustling cottonwoods lean over the streams and ponds of Quitobaquito, a spring-fed oasis. Tangled brush harbors the voices of Wilson's warblers and verdins, their tiny yellow and brown bodies hidden in
bird-sized spaces I can't find. On one of the larger ponds, American coots preen their
black feathers in the sun and a pied-billed grebe dives and resurfaces, dives and
resurfaces. It's odd to see such a radical shift in vegetation; a ten-minute walk takes you
back among the cacti again. One of the ponds where the desert pupfish live I could cross
in three long steps. The largest pupfish are about the length of my index finger. The males
flash iridescent turquoise sides as they vigorously defend pancake-sized territories in one
half of the pond. The fish on the other side of the pond forage among the detritus, the
males among them totally unconcerned about personal space. Pupfish used to be found in
Arizona, California and northern Mexico throughout the Colorado River drainage. They
are now endangered, mostly because of the recurring theme of disappearing species,
habitat loss and fragmentation. Pupfish live in extremes. They can withstand temperatures
between 50 and 100 degrees Fahrenheit and anything from fresh water to saltwater more
concentrated than the ocean. But they can't live without water. Even here, in a national
monument, some of the charm of finding fish far from any river drains away through the
cement culvert where the path crosses the pond. Because of pumping and water diversion,
the water table in the Sonoran Desert has dropped anywhere from 160 to 1,000 feet.
Quitobaquito has been used by people as a water resource stretching back into prehistory.
I wonder who poured the cement here, and when.

The next day, we drive down to Mexico, to the beach at Puerto Penasco. At first,
seeing road signs in a foreign language seems fun and exotic. I try to puzzle out the
meanings as the signs flash past. Restaurant advertisements and gas station signs try to
peddle their services in Spanish. On the outskirts of the border town and for several miles
beyond, the roadsides are speckled with trash. Beer bottles, sandwich wrappers,
amnonymous papers, and aluminum cans line the drainage ditches and the shrubs behind
them. Then the saguaros disappear from the landscape, leaving desolate plains with far-
flung creosote bushes. Even though the ground was open in saguaro country, it never
seemed barren. Something always found a way to grow. In the distance, a dust devil spins
dirt up into the sky. Maybe it's just because we're driving past the landscape and aren't in it, but I lose the sense of connection I feel within the saguaro skyline. The plants here seem to repeat themselves over and over without change, and the trash only makes the emptiness seem shoddy.

The ocean is refreshing to the point of sending me shivering to my towel after ten minutes. The beach itself is decent, if you manage to avoid the horseback riders and the four-wheelers. Sea birds flock over the returning shrimp boats. I know this scene would conventionally be called pleasant: the clear sky and calm ocean. I have difficulty feeling entirely at ease as children constantly try to coax us to buy bracelets or rings, women keep asking if they can braid my hair. We eat dinner on a restaurant balcony, watch the dinosaur profiles of brown pelicans fly across the sunset. I fall asleep on the way back to cactus country, the moon an amber marble on the horizon.

I spend the morning collecting data again, bringing a lunch to eat in the field. In the early afternoon, the sun bleaches the blue from the sky. The desert settles into a profound and timeless silence, as if the chiming of a clock tower just subsided. The birdsong ceases. There is a pause between the inhale and exhale of the morning and evening breezes. My ears start ringing out of the sheer absence of sound. I feel like I have time to think, to finish each thought fully and move seamlessly to the next in my green cave of palo verde branches. In the stillness, I can hear the whirr of a black-throated sparrow's wings from twenty feet away. A curve-billed thrasher runs across the sand, and I can hear the tiny drum of each footfall. This is the time I've come to enjoy most, when I can set aside the pretense of doing a "study" and submerse myself in my surroundings and reflections. I didn't realize I'd forgotten how to be still until this week among the saguaros. They are patience made solid, these plants, spending most of their time waiting for rain. Their slower time scale has begun to seep into me. As I sit and practice patience, a lizard creeps near to sun himself on a rock, oblivious to my presence. I began the week
knowing I didn't really want to be a scientist, but feeling that I should try, confusing the results with the method. Instead, I've threaded my way to the underlying desire, to let a landscape fill my senses. Close observation has nothing to do with equations and tape measures, at least for me. My classmates would probably raise their eyebrows if I told them I enjoyed the company of plants, that there are lessons in a cactus that have nothing to do with chemistry.

Perhaps I wouldn't like the desert so much during high summer, when the heat gels the air so thick it shivers under its own weight. But as the sun sets this last evening, taking the green of the saguaros with it and leaving only tall shadows against a scorched red sky, I know I'll return. Moonrise won't be until late tonight, and the Milky Way gradually appears, spilling stars into all the corners of the sky until even Orion relaxes into their multitudes.
Works Consulted


The Flow of Time

The first night of our Missouri River trip, I slept in the trunk of my car. A Ford Escort, mind you. I was late. The faster I tried to push, the more circumstances pushed back, and I missed our meeting time. As I drove across central Montana, my thoughts circled around my tardiness. Everywhere, there were reminders. The glowing green minutes on the dashboard clock that jumped ahead when I wasn't looking. The sun reeling across the sky. This was more than my usual ten minutes late. I had guessed wrong by an hour and a half on top of leaving late. Crossing the horizon-wide grasslands north of Billings didn't help. The only curves in the road were vertical, up and down, up and down the long, gradual hills like ocean swells. My eyes found no purchase on the blurred gold at the side of the road, and several times I glanced down at the speedometer to be sure I was still moving. I tried to imagine crossing the Great Plains in an ox-drawn wagon. It must have felt like being lost at sea.

The plan was to meet three friends for a week-long canoe expedition through the Missouri Breaks. I had a vague notion that the route through the Missouri River valley involved badlands, but aside from leafing through maps, I had deliberately avoided looking at pictures. We were supposed to rendezvous at our take-out point, the campground at James Kipp State Park. Deb, Becca, and Jason were hauling the food, canoes, and tents from Missoula to the put-in at Coal Banks, then arriving at Kipp in time for dinner. I was driving up from Red Lodge, on the southern border of Montana, six-ish hours (so I thought) south of Kipp. I had the personal packs and a Dutch oven for our send-off feast. Nothing happened in the time frame we planned.

As Billings drew farther and farther from my rearview mirror, the wildlife ranged closer to the two-lane road. The animals were a welcome distraction from my losing
battle with the clock. Every creature seemed to be a tawny distillation of the prairie grass. Pocket gophers popped up on the narrow shoulder, standing on their back legs before making a split-second decision to dash across the road or back into the grass. The wrong decision for some—their little corpses lay stretched out along the side of the road.

The first pronghorn surprised me. He sprang away from the roadside just as I crossed the brim of a hill. He trotted to a halt not far away, and I had a snapshot view of his white neckerchief stripes and solid black horns as thick as the handle of a Louisville Slugger. I hadn't seen a pronghorn this close before. They're alone in the world, the sole surviving members of a family (or subfamily, depending on who describes them) of hoofed animals that originated in North America. The other eleven species died out over 10,000 years ago. Pronghorns aren't related to African antelope, despite the "where the deer and the antelope play" misnomer. They've grown up on the Great Plains, so to speak. Their hair is hollow, to insulate against the banshee-winds of winter. In the summer, they can selectively raise portions of hair for ventilation. I imagine it feels like giving yourself goosebumps. Pronghorns are sometimes considered part of the same family as cows. One characteristic they share are bony horns with a sheath of keratin, the same material as fingernails. Every year after mating season, male pronghorns shed the keratin, but unlike other bovines, it comes off in one piece instead of shards. Females also shed this outer part from their fingerlength horns, but not as regularly.

I admit to being a statistics junkie. While my peers growing up memorized facts about pop musicians or sports stars, I was hooked on odd animal facts. Like the green moray eels at the aquarium that were actually blue, but covered with yellow slime, or the two-hundred-mile-an-hour stoop of a peregrine falcon. That fascination has deepened over the years, and now I can clothe it with words like "adaptation" and "biodiversity." What it boils down to, though, is that humans are the wimps of the animal kingdom, and I want to know all the attributes we traded in for wrinkly brains and opposable thumbs. Pronghorns, for example, have been carved by time to reach the county-road speed limit
of fifty-five miles an hour. How exhilarating it would be to glance out the passenger side window and see a pronghorn charging alongside. I wonder if I could even distinguish the movement of its legs, or if they would just be a blur. Unfortunately, none of the ones I passed seemed inclined to race. They would have trouble out-sprinting a cheetah, the world speed champion at sixty miles an hour, but they could outlast one. The cats can sustain their top speed for only a few hundred feet. Pronghorns can dash forty-five miles an hour for up to four miles. Nothing else living in North America can match them. Their speed marks a trail to the past. One theory is that they actually did evolve to escape fleet-footed cats. The cats just picked a short straw in the same extinction event the pronghorn's relatives experienced. The cloven hooves of pronghorns are built to cushion their legs from the jolting when they bound at high speed, sometimes covering up to twenty-seven feet in one leap. The honey-colored creatures along the highway don't perform any such acrobatics. They must have learned that cars won't chase them across the prairie.

One male twisted his neck to watch me over his shoulder. Technically, he shouldn't need to turn to see me, since pronghorn eyes protrude from their skulls, giving them a nearly full-circle view. They can also see as well as I can through binoculars, all the better to spot predators that can quickly cover long distances. I wonder what he sees when he's running, watching what's in front zoom toward him while what's behind him bounds into the distance. I don't see any fawns, but it could be too early for them to appear in public. Even though able to outrun a horse when only a few days old, their young bodies don't have the stamina of an adult. Instead of speed, fawns depend on their mothers to distract predators for the first few weeks, while they lie frozen in the tall prairie grass.

Between pronghorns I watched for other signs of life. Meadowlarks perched on occasional fenceposts and telephone poles. The birds facing the eastern horizon presented mottled brown backs, flashy as grass shadows on dirt. When they faced the road,
however, the black V across their chests vibrated against their vivid yellow fronts. The males were singing, heads thrown back and narrow beaks open to the sky, as if they couldn't bear to keep their song in any longer. Once I thought I saw the dark, long-winged shape of a harrier gliding just above the tips of the grass in the distance, but it was gone before I was sure. The last sunlight flared crimson along the underbellies of the clouds now covering most of the sky, burnishing the western faces of the hills copper-red.

The rain settled into a steady drumming by the time a small sign for James Kipp flashed past. I nearly missed the turn in the dusky light. Almost 9:30. My tires grumbled onto a gravel road that wound down toward the river. Entering the campground, I thought guiltily of the Dutch oven squatting in the carrier. I hoped my friends weren't still waiting for dinner.

The campground wasn't large, two loops for tent campers and one large loop with RV hookups. I drove slowly through all three, peering through the rain for a glimpse of Becca's blue Volvo station wagon. No luck. Where were they? They planned on leaving Missoula at eight in the morning. Even if they left a few hours late, they would have been here for an hour or two already. I slogged around each loop on foot, still nothing. I even checked where the road trickled into the brush beyond a decaying overpass. Doubt about the name of our meeting place crept into the edge of my mind. What if I was waiting at the wrong access point? I was sure we said Kipp, but I hadn't written it down...

Electric light poured from the campground hosts' trailer. Water dribbled off the edges of the awning, a counterpoint to the laugh track from a television show inside. I knocked on the aluminum door. A woman in her sixties with short, curly gray hair and a pink sweatshirt opened the door. Just behind her stood a stocky man, about the same age, with glasses and a squarish face. No, there was no official registration, just a fee box. Had I checked the overflow campground by the boat ramp? Where were my friends driving from? I didn't want her to worry, especially if I was waiting in the wrong place. I told her they probably just left late from Missoula. She said to let her know if I needed anything
else. A square of light disappeared from the ground as she closed the door. The rain
dripped off the brim of my hood and onto my nose. I tugged my hood further forward.
Maybe they were by the river.

The rain already half-filled the hollows in the road. I stayed in the center of the
road to avoid completely swamping my muddy, wet boots. No blue Volvo in the boat
ramp parking area. I followed a path to the little ring of campsites, even walked around
with increasingly dogged thoroughness. Two men and several small boys huddled around
a fire at one site. Across the way, a woman herded two young children toward a tent,
overruling their protestations that it wasn't time for bed yet. I sighed and headed back to
my car.

I pulled halfway off the road along the RV loop. I had no idea where my tent was.
Or rather, I knew it was in Becca's trunk, but I didn't know where Becca was. The ground
was a muddy mess, so no sleeping out. I eyed the back seat. My brother used to joke that I
would fit in the trunk. Time to find out. I folded the back seats down and scooted inside.
If I lay diagonally, I could just stretch out. The seats didn't fold all the way down, but they
felt tolerably comfortable, like a bolster pillow covered with indoor-outdoor carpeting. I
unrolled my sleeping bag and proceeded to take stock.

Clothes? I had a clean change of clothes for the trip, including, thankfully, a dry
pair of socks. Not bad.

Breakfast? A power bar and a Dutch oven. I usually wake up with my stomach
gnawing at my ribcage. A power bar wasn't exactly a decent start to the day. I thought
glumly of my favorite section of the *Tao of Pooh*:

Piglet: "What's the first thing you think in the morning?"

Pooh: "What's for breakfast? What do you think?"

Piglet: "I wonder what's exciting that's going to happen today."

Pooh: After a moment of thought, "Same thing."

Not so exciting.
A plan? None. We hadn't discussed what would happen if we didn't find each other. Voicemail might work. If I left Deb a message, she could respond with one telling me where they were. Of course, that assumed she a) could find a phone and b) would think to check her messages back in Missoula. I had to readjust my expectation of meeting up with them. Instead of a few hours, it would be in the morning, if things went smoother. The great swaths of grassland required more time than we anticipated. As I started to fall asleep, the message-relay plans grew more and more elaborate, like those horrible logic problems they made us do in junior high math. If I called her and said I was at James Kipp, and that she should call my house and tell me where they were and when she would check her messages again, then I could check my messages and find out where I was supposed to be and leave her a message about when I left Kipp and hope the three of them weren't steamed about not having dinner last night.

Knock! Knock! Knock!

I sat up and banged my shoulder on the frame of the seat. Was the campground host going to tell me to move? Knock! Knock! I had to roll down the window to see the knocker.

In the glare of headlights I saw Deb's grin. I hadn't been so relieved since I finally got a flight out of Roanoke, Virginia after being stuck there for eighteen hours (I thought I glimpsed someone dressed like a pilgrim in a dark corner, but that could just have been lack of sleep).

"You found me!" I'm very eloquent when I first wake up.

"Sorry we're so late. It took forever to drive here from Coal Banks. Especially when it started raining. Did you see the sunset, though? And we stopped for burgers at this little bar where they were having karaoke night, so that took some time. We figured we were late anyhow."

"Oh good. I'm glad you ate."

"Are you going to sleep in your car?"
"It's dry. I don't feel like setting up in the mud."

"Good idea. Becca can stretch out in the back of her car, and we borrowed Jeff's car, so I think Jason and I can fit in there. Can I borrow your headlamp so I don't have to dig mine out?"

I fumbled around on the floor and handed her the light.

"Thanks. Goodnight!"

"Goodnight."

I rolled the window back up and lay down again. Watching the headlights creep forward and off the road across from me, I smiled. Looks like I'd have breakfast after all.

I wake up to white clouds chasing each other across blue fields. I crawl out of my Ford cocoon just as Deb returns from showing her border collie Sundance the river.

"It's our lucky day. There's some sort of Lewis and Clark reenactment this morning, and there's a Boy Scout troop cooking a pancake breakfast."

Better and better. The Scouts offer pancakes, sausage, eggs, coffee, and juice. I take some of everything. We chat with a couple who brought a bevy of grandchildren out for the day. We discuss the joy of spoiling grandchildren, ranching, and river levels. Some of their neighbors have already sold cattle to places in Nebraska, where there was enough grass to feed them. The river, they say, usually isn't this low until mid-July.

I'm not sure if the river's rhythms being off is good news for our trip or not.

After breakfast we tour the reenactment setup. The men introduce themselves as a blacksmith, a doctor, William Clark, and a trapper. Some tipis stand off to the side, but people still bustle around setting them up. The trapper impresses me. He catches beaver during winter, using equipment based on historical paraphernalia, including a cube-shaped Duluth pack for hauling. He wants to know what that lifestyle was like, and instead of just reading about it, he enacts it, learning the history with his body as well as his mind. I don't know if he thinks about it that way, but I respect it. There are some
inconsistencies. He shrink-wraps and then freezes the carcasses until he's ready to use them. After curing the hides, though, he transforms them by hand into hats or leggings. The meat feeds his dogs.

Even though trapping is a hobby for him, I envy the seasonal slant it lends to his life. There are some activities of mine that depend on the seasons: cross-country skiing, floating rivers. But those occasional forays are not a part of the set rhythm of my life, like trapping is for this man. Instead, I am tied to the smaller chunks of time printed on calendars. Seasons chopped into months, broken into weeks. In a way I suppose it helps during the harsh seasons, being able to mark off bits and pieces of winter so you know it really is passing. But the seasons never quite match up to the little numbered boxes on the paper, so we complain about a late spring or early winter. It's absurd, when you really stop and think about it, expecting spring to change to summer at the exact date every year, given the number of variables that influence the changing of the seasons and weather. Of course, the position of the sun ultimately determines seasonal change; but in between the sun and the ground are layers of vast swirling air masses that, like a river several thousand feet high, never passes the same point the same way twice. But I guess it makes us feel more in control if we at least attempt to predict what the seasons will do. I wonder if it's a human characteristic or just a Western one, the immense self-aggrandizement that drives us to even attempt to harness the seasons to our own time schedule.

A writer and scholar named Lewis Mumford offers the idea that artificial time, standardized hours and minutes, have made a technological society possible. This makes sense to me. First of all, much of our technology relies on precise timing. Cars don't work if their timing is off. Computers process information at a breakneck speed, fine slices of time. Large masses of humans need a schedule to live together. Think of any major city, Chicago for example, and try to imagine all those people living together, all the different jobs and shift schedules, without a standard unit of time. Chaos. Things might still be accomplished, but they would be a lot messier. One familiar example of time organizing
large numbers of people is television. How many millions of people sit down at specific times to watch specific shows? Because of standardized time, all those viewers know exactly when they can expect which program.

At the same time, such organization can be frustrating. Events are scheduled by a standard clock, and especially for large scale events, individuals have minimal control. And because everyone is expected to follow the same standard time, sixty minutes in an hour, sixty seconds in a minute, there seems to be a tendency to forget there are other modes of time. Time not chopped into smaller and smaller bits. It may be less precise to orient yourself to something other than the minute hand, but it can also relieve some of the pressure of always trying to conform to a socially accepted timeframe. And what if you aren't in that timeframe? Out in the backcountry, where there are no social references, and a clock becomes just something else to carry? My favorite part of trips like this is when I tuck my watch away. I like the sensation of resetting my sense of time to the rhythm of the sun's movement, of planning my activities based on the heat of midday or how much light remains. A few years ago, I served as a counselor to a group of high school women on a week-long canoe trip in Ontario's Quetico Provincial Park. We tried to collect everyone's watches the first morning, to wean them away from artificial time. One woman wouldn't do it. She said she needed to know what time it was. We explained the point was to learn other ways of telling time. She adamantly refused to try. By the end of the trip though, she proudly announced she didn't look at it nearly as often.

We don't reach the canoes until 4:00. I'm starting to sense a pattern—schedules made in the heart of a city don't really work out here. The turnoff to the river access cuts down through the low hills, one level closer to the river. A huge pickup rumbles by, kicking up stray rocks and leaving a heavy white plume of dust slowly swelling over the road. That, apparently, was rush hour. A few houses dot the last seven miles of road,
spaced far enough apart you couldn't hear your neighbor hollering. A fat, lazy caterpillar of hanging dust marks the trail of the pickup from a driveway.

The clouds loom lower and darker. We stroll over to fill out an itinerary with the campground host. The woman who answers the RV door is the youngest host I've met, maybe in her early forties.

"Oh, you made it back! Good." Deb, Jason, and Becca chatted with her yesterday morning.

Jason asks if she's heard the weather forecast.

"I think there may be storms moving in. Why don't you come in? I can turn on the weather channel for you. Take your shoes off by the door though, the mud is hard to clean up."

She rattles on as we shuck our shoes onto a little linoleum square.

"Don't we have to fill out some forms about our trip?" Becca interrupts.

"Yep. Just let me get my clipboard."

The form requires basic data: number of people, length of trip, put-in and take-out points.

"You really should wait until tomorrow. Storms can get pretty nasty along the river. I have some pictures on the computer I can show you." She fusses with the mouse, then brings up pictures of lightning in leggy streaks over the hills.

"That one we took not far from here last summer."

She shows us other river photos, trying to convince us the whole time to wait until morning. Just as I start to think maybe she spends a little too much of her life glued to the weather station, we manage to find a convenient escape hatch in the conversation.

We set up the tents and wait for an hour. The thunderous part of the storm mutters over distant cliffs, merely pounding us with rain. A few hours of daylight remain when the rain decrescendos and the wind stalks downstream to toss other trees. No one wants to
pack everything wet and then unpack again in a few hours. Instead, we opt for a leisurely
dinner and some serious lounging afterward.

The next morning reveals a cool, gray world outside the tent, with rainless, high-
riding clouds. The Missouri looks more like a Midwestern river than the fast, clear
currents further west—slow and calm and carrying so much silt that everything
disappears two inches below the surface. The river face reflects a dirty rendition of
clouds. The banks here at the put-in aren’t impressive: grassy slopes slant down into mud,
punctuated by grayish-tan sandstone bluffs topped with green toupees. A bend
downstream harbors a grove of tall cottonwoods, but otherwise the vegetation grows
tangled and low.

A friend of mine, Mary Hamer, studies cottonwoods. Her enthusiasm about their
biology is infectious, and the more I learn about them, the more fascinating they are.
Cottonwoods are river trees. They require damp, bare soil to begin their first sunward
race, such as the areas left behind after a flood. Stands of cottonwoods tell living stories
of river history, outlining old flow patterns, testifying to past floods. Cottonwoods that
gain a root-hold after a flood usually grow above the regular channel in linear stands, all
the trees the same age, marking where the water once reached. In areas like parts of the
Missouri Breaks, where rock pins the river into its bed, where it can’t meander, floods are
especially important for cottonwoods. It’s the only way the moist, exposed soil they need
forms. In more open areas with softer soils, old meanders leave behind cottonwood stands
arranged in nested arcs, each arc a different age group. Water chews away at the outside
curve of a meander, resettling the debris and soil along the inside curves. These deposits,
called point bars, are havens for cottonwood seedlings. As the bar expands, new
generations of cottonwoods settle in the freshly created land. Sometimes part of a river
channel will narrow, perhaps in a dry year, or the river will shift in its bed and cut off part
of its channel altogether. These gradual shifts allow cottonwoods to colonize the
abandoned mud. The resulting groves are a mixture of ages and amoebic in shape, usually with the long axis mirroring the river's direction. I guess the cottonwood grove within eyeshot of the boat launch, given its location, grew because of the crook in the river.

Grayness aside, I can't prevent a little glow of excitement from spreading a smile on my face. Six days on the river. Splitting four people and a dog between two canoes leaves room for a cooler bursting with food, and Deb's backpacker guitar. The camp host informs us that four inches of snow dumped on Missoula last night. I'm wearing shorts. For a moment I stop packing to stand with the water like a cool silk sheet around my ankles, watching two mourning doves shoot over the water, their wings whistling softly. Hello, Missouri, I think. Glad to meet you.

A family reunion invades my moment of quiet. A trailer with a rack of six canoes backs halfway down the ramp. A white-haired man marshals several sulky teenage boys into unloading them. Anywhere from four to eight kids dart around, weaving in and out among the adults, sprinting around the front of the truck and under a canoe being unloaded. I hope someone counted them before they started moving, because now they're bouncing around like subatomic particles and it's difficult to get a fix on numbers.

"That's everything for our canoe. Let's get off the ramp so we're out of the way. Front or back?" Becca asks.

"Front, for now." I climb in and wedge my paddle against the concrete ramp to hold the canoe steady. As we drift out into the eddy, the conversations from the family on shore jumble together into a babble of "Where did you put the hot dogs, Jim?" and "But Mom, he was chasing me!" and "Don't drop the canoes, you'll dent the bottoms!" The words carry clearly across the water until we round the bend.

After paddling for a while, we stop and pretend we're driftwood. Swallows boomerang back and forth across the surface of the water, flicking into different directions, rising skyward in sudden, inverted dives, then skimming along just above the surface tension of the river. It's like floating through a beltway of little feathered meteors.
One bird dips his beak into the water for a drink as he flies, leaving small V-shaped wake behind. At least two different species swirl around us—the cliff swallows with a flash of rusty red across their throats and white foreheads, and one of my favorites, violet-green swallows, with a sheen of iridescent purple on their backs and green on their wings. A streak of white behind their wings curls up toward their backs, and another wisp twists up their cheeks to wrap around their eyes, markings that make violet-greens easy to spot. I don't see many insects, but something must be rising off the water to draw them here.

Douglas Warrick, a biologist who researches flight mechanics, has an interesting theory about why swallows fly so fast chasing insects close to the ground, and I think it applies to over water as well. Insects buzz around thickest close to the ground because it represents safety, they can dive down to hide under a leaf or lose themselves in the grass. Insects darting around over the water may be there because they're emerging as adults from a water-dwelling larval stage. A swallow zipping along gives the hapless prey less time to notice it and escape. Another part of the theory deals with the flight mechanics. Speed actually assists with maneuverability, so a bird can execute tighter turns at high speed than when it flies slower. The faster a swallow flies, the more lift its wings generate. Lift is caused by the curve of a bird's wing—picture an airplane wing. The top edge has a slight convex curve, while the bottom is flat. When air moves past the wing, the air moving over the top has to cover more distance than the air below, in the same amount of time, so it flows faster. The faster air creates lower air pressure, so the wing is drawn upwards. At higher speeds, more lift is available for turns because the air is already flowing quickly. A swallow can spend energy twisting up or rolling to the side to snag a winged morsel instead of trying to gain enough speed to stay in the air.

The river, however, isn't in much of a hurry to go anywhere. We're moving at only two or three miles an hour. The surface doesn't betray any signs of a current, none of the show-offish riffles and splashing of a faster river. Now and then something will float past, a white down feather, a bit of stick, bubbles from a fish jumping, betraying that the water
actually is moving and not just a still mirror of the pale pewter sky. We pass more stands of large-girthed cottonwoods.

Cottonwoods rely on river cycles. They can only take solid root with the right combination of physical and temporal habitat: available soil and enough water that they have a chance to sprout. The Missouri Breaks area is one of the last relatively free-flowing stretches on the river. There are dams above and below. Historically, the seeds needed the large deposits of silt dropped by fast, full spring floods. With upstream water regulation, these floods aren't as strong. And even if a moderate spring flood occurs, and seedlings begin growing, unless they are far enough above the ice-scouring line, they may not survive. The most water charges down the river in the spring flows, but the highest water levels occur in the winter, when ice jams cause the water to back up. In the winter, dams release more water than would normally occur, so the ice jams reach higher. Even if the spring flow is adequate, regulation has to extend to winter water levels as well. Oversimplifying the intricacies of river flows to fit a human schedule results in problems for the trees.

We hear voices coming from behind. Looking back, we spot the teenage boys from before, paddling furiously. My own paddle nestles along the side of the canoe, making a little puddle of muddy water under my feet. Are they racing? Maybe they just hate being on the water. Or maybe they're genetically predisposed to rush, because the rest of the flotilla soon paddles into sight. They pass us, with a brief greeting by the white-haired man. It's an unpleasant reminder of my futile hurry to arrive at Kipp, the anxiety and frustration of holding myself up to an unrealistic schedule. What schedule are they trying to keep on this sluggish waterway? I wonder if they even notice the swallows, who actually have a reason for speeding along.

They remind of the young woman who refused to give up her watch. They keep the mechanisms of human time firmly in front of them, buffering them against the world
surrounding them. In a city, this makes sense; there, the time kept by a watch helps you navigate through the complex interactions of masses of other people. But here, it seems slightly absurd. And maybe even detrimental, in a conservation sense. Timing is important in the natural world, but not the kind of timing framed by minute and second hands. Cottonwoods, for example, spend the first year or so of their lives racing sinking moisture levels. If the water level sinks rapidly enough, the new trees put more effort into growing roots, sacrificing the amount of leaves they maintain. Their roots can grow up to one centimeter a day. Every second counts, every cell division that lengthens their roots means they are that much closer to surviving into a long, slow adulthood. People, by ignoring other ways of measuring time, dissociate themselves from the natural world. By trying to standardize time, we may miss important rhythms, such as the frequency and interconnectedness of different parts of annual flooding cycles, that are key to the survival of organisms. This applies to longer stretches of time than we're accustomed to thinking in as well. Instead of contemplating the long-term survival of a species or ecosystem, we remain mired in human time frames, fiscal years or terms of office. How can we protect anything if we don't even acknowledge the pace of its existence? Once you start watching, there are an enormous variety of spans of time.

The shoreline gradually heaves itself up from the river as we drift closer to the White Cliffs area. Sheets of sandstone begin to appear among the rolling bluffs, slowly stretching the gentler slopes into vertical cliffs, widening the space between the grass by the water's edge and the greenery on top. Soon the cliffs tower over the cottonwood groves. The color in the rock shifts subtly from a palette of khaki to a dull white, the color of old bone, of stone that's tired and weathered, that maybe once had a potential for blinding whiteness, but now doesn't have the energy. The diffuse light filtering through the clouds flattens the shadows on the sandstone, hiding many of the knobs and pillars so that as we drift past, the rockfaces keep turning new profiles. Mushroom-shaped pillars
sprout everywhere, thin necks of stone topped with flaking tables of rock. Round and oval holes pockmark the cliffs, ranging from fist-sized to small caves.

After lunch, a wind wrinkles the water. Watching the surface makes me feel like we're floating backward. A chilly drizzle leaks from the clouds, so we began paddling again. At one point, high on a cliff, a great blue heron perches above the river. There is something both regal and ridiculous about the bird—odd to see such a large water bird standing at the edge of a high cliff, long, knobby wader's-legs holding it above dry stone, but at the same time it holds perfectly still, neck in a graceful S-curve, a slender silhouette against the skyline. It must have seen us float by below, but it never even turned its head.

We set up camp early, across from LaBarge Rock. Named after a skilled steamboat captain, the dark igneous rock rises nearly half-again as tall as the pale sandstone at its shoulders. The darker rock formed from magma forcing itself through the existing layer of sandstone. Water then wore away the softer sandstone over thousands of years, exposing the hidden formation beneath it. Vertical formations like LaBarge are called dikes, and an extensive network of them runs perpendicular to the river. The dikes connect two mountain ranges created by volcanic activity, the Bearpaws and the Highwoods. Along the Breaks, water and time have revealed the once-underground latticework.

We covered only a little over fourteen miles, but the flat, open area under the cottonwoods draws us off the water. As Becca and I scout the meadow behind the trees, picking our way among dried cow flops, the sound of a motor chugs through the air. What basically amounts to a flat-bottomed barge pulls up. A man and a woman hop off the front and began securing the boat. Jason wanders over to chat with them. After a brief conversation, he walks away. People began disembarking, an Elder Hostel group trickling down onto shore in ones and twos. To my disbelief, the deckhands begin unloading
wicker tables. Other crew members set up a large white canvas tent, apparently the dining facilities. If we tried to enter, we would probably be turned away for improper dress.

   Jason and Deb join Becca and I by the tent bags, both fuming.

   "They told us to move, this is their campsite," Jason reports.

   "What?"

   "We were making small talk, complaining about the low water, you know, and I mentioned that was a large group on his boat. He said he's been doing these trips for a dozen years. They always camp here. I agreed it was a good spot, then asked how many tents they were going to set up. That's when he said they needed this whole area and suggested, strongly, that we move."

   "That's rude," Becca said.

   "Yeah, well, there's not much we can do, but it pisses me off."

   "We probably wouldn't want to be this close to them anyhow." I try to make the best of the situation, but it curls a knot of anger in my stomach. A half-mile of flat shoreline and the guy couldn't be bothered to dock farther down? Returning year after year for some creatures might establish ownership, but last time I checked that wasn't BLM policy.

   After schlepping the tents farther downstream, we wander in separate directions for a while. I pick my way over the cobblestones at the river's edge, idly noting what the river didn't want anymore. Some small pieces of driftwood, twisted wet twigs. The thin white comb of a fish's ribcage. A small black spider stops on a smooth rock, then scurries away, as if checking its direction. A killdeer patters across the stones, its brown back a feathery version of the smooth, oblong rocks. The bird darts forward a few feet, then stops, sometimes pecking between the cobbles. It zigzags in front of me, watching me over its shoulder. The two black bands on its throat remind me of the pronghorns. I wonder if there's any connection. Both seem crafted from the patterns and colors of their
surroundings, gray-browns and whites and dusty yellow, stark blacks like bars of shadow in mid-afternoon.

Suddenly, the killdeer decides I'm too close. Instead of flying, though, it lies down on the ground and begins fluttering its wings, calling *kill-dee, kill-dee*. I've heard about birds feigning injury to deflect attention from their young, but I've never seen it. She must have chicks somewhere nearby. I watch, fascinated, as she scoots over the ground on her belly, flapping and calling, dragging one wing. I scan the cobbles for balls of fluff. She stops now and then to make sure I'm still following. Finally I either come too close for her to stand or she's led me far enough away from her chicks that she gives up her act and flies down the shore, *kill-dee, kill-dee*. I missed the little killdeers entirely, so I guess the broken-wing ruse works.

I squat down to sift through the rocks. I turn a few of the larger ones, to see if any little invertebrates are home, but a small flat rock distracts me. It's a smooth, white oval, about as long as my thumb. I can't resist—I curve my fingers around the stone, cock my wrist and toss it over the muddy water. It skips once and sinks, *pat splash*. Very unsatisfactory. There is something soothing about skipping rocks. Maybe the concentration of looking for the perfect stone, or perhaps the knowledge of restarting a cycle by sending a piece of land back to the water that smoothed its edges. Or maybe it's simply the lure of wondering each time how the rock will fly, how far it will skim over the surface, defying the gravity of sinking objects for a few seconds. I walk along, scrounging for smooth river stones small enough to throw. The third one skips seven times across the current. I try for a while to break that record, but without success.

After dinner, I grab a sweatshirt and flashlight from my tent. On the way back to the fire, I find Jason talking to a man wearing a hat with narrow scarlet, royal blue, and lemon stripes. It's the same pattern as the traditional Voyageur fur-trader clothing I'd seen in Ontario. Just before dinner, a large red wooden canoe with a high bow and stern pulled up. It probably sat ten people. Jason tells the new stranger how the barge man booted us
off our camping area. The man rolls his eyes, suggesting we file a complaint with the
BLM. The good news is that the barge tour ends at Judith Landing. Jason mentions we're
floating down to Kipp, asks if the stranger has been there.

"Yeah. I've been floating the Breaks for about ten years. This time of year, you're
better off spending your last night about twelve miles upstream of Kipp. The buffalo
gnats get really bad there."

Two nighthawks quarter the sky for insects. Just enough light remains to highlight
the white bars across the bottom of their wingtips. Although its bill looks small, a
nighthawk has an enormously wide mouth for its size; the hinge reaches well back under
its eyes. When it opens its mouth, the lower jaw changes into a half-moon shape so the
bird can scoop up anything from a mosquito to a moth. Its large eyes almost take up the
rest of its head. All the better to munch insects in the half-light of dawn and dusk.
Nighthawks' two-syllable tee-ent calls have a slight buzz to them, like a cross between a
locust and a squeaky gate.

The last of the swallows have disappeared for the night. There must be different
insects out now, or at least they're flying higher, because the nighthawks circle a good
twenty feet over the cottonwood crowns. Watching the nighthawks draw curves against
the sky, I can't help but be impressed by the efficiency with which different species
dovetail their lives together. Where the swallows leave off, the nighthawks take over, not
just in altitude but in time. And when they settle down for the night, the bats take over. I
remember learning about niches in an ecology class, the concept that different animals
have slightly different methods of gathering food, or slightly different locations where
they forage, in order to avoid directly competing for the same resources. I don't recall,
though, that we talked about time as a major dividing line between niches. I like the
rhythm of it, more elastic than minutes or hours, knowing that we should be done with
dinner when the nighthawks call, and that the day's end has arrived because a bat crosses
the starlight overhead.
When we wake up, Deb and I take Sundance for a romp up the back of the canyon. We can see the top of LaBarge Rock, dark chocolaty brown against its pale sandstone neighbors. The river mirrors the cliffs in its slow current, tinting everything beige. The cottonwoods and the grasses by the riverside provide relief from the nearly monochromatic waterfront. Most of the cottonwoods are massive, bird-filled old creatures, above the ghost of a high-water line. The only people stirring in the tent city are the guides, probably setting up for a seven course breakfast. Camping, British Empire style. I know I shouldn't begrudge them their experience of the Breaks, but I still feel a little sour their treatment of us last night.

The birds don't stop singing all day. Yellow warblers dominate the chorus, accompanied by the liquid songs of western meadowlarks, occasional redwing and Brewer's blackbirds, magpies, mourning doves, and the ubiquitous killdeers. In the late afternoon the nighthawks reappear, making good use of the cloudy day. A smaller bird with a blush of lemon across its stomach darts out from some bushes, turns back and lands again. As we drift closer, I can see black wings and a gray head that matches the clouds overhead. A western kingbird, another insect-muncher. Kingbirds are a type of flycatcher. They hunt from a perch, launching themselves on unwary invertebrates and then returning to their spot. Not too far downstream an eastern kingbird makes his debut for our trip. The two species don't look much alike, as the eastern is all black above and white below, with a band of white across the bottom of its tail.

We pass through belts of swallows again, this time centered around the flurry of a cliff swallow colony. Some of the nests are half done, little semi-domes of sticky river mud and bird spit. Just downstream of the nesting wall, two dozen swallows at a time gather nest material from a little mudflat. They land, tails held high, wings arched and fluttering over their backs like butterflies, and dip their beaks into the mud. When they
The Mud Masons (Cliff Swallows)
have a mouthful, they fling into the air and dart back to their construction site. As soon as one leaves, another lands.

Cliff swallow nests are another opportunity for animal statistics. The finished nests look like squat, overturned flower vases. Sometimes swallows will reuse old nests. But the amount of effort required to build a new nest is what amazes me. Depending on the structure of the nest, a pair of birds will carry anywhere from 1,500 to 1,800 mud pellets. Nests anchored at the top use the most mud. Sharing one wall of a nest with a neighbor cuts out about two hundred mud trips, and sharing two walls eliminates another one hundred trips. All told, over the thirteen or so days it takes to build a nest, each member of a pair may fly up to 400 kilometers. They work long days, from fourteen to sixteen hours, not including time spent foraging. And then they have to lay eggs. It turns out that the prime real estate is a nest site that shares two walls; in one study, wherever the opportunity for such a site opened up, it was immediately taken. The time saved adds up to nearly twenty minutes a day, time that can be spent chasing bugs. And cliff swallows seem to want to finish building as soon as possible. They switch mud patches from day to day, depending on if it rained or not, and the consistency of the mud. In order to reach more distant patches, swallows flew faster, as if they didn't have a moment to lose.

The white cliffs loom taller along this stretch. In one section, rectangular canyons stretch back from the river, like enormous opera boxes. A colony of pigeons has commandeered the riverside corner of one canyon. They flutter in and out of the cubby-holes, and when conversation pauses, their cooing softly follows us over the water. Some of the cliffs have shallow partial-caves carved out of their flanks, as if a giant in a snacking frenzy had come along with a melon-baller. More mushroom gardens teeter on the cliff faces, increasingly accompanied by fingers of rock and half-carved pillars.

The color of the stone shifts from off-white to a darker shade of cream with pale washes of cinnamon or dark gray-brown in some spots. A black pinnacle adorns one
spire. The odd color makes me scrounge for my binoculars. A golden eagle. He perches on the highest point of a wall between two canyons, pulling the feathers of his tail through his beak. When he twists his head to rearrange the feathers over his shoulder blades, I can see a slight blond wash across the back of his neck. He's relaxing, not hunting, maybe just waking up from a late morning nap, or taking a break from scanning the hillsides. He could have been up there since dawn, wind ruffling his feathers, and finally decided to put everything back in order. I keep my binoculars fastened on him until another wall blocks my view.

In the early afternoon, Hole in the Wall inches out around a bend in the river. When we first see the natural arch high over the river, the hole looks almost perfectly round. The outcropping of rock is almost a perfect right angle, with the sky showing through in the very top corner. Our friend in the Voyageur hat said there was a trail up onto the top, and once we beach the canoes I can just make out a faintly scuffed line through the sagebrush. The trail swings around the back of the rock peninsula, up the shoulder of the hill, and then snakes across the backbone of the ridge until it reaches the point where bare rock breaks through the soil. From there it squirms up through a narrow slot canyon to spit us out on the parapet of Hole in the Wall.

The pale stone throughout the White Cliffs area once rested at the bottom of an inland sea. Way back in the Mesozoic, the inland sea swelled and retreated, at its highest levels stretching all the way from the Arctic Ocean to the Gulf of Mexico. Hole in the Wall is part of a layer of rock called the Eagle formation. During the Cretaceous, the sea was in a retreating stage, slinking back east, and beach sand deposited then eventually became the sandstone of the White Cliffs. Craning my neck to look up hundreds of feet, I can hardly imagine the vast expanse of time required to lay down that much sand. The sandstone erodes easily, creating fingers of rock, called hoodoos, as well as arches and other fantastic shapes. The mushroom formations that are becoming so familiar are the result of iron-rich concretions, hard spots, that don't erode as easily as the paler sandstone
underneath. Geologists don't really know what creates concretions. When you slice one open, the sandstone texture doesn't look different, but there are concentric layers of color, indicating a process of mineral deposits. One theory, at least for the concretions we pass in the White Cliffs, is that some seed or core particles exist in the sandstone. Because of the rusty coloration, it could be something like magnetite. The magnetic mineral would draw out iron dissolved in water passing through the rock, adding layer upon layer. Later, when erosion exposed the concretion, it would take longer to wear it away than the regular sandstone, and the water would begin carving free-standing formations.

The Missouri is a newcomer to this canyon. The hoodoos and arches wouldn't exist in an ancient riverbed. Even the staunch concretions would have been reincarnated as sediment once again. By human standards, the river has been gnawing at the earth here for a long time, a minimum of 10,000 years. In geologic terms, however, the canyon appeared in a heartbeat. In its youth, the Missouri flowed north across Canada, finally mixing its waters in Hudson's Bay. Then the glaciers moved south, blocking the riverbed. The Missouri backed up to form Glacial Lake Great Falls; along with its neighbor the Yellowstone River, it formed part of a chain of enormous lakes along the wall of ice. When the glaciers pulled their toes back north, the rivers couldn't reach their old beds because of the sediment left by the lakes and the ice. With the next glacial advance, the Missouri excavated its current channel. When the ice finally retreated, the continental divide between the Arctic Ocean and the Gulf of Mexico had migrated almost four hundred miles north. Looking at a map, the Missouri hangs a hard right near Fort Benton, a record of the power of ice.

This whole section of river reminds me of the red rock canyons of southern Utah, just with all the color bleached out. I'm growing to like the spare coloring of the Missouri. I begin noticing the rich variety of grays: blue-gray speckles of rock, green-gray lichens, dark reddish-gray igneous rocks, gray so pale it's only a suggestion on cream-colored stone. Next to the grays, the rusts and browns seem almost flamboyant.
Climbing around in the slot canyon, my appreciation of the colors joins with the amazement at the variety of shapes. In some places the rocks look like they were piled on top of each other and then their edges softened and rounded off, so that there aren't many sharp edges. Most of the corners look like softened butter. Little holes and half-holes appear everywhere: one starts at ground level and is hollowed out up to my knees, about the height of a fireplace; some I could fit my fist into, some just a finger or two, like a bunch of crazed woodpeckers with titanium beaks rampaged across the walls. Flakes and chunks of rock litter the ground, until we arrive at a section where the path forces us to clamber up the steep, smooth incline in a narrow defile. Pillars lie half-submerged in the walls.

From the flat top of the wall, we can see that the canyons along the river are only the front ranks. Behind the ridge we climbed up stretch at least two more canyons, with more hinted at beyond those. I could spend years scrambling around and not see everything. For the past two days we've been drifting past miles and miles of canyons we didn't even know existed, all of it just as strange and wonderful as what we could see from the water. How much were we missing? Beyond the canyons, the land levels off into fields and rangelands. We've been floating a couple hundred feet below the surface of the ground. Climbing up to this lookout has simply brought us back up to ground level.

The river barely hints at a current, placidly reflecting the layered browns of the cliffs and the flat gray of the sky. We can see our canoes from up here, shrunk down to red and camouflage cupcake sprinkles. Near them, a single old cottonwood marks the edge of the vividly green band of the river's influence on the vegetation. Behind the tree, the predominant color is the dusty gray-green of sagebrush, mixed with the brown of dried grasses. All that water, and it only manages to green about thirty or forty feet of the shoreline. Perhaps if the rainfall had been up to normal this year everything would be greener, but in a way, the dry season reveals just how narrow and delicate the river's corridor is. The cottonwoods serve as havens for all the singing birds we've been hearing,
and the river does the same for the waterfowl. This morning alone I've seen several species of water birds—the ubiquitous mallards and Canada geese, but also a pair of northern shovelers (which look like mallards with oversize bills), a western grebe with the crisp dividing-line between its black topside and white underparts, and a common merganser with his snowy white body. All drawn to the river and the thirty-foot swaths on either side.

On the way back to the canoes we slither down the steep parts of the slot canyon. At a few points I mostly just crouch down over one foot until I'm almost sitting on it and slide down the rock, with my other leg stretched out in front to break my fall. We try another, more direct trail down. Coming around a corner just where the canyon has started to widen out, I'm startled to find a rose bush, growing seemingly out of the rocks. A narrow band of wet earth shows that the rose has discovered a little runoff path. The plant rises nearly to my shoulder out of its meager soil. In a greener area, I might not pay much attention to it, but here the colors thrum against the mottled gray rock. The stems are red-brown, and the leaves, with their tiny serrated edges, range from summer-lawn green to a pale yellow-green on the new growth. Rose hips linger on the tips of some of the branches, just a shade brighter than blood. The flowers aren't the layered blooms of domestic roses, but a single tier of pinkish-purple petals, fully open to expose the pollen-yellow centers.

We haul the canoes out at Slaughter River, one of the marked campgrounds on the map. A steep, slick trail leads up the bank. I've never encountered anything like the "gumbo" that makes up the soil in this area. The shales and igneous rocks are the culprits. They disintegrate into clay particles, especially the sedimentary layers formed from volcanic ash. Just add the smallest amount of water, and the earth turns slicker than a wet watermelon rind. And sticks. To everything. When I step out of the canoe, the mud leaps onto my sandals, creating inch-thick clay clogs that weigh nearly a pound each. It's pointless to scrape it off until we're on high ground. A slightly oozier version of gumbo
composes the river bottom just offshore. While I ferry gear to shore, the mud slurps and sucks delightedly at my sandals, almost pulling them completely off a number of times. So far, anything that touches the canoes has smears of mud on it. Rinsing with river water helps marginally. Once the water evaporates, you're just left with a thin film of mud instead of a thick one.

The little designated-campsite symbol on the map translates into a few metal fire grates, permanent pit toilets, and a small shelter with side-by-side three-walled rooms. I'm a little apprehensive at first because we saw another canoe just down the way from where we put ashore. It turns out to be a man in his early sixties and his son, both from South Carolina. Their belongings are draped throughout the two rooms. One of the first things they offer to do, in their faint southern drawls, is consolidate into one room so we can use the other.

The two men tell us they drove here from South Carolina, hauling motorcycles. They used the bikes as their shuttle vehicles. They've wanted to take this trip for a long time, and finally arranged everything with wives and children so they could take a few weeks for themselves. The two men are soothing conversation partners. Soft-spoken, quietly content to be where they are, and at least pretending to be pleased to share the space with us. Their only plans for the rest of daylight are to clean up from dinner and go to their respective tents to read. They spent most of the day lounging here, drying out, and want to start as close to daylight as possible tomorrow.

After eating, Deb and Jason pass the guitar between them. A lone nighthawk calls overhead. I'm starting to enjoy the rhythm of the evenings. Dinner, clean up to the sound of nighthawks, then some music as the last of the light fades. I don't even really think about what time my watch would read if I had it on. I wander off to bed when I'm tired. The idea of the hours-minutes-seconds obsession I'm usually immersed in seems vastly distant, like a hazy plateau. Normally, I'm surrounded by clocks. I wake up to my alarm clock, there's a clock on the stove, one in my car, clock on the bank sign. I don't even
really need a watch, the other clocks are always broadcasting their silent agreement that
yes, at this moment the time is 1:42. In their absence, I feel like I pay more attention to
other timekeepers. When I'm tired, I go to bed. I wake up when I can't sleep anymore,
when the sky grows too bright, or the birds intrude on my dreams. I feel like I sleep all the
better for it, sliding into the murmuring river's world, freed from the artificial strain of
bending my life to minute hand.

Gradually, we're able to discern more of each other's faces than just the flickering
firelight allows. A full moon heaves itself into the sky across the river from us. Just as it
clears the hills, Becca says "You should come over here and look at this."

From the vantage of her log seat, two tall cottonwoods perfectly frame a moon full
to bursting. The shadows from the tops of the hills flee down into the valleys. The river
flows so smoothly that it disappears, merging the cliffs opposite us with their reflection,
creating a canyon twice as deep as the daylit landscape. The moon's double reclines on
the on the dark river surface. The nighthawks glide overhead, dropping their nasal *tee-ent,
* *tee-ent* calls. In the bright light, the white bars on their wings grow luminous against their
black silhouettes.

The moon tangles in the bottom branches of the tree-frame when we disperse for
bed. I linger alone by the river a while longer. I can almost make out colors in the cliffs
across the Missouri. Each layer of rocks appears distinct, even in the reflection.

Something splashes in the middle of the river, a fish jumping for insects, or maybe just
leaping at the moon. The ripples on the surface make the water-cliffs tremble, stretch the
river-moon in odd directions, breaking the edges of the reflection into sharp wave-top
shards. The calm of the river seeps through my skin. Or maybe I've been absorbing it
these past few days, I just finally noticed it. Unhurried but moving, nearly silent but
strong. I haven't felt this content in a long time, and I hope to keep at least a small piece
of it tucked away in my head when we leave the river.
The cliffs subside into brown, dry hills, receding from the river's edge, leaving small flats cupped between the shore and the steep ground. Fences outline polygons of property here and there, sometimes down to the river edge. Cattle attempt to graze on dry grass and small-leafed shrubs.

The map declares several rapids along this stretch. I keep waiting to hear water snarled around rocks, but we're almost through the first one before I even realize we're in it. The canoe bobs through inch-high riffles, water splashes my leg once. Maybe if the spring runoff was up to average this year the rapids would be a little more, well, rapid, but I'm not so sure. After the excitement ends, we lash the canoes together. That way we can all chat, and both canoes together won't turn so easily in the current.

We reach Judith Landing just as the sun slides past overhead. A massive bridge appears, stout concrete legs planted firmly in the river, overpowering the two halves of the gravel road it connects. Our voices echo against the shadowy underside of the bridge. Cliff swallows swish in and out, building nests in the joints of the legs. When we reemerge into the sunlight, a small, harried-looking crew loads the last of the barge trip onto a school bus. Several older people stand by their luggage near the bus entrance, seemingly unsure of where to go, or where to put their luggage, or maybe, since the bus looks stuffed to the gills, unsure whether they or their suitcases have precedence. We beach the canoes just past the landing, out of the way of all the bustle.

We shouldn't have worried. The buses roar off as our feet touch dry ground. Soon we can hear the bees humming in the shrubs next to the river and along the waterline. Some men lounge near a truck outside the tiny store. Jason asks if they know the weather forecast for the next few days. One of them mildly jokes it will probably be hot and dry, like the rest of the summer, although they could use the rain. I can't shake the feeling that they're poking fun at us somehow, although they don't say anything overtly. They inform us that the family reunion from the first day left the river that morning. Something must
have changed their minds, because at the put-in one of them told us they were going down to Kipp. Too much family togetherness, perhaps.

After talking just enough to be polite, we stroll to the store. Inside, it feels stuffy and cramped, with a few shelves of provisions, some postcards, and something that immediately draws our attention: a cooler with ice cream bars. The woman behind the counter reads a magazine, barely glancing up when we walk in. She's roundly pregnant and perched on a chair made before ergonomics. The four of us mill around for a while, ogling the snack food. A tall, lanky man steps in through a door behind the counter. He's so thin a strong grasshopper could knock him over. A cowboy hat shades his long, narrow face, and a thin brown mustache emphasizes his bare cheekbones. He instantly has her full attention. She asks him what time he'll be home, and he tells her not until late since he's going to town so someone can look at his truck. By this time we've all picked out what we're going to buy and stand waiting at the counter. I can't really bring myself to interrupt. She looks like this may be the most interesting part of her whole day. Finally they kiss quickly and he ducks out the back door. Becca asks if they sell any water. The woman tells us they used to, but the well dried up, so we're out of luck. We were hoping to supplement the water that's left, but we have at least two untouched jugs, which should be enough for the next few days.

I don't feel like interacting much with the people here. Maybe it's because we're only here for a brief stop. But I think it's more that we're in the middle of this river trip, and the people at the Landing don't seem terribly relevant to what we're doing. I feel disconnected. Not in the sense of wanting to connect or being unable to, but rather that they're stationary while I'm in motion. I'll climb back into the canoe in a little while, and the woman here, the men outside, will be spending the silent, dusty afternoon in this spot next to the concrete bridge. When night comes, the men will drive home, the woman will shuffle to the house across from the store, and in the morning she'll be back again. I wonder if any of them will even look out at the stars. I hope so.
After several hours of intensive basking, we stop to swim in an eddy behind a boulder the size of my old VW Rabbit. Wading into the water turns out to be a lot colder than just dabbling my fingertips. The water swirls around my ribs, and it becomes a game to keep my feet planted on the riverbed rocks. I try a brief breast stroke upstream, but I don't want to swim too far out into the current. I can't see more than a few inches into the water. All sorts of little bits of things float by me: little sticks, leaves turned into lace by insects, a dragonfly wing, a dead bee. I could pass within inches of a hundred pound paddlefish and never know. With that thought, I let the river carry me back to the rock and haul myself onto the moss like a seal. I leave my feet dangling in the water so the river can tug at them in a slow dance.

Later, we spy an open, grassy area next to the mouth of a creek. We pull up downriver of the creek, paddling towards the shore. I'm in front, so I drape a leg over the side and step out of the canoe to pull it onto the back. Or at least, that's what I intend to do. Instead, I put my foot out, feel it hit mud, and keep right on sinking. I lunge for the canoe as best I can without ground to push off of.

"Don't bother getting out here. There's no bottom." That fabulous river gumbo coats my leg up to mid-calf. We shift downstream a ways. This time, my foot hits bottom, but the mud is over my ankle and when I take another step, my sandal doesn't. Luckily, I catch my toes on the ankle strap, so I don't lose it. Shluping and sucking with every step, we pull the canoe partway up the bank. There are cottonwoods back from the bank, and the ground is level for thirty feet or so, until it slopes up into dense thickets of brush.

The nighthawks begin calling as we finish dinner. Jason brought a fire dropcloth we haven't used yet. In light of all the grass here, it seems like a good time to experiment with it. Basically, it's a square of fireproof material, used in place of a fire pit. At the fire that night, we nestle potatoes among the orange coals, little phoenix eggs to be resurrected as hash browns in the morning. Moonrise is later than the other night, so we
have a chance to admire a sky riddled with stars. Tomorrow, I may try and sleep outside. Tonight I just want to revel in a dry tent and dry sleeping bag.

The next morning we devote to a lavish breakfast. Coffee, omelets, thick bacon, hash browns. The result is a savory meal under a clear, sunny sky that begs for second helpings and lingering over coffee. We eat until we're stuffed, then lie around like sleepy hippos. Such a luxury to choose what we want to do moment by moment, without worrying that we're displacing something else. Without a thousand small deadlines breaking the day up, time seems to move slowly, like a bumblebee on a hot summer day. And yet, I'm surprised when we finally launch back onto the water that the shadows are starting to creep out from directly under the trees again.

Small islands dot the map downstream from where we camped, so we delay hitching the canoes together. The first island we clear without problems. Next are two islands together, guarded by a gravel bar. The bar rakes shallow V's where it nearly breaks the surface. Becca and I ground out once, the middle of the canoe dragging itself onto the gravel with a hissing, grinding noise. Up ahead, a white pelican rests on the water. His feathers are nearly blinding in the bright sunlight.

"Hey Becca, let's head towards the pelican. It should be deep enough for us if he's floating."

"Sounds good."

She paddles a bit and I steer toward him, on the far side of the next gravel bar. He's busy shuffling his long bill through the feathers on his chest, stretching his neck as far back as it goes. Those medieval bestiary folks who maintained that a mother pelican fed her young by piercing her breast and letting them drink her blood must never have seen an actual pelican. I don't think the mother could get the leverage to pierce her own chest. Pelicans do spend time stretching their pouch, keeping it limber for fishing. Supposedly one way is to angle their heads down, as this one is, and spread the pouch
over their chest. Maybe, from far away, it might look like a wound. We're only about thirty feet from the bird when he decides to stand up. On the gravel bar he was sitting on. It takes me half a second to realize he wasn't floating at all.

"Becca, backpaddle! We'll get stuck if we..." ssschunk! "go that way."

The front of the canoe digs in, and we slowly pivot around. We try backpaddling, but the current keeps us wedged on the gravel.

"It's not working. Just let us swing around," Becca suggests.

I lay my paddle across the thwarts of the canoe and let us drift. The weight of the rest of the canoe being pushed by the current does manage to pull us off the gravel with a sound like a Guinness-Book-of-World-Records-sized paddlefish gnawing on the aluminum bottom. Of course, now we're floating backwards. We turn around just in time to see the pelican, who's decided the neighborhood's going downhill, fly upriver. The tips and edges of his wings look like they were dipped in India ink. He flies just above the Missouri, head tucked back against his shoulders.

In the late afternoon we pull over to scout for a campsite. We're definitely in the badlands now. The shrubs grow widely spaced from each other, and clumps of prickly pear spread their spines across the dirt. A dry creek drainage pries a space between the bluffs. The mud in the creekbed dried with the tracks of running water still on it. Rounded V's point downslope, each layer crepe-thick. A set of deer tracks crosses the bed, and we follow them to a narrow trail up the wall of the canyon. I'd thought the strange rock formations were limited to the White Cliffs, but this little waterway has its own small-scale oddities. We wind around mini-archways and pillars of stacked rocks. Finally we scramble out onto the bluff. I'm wearing sandals, so inevitably I have to stop and pull a few needles from my toes before admiring the view. The Missouri twines sinuously around the bluffs. They're shaped like giant anthills of dark, purplish-brown rock and dirt. The color and shapes seem older, more worn down than the White Cliffs area. Tiny water
channels carve veins across the ground in the slightest depressions. Water could have flowed across this bluff yesterday or not for twenty years.

One of the coves downstream holds promise of a good campsite—at least a tree or two grows there. We're paddling down the middle of the river when I see something twisting in the water.

"Becca, is that a snake?"

"Yeah...I think it's a rattlesnake."

Fascinated, I watch the snake draw S-curves through the water, head held just above the surface. If it suddenly stiffened up like a board, it would easily reach four or five feet long. I had no idea rattlesnakes could swim, although I guess the motion isn't all that different from slithering across open ground. I wonder if it's headed someplace in particular, or if it just felt the need to keep moving. Did it hesitate before sliding into the water? Does it have any concept of how wide the river is?

"Hey, do you see the snake?" I call back to Deb and Jason. My eyes remain fastened on the three or four stubby rings on its tail.

"Yep. It's huge."

At this point, splashing breaks out. I twist around to see Deb and Jason backpaddling furiously. In trying to give it space to go between us, Deb and Jason wound up directly in its path. It noses against the aluminum camouflage, rising higher and higher against the side. Its tongue flickers. Luckily the backpaddling finally takes hold and they pull back enough that the snake continues on its way. What would they have done if it crawled into the boat with them? Hold still? Whack it with a paddle? The little warning brochures don't give any instructions about that.

Finding camp is anticlimactic. The sky remains clear and the moon rises late tonight. A good night to sleep out. After another long evening by the fire, I snuggle down into my sleeping bag. The Milky Way brightens. My sense of pacing has slowed down on the river. There's a certain sense of freedom in not having any particular destination each
day. Such a difference from even the amount of scheduling it took to get us all to Kipp. I trace the lines of Cassiopeia's throne above me. There's a psychological theory that you only notice time when it progresses differently then normal. It's true in this case. Instead of rushing around worrying, keeping track of how much time I can afford to allot for different activities, I've been drawn into what's around me. The colors and textures of rocks, the gestures and sounds of birds. It feels fuller than my normal routine, although it would be a short list if I had to compare my activities on the river with my normal to do list—wrote in journal, watched cottonwood leaves flutter in the breeze, counted swallows. I scan the sky for one of my favorite constellations, the Corona Borealis, the Northern Crown, a perfect circle of stars, usually almost overhead. The stars cluster so thick I almost overlook it. If I can just keep a small sense of river time with me when we leave, of the humility of drifting through non-human time, this trip will be worth it.

The next morning we tackle the prickly-pear flats. The plants away from the river tend towards the gray end of green, as if they're too hot and tired to produce much chlorophyll. A few brave prickly pears, however, struggle to bloom. Most of them just have pale buds at the end of one or two of their segments. One precocious plant manages a full bloom. Against the prevailing brown-gray dirt and green-gray vegetation, the yellow flower stands out like an exclamation, a shout of color, more golden than a buttercup, with drops of magenta tipping the outer petals that formed the husk of the bud. The petals are arranged in nested layers, like a rose, and feel slightly waxy to the touch. I run a finger over it softly, enjoying the smoothness in contrast to the inch-long porcupine spines just below the flower.

The flats gradually slope up to a series of hills and another dry creek. This one is wider than yesterday's. The bottom carries a map of where the last water flowed, and flowed quickly, judging from the fact that there aren't many plants growing within the waterline. We find a narrow chimney of sorts to scramble up. It spits us out along a ridge
below the steepest part of the hills. The dark rocks are already warm to the touch. We're sipping water and considering the intrigue of several gullies when Becca calls us over.

"I think there are some bighorns up there. I was looking through my camera when I saw something move just behind that cliff."

Deb and I pull out our binoculars. At first, I don't see anything. Then, way up one of the steep anthill slopes I see a male bighorn sheep, leading the way across a precipitous slope. Two kids and two ewes follow him. With each step, a little section of dirt tumbles down. The surface isn't much more than soil that hasn't slid to the base of the hill yet.

The male stops, climbs up higher and stands looking in our direction. The kids halt, refusing to go further. One of the females nudges the nearest kid. He doesn't budge. She carefully steps around the youngsters to the front of procession. They all remain still for a bit. Trying to decide if we're a threat? Examining the route? Suddenly one of the kids jumps onto the slope, kicking up his heels and bouncing a few steps until he's first in line. The male picks his way back to the first female, each step slow and deliberate. He pauses next to her, keeping his head turned in our direction. After a while, he turns around and heads back the way they came.

The plague of gnats hits after an hour on the river. They start with advance scouts. I half-heartedly wave them away from my eyes and ears, reclining in the stern of the canoe, dozy with the sunlight. But the bugs don't wave away. More and more dance around my face and neck. I spot two kinds: one with a short squat body not much bigger than a comma; and one that's about twice as long and shaped like a miniature cigar. After a while, I'm not sure which is worse, the gnats diving for my eyes or the gnats I can hear circling my ears. The whine of their wings isn't as high-pitched as a mosquito, and has more of a buzz to it. Wearing a hat simply invites them to crawl around under the brim, and I can still hear them. I finally tie a bandanna kerchief-style around my head, tugging it
over my ears. Still they kamikaze into my eyes, and I swallow at least two thrill-seekers while I'm talking.

By the end of the afternoon, we look like refugees from a movie lot. Deb and Jason wear straw cowboy hats, Jason with a bandanna around his nose and mouth in classic Western train robber style. I've added a bandanna across the lower half of my face, like a Technicolor extra from the set of Lawrence of Arabia. Becca has her shirt pulled halfway off so that she peers down the tunnel of the neck hole like a Jawa from Star Wars. Only thing missing are the glowing eyes. Sundance lies curled up on her little shelf behind Deb, gnats crawling on her eyes and nose. Her whole body is limp and still, an unheard of phenomenon. Her blue eyes blink out the bugs now and then. Listless, I watch the dark rocks of the badlands fall away. I wonder where all the swallows went—only couple hunt over the water. I want to cheer as they skim past us. And where are the kingbirds? Someone should tell them they're missing out on a feast. Unless, of course, the gnats would swarm them too and drive them shrieking back upstream.

The "buffalo" part of "buffalo gnat" comes from their hunched over posture, supposedly like the hump of a bison. They're also called black flies. Until they're full adults, they depend on the river. Females lay eggs on whatever submerged vegetation or debris they can find. Temperature is crucial. Cooler temperatures cause the eggs to hatch later. In some species, autumn eggs won't hatch until the water warms again in the spring. As larvae, black flies fight the current by anchoring themselves with suction discs and tiny hooks at the end of their bodies. They comb their meals from the current with a fan on their head. They also have gills, so they remain submerged until they're adults. The odd thing is, they actually grow smaller when they change from larva to pupa. Larvae are usually about a quarter inch long, but when they metamorphose, they shrink down to about half that. A few days in a cocoon, gill tendrils waving in the water, and the adult black fly emerges, floating to the surface in a bubble. If you could shrink yourself down to black fly size, it must be an amazing sight. The new insect wriggles out of a close-
fitting cocoon into a silvery bubble. The bubble rises to the surface, perhaps allowing the fly a brief fisheye view of the sky before it bursts, exposing the insect to the air for the first time in its life. It flies away immediately, in search of a mate and food.

We range across the width of the Missouri, hoping to find a corridor of respite. Even floating down the dead center of the river, they find us. We try just floating. When a breeze picks up for a few minutes, the number of gnats slacks off. As soon as it stops, they're back. We try paddling. It doesn't ease the presence of our tiny flying tormentors, but it gives me the grim satisfaction that we're closer to stopping for the day. I hope that once we're clear of the water, the gnats will leave. It's probably the only thought that keeps me from diving into the river. (Well, that and watching cow standing in the shallows take a dump directly into the water.) I spend long swaths of time fantasizing about being able to selectively shiver my skin like a horse. I wish I had listened more carefully to the outfitter with the Voyageur hat. I thought he said "The gnats get bad down around Kipp." What he actually said was "You'll wind up feeling like one of those bug-stunned water buffalo on the Nature channel that would gladly stick its head in a crocodile's mouth just to escape the gnats for a split second."

Late afternoon, and the gnats remain with us, tirelessly orbiting our heads. We take refuge on a little stretch of mainland that allows us to escape the waterside. At one point, something wore a steep trail up the eight-foot bank. We beach the canoes and unload everything in record time. Tents first. We set up well back from the water, among the prickly pear. The gnats continue to hound us, and I'm ready to believe they're a supernatural menace. Deb and Jason dive into their tent, and I scramble into Becca's as soon as it's upright. Becca earns my undying gratitude by remaining outside long enough to mix apricot-and-vodka cocktails for everyone. I'm not much of a drinker, but the sweet burn of the cocktail makes me feel human again instead of like a half-crazed ungulate.
A rumble from the sky half-wakes me. My first thought is that it's another fighter jet flyby from the Great Falls air force base. Another rumble, long and drawn out, louder. Thunder. We didn't pack anything in the drybags last night. Another rumble, more insistent. I wake Becca up and we stumble out.

Clouds tear across the sky, yet none of the wind reaches the ground. Lightning flickers in the hills. The gnats hit us only a few steps from the tent. I pull a bandanna over my ears again, and the two of us frenetically pack food and dishes, the stove, then return to the tents to stuff sleeping bags into drybags, stash all the clothes and books and dry shoes. Deb asks why we're making so much racket.

"There's a storm..." The next clap of thunder stomps out my voice.

The clouds roll overhead in distinct, sinuous bands, each darker than the one before. The wind pounces on the trees barely a minute before the rain. Becca unearths some cards and we play rummy. The rain on the tent sounds like the inside of a drum. The wind leaves the trees as suddenly as it arrived, but the clouds overhead continue sailing fast. Sitting still after all the excitement, I find out another important piece of information everyone neglected to tell us—buffalo gnats bite. I'm covered with tiny red welts, and I haven't itched like this since I had the chicken pox. I groan inwardly. I spent all day in my swimsuit in an effort to keep cool. I might as well have put an "EAT HERE" sign on my hat.

All of us are covered with bites we didn't feel yesterday. At least mosquitoes have the courtesy to bite hard enough to cause a sensation. Even Sundance has pink bumps under the short white fur of her snoot. Twenty-one bites cover my left leg. A dozen speckle the top of my chest. Only females buffalo gnats bite. They need blood to produce their eggs. Otherwise, they join the males in drinking nectar and plant fluids. The females have sharp, serrated mouth parts designed for slashing skin, and spongelike mouth parts for lapping up the pool of blood that results. Males only have the equipment to terrorize vegetation. The itching buffalo gnat victims face probably results from histamines in the
insects' saliva, a chemical that causes capillaries to dilate. A high number of bites can cause headaches, fever, or even nausea. Buffalo gnats use any method they can to find prey: carbon dioxide, moisture from exhaling, dark colors, sweat, and some perfumes. Some species may prefer a specific animal as a host, but they'll try anything. Black flies attack humans, livestock, wild animals, and birds. No wonder the river is so quiet along this last stretch. Females bite for about three weeks before laying eggs and dying. In that time, they may cover an epic distance for their size, sometimes up to ten miles, in search of a blood source. Their whole lifetime lasts only a few weeks, but it must seem like a full life from their vantage point.

Sometimes the consequences of gnat attacks are more serious than itching. Dairy animals may produce less milk during heavy attacks. There have been cases of black flies so thick that livestock breathe them in, sometimes dying as a result. Other times, animals have been bitten by so many flies they die from the injected venom, or from anaphylactic shock, which causes difficulties in breathing. I would probably add psychological torment to the list.

The next hurdle for the day turns out to be reaching the canoes. I grab a water jug and set foot on the path. Next thing I know, my spine feels like I got thrown from a horse and the mud is soaking into the seat of my pants. The rain turned the path into a gumbo slide. Becca tries going down, more carefully after my mishap, but she only makes it two steps further before she winds up parallel to the sky. Both of us eye the cooler. We solve the problem by avoiding the path altogether. Jason and Becca slalom down to the water's edge, while Deb and I lower the remaining gear. The whole situation seems a bit ludicrous, enough to make me forget the gnats for a while.

It seems ironic that in what basically amounts to a drought year, we've managed to pick the one week of rain. We float along, paddling a little. Jason and I begin an in-depth conversation on comic books and graphic novels. After an hour, something mumbles in
the distance. We ignore it for a while, but it grows more insistent. Lightning flares inside
the clouds behind us. Still no wind, and the ever-persistent gnats.

Becca examines the map.

"Well, the river turns up ahead, so the storm might pass behind us."

We unhook the canoes and paddle hard. I try to remember to pull with the muscles
in my back, not just my arms, and that helps with the fatigue. But not enough. We pause
for a weather check. The clouds still follow directly behind. Back to paddling hard. Deb
turns around in the front of her canoe to paddle backwards, to rest the forward-paddling
muscles in her arms.

We round the bend. Two more canoes appear behind us. Lightning reaches for the
ground. I'm increasingly nervous. I grew up in the Midwest, and you don't mess around
with thunderstorms there. Even when they don't turn into tornadoes, the wind and the
lightning sometimes turn ugly. The clouds behind us are blue-black. There's also the fact
that we're sitting on open water in aluminum canoes.

I suggest we stop if the lightning catches up. Becca agrees with me. She's worked
out in Idaho during some ear-splitters. Fifteen minutes later, we drag the canoes onto a
gravel bank and climb up onto a grassy island. The gnats are still ferocious. Again, the air
remains still until just before the rain pelts us. We have a gnat-free window of about five
minutes. I join Becca and Deb in huddling under a tarp for a while, but I can't see
anything and really it's too small to cover all three of us and the dog. I duck out into the
deluge and stand next to Jason, admiring the blue-white lightning flashing momentary
river-maps against the dark sky. The canoes behind us pass by, refusing to stop. They'll
probably be fine, but I wish them luck anyway. One of the men said his canoe was made
out of some sort of ultra-light plastic, so he'll at least be safe. The rain pockmarks the
river, and the water turns a darker shade of brown. The wind rips leaves and twigs off the
trees, bends the grass almost flat.
The heart of the storm passes over, and soon the rain slackens off. The wind charges along the river, stirring up small whitecaps, and then suddenly disappears. Deb and Becca lift the tarp, and Sundance leaps into a sprint, dashing across the island. By the time we make our way to the canoes, the gnats have found us again. I can't believe there are any animals on this stretch of river; I would have thought they would have thrown themselves off a cliff by now. And yet, we see a beaver crossing a short channel between islands when we take off. Maybe he just ducks into his snug little lodge when the gnats are too bad.

Two hours and we reach the general recreation part of the river. We start passing the weekend crowd. A group of men, fishing from the bank, are already into their second six-pack. Just after we pass them, I spot some mallards bobbing near shore. Just above them, in the brush, a coyote watches intently. He glances up when we float by, hesitates, then disappears into the brush. Soon, nearly every flat space by the water holds an angler or two, settled into lawn chairs for the morning.

We paddle up to the Kipp boat dock shortly after noon. We unload our bags and paraphernalia off to the side. Deb and Jason set off to bring the cars around.

When they return, they share some interesting trivia.

"The host told us regular bug spray wouldn't have helped with the gnats anyway. The only thing that seems to work is vanilla. She gave us some Skin-so-soft to put on."

"Does it work?"

"I don't know. They don't seem as bad here."

The shuttle back to Coal Banks eats the rest of the afternoon. One last dinner under the nighthawks. A fire to round out the night. The sunset flares across the sky in pinks and purples and tangerine, glowing red-orange on the scattered cloudlets. Deb tunes her guitar softly as we sit and watch the colors change and fade. She plays for a long time tonight—Dar Williams, Indigo Girls, Kate Wolf. Love songs, goofy songs, songs about trouble and hardship and a couple about rivers. Jason steals away to bed first. Deb and
Becca and I stay. Deb sets aside the guitar. We watch each other's faces flicker orange as we talk quietly. The conversation skips like a stone on the river surface, touching on the joys of showering for the first time in a week, on surviving the gnats, on side canyons we want to return to explore. The topics expand to the pleasures of traveling, to finding a place to stay home, stories and wishes weaving in and out of each other, we talk about the future until we can't keep our eyes open. We take the last of the water jugs and dump it over the fire, hissing and smoking and popping, until the flames lie down in the ashes and go out.
Works Consulted


Stepping onto the ice feels like entering a Ray Bradbury story. The one where the sun appears for only a few minutes every seven years on Venus, and the children who have never seen it rush around in the brilliant, squeaky-wet jungle until the rain comes again. In my version, we all spill out of a snowcoach onto the Athabasca Glacier: the Japanese and German and British tourists and my sister, brother, parents and me. We have twenty minutes before they round us up and we climb back onto the six-wheeled moon-buggy bus. Twenty minutes to taste the water that was frozen before the Industrial Revolution. Twenty minutes to slide and slither and crunch over meltwater-carved runnels on the surface of the glacier. Twenty minutes to squint at the red and blue flecks of a walking tour setting off on the far side of the glacier, where the ice spreads over the lap of Snow Dome. It seems a paltry amount of time compared to a morning spent waiting in line at the visitor center—in line for tickets, in line for the bathroom, in line to get on the snowcoach.

I suppose I should complain about being herded around with other tourist-cattle, but I'm too energized, or maybe enthralled is a better word, by the fact that the ice under my feet has been crawling for over a century, that it's in motion at all, the whole solid hill of it, a mountain of frozen water that won't stay still. The brochure from the motor coach company lists the surface speed of the glacier where we're standing at 25 meters a year, about 80 feet for us Yanks. It seems odd to speak of such creeping motion as "speed" or "velocity," although I know those are the technically correct terms. The movement of the ice isn't uniform. The leading edge of the glacier, the toe, moves at a much slower pace of 15 meters per year (50 feet) and the icefall, where the glacier does a slow motion tumble
over a steep cleft between the mountains, tears along at the ripping rate of 125 meters a
year, nearly 400 feet every time the earth spins around the sun.

The glacial scale of size and time seems to naturally slide my thoughts back
towards a more human dimension. I have difficulty keeping my mind exposed to the
vastness, and seek shelter and comfort from the people around me. At the bottom of my
thoughts, underneath enjoying another family vacation, simmers a slight ache. I miss
them. After these next couple weeks, they're all going back to their lives 1,600 miles
away, to live in a place I have no desire to return to.

Nearly every summer I can remember, my family embarked on a two-week
vacation. At least one destination was a national park. Acadia. Rocky Mountain. Bryce,
Arches, and Zion in one fell swoop. Grand Canyon. Mesa Verde. Great Smoky
Mountains. Dad is the geographer of the family. He planned the routes and timetables,
calculating distances and stopping points. A few days before we left, Dad would spread
the road atlas over the dining room table and John, Karen, and I would kneel on our
chairs to watch him highlight our route, crossing state lines and rivers, passing through
the dots of distant towns. The day before, Mom would take us to the library to pick out
our vacation reading. We took great care in choosing which three or four books we would
bring.

The vacations started when I was too small to hike. There's a photograph of my
dad, grinning under his mustache, with me in a blue kid-backpack, chubby legs sticking
out the holes in the bottom. Another picture shows my siblings and I with my mom: I
look about ten, and am carrying my three-year-old brother piggyback, while Karen flashes
a gap-toothed seven-year-old grin. The car seemed to shrink as my siblings and I got
older, crowding our legs and elbows together. We developed a system of rotating who sat
in which seat, so that each one of us would spend equal time with our feet squashed
between the bag of books and the bag of swimsuits. When Mom was driving, Dad would
turn around so we could play rummy, passing around a book as the tabletop for the
discards. When it was Dad's turn to drive, Mom would read to us from books such as Mr. Popper's Penguins or Charlie and the Chocolate Factory or The Lion, the Witch, and the Wardrobe, filling our heads with stories as we drove across the country.

My most vivid memories of childhood are from those vacations. They were our own versions of National Geographic specials, trips to explore new places. Sometimes they were relaxing and mellow. In Virginia's Kiptopeke State Park, we camped in open pine forest on the Chesapeake Bay during the park's inaugural year. We were one of about three small groups of visitors, another family and a middle-aged couple on motorcycles. There was almost no groundcover, and the large columns of the trees grew just far enough apart they created islands of dappled shadow separated by bright sunlight. You could see our entire camping loop and the next one over through the gaps between the trees. One morning Karen, John, and I took a canoe tour of a salt marsh along the shore (we were the only ones that showed up, and the ranger was delighted we did). Some of the channels we navigated were so narrow the grass hissed along the gunnels of the canoe. Later that afternoon, the same park ranger taught us how to fish for crabs by trailing chicken feet in the water.

Our trips didn't always go according to plan. We attempted to go whale watching in Maine, but had to give up after six attempts. Most of the trips were cancelled because of weather, but the one brilliantly sunny day we went out, one of the boat engines broke. We went two days later, even though it was foggy, because the woman at the boat ticket sales counter raved about how the fog had lifted once they reached open ocean the day before. They had seen four humpbacks blowing bubble nets to catch fish. The fog remained stubbornly in place. All we saw were a scuba diver, a puffin, and John turning the same pale shade of green as our bathroom tile at home (we didn't know he was prone to seasickness). Karen and I spent our time on deck, trying to balance on one leg as the boat rocked over the swells. Another time, while driving through Utah one summer, a storm swept over us, wind rocking the car and the rain falling in curtains across the
windshield. Dad finally pulled over. Then the hail started. The rain had been loud, but we couldn't hear each other shout above the rattling of the hailstones. It was like being stuck inside one long, continuous cymbal crash at the end of a symphony.

The whole landscape in the Canadian Rockies is one large echo of the groaning, slow shift of glaciers, a sonogram written in rock. Remnants of the last reign of glaciers still slide ponderously through the mountains, hinting at what this corner of the world used to look like. The Athabasca Glacier, for example, is only a tongue of the much larger Columbia Ice Field. Other glaciers, parts of the ice field, peek over ridges at the head of the Athabasca. A hanging glacier slumps over the edge of a cirque, the sheared-off sides revealing layers of gray and white ice. Dark bands indicate ice exposed during summer, a time when the glacier flows relatively quickly and is more prone to cracking, when it collects dirt and pollen. Snow protects winter ice from debris, and it flows slower, with less cracking, so it tends to be whiter in color. The end of the hanging glacier drapes over a steep section of rock, like thick grayish cake batter halted in mid-pour. Further up the valley, towards the mouth of the Icefield, tumbled, jagged blocks of ice mark areas where the glacier wrinkled over rocks on its journey downhill. Patches of deep blue sky curl and twist between the fast-running clouds. The ice blazes white in the sun, dimming into muted blue-grays and gray-greens under the cloud shadows. The cold breath of the ice seeps through all three layers of my clothing. It is the first week of August, and the mildest mood the glacier will be in all year.

I didn't read John Muir until my early twenties. He didn't change my life, although I enjoyed reading him. I already knew I cared about the types of places he wrote about. Driving for two days straight to visit a park told me more than any essay that my parents valued those places, that they were worth seeing. I admire Muir's fierce praise of wildlands, but I could never entirely sympathize with his penchant for solitude. My first mountains, the Rockies, solidified on the horizon during a family vacation. The first time
I felt the ocean washing sand around my ankles, family vacation. A dusty mule ride down a narrow trail into the maw of the Grand Canyon; peering into the dim, cool doorways of adobe cliff dwellings at Mesa Verde, ravens blacker than shadows circling at eye level; the steaming turquoise of Morning Glory Pool in Yellowstone, all on family vacations. There aren't many wilderness stories about traveling with your parents. Aldo Leopold wrote about canoeing with his brother, who stays mostly in the background of the story. I suppose there is something far more romantic to the American mind about a lone soul engaging the wind and rocks than the intricacies of a family in motion. In Muir's essays, no one fights over whose turn it is to do the dishes. But there is also no one, except his pen and paper, that Muir can turn to and say "remember when we hiked through a blizzard on the fourth of July, and saw the duck skating on a frozen lake?" That type of shared memory forms the bedrock of my outdoor experience, and I pity Muir a little for all his solitary journeys.

We're the stragglers on the ice. By unspoken agreement, all five of us spin the allotted time out to the last second, when the tour guide waves at us to return. I snap some pictures, but what I really want to do is poke and prod at the ice, examine the gravel encased inches below the surface, let the meltwater turn my fingertips red. After the snowcoach rumbles us back to the visitor center, we walk to the toe of the Athabasca Glacier.

Although the last major glacial advance, the Wisconsinan, ended over 10,000 years ago, the Athabasca continues its slow waltz across the mountains, advancing and retreating on a smaller scale. In the mid-1800s, it was a third larger than it is today. After that mini-peak, it gradually retreated, until by the 1930s it recoiled far enough that there was solid ground to support the Trans-Canada highway. My boots crunch on the wet gravel of the path to the glacier. The closer we approach to the glacier, the softer and more saturated the path becomes. We pass Sunwapta Lake, a blue-gray basin of meltwater from the Athabasca that formed in 1938. The lake swelled to its largest size in 1966, but
Athabasca Glacier
now the chalky tributaries are busy filling it with debris. On warm days in the summer they deposit up to 570 tons of sediment. At its widest point, the lake almost spans the width of the glacier, maybe a little over a half mile.

Gelatinous spots riddle the mud at the very edge of the ice, appearing solid until you try to step on them. Signs warn about the danger of crevasses, and recommend not going past a certain point unless you're with a guided tour. In our exuberance, and above Mom’s protests, John and I climb up to that point, weaving our way around the interlacing runoff streams. Ever since he was small, John has driven Mom crazy with his tendency to scramble up trees and rocks, and for once I join him. Crevasses a handbreadth wide reveal pure glacial ice, a bright, rich sapphire, a stained glass window with a view deep into the ice. Glacial ice is a different creature than the ice that forms on rivers and ponds. Instead of growing ice crystals in place, this type of ice originates as snow. The Athabasca Glacier averages ten meters of snow every year. When snow falls on the glacier, for several days melting and compaction take their toll, shearing the delicate spikes and feathers off the snowflakes until they become round grains of snow. The "old" or "corn" snow particles fit snugly together, and as new snow falls its weight presses on the older layers. After about a year of being increasingly crushed, of melting and refreezing, the snow becomes a new substance halfway between ice and snow called firn, or névé. Although not as solid as ice, the old snow crystals are no longer entirely separate either. As the inexorable process continues, the weight of millions upon millions of snowflakes crushes the openings between the grains of firn, squeezing out most of the air until what's left is sealed into bubbles, little time capsules of air sealed from the atmosphere. The fine, light snowflakes, with their delicate six-pointed structure, have finally become ponderous glacial ice, impermeable to water or air, a substance so hard it is sometimes described as a mineral, or as writer Bart Robinson phrases it, "rock with a low melting point."
This is how leaving for vacation goes. The night before, Mom wants to pack the car, have everything ready so we can stumble downstairs and out the door in the morning. Dad would rather watch the Cubs game.

"Tom, could you bring up the stove and the cooler?"

"At the next commercial."

Ten minutes later. "Have you packed your clothes yet so I can bring the duffel down?"

"Not yet."

"When are you planning on doing that?"

With each comment, the volume cranks up a notch.

"The game's almost over."

"If you wait until the end of the game it'll be 11:00!"

"It won't take that long."

"Fine. You're the one that wants to leave at six in the morning. And don't blame me if you don't have any clothes to wear."

Karen and I grin at each other over the half-packed duffel. "Ahh, it must be time for vacation again." Karen and I shared a room growing up, and we always packed together as well, following the One Duffel Principle: no matter how long we're leaving for, two days or two weeks, we always fill one duffel bag. Mom is a great believer of preparing for every weather possibility, and it rubbed off on us. We include everything from long underwear to swimsuits.

We all want to go. That's never a question. Yet for some reason crossing the threshold between the world of work schedules and the world of relaxing out of doors throws my parents into nights and mornings of crossness. When I was little the "loud discussions," as Mom calls them, worried me. I finally realized that my parents only yell about inconsequential problems. Serious issues merit quieter discussion. It works for them; they've been married for thirty-two years. Karen and I zip up the duffel and join
John in quietly carrying tents and pots and pans up from the basement, unearthing sleeping bags from the depths of closets while the "discussion" continues.

The sun hasn't cleared the horizon when I roll out of bed the next morning. A quick bowl of cereal, brush my teeth. Dad frets about the time—he wanted to leave at 6:00, and it's already half past. He has to rearrange the sleeping bags and suitcases in the car carrier because we forgot pack the Dutch oven. Mom asks everyone for the fourth time if we packed our hats. The sun heaves itself into the branches of the old maple in the backyard. I run upstairs to grab a pillow, plucking Mom's sunglasses from the kitchen counter on my way out, and scramble into the back seat over a bag of books. We have to stop halfway out of the driveway so John can hop out and shut the front door of the house. Three blocks later, Dad remembers he left the ax leaning against the garage. Back one more time. I don't recall ever leaving on the first try. By the time we finally pull onto the highway, morning traffic is just beginning to thicken, but we still manage to hit the toll booths before Chicago rush hour slams into full force.

The sapphire heart of the glacier revealed in the crevasses is the purest form of glacial ice. The crystals absorb the long waves of blue and green light, filling with color. The skin of the glacier under our feet has been corrupted by dust, changed by evaporation or melting, and scatters the whole spectrum of visible light, appearing gray or white, hiding the glowing blue below. As I follow the crevasse uphill, I think of the whole mass of ice plugging up this valley, two and a half square miles of semi-precious blue hidden beneath the gravelly grays. The ice melting beneath me probably froze about one hundred fifty years ago, and has been slowly falling downhill ever since, the strains and stresses of uneven terrain causing it to split open in spots along the surface.

Even in a compacted, solid state, a glacier doesn't officially become a glacier until it starts moving. There are specific parameters that lead to flowing walls of ice. When ice reaches a depth of about thirty to thirty-three meters, the sheer weight causes it to become elastic enough to flow without cracking. There are two main theories concerning the
actual mechanics of a glacier gliding over bedrock, and both may occur in individual glaciers in different ratios. The first theory involves "basal slippage," in which a thin layer of meltwater eases the glacier's passage over the rock. The second theory involves minute adjustments and shifting in individual ice crystals, so the glacier as a whole slides forward. In both cases, the steeper the rock floor under the ice and the thicker the ice, the faster the speed of the glacier.

I was born just as the dense, heavy heat of Midwestern summer reached full stride in early July. The date of my birthday parties tended to wander like a dizzy squirrel, however, because vacation always seemed to stretch across my birthday. My parents made sure that we always celebrated on my birthday. They packed a travel-size party every year, stashing a few small presents in their suitcase, and a package of candles. If we were camping, Dad heated coals for the Dutch oven and Mom would make a cobbler or a cake, so the candles had somewhere to stand upright while they burned and everyone sang loudly, off-key.

I was thirteen the year we traveled to the Rockies for the first time. You could set your watch by the afternoon rain—4:00, everyday, the clouds dropped a fifteen-minute downpour. It had just ended the day of my birthday, and we decided to go for a walk around the campground. My feet crunched over wet gravel. Everything dripped. Bushes and plants by the roadside, the firs and pines stretching overhead. Even the chickadees looked damp. I knew the skies were clear at home. We hadn't had time for a party before we left, or to plan one for when we got back. I wondered if my friends even remembered it was my birthday. I was on the way to getting a good funk underway when I came over the crown of a small hill. I froze. Arcing over half the valley below was a double rainbow, the top arch mirroring the colors of the one below. Something shifted in my head, like rocks resettling. That one vista pounded home what my parents had been trying to point out for years: how unusual it was to celebrate in places like this rather than in the middle of the commonplace routine. Instead of having a regularly scheduled party, I watched the
dark clouds skimming over a valley on the spine of the continent, still hiding the crowns of the mountains on the other side. I stood there until the rainbow faded, feeling my mood lighten as the colors melted back into white light. I smiled at Mom when she caught up to me, and I'm not sure, but I think she looked relieved.

The sign warning about crevasses tells of sudden caves opening up at the base of the glacier, and of ice dams breaking deep inside and releasing flash floods in ice tunnels. There are an estimated 30,000 crevasses in the Athabasca Glacier, some of which extend forty meters into the body of the glacier. They don't usually extend deeper than that, simply because of the elasticity of the ice below the thirty-meter mark. Ice at the surface doesn't have the weight of the whole glacier pressing it into a bendable state, so it tends to fracture when stressed. When ice flows at different speeds or different directions, it causes strain where the two patterns meet. If the strain pushes stronger than the tensile strength of the ice, it tears open into blue maws. As long as the bedrock lies at a smooth, shallow slant, the ice flows evenly and doesn't break. When the underlying terrain is steep or rough, the ice follows suit. The orientation of the crevasses indicates what's causing the strain. My brother and I pick our way among radial crevasses crackling the toe of the glacier where it thins and spreads out. Earlier, we saw marginal crevasses on the main body of the glacier, parallel to the flow. The edges of the glacier grind against the rock of the valley wall, the friction slowing them down. The middle of the glacier, however, keeps trundling along, cracking off the slower parts. Transverse crevasses run perpendicular to the flow. On extreme inclines, like the cliff at the head of the Athabasca, gaping crevasses open in the ice as it tumbles in slow motion, torquing and twisting, sometimes creating sky-scraper blocks of ice, rearranging whatever layers exist like pulling taffy. At the bottom of the ice fall, the ground supports the ice again, and the weight of the glacier melts it back into one flowing piece, continuing its journey to the melting zone at the end of the ice.
John, like me, has always been interested in science, but wound up as an English major. Karen stuck with biology. Mom enjoys telling the story of how he flummoxed his third grade teacher by trying to discuss the difference between a googol and a googolplex (a googol is a number one followed by one hundred zeroes, while a googolplex is a one followed by a googol of zeroes). I was at college while John was in junior high, so summers, especially vacations, were our chance to catch up. One evening while we were camping, John and I walked over to a playground near the campground office.

"I wish we could talk about interesting things in science, we just keep going over and over balancing equations."

We spent the next hour discussing quarks and string theory as we twisted back and forth on the swings. His friend Frank would listen to him when he talked physics, but didn't do much reading, so it wasn't really a conversation. From there we wandered into talking about John's teachers and school. He had some of the same ones I did, including the obnoxious and slightly unbalanced music teacher Mrs. Brown.

At this time of year, the glacier sweats. Meltwater cuts channels like an anatomy of veins across the surface—trickles I can plug with my finger, runnels that I can bridge with my foot, streams I can jump across, and larger ones that I wouldn't attempt even with a running start. I straddle one stream and bend down to let it pour into my hands. The water fills my mouth with the sensation of cold and an absence of taste. The last time this water flowed as a liquid was before the spread of smoke- and pollutant-belching factories. Signs in the visitor center boast that it ranks among the purest in the world. Across the span of a day, the streams swell in the afternoon when the temperature is warmest, posing problems for hikers who set out early in the day and expect to follow the same route home. Glaciers may be impermeable as rocks, but the surface changes with melting and refreezing more than any granite cliff changes its expression. One of the streams I follow dives into the glacier through a round hole, called a mill hole or moulin. This is just a small one, but sometimes they can gape several meters across. This little rivulet may
connect up a larger stream inside the ice, just warm enough to melt caves and tunnels into the ice before pouring out the toe in a dash to Sunwapta Lake. The caves shift, collapse and remelt, in keeping with the glacial nature of motion.

Karen and I used to stay up past our bedtime whispering in our room.

"I hate Scott," Karen says into the dark.

"Scott McClure? Why?"

"He chases me around at recess and tries to kiss me." A fate worse than death for a kindergartner.

"Still? I thought he stopped."

"No. He just keeps running around with his lips stuck out like a fish." I can tell by her voice she's talking through pursed lips, imitating her nemesis.

"Is he scaly too?"

I'm rewarded with a giggle. "No, just slimy."

After smothering a laughing fit with my pillow, I say "Tell me next time Fish Lips chases you. I'll make him stop." As a mature fourth-grader, I take my Big Sister duties seriously.

"Girls! Go to sleep!" Mom yells up the stairs.

Karen and I graduated to our own tent when I was eleven. If the Blue Tent were magically transformed into a person, it would be a wrinkled old woman with sky blue skin, a voice like a rain fly muttering in the wind, and a geometry fetish. Setting up the Blue Tent is an art form. It's an-old school backpacking tent, with poles forming two arches on the short ends of the tent and fourteen guy lines splayed out in every direction to keep it from falling. The waterproofing on the floor peels like a bad sunburn, and the zippers grow more cantankerous every trip. Sometimes the Blue Tent stands taut and roomy when we're finished, the way it must have looked in catalog photos. Other times, no matter how tight we pull the guy ropes, it refuses to look like anything other than a swaybacked blue rhinoceros.
It takes teamwork, honed over years of setting up the Blue Tent at night or in driving rain. I always feel a little thrill the first time we set up the tent on a trip, the start of a new adventure that stirs up memories of all our past excursions. The shock-cords in the poles have lost most of their shock, and are now more like mild-surprise cords—they pull a little for the first two pole segments, but you have to stuff the rest of the cord up into the pole to slide on the last segment. I stepped on one of the straight poles when we were frantically deconstructing the tent in the rain on a previous trip, so one of the arches stands a bit bowlegged. Two ropes anchor the arches; they need to be pulled perpendicular to the poles, otherwise it sags. Karen positions each stake, and I use the back of the ax to pound it in. We always do it that way. Next, the corner stakes, and if it's windy, the side loops. Time for the rain fly. That's when the fun starts.

Dad gave us precise instructions when we were first learning. "Remember, you want a 45 degree angle for the corners of the fly, otherwise it'll touch the sides of the tent and the walls will leak." The trick is judging whether the angle of the rope is truly 45 degrees. Karen measures the angles, extending the rope to 90 degrees from the front of the fly, then pivots to the corner. I set the stake under the loop she's holding. We don't really talk much while we're raising the Blue Tent anymore. The ritual is set, and we only interrupt with a word here, a question there.

Minor adjustments, and I pound the stake into the ground. Despite its faults, I'm quite fond of the Blue Tent. After setting it up so many times, we both respect and work around its idiosyncrasies. And really, the fact that a tent over twenty years old hasn't just disintegrated demands a certain amount of respect.

When I reached high school, I stayed up past Karen's bed time doing homework. She was always asleep when I finally went to bed, so our late night conversations disappeared. Being squished into the blue tent on vacations brings out the giggling again.

"Can I turn off the light?" my sister asks me.

"Wait a sec...I can't find my socks."
"You're sitting on them."

"Oh. Lights out."

In the dark, my flannel shirt crackles with blue sparks.

"Hey, Karen..." The little fireworks show makes me grin in anticipation.

As I change into my pjs, I shake my bra in the dark, sending crumbs of electricity flying. "Electric underwear!" We both splutter, trying to control our laughter but failing miserably. For some reason we always find this phenomenon immensely funny.

"Girls, go to sleep!" Mom calls from her tent. Trying to be quiet just makes us laugh harder. I finally regain control when my ribs start to hurt.

On this trip to Banff, the Blue Tent stayed home. Even Karen, the family tradition-minder, had to admit it wasn't in top form anymore. We used my new tent. It stands on only three poles, and I can set it up myself in five minutes. It isn't nearly as fun to put together, although it is drier. As I reflect on the passing of the Era of the Blue Tent, I realize the reason that the glaciers fascinate me are that the small accretions of snow and ice gradually build until they have the force to chew up mountains. I can see the same slow processes in the little traditions of our family vacations. The rhythms and patterns repeated with slight variations—playing the same card games, setting up tents and stowing them again, pointing out insects and twisted trees and cloud shapes as we hike—add up to the solid bonds between us. Odd occurrences, like meeting a professional mini-golfer or the man in West Virginia with such a thick southern accent we couldn't understand a word he said, become particles of family history. Little accretions that build until they have shaped the landscape of my mind. That's what the solitary wilderness explorer misses out on: the fundamental connections forged by traveling with someone else. Bit by bit, the rough edges of each experience wear away, and they blend together into my memories of "vacations," which aren't frivolous at all, but the truest, clearest times of my life.
The Rockies rose from land moving east. Learning the history of mountains requires a special vocabulary, language developed to describe the folding and wandering of rocks and continents. One of the first words to learn is "terrane," a large mass of the earth's crust bobbing along on the planet's molten interior. Each terrane has its own geologic history, and is separated from neighboring terranes by faults, like the cracks between dried mud on a vast scale. About 170 million years ago, a conglomeration of terranes called the Intermontane Superterrane crashed into the western edge of North America. The resulting buckling and bending created the mountains of inland British Columbia—the Purcell, Cariboo, and Selkirk mountains. Compacting the land also raised it up higher. The next major event involved what was called the Insular Superterrane, which shoved into North America beginning about 100 million years ago and ending its movement about 65 million years ago. This second terrane pushed up the Rocky Mountains. Looking at a map, this seems a little counterintuitive. The Rockies are on the eastern side of the B.C. mountains. How could new mountains form on the other side of existing ones? The force of the new terrane broke the continental shelf, which had already been elevated by the first collision, from its anchoring rock, fracturing it along fault lines. The eastward pressure shoved these chunks up onto each other, like shingles, in what are called thrust faults. At the same time, the collision forced the whole complex of thrust faults east, maybe as much as 250 kilometers. In this way the other puzzling characteristic of the Rockies was created—older rocks lie on top of younger ones where one segment pushed up onto the back of another. The older sedimentary rock at the bottom of one segment slid onto the most recent layer of sedimentary rock of its eastern neighbor.

Dad grew up going on family vacations. One week a summer they would go up to Wisconsin to stay at a lake cabin with all the aunts, uncles, and cousins. They also took long road trips, to California and Yellowstone and the Grand Canyon. Sometimes, as we're driving, Dad tells some of his stories. Like when they lost his younger sister at Old Faithful because his parents each thought she was with the other. Or when his older
brother was driving, and the two of them were the only ones awake. Uncle Dave tried to see how fast he could drive and wound up nearly sliding off the road at ninety miles an hour. Or when, exasperated by arguing with my grandmother over where they should stop for dinner, my grandfather said they would stop at the next restaurant, even if all they served was Shit on a Shingle (an epithet for one of the meals served during his army days). My aunt started crying in the back seat. When they finally calmed her down enough to ask what was wrong, she wailed "But I don't want to eat shit!"

The last memory I have of my grandmother on my mom's side was receiving a doll when I was about six. She moved to Florida when my brother was born and didn't tell us. We found out from mom's half-sister. Mom grew up with several stepfathers. Just after I finished college, she got reacquainted with three stepsisters I didn't even know she had. My uncle John, Mom's older brother and only full sibling, calls her once a year to say "Happy Birthday, you old bat!" (This is usually followed by "Umm, Uncle John, do you want to talk to Mom?") At my cousin's wedding, she hadn't seen her brother for eight years, since he left his wife of twenty-five years on her birthday. My aunt hadn't spoken to us in that time. I've seen Mom drink alcohol half a dozen times in my life (mostly Bailey's, with two Mai Tais). The wedding reception was held in the gardens of a hotel, next to an ornamental lake. Karen was at another wedding. John and I stuck together since we didn't really know anyone. Waiters in tuxedos served colorful hors d'oeuvres. Mom stepped up to one of the bars and ordered a vodka Collins. My brother and I both blinked. "Mom's drinking vodka?" he whispered.

The little things count. My parents don't grab handfuls of oatmeal and stride off into the Sierra Nevada as Muir did. But there is something quietly heroic about their conscious choice to invent small traditions and weave them together into a close family. They are two of the people I admire most in my life. I would like to say my interest in the conservation of wild places is altruistic, that it's based solely on the principle that consuming everything in our path is short-sighted and wrong. That is a part of it, but the
underlying reason is more selfish. Those pockets of the natural world that are left are inextricably tied in my head to my family, to cooking breakfast on a Coleman stove on a cold Rocky Mountain morning, or taking a group photo on windswept Cadillac Mountain in Maine. Because my parents thought those places were important enough to bring us there to be together, I want to keep those place whole.

The hike up Sulphur Mountain, with its hot springs at the top, is deceptive. The sign reading "2 km" neglects to mention it measures the straight distance, sans switchbacks. A gondola constantly runs trips up to the top and back, but we figure a short hike will be just the way to start the day. As the hike wears on, the chatter dies. Chicago rises only 600 feet above sea level. Mom had requested earlier that we do an easy hike, she didn't want to overtax herself. Now her face matches the hot pink of her shirt, and both she and Dad are breathing hard. She trudges on, concentrating on her feet.

"You guys can go ahead if you like. I need to rest."

We stop to share some of the cherries we bought at a roadside stand in Montana. Juice floods over my dry tongue and throat. After the break, John charges ahead, one switchback, two, gone into the trees. His moody eighteen-year-old self can't bear the slow pace. Karen and I stay together, now and then commenting on twisted trees, measuring our altitude gain by looking down the swath of cleared ground between the trestle legs of the gondolas. Every now and then we rest on a rock or downed log, waiting to catch a glimpse of Mom and Dad below. They stop at the corner of every switchback to catch their breath. Mom looks grim.

"Where's your brother?" Mom asks when she can get enough breath for words.

"He went up ahead. We haven't seen him for a while," Karen answers.

"Mom, are you sure you want to keep going?"

"I've made it this far."

This is more exercise than she's done in a month. I admire her for not just turning around and heading back to the bottom. Karen and I tackle the incline again.
We catch up with John at the top. He’s standing at the edge of the path, held at bay by a female bighorn, who is industriously licking his hand and forearm. Another is just leaving. He can’t step back—there’s a ten foot drop-off. The sheep’s horns aren’t long, but they look sturdy and sharp. John watches them closely, not entirely at ease. After a stunned second, Karen and I start laughing.

"They seem to like human sweat," he says defensively. "There were more here before." He tries to edge past the sheep off the overhang. A little girl of about five or six pipes up "Mommy, I want to pet the sheep too!"

"No, you don’t," John informs her, and finally makes good his escape as the sheep decides she’s received her daily recommended allowance of salt. He wipes sheep slobber on the front of his shirt and shoots a dirty look at Karen and me.

Mom and Dad finally trudge into view fifteen minutes later. Lunch should have been hours ago. We unanimously decide to skip the last couple hundred yards to the sulfur springs and eat lunch. Even after a meal, the springs hold no appeal. No one argues about taking the gondola down.

My brother is the designated polar bear of the family. He takes an open body of water as a personal challenge to swim in it, regardless of temperature. The first time my siblings and I saw the ocean, we were on vacation in Maine. The Atlantic Ocean is not exactly balmy that far north. First we waded in up to our knees, waiting for our feet to go numb before progressing. Karen and I bodysurfed a few waves, returning to shore when we couldn’t feel our fingers. John played on the waves a while longer, only coming out when Mom called. His whole body was bright red, and his lips purple, but he insisted he wasn’t cold. Another year, when we were up Lake Huron, John again won the award for staying in the longest. We hiked along the lakeshore, working up a good sweat on the warm July afternoon. The water was a biting fifty degrees, but we all tried to swim. Mom and I surrendered first, with Karen soon after. Dad splashed around with John for a little bit, then hauled himself out to bask in the sun. John swam a few more laps around our
little cove, amusing himself by diving under and seeing how far he could swim on one breath.

John's all-time favorite vacation activity combines climbing and water. He likes to jump off cliffs. Just small ones, not over fifteen or twenty feet. I think half of the fun is scrambling up a rock wall while Mom isn't watching. Then he calls to her just before jumping. He usually grins through the entire scolding he receives when he rejoins us. Swimming in most of Banff's lakes would mean almost immediate hypothermia. One or two are a little warmer though, and we go to lake Johnson for an afternoon. On the opposite shore, we see people flinging themselves off a rope swing, and Karen and John convince me to swim across with them to give it a try. A bunch of local teens lounge around the rope platforms. We scuttle up the hill to get in line. John jumps first, hanging suspended in the air for a split second at the height of his dive, arms and legs outflung like a water strider. Then I'm up. Heights don't bother me. Falling does. I wouldn't quite classify it as a phobia, just an extremely healthy respect for gravity. I stand on the platform looking at the water fifteen feet below, trying to convince myself it will be fun. Finally one of the Canadians says "It's only water, it won't hurt you." I take the hint and jump, plunging into cold water after a stomach-flipping drop. Once was enough. As I swim back to shore, I hear Karen's blood-curdling amusement park scream (I've tried to convince her to audition for horror movie soundtracks). Later, Dad says they could hear her across the lake. Karen and I sit on a log at the water's edge and shiver. John gets back in line for two more jumps before we swim back to our sun-warmed towels.

One morning we sign up for a whitewater trip on the Kicking Horse River. Supposedly, one of the explorers of the area was kicked in the head by a horse and remained unconscious for several days. Just as his companions were about to abandon him he woke up. The guides hand my family and the other four rafters, a couple my parents' age and two young British students, wetsuit overalls and shoes, offering spray jackets as well. The river flows a pale, wintry turquoise with the milky opacity of jade;
the riverbed remains hidden, but the color is coldly luminous in the sun. The first splash on my face stings, it's so cold. The river lives up to its name, bucking and rolling us over rocks and into wave troughs. The last rapid our guide tells us we can swim. John jumps in immediately. Karen and I look at each other.

"Are you going in?"

"I will if you will."

On the count of three, we swing our legs over the side and seal-slide over the side of the rubber raft. My lungs contract as I hit the frigid water, as if they're trying to clench as far from my skin as possible, and for a second I can't breathe. Then the water in the wetsuit warms up, and my lungs work again. I have to hold my hands out of the water because the tingling is almost painful. I bob along like driftwood, retaining its turquoise even at this angle. The two young British men in the boat jumped in just before I did, and both are already clambering back into the raft. Now that I'm numb, I enjoy the weightlessness of floating, and the power of the current pushing me. Wherever I'm submerged the water erases me from sight. By the time we scramble ashore at the end, the feeling in my hands has retreated so far inward that I can barely unzip the wetsuit, and pulling off the suctioned-on shoes takes four or five tries.

Throughout the whole Banff region, water burns in gemlike colors against the stolid gray rock. The glaciers are behind this phenomena too. The ice erodes the rock it crawls over, creating fine sediments called "rock flour." Because the particles are so small, rock flour remains suspended for months at a time. Also because of their size, they scatter the blue and green wavelengths of light while absorbing other colors. Meltwater transports the rock flour from the glaciers in freshets and streams, gliding its way to rivers and lakes. During the spring runoff, the higher volume of water carries larger particles, and the lakes look grayish-green. These larger sediments drop out of the slower flows of mid-summer, leaving the suspended rock flour to color the water, so the lakes shift toward deeper emerald greens. As the summer progresses, the rock flour gradually settles
out and the lakes become bluer. Finer shadings of color in the lakes are caused by various amounts of minerals dissolved in the water, such as iron or copper.

One of our other family traditions is to always stop at visitor's centers. We hiked a number of nature trails, flipped through field guides. It wasn't enough to just snap pictures at the scenic overlooks. We wanted to know what we were seeing, to name what we saw, to be engaged with the landscape around us. An intrinsic part of how I learned to encounter new places involved paying attention. To how many petals were on that white flower I wanted to look up, to the pattern of gray and black of the bird that followed us all the way up the trail. A tradition of curiosity. Reinforced by the interest we all felt about places so far from our daily lives.

After a leisurely half-day of hiking around Emerald Lake in Yoho National Park, we stop at a visitor center. A dimly lit side room is devoted entirely to one of the most famous features, paleontologically speaking, of the Canadian Rockies. The display features models of creatures that look like they escaped from a Star Trek episode. My favorite is *Opabinia regalis*. The body looks like a long crayfish tail with lobed fins overlapping each other, the head sports five eyes on stalks, and an elephantine appendage with a claw at the tip extends from the front of its head. Presumably it used the claw to drag prey to its mouth, tucked underneath its head. All the models are based on fossils from the Burgess Shale up on the ridge next to Mt. Field, which you can see from the front door of the visitor's center. If you look closely, you can see the white rectangle of the fossil quarry halfway up a scree-slippery slope.

In 1909, a geologist named Charles Walcott discovered a paleontological jackpot—a huge deposit of exquisitely preserved fossils of ocean animals from the Cambrian time period, over 500 million years ago. Animals that swam warm seas 130 million years before life first slithered onto dry land. Some of the fossils are clearly related to modern animals such as sponges and certain types of worms. Then there were the "problematica." New *phyla*. Animals that didn't resemble any of the thirty-five body
blueprints scientists use to categorize all living things. The ocean held a web of species at least as diverse as today. Some scientists say this causes problems with the way we view evolution, as a movement from simple arrays of species to more complex systems. A newer theory says the oddballs may not be new phyla at all, but may represent "missing link" species between modern animals and their ancient counterparts. About 85 percent of the genera found so far in the Burgess Shale don't have a skeleton that was converted to minerals, which means that they simply don't appear in most other Cambrian fossil sites. Without the Burgess Shale, we may never have known they existed.

What makes the fossils so unusual is that soft tissues left impressions in the rock. In most cases, soft parts like tentacles or viscera decay before fossilization occurs. Some of the Burgess Shale fossils preserved worm or arthropod impressions that include innards squished out from the animal after it died. For some reason they didn't decay. The key lies in the Cambrian landscape. All these creatures lived in a relatively shallow sea—at the edge of a cliff estimated to be 160 meters high. This limestone cliff still exists as a layer of Mt. Field, called the Cathedral Escarpment. The best fossils lie close to the Escarpment. The Burgess Shale, originally fine sediment and mud, fits within a larger layer of rock called the Stephen Formation. Back when the Escarpment stood underwater, something periodically caused large amounts of sediment, and any unfortunate critters living in or near it, to be swept over the side. Storms, collapsing sections of the cliff face, whatever the impetus was, animals tumbled over the edge. The willy-nilly positioning of the fossils indicates that each event happened swiftly and anything alive as it went over didn't stay that way for long. Such a turbulent end jammed mud into all the spaces in the bodies, sometimes even into the body cavities. Even if their abrupt burial allowed some decay, the animals weren't disturbed after they were covered, so the mud retained the shape of any soft tissue that disintegrated.

Walcott collected nearly 65,000 specimens for the Smithsonian Museum. Many of the fossils then gathered dust until the late 1960s, when a new wave of research began.
My two favorite stories involve mistaken identities. The first story deals with an animal called *Hallucigenia sparsa*, originally *Canadia sparsa*. The first mistake was that it originally was classed as similar to another worm, which it turns out not to have resembled at all. After renaming it, the researcher Conway Morris depicted it with a long worm body with a club-like appendage at one end and a tube at the other. Seven pairs of long spikes grew from the bottom of its body and seven pairs of tentacles waved from its back. After further investigation, researchers finally decided *Hallucigenia* actually spent its life flipped over from the original drawings, using the tentacles to walk while the spikes projected up porcupine-style.

The second story involves an even more bizarre animal that once was believed to be at least three separate creatures. *Anomalocaris canadensis* looks like a cross between a walrus and a crayfish. It has a similar body to *Opabinia*, like the tail of a crayfish, except with overlapping fins like a fringe along the sides. It only grew two eyes on stalks, but sprouting from the front of its head are two curved, segmented appendages that could sweep food into its mouth. The mouth is a disc with sharp teeth directed toward the center. It may have had flexible legs under the fins, and a fan-shaped tail. It probably grew between half a meter and one meter, and must have been one of the most formidable predators of its time. Until researchers unearthed a complete fossil, the pieces were mistaken for entire creatures. The mouth was described as a jellyfish. The appendages on its head were thought to be a type of centipede. And of course the body was considered its own species. But with the revival of research, the pieces were assembled, and this strange creature has become a star in one of the oddest stone menageries anywhere.

Mt. Rundle dwarfs the town of Banff. Clouds catch and tatter on the peak, hiding it from below. The peak seems to lean away from the town, and its profile changes from different parts of the valley. Karen and John and I make a game of trying to pick out Mt. Rundle as we work our way through the local hikes. Because of the way they were generated, the Rockies form distinct ranges, divided the Front Ranges or the Main
Ranges. Rundle lies in the Front Ranges, which include about fifty kilometers of the eastern portion of the Rockies. The Front Ranges are made up of a type of sedimentary rock called carbonate, composed of calcium, carbon, and oxygen, and sometimes mixed with iron or magnesium. The limestone found in the Rockies consists of calcium carbonate (CaCO₃). At one point, before the mountain building began, a shallow inland sea covered the area. The skeletons of corals, algae, and the shells of other creatures provide the source of calcium carbonate. Beginning nearly 710 million years ago the remnants of these subtropical, or even tropical, creatures settled onto the bottom of the sea. Over the next several hundred million years, they were transformed into rock, eventually thrust back into daylight as the flank of a mountain.

Unlike the Purcell and Cariboo mountains west of the Rockies, the Rockies themselves follow a repetitive structure, like a series of waves on water. Ridges in the Rockies tend to be steep on the northeast side, where the fault snapped off from the section in front of it, while the western slopes follow gentler angles where the blocks recline on each other. The carbonate of the Front Ranges is strong but brittle; instead of folding during uplift, as the weaker rocks of the Main Ranges did, the Front Ranges just gave way. The thrust faults broke apart the bed of the ancient sea, so the same types of rocks appear in similar positions from range to range. Mt. Rundle showcases a common triplet of layers. Limestone forms steep gray bottom slopes of the Palliser Formation, born in the tidal zones and areas just below the tideline of the ancient ocean. On top of that, a slightly browner and gentler-sloping section reveals the softer shale of the Banff Formation. The shale formed from clay and silt deposited during a deep phase of the sea when the corals couldn't grow. When the sea level subsided again, the tidal zone life built up, resulting in the layer of limestone capping Mt. Rundle known as the Livingstone Formation.

Since the rocks began reaching for the sky, erosion and glaciers have been slicing them into the current peaks. Glaciers first slunk down from the north over two million
years ago, starting a cycle of advances and retreats. Each successive advance obliterated most of the tracks from its predecessor, so only the most recent glacial age left any intelligible traces. Ice withdrew from the Bow River valley about 9,300 years ago, a mere wink in the life of the Rocky Mountain stone. Glaciers straightened and excavated the valleys between the mountains, leaving U-curved bottoms as footprints. Valleys on mountainsides that end abruptly high above the feet of the mountain were once glacial tributary valleys. Now they often provide beds for spectacular waterfalls. The blade-sharp ridges on some mountains are where two glaciers almost rubbed shoulders, carving the peak from both sides. The massive weight of the glaciers ground the mountains down (the Cordilleran ice over the mountains reached a maximum height of 2,440 meters), and after the final retreat, the land sprang back up slightly. Some estimates say the mountains near Banff were once at least a half a kilometer higher. Looking around the peaks encircling the valley, that's a lot of rock.

Vacations are the times I've learned the most about my parents. When I was in fifth grade, we traveled out to Washington D.C. We stopped at the Viet Nam memorial. The monument was striking in its black simplicity, but what I remember most was my father standing at one of the podiums with a directory of the names inscribed on the wall. He leafed through the pages, looking for the names of men who had been in basic training with him. Dad still has some of his army equipment, a duffel bag and a few clothes. He wears an olive-drab jacket for painting the house or working on the car. Until he lost it on the golf course, he wore his floppy-brimmed booney hat during vacations. I had a cap he let me use that I liked to wear while I was studying. It was the first time I realized he knew people who had been killed in a war, and suddenly had an inkling of how Mom must have worried that whole year he served overseas. They hadn't been married very long. She lived with his parents while he was gone, and they would record tapes to send to him. They wrote back and forth. Once in a while, one of those letters or tapes resurfaces when Mom cleans the back of her closet, or my grandparents sift through the
attic. Mom said she walked right past Dad at the airport when he returned. His beard was bleached a lighter color and he had lost a lot of weight. She had to have him paged to find him.

Ice still plays a minor role throughout the Rockies, freezing and thawing in crevices until it snaps off chunks of rock. Shale doesn't fare well against this type of onslaught, which is why it forms gentler slopes in the triumvirate of formations in the Front Ranges. Fields of shattered rock cover the shale slopes of some mountains. The fragments are actually from the carbonate layer above the shale. Carbonate doesn't erode easily. But the shale supporting the carbonate may erode enough that sections of the carbonate become undercut, eventually hurtling blocks at the slope below. Even the weather conspires to shape the mountains. Northeast-facing slopes receive the least amount of sun during the day, so over the course of the year snow may remain even through summer. Southwestern slopes receive the most light during the warmest part of the day, so snow melts faster. The chill, shady northeastern slope provide good conditions for glaciers to form, where they often gnaw valleys like dimples in the mountainside.

One morning, we start on a hike up Stewart Canyon. About ten minutes onto the trail, we see an older couple peering through the trees. A narrow turquoise inlet of Lake Minnewonka laps against steep canyon walls. Tempted by the cool water below, a female bighorn paces back and forth, trying to find a way down. Large slabs of the cliff side have flaked off, leaving steep, shallow ledges that she delicately navigates. She steps slowly and deliberately, placing each foot before moving the next. She stops to cock her head, as if checking that the water hasn't gone anywhere, and that she really is thirsty enough to keep trying. A number of people stop and watch for a few minutes. When the bighorn doesn't make any spectacular leaps or swan dives, they move on. The bright sunlight washes the bighorn nearly white against the drab cliffs. Karen and John and I watch her
Thirsty (Bighorn Sheep)
come within twelve feet of the water, but the last drop-off is just too steep, and she turns around in place to climb back up. She attempts one more treacherous path, but finally disappears into the trees.

We couldn't find Bear Falls. Mom was reading in the front seat, to avoid looking at the drop-off next to the winding road. My siblings and I were on the lookout for the turnoff to the trailhead. No luck.

"There's the visitor center—we've gone too far," Karen announced.

"We might as well go in and look around," Dad said.

"And get directions." Mom marked her place in her book.

The first thing that caught my attention was a brass Howitzer shell on a podium just inside the door. The placard explained this was the size artillery Parks Canada used to induce avalanches. They bombed the mountains? It made sense, I suppose, the sound and the impact of the explosion triggering the precariously balanced snow, but who thought of that? In the main room, guarded by stuffed marmots and eagles, a scale model of a train wreck caused by an avalanche gathered a few curious visitors. The miniature boxcars were strewn across the kitchen-table-sized valley, and tiny plastic rescue efforts were underway. Men armed with thimble-size shovels vainly tried to reach their buried comrades, who hadn't made it to the shelter of the railway tunnel.

In order to avert such disasters on the Trans-Canada Highway, Parks Canada built a series of avalanche tunnels below the chutes the tumbling snow has chewed through the forest on the mountainsides. And they shell the mountains, kicking the avalanche in the shins until it wakes up and stomps into the valley. Impressive, that they can schedule an avalanche.

"Hey, Joe, how does next Tuesday sound for some shelling?"

"Well, Wednesday would be better, I have a meeting all morning on Tuesday."
The engine ticks in the quiet. A magpie chuckles overhead. The trail zigzags back and forth down into a narrow canyon. The hill is steep enough that the trees on the downhill side of the path have their roots anchored far below our feet. I have to tilt my head all the way back to look at the canopy far above. With every step towards the canyon floor, the trunks grow more massive, until they boast girths of five or six feet. Another flight of stairs lands us on the floor of the canyon. The air feels cool and moist against my bare face and arms. The underbrush fills every space between the tree trunks and the slabs of rock shed from the canyon walls. Chartreuse moss, ferns, dogwoods, a kind of broad-leaved grass. I still don't hear the falls.

The path leads us to an old wooden bridge. A wood-burned sign declares that we're standing over Connought Creek. Just upstream the creek takes a series of short hops down a fall of rocks.

"Those better not be the falls," Mom says. "Not after all those stairs."

We parallel the creek for a while. As soon as I step around a bend in the trail, the sound hits me—a huge pounding of white noise, until now hidden by a trick of acoustics, that can only mean a large waterfall. One more bend, and we come in sight of the bottom of a frothing mass that is somewhere between mist and whitewater.

A set of stairs mirrors the climb of the falls, curving up and behind the rock wall as if leading to a turret. My siblings and I duck off the path to clamber over the streamside boulders for a better view of the base of the falls. Spray from the falls slicks the rocks. I step on a shard of stone, and it cracks in half. Thin, sharp edges abound, and the even the boulders are shaped like massive stone age ax heads. Moisture saturates the air, and my clothes feel slightly damp. The roar of the falls flattens anything quieter than a shout. From the side of the whirling plunge pool the falls look about one hundred feet high. A massive amount of water pounds down. I try to watch individual sections of water as they spill over the lip of the falls. The shapes keep changing, but somehow the form
stays the same—a rock juts out from behind the water, and though the water splits around it in an infinite variety of splashes, the flume remains coherent.

The drop-off at the water's edge is too steep and slippery to explore, so we climb the stairs. The top of Bear Falls isn't quite visible from the end of the path. The creek-bed crack in the canyon turns sharply just where the slope starts to level off. The ground here seems, if possible, even wetter than below, the sharp points of the stones dripping, our feet skating across the mud. I sidle as close as I dare to the edge and peer over to where the water meets the ground again. It's difficult to see anything at the bottom, except spray rising from the tumult and the ghosts of rocks through the mist. On the canyon wall opposite us, rising almost completely vertical from the streambed below, green things still struggle to make good use of the water. Trees grow right to the edge, some with a few roots dangling. The smaller shelves of rock host small shrubs and more ferns, fronds stretching into the mist.

When my parents reach the top, Mom wants a picture of the three of us in front of the falls. We each strike our version of a heroic pose, Karen and I with one fist raised, John behind us with his arms spread in a ta-da gesture. Afterwards, John picks up a fist-sized rock and tosses it over the edge. It disappears without a sound, dissolving into the mist.

I have moments where I wonder if this will be the last time all our schedules fit together. If this is the last of the vacations we'll take. We follow the old traditions, swimming in a lake for an entire afternoon, a campfire, card games. But they're unraveling. John's been dating the same woman for over a year, and I wonder how long until she joins us on these excursions, or he doesn't. My parents won't be able to force themselves up mountains forever. So it's important to know that the pattern etched by memories of setting up tents in the dark, of driving for days to explore the far corners of the country, has left lasting valleys in my mind. Ironically, those valleys have led me to
move half the country away from my family, in pursuit of my desire to protect the kinds of places where I learned to love my parents and brother and sister.

The last night of vacation, we race the sunset to the top of a mountain in Revelstoke National Park. Up the twisting, winding road, the only ones moving uphill. At the top, the Indian Paintbrush runs riot, mingled with lupines. We pass a still pond where the moon floats like a fat silver fish in a scarlet sea. The sun hesitates over the ridge across from us as we reach the overlook. The river below already reflects a sky cooling to dusky blue. In the valley, the shadows boil up from the mountains' feet. The tip of one mountain nips off a wedge of sun. We made it. A few scattered clouds hold tightly to the last oranges and pinks. With a last sigh of brilliance the sun disappears behind the valley wall. In the last light, I see that we're all smiling, and I try not to think about tomorrow.
Works Consulted


