

Meeting the Night:
The Science and Mystery of an Endangered Habitat

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Introduction

One night this past December while visiting Portland, Oregon, I had a chance to see colorful holiday lights sparkling from a parade of boats gliding on the Willamette River. Their cheery reflections blinked and mingled among the customary red, yellow, and white lights that wavered in the water from the illuminated bridges and buildings. Adding to the sense of celebration were songs of the season foregrounding the usual sounds of city trolleys, buses, trains and planes. It was a lovely and sense-rich experience. By taking some giant steps back for perspective—until we're well above the Earth—we can witness a similar phenomenon on a grander scale: the view of our planet at night, its bright constellations of cities connected by a shimmering web of highways. This popular satellite image is a familiar one, often used for advertising human progress and connectivity. But, whether we're witnessing a single city view or the global one, the story is the same. Wherever our cities grow and glow, the night is disappearing. This is my concern, and the focus of my writing project.

This Environmental Arts and Humanities project consists of a series of essays that advocate for the night as an essential habitat and natural darkness and silence as qualities vital to planetary wellbeing. When viewed as a resource, the night is extraordinary because of its spatio-temporal character, which, in turn, leads to its many crucial roles. The night serves as refuge to wildlife species, as trigger for animal and plant behaviors, and as backdrop for animals' nocturnal migrations. Even human health and wellbeing depend upon the rhythms shaped by nighttime's darkness. Clearly, the nocturnal world matters, and there is much to lose if we allow it to vanish. To emphasize the inherent value of the night, my essays include themes such as wild spaces and species, mystery,

and loss, all through the lens of the nocturnal world. And since nocturnal habitats are significantly disrupted by encroachment of noise and light pollution, I also explore in detail the significance of both of these oft-overlooked pollutants in our environment, especially in regards to their disturbance on human and animal populations.

Methods

My bond with the night has been fashioned through an accumulation of personal experiences, many of which I've collected while camping or backpacking. Over time, many nighttime sounds and sights have become familiar to me, like those of owls, bats, and shooting stars. Others are remarkable for having occurred but once, like the unexpected chorus of wolves that awakened me in Idaho over ten years ago. Yet I admit I've always been a strongly diurnal person who heads inside after sunset, either to my tent or home. So, as a part of my place-based investigation of the night, I decided to resist my usual urge to go to sleep at the end of day, and instead sit attentively with the night on its own terms. I hoped that my site visits, which I call "nightwatches," would help me examine my own patchy relationship with the night, and therefore help me better understand why people have generally been so casual about losing this special and endangered "other" world.

Most of my nightwatches occurred in the H.J. Andrews Experimental Forest (hereafter Andrews Forest), an ecological research site in the western Cascade Mountains about 90 miles southeast of Corvallis, Oregon. There, in early summer near a gravel road far from human-generated light and noise, I spent my nights alone, awake, and without a flashlight or campfire, so I could capture the nature of the nocturnal world as completely as possible. I also conducted nightwatches in late August at a campsite in Central Oregon,

which provided a satisfying ecological contrast. By conducting my site visits during the summer months, I was able to maximize the number of continuous hours I could sit outside in the night.

There is no doubt that my nightwatches nourished my research of scientific literature and deepened my personal reflection regarding the nocturnal world. Because of the combination of ecological and contemplative themes woven into my project, I have been able to cross the genre boundaries of popular-science writing, nature writing, and creative nonfiction writing. It is my hope that by undertaking such an expansive method of engaged journalism, I will reach a rich assortment of readers and contribute to their greater understanding of the night as a precious resource worthy of their appreciation, concern, and advocacy.

Dedication

This poem is inspired by the complexities embedded in the human/night interface, situated in both outer and inner landscapes. I dedicate it to all the species of the night.

Fragments of Night

I first saw the impossible color of moonlight in my little sister's baby-fine hair. In our everyday family of earthen tones, we had a gleaming daydream, a baby girl who glowed like the moon.

Myself, I was a tomboy who collected jokes, feathers, bones and stones. Early on, it was the green, diamond-studded caterpillars in our backyard that mesmerized me. The larvae were easy to grab as they lumbered across the lawn, and I loved outfitting their jars with assorted foliage. I wanted to know them. So I watched them chew leaves, release peppercorn droppings, and crawl up gray-brown sticks. (Best of all was when I watched one weave her head in lazy eights to craft a fine, double-layered cocoon.) In fall after the leaves had dropped, I would creep in the shadows between shrubs to find more tough-skinned cocoons secured among naked twigs. I gave each cocoon its own gauze-topped jar. My quiet collection of woven homes.

I waited for weeks and months, through winter and most of spring. Mostly, the cocoon husks produced no life. I wished with all my 9-year old heart for a winged one to emerge, praying that my dreams would make it so. One happy morning, prefaced by some scratchy sounds from within a cocoon's dry cave, my hopes burst alive: a barrel-bodied moth finally struggled out. An expansive beauty—dusky wings with red crescent eyespots, a night-flying *Cecropia* who shunned the sun.

Last week I found out that moths and bats fill our twilights with a constellation of songs, ultra-sonic ballads for their ears only.

Lately I've been trying to learn something about blind spots. I've been fending off my own vision loss, listened with horror to my eye doctor as he clinically described a blindness that progresses from the outside in. Now I often contemplate the tyranny of tunnel vision. The Pope and I agree: wisdom resides on the peripheries. Where coral reefs, silent nights, leopards and bats reside.

I want you to know, if you ever read this, you can count on moths, crescent eyespots on their wings, to whirl over worlds they've never met before. To re-wild the peripheries as they sail on the river of the moon.

Noise, Soundscapes and Nature's Silence

It was mid-July, and I was six weeks into my summer job at a museum in Stanley, Idaho, a small town perfectly placed at the base of the stunning Sawtooth Mountains. The high basin was still blooming with flowers and a record-breaking profusion of tourists. I'd been wondering where to go camping on my day off, since National Forest sites had been reserved weeks in advance. By end of my workday, I'd finally decided to do some primitive car-camping in the nearby foothills, where I would find some sagebrush, moonlight, and sparrows.

I'd just awakened from a tent-less sleep surrounded by the jagged, snow-streaked mountains. Even though fingers of sunlight had already touched the hilltops around the quiet meadow, dawn's long shadows and chilly temperatures were keeping me cocooned in my sleeping bag. Suddenly an eerie sound low in the sky pulled me out of my bag like a magnet. I'd heard their distant cries for over a month, but on this chilly morning their haunting song was floating directly toward me—at last, I would get to see my first pair of sand hill cranes. Within seconds, the duo's graceful flight flowed directly overhead, their ancient call-and-response duet draping the landscape, drenching my soul. I was smitten with sound. So smitten, in fact, that for the rest of the summer, my camera and I would be in pursuit of these striking birds, my ears attuned ever more sharply to their primeval purrs and cries.

In September, when I returned to my hometown in western Oregon, the rhythmic chirping of crickets welcomed me home. Without realizing it, I'd missed their familiar presence during my months in Idaho's high country, and their pulsing music was like an auditory hug. Crane duets and cricket choruses had unexpectedly awakened my

unpracticed ears, and I found myself wanting to chase more songs of the wild. Over the years, I'd sharpened my inner focus with pen and paper, and honed my emotive eye through the lens of a camera. Now nature's trills and cries were calling for me to practice the deliberate art of listening.

So, armed with a hand-held audio recorder on loan from the library, I set out on a personal project to capture the local sounds of nature. My first destination was a nearby wetlands known for its wildly vocal blackbirds and marsh wrens. The boardwalk creaked, swallows pitched their voices and blue-green bodies above scattered trees, and a pair of hidden frogs exchanged throaty greetings in the dry September grass. Frozen in place, I turned on the recorder and waited for it to collect the rich array of marshy sounds. I strained to hear every wisp and whisper, but also heard the decidedly busy backstory: the heavy drone of harried traffic on distant Highway 99, a sudden chugging cough of a motorcycle, and the rasp-and-buzz of a retreating private plane—each one an irritating gnat fussing at the edge of my awareness.

For over an hour I patiently pursued subtle strands of sounds embedded in the grasses, shrubs, and trees, but I just couldn't escape those pesky nuisances called noise. I bent close to gurgling inlets and pursued the chip-chip chatter of juncos, but my quarry was more elusive than I'd believed. Already, my quest began to shift; I realized I was actually on the prowl for the absence of noise.

I needed to know more about my new adversary. What exactly is this thing called noise?

Derived from the Latin word *nausea*, meaning "seasickness," noise eludes easy definition. It is generally described as unwanted sound, considered unpleasant because of

a composite of factors, like loudness, time, place, source, duration, or repetition, each of which impacts us. The Right to Quiet Society, a Canadian non-profit organization, points out the transient nature of noise: once it stops, the environment is free of it. So even though individual noise events are quantifiable, it can become difficult to measure overall effects of accumulative exposure. Noise is also linked with point of view. While a neighbor's leaf blower at 8 am would constitute noise for most of us, other sounds convey varied values depending upon who's listening. Consider a raucous restaurant during a play-off game, or the squeaky approach of a city bus. Either of these sounds could certainly generate irritation and stress. But if it's your team who's winning during a loud happy hour, or the city bus you barely caught in time, both of these potentially unpleasant noises become music to your ears.

Its subjective, transient character notwithstanding, when noise becomes excessive, it's regarded as a pollutant. Once epidemiologists discovered a correlation between high blood pressure and chronic urban noise in the mid-1900's, they reassessed noise as "toxic." And today noise is blamed for a host of stress-provoked ailments, including heart disease, stomach ulcers, and weakened immune systems. According to the Environmental Expert Council, our cardiovascular health suffers greater risks once noise exceeds 65 decibels (dB), which approximates the intensity of highway traffic. The decibel is a logarithmic measure of sound intensity, with human perception ranging between 0 and 130 decibels. Each gain of 20 dB sounds roughly four times louder to our ears, so we perceive a night club (110 dB) as 1,000 times louder than rustling leaves (10 dB). Simply put, loudness becomes a stress-inducing audio contaminant.

Dr. Bart Kosko, electrical engineer and author of *Noise*, further explains why noise creates stress, recalling that for millions of years our human ancestors' very survival depended upon "flight or fight" responses whenever sudden screams, animal roars, or thundering herds shattered the silence. Developmental psychologist Sharon Heller draws more parallels between today's noises and deeply ingrained human responses. She uses sound-pitch for her explanations, pointing out that low, deep sounds below middle C, like the rumble of passing trucks, emulate a thundering herd. These lower sounds are transmitted through our joints and bones, so we "feel" the sound as sources of stress. In contrast, high pitches above middle C convey signals of alarm. So it's no wonder that the onslaught of screaming sirens, roaring aircraft, and screeching tires stimulates our deeply ingrained adrenaline response, propagating irritability, neurological disorders and a subsequent suite of health issues.

Unsurprisingly, we have greatly increased our noise production over recent decades. A team of biologists led by Dr. Graeme Shannon acknowledges that urbanization, resource extraction, and our increasingly widespread transportation networks are to blame for our louder world. Their list of human-caused noise sources is daunting, encompassing a range of outputs from power generation, recreation, manufacturing, transport, and construction to mining and military training operations. Closer to home, we all deal with more mundane neighborhood noisemakers: lawn mowers, leaf blowers, garbage trucks, and the jarring hammer of home repairs.

Regrettably, humans aren't the only ones who are adversely affected by noise pollution. According to research prepared by Memphis State University for the EPA, wild animals also suffer from hypertension, stress-induced hormone response, and greater

susceptibility to diseases when they're chronically exposed to excessive anthropogenic sounds. Noise alters species' long-held patterns of steroid release, which, in turn, causes a cascade of behavioral and neuro-hormonal responses. The resulting health problems, including high blood pressure, change in glucose availability, and adrenal stress, can exhaust animals' resources and overall fitness for survival. Sage grouse release heightened stress hormones when their habitat is exposed to drilling or traffic noise and, likewise, spotted owls fledge fewer offspring when forest roads are located too close to their nests. Excessive human-caused noise during the winter is particularly devastating to hibernating animals. Auditory disturbances raise their metabolic activity, which draws on their limited fat reserves when conditions are cold and food is scarce.

Of course, high noise levels impose the greatest impact on wildlife species dependent upon their sharp sense of hearing for survival. To better comprehend animals' reliance upon sound, biologists use a cross-disciplinary branch of research called bioacoustics. The goal of this research is to investigate the physics of animal-produced sounds and learn how those sounds interweave with the life histories and behaviors of particular species. Included in the studies are the notably noisy insects—crickets, katydids, cicadas, grasshoppers, bees, wasps and flies—as well as amphibians, birds and mammals. In each case, animals need to hear and be heard for a profusion of purposes. Their specialized songs, croaks, calls and howls attract mates, signal alarms, maintain territories, and create social bonds throughout their lifetimes.

Bioacoustics research confirms that wildlife communication is disrupted by human-produced noise. Multiple bird studies have documented that changes in birdsong pitch and duration, higher stress-hormone levels, abandoned nests and lower population

numbers result from noise. Likewise, research shows that loud road traffic in the Pacific Northwest is starting to drown out the mating songs of Pacific chorus frogs, essentially shrinking their auditory range. This means that female frogs are less able to hear potential mates calling out to breed with them, adding yet another challenge to a population already vulnerable to invasive species and habitat loss.

Noise pollution crosses into marine habitat, as well. Our use of commercial and military underwater sonar interferes with marine mammals that rely on audible cues for their survival and wellbeing, forcing them to work harder to communicate with each other. But underwater noise is not just an inconvenience; it can be fatal. Sonar systems can deliver crushingly intense sound waves of 235 decibels. Even 300 miles from their source, these sound waves may still surpass the intensity of the world's loudest rock band. To escape these booming walls of sound pressure, whales will swim for hundreds of miles, change their depth too rapidly, and suffer lethal hemorrhages.

Closer to shore, motorboats generate an unprecedented flood of noise in our coastal regions; in 2013, over 12.5 million motorboats were registered in the US alone. The barrage of acoustic disturbance reduces foraging success among fish, elevates their metabolic stress, and makes prey-species more susceptible to predation. Coastal conflicts between manatees and boats still occur in Florida, where slower boat-speed regulations have been implemented to reduce watercraft collisions. The decelerated propellers generate lower tones, which seem to render them acoustically invisible to the manatees until the boats are literally on top of them, inflicting serious or mortal wounds to the unsuspecting mammals.

For four decades, the science of bioacoustics has been addressing impacts of anthropogenic noise upon wildlife species and their overlapping communities. Now arrives the newest branch of acoustical studies, called “soundscape ecology,” introduced in 2011 by landscape ecologist B.C. Pijanowski. He and his team of researchers show how this new field stresses an even wider consideration: the *ecological* aspects of sounds and their patterns in time and space as they emanate from the landscape. To get a feel for this new ecological discipline, imagine a marsh and its crickets, frogs, and redwing blackbirds creating their chorus of sound. This biological composite of sounds is called the “biophony.” Now consider the effects of water, earth, and atmosphere, such as trickling currents, pulses of wind, or crashing thunder. This geophysical complex of sounds is called the “geophony.” The third acoustic component of soundscape ecology, generated by people’s technology, toys, and activities, is termed “anthrophony.” According to soundscape ecologists, these three auditory constituents offer significant measurements reflecting patterns between social and ecological systems. It turns out that the interface of sound between humans and nature serves as an indicator for both environmental integrity and human wellbeing. For we, like wildlife, are positively affected by natural soundscapes—streams, breezes, and songbirds transmit a sense of place and an aesthetic sense of wildness.

It’s no wonder that many of us head for primitive areas to escape our noisy, stressed-out lives. Results from a US Park Service survey indicate that nearly the same number of visitors come to national parks to hear the natural soundscape (91%) as come to enjoy the scenery (93%). But noise is indiscriminate and has invaded even our most remote landscapes. This is why both the National Park Service and worldwide

soundscape ecologists already regard “natural quiet” as an endangered resource. And for the sake of both wildlife and human life, they are calling out ever more loudly for its preservation.

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It’s clear that wildlife species depend upon environments unsullied by human sounds. But why is nature’s silence of such integral importance to us? On my recent quests for “no noise,” a few answers started to unveil themselves. One drizzly October afternoon while sleuthing for silence, I hunkered down among fern fronds bobbing in the light rain. Soon after I started recording the raindrops’ pattering cadence, my mind began relaxing its steely grip on the week’s deadlines. Several minutes later, a nearby splashing stream further deepened my sense of calm. The following week, while strolling on a rural trail, I looked up to see surges of geese wheeling above me in what seemed to be joyous jubilation. Once again, my cares evaporated; I simply listened and watched, transfixed.

As so often happens, my undertaking has begun to project daily changes upon me. In my search for sounds of nature in the absence of noise, I’ve become alert to all sounds at all times: melodious jazz in a city park, animated squirrels above parked cars, wind-whipped paper caught in underbrush, opinionated crows outside an art studio. Just as pieces of stress ride the brittle waves of noise, so too, bits of peace ride the currents of nature’s sounds, no matter where we chance to hear them. I am simultaneously annoyed and enthralled in this blended world of noise and quiet.

This fusion of boundaries between nature and city confirms that these worlds have long been merged. But while we can be grateful for nature’s sounds within our cities to link us to the world of wildness, that is not enough. Our sanctuaries of quiet are quickly

losing ground, and they need to be discovered, cared for, and preserved. Gordon Hempton, acoustic ecologist, agrees. As founder of The Square Inch of Silence Foundation, he is among the many environmental activists who are recording the vanishing soundscapes and working for their preservation.

We must diminish the incessant clank and roar of our accelerated lives, and let the rich soundscapes of prairies, deserts, and forests remind us of the age-old beauty of peace and solitude. It is equally imperative to also acknowledge the deep value of silence for our wild ones—from cranes to crickets—that they may continue to hear and be heard, no matter where they live.

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Neighborhood Nightscapes

We need to slow down and encounter silence and solitude if we are to enrich the soil of our soul. I have found that this sense of peace is within reach whenever we simply unplug from our usual habits and turn to the quiet pace of the nocturnal world.

Fortunately, there are countless pockets of night easily accessible to us, just off the porch or in our backyards. But these nearby “neighborhood-nights” are also where our casual, light-bright and noisy habits can easily erode the tranquility of nighttime’s dark silence. Maybe if we take time to know the night first-hand and realize its richness as refuge—for ourselves and for all beings—we can begin to curb our chaotic outpouring of unneeded light, of unnecessary noise.

Hoping to find some twilight tranquility within my hometown, I stepped out for a nighttime walk last June with my partner, Cub. We live in a steep-sloped Corvallis neighborhood surrounded by a soothing helter-skelter of green space, the small property lots dense with stands of oak trees interspersed with vine maples and Douglas firs. Sidewalks curve uphill and down, leading you over bridges, to city stairs, dead-ends, and forest trails. I wanted to re-see our neighborhood with eyes and ears attuned to the dark as we walked along the familiar streets. Rewards were immediate: within minutes of embarking on our evening stroll, Cub and I caught glimpses of bat wings and scents of wild mint.

We slowed down and gathered the neighborhood’s night around us, strolling past front yards and neighbors’ shuttered homes. It was well after dinner and most families were indoors, children slowing toward sleep. The yellow glow of light pouring from their windows didn’t overly dampen my spirits, since I could still spy a glitter of stars above

rooftops. However, our walk was acoustically messy. The constant drone of highway noise competed with cricket splendors, a distant car alarm throbbed through the air, and a sudden clamoring of dogs overwhelmed the faint longings of a great horned owl. These noisy intrusions jabbed more than I'd have liked. But staying indoors where the fridge hummed and the screen glowed blue did not pose an acceptable alternative. Nor did heading downtown, where neon lights and traffic noise would erase the night even more. It was, frankly, preferable to accept the neighborhood night as it was—no escape routes needed, just a patient practice of filtering unwanted noise and light from my ears and eyes.

We continued winding along the curving walks bordered by shadowed trees, through occasional pools of streetlight polka-dotted with fluttering moths under the generosity of a moonless sky. It turned out we didn't have to roam far at all to meet the night and its denizens. From within our own little neighborhood, we were able to greet bats, starlight, and moths, to stand in their presence, and serve as their witness. As any good friend would do for us.

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Within walking distance of our home, Corvallis has a hilly natural area, Chip Ross Park. Its trails wind around and through grassy knolls of oak-savanna into an adjacent forest. A few days after our neighborhood evening walk, I wanted to extend my knowledge of the local nocturnal world by adding this nearby green space to my nighttime exploration. So I asked two naturalist-friends, Don Boucher and Lisa Millbank, to serve as field-trip leaders, since they regularly take on that role for the local Audubon Society chapter. As co-founders of Corvallis's Neighborhood Naturalist program, they

share their enthusiasm for local ecology by leading nature hikes throughout the Willamette Valley. I trusted that they would be able to identify most, if not all, the wildlife sounds we might encounter during our outing. Cub and I met Lisa and Don at the Chip Ross Park trailhead just before sunset on the last Saturday of July. Our hike would begin at 8:30 pm and end an hour after midnight. I had never walked these familiar trails at night before. It would be like greeting a new land.

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Dusk in July lasts a long time here near the 45th parallel. The hillside is in constant, dust-laden movement, with ground squirrels and little brown birds scurrying along the trail. Sun-brittle grass accentuates each gesture of breeze and feathers. A western wood-pewee sounds its nasal burry call from above, where oak branches lend leafy hiding places. Wrens take a final dust bath in the trail ahead of us, and a woodpecker family holds its last clutter of conversation before retiring to bed. From the long grasses at the side of the trail, Oregon katydids send soft rhythms into the air, which is still hovering in the low 80's. We're all in short-sleeves, and we're open-eared, open-eyed, and careful of our steps as we walk through the oak stands of Chip Ross Park. As we head uphill to enter the McDonald Forest, dusk deepens and our pace slows. Each root and rock in the trail poses a possible trip into pain, yet we are each so care-minded that our feet seem more certain in the falling light than in the leaf-dappled daytime. We're on a collective quest for owl-hoots, bat-flights, and singular experience in this familiar place, exotic now in the alchemy of shadows. The grand old conifers seem to loom taller and straighter into the blue-black sky. Stars pop into place in the lattice-mesh of branches above. Breezes carry pine-sharp fragrances. I love what Don says: "You can

hear the shape of the wind out here.” You can feel it, too—pulses of coolness, interspersed with waves of warmth.

It’s past twilight now, and the conifer stands are thick, dense, and dark. We agree that it’s time to use our flashlights, which we switch to the red-light option so the longer wavelengths won’t diminish our recently earned night vision. We hike up the trail, red lights bobbing ahead of us while katydids send up their subtle background whisper. Glints of moonlight barely find their way between tree trunks; the violet sky glows bright compared to the blackening forest corridor.

We stop when a crackling sound ripples through nearby underbrush. Lisa, whose ears are keen for wispy sounds, hears tiny teeth gnawing on wood. This is the time of mice, voles, and wood rats, invisible and nearly inaudible. And then we see bats. Their erratic flights are most visible in the clearings, their bodies silhouetted against lighter sky. Our flashlights illuminate their flight-paths along the trail, a couple of them nearly dive-bombing us. Maybe we’re stirring up winged insect-meals for them as we walk, or maybe their paths are simply meeting with ours, a quick stitchery of intersections from moment to moment. Over and again, we are reminded that the night world is flush with life. It’s simply up to us to wake up to it.

Suddenly, a shrill wavering of ambulance sirens ruptures the quiet night. To my surprise, Don and Lisa don’t register even a whiff of irritation. They simply stop and become alert. Don explains, “Coyotes are common out here in the rural edges. They like to sing with the sirens.” Both Lisa and Don are confident we’ll hear them now. We cup our ears and strain to hear bits of coyote song in the midst of siren wailings. Sure enough,

nearly at the same high-pitched tone, we catch the sound of distant yelps beneath the quaver of the human-made racket. The coyotes have their say, and then they're done.

Sirens as background music . . . an unexpected way to reimagine noise.

We continue walking. There's an implicit agreement among us to keep our conversations few and low-toned. We're moving uphill, heading for the older stands where Lisa and Don have seen owls in the past.

Every so often, when we've reached a patch of old-growth, Don steps away from the group to offer up a tantalizing revelry of owl calls. He's a master mimic, intermixing long, slowly paced whistles with faster, intricate vocalizations. These are invitations for the barred, screech, and saw-whet owls to respond in kind. Lisa reminds us that even though owls abound in this old-age forest, they probably have no need to respond. We're well into summer, so their breeding and territorial time has come to an end. It's the season to feed babies and teach them how to fly their new-fledged lifepath, which doesn't include entertaining us.

We walk again, pausing every now and then to just listen. In those moments, my favorite moments, we turn off our flashlights, find a seat on a log, and let the forest enter our senses. By now, the breeze has died down and thin bands of moonlight gleam faintly through the density of Douglas fir branches. The main sound we hear is forested silence. Once, Lisa and I detect a distant hoot, the only owl we will hear. We continue winding through forest corridors, past streams, up and down hills, pausing to choose which fork to pursue. I am glad to follow my leaders, for I have lost my sense of normal time and place. I feel like I'm in a nowhere land, even though by day, I know these same places by name: Lower Dan's Trail, Middle Dan's Trail, Jackson Creek. But tonight I know these sites by

the soundscapes they offer: the spot where a rodent patters, the place of katydid-murmurs, the hill of slowed-down footfalls . . .

Two hours have passed, each of us walking behind our personal bobbing cone of red light. Shadows change, and our legs keep to a steady pendulum swing, quiet, dreamy, hypnotic. A creek sends up its inscrutable gurgling sounds, and a trundling rustle down the embankment suggests a casual raccoon wandering on its oblique, unconcerned way. Then, two staring eyes reflect off of Don's flashlight, a forward/pause motion of a cautious deer skirting our presence. We must be the most clamorous episode of its night, and we are easy to avoid. Except for the katydids and dried leaves sighing as we walk by, things are pretty quiet on this warm summer night, a night shaped by summer breeze and subtle expectation.

Soon after midnight, it's time to turn around. Even though we're all stumbling more often as tiredness takes over, this adventure continues to fill us up with the "other" side of the day-lit story. The summer night air overflows with spaciousness. Rivers and streams create crevices of mystery. Scented breezes wrap the forest in untold narratives.

Nighttime is an exotic terrain; it's a pleasure to step beyond our locked and bolted lives and become acquainted with it. In a few weeks, I'll travel to Central Oregon, one of my favorite (although more distant) neighborhoods, to take notice of the stories it has to tell.

Listening to the Desert of Central Oregon

It was late August when I drove five hours east of Corvallis to meet Central Oregon's nocturnal soundscape. My destination was Cabin Lake Campground, a

primitive, high-desert campground 40 miles southeast of Bend. When I arrived in mid-afternoon, the warm breeze was hazy with smoke from wildfires in the nearby Cascades. Most notably, the no-frills campground was shrill with raucous pinyon jays and Clark's nutcrackers as they flapped between pine trees and ruptured the afternoon air with their ceaseless caws and *kraaks*. Locusts and gray squirrels added their dry comments to the chatter while I set up my tent between stately ponderosa pines. This site would serve as a home-base for my high-desert nightwatches, certainly a more open and arid neighborhood from that of my own Corvallis home. For the rest of the afternoon, I explored the surrounding landscape of basalt outcrops, juniper, and sagebrush, and inspected garbled animal tracks imprinted in the dusty roads. When the smoke-reddened sun dropped toward the western hills, the birds gradually quieted, and I prepared dinner on the old splintered picnic table. Then I turned my attention to the coming night.

Field notes: In this wide-open place, twilight hands herself over to the elements: wind-tossed sounds of ponderosa boughs in unmapped rivers of air, smoke smudging the hills and blotting out horizon's stars, the sharp odor of burnt forests mixed with vanilla scent of pine. I hear a solitary bark in the distance—a coyote—and occasional rodent scritchings in the shrubs close by. According to today's pageant of dusty tracks in the road, rabbits, coyotes, and deer are to be my nighttime companions.

After cleaning my dinner dishes, I noticed the brisk flight of a bat in the darkness, so I grabbed the Belfry bat detector that Lisa and Don had lent me for this high-desert outing. About the size of a smartphone, but thicker, the detector is a gizmo that converts ultrasonic waves to audible clicking sounds as bats emit their echolocation hunting songs. Even when I couldn't see anything against the black backdrop of trees, the detector delivered a gratifying shower of blips whenever bats flew within 75 feet of me. Each evening, I would prop the Belfry box on the picnic table while I did my after-dinner

chores, furthering my feeling of camaraderie with the aerodynamic insectivores as they fluttered through my otherwise unpeopled campground.

The next night, a couple of hours before dawn when stars were still vivid, I heard a coyote's announcement, faint but unmistakable. Its sound didn't go unnoticed: a sudden response arose from the open country close by—maybe two coyotes. They sent their yappy messages back to the originator, their pitch perfect for the setting: keen and sharp, discordant yet musical.

On my final night, an anguished scream awakened me. I didn't move; I just peered into the blackness of my tent and listened, troubled by the animal's harrowing sound of distress. The animal was frantic, maybe dying. I heard a repeated thump of feet on the resonant desert ground. It was a mammal. Its high-pitched squeal receded and then came close again, behind my tent. My throat ached; the animal's cries yanked hard at me. But I stayed still, knowing there was nothing I could do, nothing I should do. The animal's terror—was its scream part of a distraction response? Was the animal lurching in the brush with a trap dangling from its leg? Or was a predator tenaciously latched into flesh and fur with razor teeth? The victim-animal went quiet. In my mind, I retraced its drum-thump run, and tried to guess what was suffering so earnestly. Soon, a couple of coyotes called out in a conversational barking-yap. Then the crying animal sent out a final long wail, its squeal descending to a quiet note. Dead quiet? I would never know.

Early the next morning before the sun broke over the ragged horizon, I strolled over the rough ground and searched in vain for tufts of fur or a ruined carcass. Although I found scattered tracks of deer, coyotes, and rabbits, they could have been from earlier in the week. But I figured that the night's terror-screams had come from either a young

fawn or a rabbit. The sounds I'd heard circling my tent—the cries, the dissonance, the long silences between—were perfectly part of the unending spiral of survival, constantly in motion under vast sky, on broken ground.

When I later referred to acoustic recordings online, I knew it was a rabbit I had heard in the dark of night. I will never know if its eventual silence signaled safety in a desert burrow, or death in the jaws of a hard-hunting predator. Either outcome would be right. And both possibilities rightfully leave me out of the story I happened to hear from my tent in the high desert on that late August night.

Nightwatch

I have arrived. My road-weary restlessness disappears as soon as I step out of my car and inhale the spicy sharpness of cedar and fir. I'm in the H.J. Andrews Experimental Forest in the Cascade Mountains, about an hour east of Springfield, Oregon. The final 10 miles of narrow, gravelly road have severed me from the rush of regular life. The mixed-conifer forest, my home for the next four days, is immediately generous with its solemn pace and tranquil peace. I've brought gallons of water, boxes of food, tent, pad, pillow, and plenty of curiosity to my campsite, where I intend to "meet the night." This is where I'll spend consecutive nights awake, without campfire or companionship. The assignment I've given myself seems ridiculously uncomfortable, but I'm happy to do it. The nocturnal world is a habitat I don't know well, and it needs my attention.

I am at home in an assortment of habitats. Many summers ago, I camped in the Colorado San Juan Mountains to assist Dr. James Campbell, a Colorado University herpetologist, in his research on boreal toad populations. He and a team of fellow field scientists—mammalogists, geomorphologists, and botanists—were studying the ecological impacts of increased snowpack from a winter cloud-seeding project that was meant to augment water supplies in Southwest Colorado. (The project eventually lost favor and funding and was scrubbed.) My job was to find, map, and measure adult toads of the alpine marshes, so Dr. Campbell could add my data to his. It was pretty easy to find the toads. They scrambled among willows in a crashing fashion and plopped in shallow waters with a telltale splash. As soon as I caught them, I measured their lengths from snout to vent (fore to aft) and weighed them with my portable spring scale. At lunchtime, I held peanut butter sandwiches with toad-tainted fingers, probably not the

wisest field decision for high health and wellbeing. But as a result of my many hours among toads, tadpoles, and toadlets, this lumpy amphibian is still among my favorite species. The more you learn about them, the more there is to love. Unfortunately, boreal toads are now listed as endangered in the western states, their habitat warming up too quickly in the high-mountain wetlands, and a fungal parasite decimating their populations to heartbreakingly low numbers.

A few years later, I found myself at home in an altogether different habitat, under the big sky of Wyoming's Bighorn Basin. From May through the end of summer, the Bureau of Land Management hired me to traverse abandoned prairie dog colonies in search of the highly endangered black-footed ferret, the sleek, masked member of the mink family. I was teamed with two fellow biologists fresh out of college, each of us so eager to find a ferret that we never complained about our pre-dawn departures in our hardy, four-wheel drive pickup. From early morning till late afternoon, we flagged transects across the uneven, pocky ground where prairie dogs once dashed and burrowed. Wyoming's old ranchers knew first-hand why the prairie dogs had disappeared. In my interviews with them later that summer, they reminisced about the systematic eradication of entire prairie dog towns with poisoned pellets to prevent livestock from breaking their legs in rodent holes. Ferrets, so weasely and supple, couldn't escape the toxins that accumulated in their own systems, and so their populations followed the demise of their prey. The entire ecosystem collapsed. We never found a bone, fur scrap, or trace of either ferret or prairie dog. Just rattlesnakes and black widow spiders occupied the abandoned prairie dog holes. We spent the summer looking for something already gone.

This summer, I will hang out with the nocturnal world before it goes missing. I want to meet the night where it's free of artificial light and unhampered by noise, where natural darkness and silence still prevail. I have camped out in wild places before, but this time it will be different. Instead of going to bed after sundown, I'll stick around to watch the evening slowly dissolve into darkness. And I know I'll find the wild presence of night here in the Andrews Forest. I'll be miles from any town and far removed from my usual electrical, virtual, and human-fueled distractions. It'll just be the night, the forest, and me.

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I am the noise bringer to this forest. My steps crunch on the gravel, I bang my car door, and my tent poles clank as I set up my home space in my new surroundings. I'm making myself part of the scene, just like the clicking beetles in the grass-covered quarry where I begin writing, and like the unidentified songbirds and breezes high in the branches. We're all making our scatter of noises, and yet it's so quiet here that the surging pound of my own blood fills my ears. I jot down my thoughts while I wait for the long June day to end. It's just past the summer solstice, when twilight takes the longest to surrender to night. As the lowering sun goes golden, it snags waving fir branches, cools, and gives up its station as giver of light and warmth. I feel a sense of good-bye lurking around the edges.

As a rule, I'm apprehensive about this dusky "time between." I usually choose to head indoors or hunker at the stony edge of a campfire when light dims. I wonder why I so often avoid this lovely threshold, the cooling end to an often over-busy day. Despite its singular beauty, throughout the arc of the year, this descent I experience at twilight is the same. So I expect to feel melancholic under the thickening shroud of dusk. But the

songbirds make it a holy, un-lonely place. The Swainson's thrush tosses its spiral of songs to the sky, catching another's phrase with its own. Mosquitoes whine in my ears and make me part of their warm evening meal. Everywhere I turn there is sound, most of it from birdlife, much of it unrecognizable, but all of it congenial.

I sit on a moss-covered berm on the roadside to watch the subtle changes as night arrives. The usual verbs don't seem to work: it's not like darkness really falls or descends. It just tricks you with its gradual approach, so incremental that it's unnoticeable. For a long while, the sky stays lavender-light, while the road, tree trunks and all of earth give up their green for darker tones. I hesitate to call the colors gray. They have no name.

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During my first nightwatch in the Andrews Forest, I felt at ease among the darkening trees. My pulse and thoughts slowed to more closely match the forest's cadence. I poured a cup of hot tea from my thermos, sat on the needle-cushioned ground against the base of a wide Douglas fir and waited. Quiet moments stretched, lengthened, and stretched some more. The darkness grew uneven. Streaks of violet sky sneaked between opaque branches up high, while blackness reigned where the forest was thick. Monochromatic gradations took on tones of blue and gray, and the unclouded sky glowed pale above with starlight, sending a soft shimmer onto glossy leaves at my feet. There was a low, invisible moon out there, too, lending some subtle light. When I gazed up, I saw the sparkle of other suns trillions of years above my dark pool of wilderness where I quietly sat.

Softly, night deepened around me. After an immeasurable period of patience, I shifted, then gathered my resolve and my belongings to lean against another tree. I opened my thermos and sipped my tea. I sat, listened, watched, waited. The darkness held fast onto its true tone. I held true to my stillness, trusting that the nocturnal world would acclimate to my presence. Perhaps a bat would do its aerial dance in front of me, or a moth would brush my arm, but nothing visited me, and barely anything called out its hello. Only occasionally was the silence interrupted, gravity provoking the most noise as twigs, needles, and un-labeled chunks of forest whispered or plunked their way down to somewhere. Gravity as creator of nocturnal sounds: this was unexpected. Pulling invisibly from the center of our planet, it orchestrated action, sound, and the slow stepping of clockless time.

As things started cooling down, I pulled on more and more layers, ending with an outer coating of Oregon raingear to help hold in my dissipating heat. Then my feet started chilling from inside my leather boots, one toe at a time. At one point, I started holding my own hands in my sweatshirt's kangaroo pocket as the night penetrated the forest and me. I needed an anchor, something a little more alive than the quiet sliver of star-spotted sky and the color black. Once my hands found each other, I didn't feel quite so solo. Mind you, I enjoy aloneness. It's my refuge and restoration. But in the cooling, implacable sameness of miniscule stirrings and sighs, it was nice to have a warm hand to hold onto.

I thought I'd be thrown into profound thoughtfulness, my island-self perched alone on this island of time, the slow sweep of constellations truncated by the canyoned opening above me, forest on all sides. But my thoughts lacked cohesion and were spare, bare of details. They went nowhere, neither forward nor backward, and they certainly

didn't go deep. They were as quiet and un-unruly as the steady, barely creeping night. The midnight was woven of such dense darkness that I was in constant search of meaning, light, and edges. I widened my eyes to capture *anything*, any sparkle, any dim movement. It felt like my little humanoid eyes were too tightly bounded by skull bones, my ears too snug and immobile. Craving a wider window with a vast peripheral view and funnel ears with pivot and twitch, I willed my senses to expand further out, further up, well beyond this place in the forest beneath the heavens. I was profoundly aware of my shortcomings, yet emphatically glad to be a visitor of this exotic night country. Certainly, I longed for much more than I was able to receive. Then, a solitary chirp rippled the darkness—a mother bird reassuring her nestlings? I almost smiled.

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Throughout the summer, each time I sat alone in the midst of nocturnal unknowns, I felt a primal tug, a decided bond with my ancient relatives as I confronted the humbleness of my humanity. Night creatures are equipped to detect the rasp of rodent fur against fern fronds or the flick of a whisker in the underbrush (an owl can hear a tentative mouse from 75 feet away!) but I knew I was capturing none of these clues with my day-adapted, human-muted senses. Humans simply aren't nighttime beings. Indeed, long ago, our primate ancestors abandoned their nocturnal lifestyles, as changes in their visual systems and ecosystems led them into daytime niches. Eyes and pupils shrank and lenses flattened. Color vision arrived at the cost of low-light vision. And the mirror-like surface behind the retina, the tapetum lucidum (which is why wild eyes shine in your headlights) was no longer needed to bounce optic rays twice through the retina to highlight things on the move in the night.

At the same time our eyes were becoming day-equipped, we began stepping to a rhythmic circadian beat, foraging by day and slumbering by night. To avoid large predators (we were the prey), we favored open landscapes, found safety in numbers, and constructed secure sleeping sites where we could return each night—ultimately accompanied by the warmth of firelight. Yet I was spending my nights alone in a thick forest without companions or campfire, decidedly not the strategies honed by my predecessors of long ago. No wonder I was unceasingly perched on the brink of hyper-vigilance; my primal wisdom had the final word.

Meeting My Neighbors

From the first day I greeted the Andrews Forest, the steep hills and dense forests inferred an abundance of wildlife. On my daily walks throughout the week, I savored the constant presence of birds, squirrels, spiders and slugs; we comfortably belonged together among the mosses, trees and fallen logs. However, my routine strolls must have disturbed the wary ones—deer, weasels, lizards, and many more—for my path never crossed theirs. According to the Andrews Forest species list, there were countless others I failed to perceive upon night's arrival: skunks, bobcats, and even bats eluded me. No doubt, they instinctively knew to avoid my pronounced presence as I sat swathed in emanations of mosquito repellant while sipping my Earl Grey tea.

I looked and listened with special care during the sun-lit hours to discover clues about my forest neighbors. I noted the chalky-dry carnivore scat at road's edge, raptor feathers caught in ferns, and agile birds scouring open skies. With each sound and sign of life, I tried to weave together a few of the forest's melody lines.

Field Notes: Low sun sifts through tangled limbs, a grouse bursts from leafy underbrush, followed by sudden scattershot of chicks. All sorts of chaos, but it works better than any straight line. Up ahead, an uproar of jays with their insistent jagged cries. A dark arc floats into a nearby stand of shaggy firs, merges with blurred shadows where crisscross branches meet. More frenzied cries, jays swoop-dive—more chaos—but the owl stays put, eyes obsidian black, her plumage barred and streaked in tune with the dusky trees. The jays swallow their calls and wing away. I look at the owl. The owl looks at me and all the things I cannot see; she tips her head down, side to side, then stone still. A shadow among shadows, absorbing the forest. She's all feathers and eyes.

My field book confirmed it was a barred owl that had triggered the frenzied jay-mob that afternoon. In truth, whenever I craved a species' name, I turned to my assorted ID books stashed in the car. I learned that ocean spray, prince's pine, ruffed grouse, and chickarees were among the many myriads of plants and animals texturing my time in the forest. It was the Swainson's thrush rallying in jubilation at first hint of sun. It was the insect-chasing nighthawk opening and closing each night with its graceful zigzag flight. It was the twinflower in bloom, the saxifrage in seed, and a Cooper's hawk nesting in the scraggle-stand of trees. Clearly, the majority of my successful species' identifications revolved around my daytime routines.

As for the nocturnal world, the only two nighttime beings I heard with some regularity were the common nighthawk and the barred owl. I relied on both of these birds to jazz up my silent nights, and sometimes I would even hear a medley of their calls at pre-dawn and dusk. The nighthawks' busy aerial cries were like static unzipping the twilight sky, while the barred owls' hollow baritone hoots glided more deeply beneath the canopy. I was quick to warm up to their cries and calls; neither of these birds was a stranger to me.

I first became acquainted with the nighthawk while taking after-dinner photos along the Ochoco Creek in Prineville, Oregon many summers ago. A robin-sized, falcon-

shaped bird, the nighthawk captivated me with its distinctive raspy call and erratic flight as it chased insects over the water. Related to the whip-poor-will, the nighthawk's name at first seems misleading, since it is neither strictly nocturnal nor a hawk. But the name cuts pretty close to the truth, since nighthawks are generally active during the hours of dawn and dusk, and hunt on the wing (known as "hawking"). In the Andrews Forest, I occasionally heard their familiar call overhead on bright, moonlit evenings, but never in the midst of the darkest, moonless nights—although I wished I did. The electric *beezzzt beezzzt* calls always sounded warm and breezy in the starry sky as they zigzagged high above chasing their prey. When it wasn't too dark, I could see their swerve-and-dart flights as they apparently zoomed directly into insect swarms with their mouths and throats opened wide. Because of their reliance on swarming insects for prey, nighthawks follow insect availability with the changing seasons, and tend to be among the latest to arrive in North America each spring, and the soonest to leave at summer's end for their wintering grounds in South America. Their migration routes, which average 4,500 miles, are among the longest migrations of any bird in the Americas.

Virtually defenseless because of their weak feet and tiny beaks, nighthawks depend almost entirely on their cryptic camouflage for survival. Their mottled coloration and daytime habit of sitting lengthwise on branches keep them hidden in leafy habitats—I know I never spotted one—helping to protect them from predators, which range from domestic pets near urban neighborhoods to coyotes, falcons, and owls in wooded habitats.

However, it is unlikely that the nighthawk is preyed upon by the barred owl, the only owl species I chanced to see and hear in the Andrews Forest during my time there.

Barred owls mainly feast on squirrels, chipmunks, mice, and voles, although they'll also gobble down small birds, reptiles, amphibians, and invertebrates. Well equipped for hunting in the dark, their extra-large eyes are about 100 times more night-sensitive than our own, and their hearing is enhanced by facial feathers that feed sound waves directly to their ears. An asymmetrical positioning of the ear slits helps them determine sources of sound with deadly accuracy. Patient hunters, barred owls watch from a perch, scanning all around for prey, the strategy I witnessed when our paths crossed in low-lit mornings and evenings.

But mostly, it was the barred owls' syncopated calls that alerted me to their presence in the forest. Sometimes their hoots were barely audible at the farthest edge of my hearing, and at other times, they were loud and sonorous high in the branches just a few trees away. As with the nighthawk, I had already formed an attachment to this species, since I've often heard them while camping and during neighborhood walks in town.

Unlike other bird species, the barred owl's call, (*"who-cooks-for-you"*) is becoming more commonplace through much of the United States and Canada. For not only have their populations been spreading, but their numbers have also more than doubled in North America in the past 50 years. Originally, this raptor was confined to eastern forests, since the vast Great Plains posed an imposing habitat barrier. However, fire suppression and tree-planting projects in the 20th century gradually created wooded corridors that allowed the adaptable owl to expand its range northward to Canada and westward to the Pacific Northwest. The barred owls' arrival to the west coast has created a ripple of ecological consequences, because they naturally compete with the less

aggressive spotted owls for prey, nest sites, and cover. In addition to displacing this smaller owl species, barred owls have also begun hybridizing with them, further compromising spotted owls' threatened populations.

The question of what can or should be done about barred owls in respect to spotted owls is beyond the scope of this essay; there are ecological, ethical, legal, and unforeseeable aspects to every decision and action we take. I am deeply concerned about our threatened and endangered species, and have a particularly strong connection to the spotted owl because of my personal encounters with them over the years. But as a co-inhabitant of this wild world and as a guest of the forest at night, I have reveled in each barred-owl call and in every nighthawk utterance I've heard in the night. I remain grateful to both of them for lending me their songs.

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Re-thinking the Dark

It was 10:30 pm, mid-July in the Andrews Forest. For over an hour I had been watching the slow tide of weightless time blacken the boughs of cedars and firs. Far from any town and enveloped in happy solitude, I was sitting among sword ferns at the edge of a forest road. A ragged wedge of sky glowed violet above treetops, and the familiar forms around me morphed and fused. Details disappeared as the Earth slowly rolled toward the deep of night.

Since my eyes were sufficiently acclimated to my dark surroundings, I decided to take a walk along the gravel road. But I was utterly surprised when, directly in front of me among rocks and pebbles, I saw my own shadow leading the way. Bewildered, I looked skyward to find a light source strong enough to produce shadows, but there was nothing up there, no moon, nothing. There was only the simplicity of starlit sky, untrammelled by human light. Was this something everyone used to witness on a regular basis—a moonless, star-drenched night sky throwing shadows down to Earth? Even when I had worked in Death Valley National Park, I had missed out on this phenomenon. From twilight until dawn, security lighting had bathed our housing and hushed the stars.

But the story of our stars fades even dimmer where most of us live, in cities, where artificial light spills from buildings and roadways as soon as the sun's daily work is done. To help us grasp the impact of human-generated light on the night sky, an amateur astronomer, John Bortle, created a 9-point qualitative index based upon his 50 years of celestial observations. For this scale, Bortle reserved Class 1 for the truly unspoiled starry sites, like Great Basin National Park on a clear, dry night. In contrast, he assigned Class 9 to brightly lit inner-city skies, which shine many thousands of times

brighter than the dark skies of 200 years ago. Washed-out, grayish suburban skies land somewhere between Classes 5 and 7, in which stars become mere phantoms of themselves, barely detectable in the gauzy haze. Even an entire galaxy, our own Milky Way, cannot compete with the fanfare of electrical brightness gushing from our cities.

The ubiquitousness of artificial light is bombarding the nocturnal world, bleaching our own star-shadows into oblivion. Without a second thought, we are disappearing the night.

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Night's disturbing decline arrives in the wake of urban sprawl, humanity heading for cities in a blaze of excess light. This worldwide move to an urban lifestyle is gathering momentum. While only one third of the planet's population lived in urban areas in 1950, today over one half of the world resides in cities, which are linked together by a network of over 8.6 million miles of paved roads. According to the UN Department of Economic and Social Affairs, this trend will persist. By 2050, nearly 70% of us will live in cities, which are likewise growing in scope, size, and scale, suggesting that the obliteration of our dark skies will also escalate. Indeed, recent findings from the German Research Center for Geosciences show that our use of artificial light at night has increased at an average rate of 2% per year in the past four years, twice the annual rate of the world's population growth. Meanwhile, Asia, Africa and South America have seen a 10% surge of nighttime illumination in the same four-year period. These statistics unquestionably point to the dire erosion of night's darkness on a global scale.

Because of this dramatic trend of diminished darkness, astronomers and environmentalists came together 30 years ago in a joint effort to protect the night. Two

non-profit organizations, the International Dark Sky Association (IDA) and the UK's Campaign for Dark Skies, gather research to promote the inherent value of dark nights and to decry the pernicious impact of light pollution on humans and ecology. Light pollution, also known as anthropogenic photopollution, is defined by physicist Fabio Falchi as inappropriate or excessive light resulting in glare, sky glow (luminance of the night air over populated areas), and light trespass (light falling where it is not intended or needed). Satellite data provided by the National Oceanic and Atmospheric Administration shows that nearly 99% of Americans and Europeans live under light-polluted skies today. Even remote areas are affected. Light from cities can travel over 200 miles, effectively washing out the starlit splendor of distant midnight skies. These sobering facts provide an unsettling context for the lovely aerial images of glitter crisscrossing our night-darkened continents, so beloved by contemporary commercials. Although these photos are meant to highlight technological progress and business prowess, they simultaneously showcase a shimmering grid of urban dominance over our wild nocturnal world.

We are fundamentally pressing the night into smaller spaces and squeezing it into ever-shorter measures of time. Why are we so bent on chasing the night away?

Night in Human History

Our need to civilize the night with artificial lighting goes back to our ancient ancestors, who, like us, were day-biased creatures dependent on visual cues. Unable to see in the dark, they dreaded all the horrors that crowded the impenetrable night. Beasts of prey, terrifying loneliness, gripping cold, and the ominous unknown—each led to a frightening sense of vulnerability. The binaries of day and night and their attendant

dualities, light and dark, were eventually symbolized through time-honored myths, with light embodying the ultimate good. The greatest gods in ancient Sumer and Egypt were the sun gods, Utu and Ra. Shining Apollo of classical Greek mythology drove the chariot of the sun, and in Christianity, Christ became Light of the World, while Satan was named Prince of Darkness. The darkness of night came to depict evil and death, and light-giving fires were meant to keep all manner of monsters at bay.

This association of night with danger persisted for many hundreds of years. In his book, *Evening's Empire: A History of the Night in Early Modern Europe*, Craig Koslofsky chronicles Europeans' relationship to darkness starting in the 1500's, when people feared almost everything about the hours after twilight. For over 1,000 years Christians beheld night as a primal force over which they had little control. They came to symbolize it as both a time of natural and supernatural danger, and the place of ghosts, witches and the devil. In their spiritual struggle between light and dark, 16th- century Europeans believed Satan, death, heresy and, ultimately, hell were born of the night. And so flourished the metaphor of light as the agency of good through which the darkness of ignorance could be banished.

By early 18th century, gas-lit lamps started to illuminate Northern European nights, literally as well as culturally. Indeed, the advent of artificial lighting may have kindled the dawn of the Enlightenment as street-lighting initiated new cultural practices. For the first time, city streets became populated with coffeehouses for nighttime socializing and exchanging of ideas. Just as they were colonizing spaces by way of overseas conquests, Europeans were also colonizing time by infusing night with artificial light and asserting its safety through the emergence of new customs.

The nocturnal world became displaced from its dimension of time, as lamps and lights edged the hours of darkness to the outskirts of urban life. Night became absorbed into the everyday realm of place—in homes, cafés and along ever-brighter city streets. After 1879 Thomas Edison’s electric light bulbs replaced gas-lit lamps, generating even more hours of light per day, further eliminating hours of darkness. Which brings us to the present, when the industrialized world has all but forgotten the worth and the beauty and our bond with the night.

Night as Endangered Resource

We hardly seem to notice—or care—how much we have marginalized the nocturnal world. Perhaps it’s the temporal nature of night that is to blame. After all, the Earth’s perpetual spin guarantees night’s perpetual comeback. Our logic declares that night will always follow day, and that we could not possibly do it harm. Not even our most damaging emissions, combustions, or extractions can stop our planet from spinning: the sun will set, skies will dim, and night will always come. Since we are not adapted for nocturnal lives, the outpourings of fluorescence and incandescence from our cityscapes seem innocent enough; they are merely meant to extend our daytime activities and banish our nighttime fears. The glow of light at night simply signals prosperity, hearth and home.

Because we now spend less time in rural places, most of us are untroubled by night’s passage to the periphery of human experience, repeating the pathway by which so many of Earth’s priceless treasures—coral reefs, glaciers, the entire Aral Sea—have become degraded or destroyed. Threatened by the relentless onslaught of artificial illumination, the night is already regarded as an endangered resource by concerned

members of the dark-sky movement. Night-as-resource is extraordinary. For unlike air, water, mineral or soil, night is a time-based phenomenon that Earth's life forms have evolved to depend upon for billions of years. Its daily cadence provides refuge to wild species and triggers hormone response among multitudes of organisms.

Even human health and wellbeing hinge upon the age-old pattern of darkness and light, foundational to our body's circadian rhythm. In response to Earth's day-night cycle, our bodies produce melatonin, a pineal gland hormone and potent antioxidant that keeps our biological clock ticking smoothly, while also regulating other hormones and boosting our immune system. In fact, the American Medical Association has identified links between disrupted circadian rhythms and heightened risks for sleep disorders, obesity, breast cancer, and depression.

Non-human beings, from plants to pumas, are also profoundly reliant on night's cyclic tempo. Without darkness, deciduous plants may bud prematurely or fail to show fall colors, and some flowers will stop blooming altogether. When night-lengths are altered by artificial light, songbirds may mis-schedule their morning choruses, or migrate too early or too late, causing them to miss ideal conditions for mating and feeding. Thousands of other organisms depend on regular intervals of darkness to govern their reproduction, sleep, and daily or seasonal patterns of movement.

Night as Habitat

Besides occupying a time of day, the nocturnal world also functions as a backdrop of place; it is an essential component of wildlife habitat. A habitat is an intricacy of food and shelter, composed of living and non-living elements—where fish swim and spawn; birds soar, roost and nest; and mammals hide, hunt, scamper and sleep. Without their

homes and havens, plant and animal populations will falter or completely vanish. But we, as diurnal beings, approach our world's ecosystems with a day-restricted, half-sighted point of view, making us blind to the value of nighttime as a crucial planetary component.

Even though we fail to discern the damage of photopollution on wild habits and habitats, physicist Christopher Kyba of the German Research Center for Geosciences considers artificial light the most drastic change humans have introduced to nocturnal habitats. By collecting urban sky-glow data from a 2011-launched US weather satellite, Kyba and his team have been able to study the impact of artificial light on ecological systems. Since the inception of their research, a calibrated instrument on the satellite has documented unprecedented loss of darkness, illustrating a dramatic decline in nighttime environments for our planet's species.

Of all our species, nocturnal animals (30% of vertebrates and over 60% of invertebrates) unquestionably require consecutive hours of darkness for their survival. Amphibians, particularly vulnerable because of their semi-permeable skin, inhabit nocturnal niches to escape daytime stressors like heat and desiccation. Darkness also provides cover for prey species, lowering their risk of depredation, and opening up habitats where they can safely forage. To avoid unnatural illumination, many nocturnal species, like mountain lions and bats, alter their customary routes in favor of dark cover. Others, like mice, stop moving altogether. Light entices yet other animals to their premature doom. Moths and other insects congregate around street lamps, where they die of exhaustion or become easy prey. Similarly, predators devour dense concentrations of fish that gather in illuminated portions of their formerly safe waterways.

There are countless other examples of light's infringement on wildlife's wellbeing. When exposed to artificial light, nocturnal frogs will postpone meals and mating, remaining motionless long after the lights are turned off. Salamanders, disoriented by photopollution as they journey by night from pool to pool, will die of exposure or predation before ever reaching their breeding ponds. Female loggerhead, leatherback, and green turtles gather in unnaturally high numbers in search of nest sites on ever dwindling dark beaches and become vulnerable to higher rates of predation. In Florida alone, millions of sea turtle hatchlings die annually after they emerge from their eggs at night because city lights lead them astray. Genetically coded to head for the ocean's moonlit horizon, the babies trek inland instead, fooled by the glare of parking lots and hotels. They tragically perish from dehydration, predation or traffic. Even water quality deteriorates because of light intrusion. Small freshwater invertebrates consume less algae in the presence of nighttime light: algal blooms intensify and water quality collapses.

Nighttime is unique in offering birds sufficiently calm, safe air space through which they can migrate each fall and spring. Free of unstable thermals and daytime predators, the night sky sparkles with starlight, providing a celestial map for feathered navigators during their nighttime flights. However, low clouds aglow with city-light now too often distract birds from their instinctive flight paths. Worse yet, the radiance of lit-up buildings actually attracts them. Once drawn to the bright beams of light, birds will fixate, circle, hover, and crash into the illuminated structures, sometimes dying by the thousands in a single night during peak migration. All told, tower collisions kill millions of migrating songbirds each year. The lives of hundreds of thousands of warblers, vireos,

thrushes, and sparrows—crushed—simply because our lifestyle burns too deadly bright in what was once a dark, safe, pristine night.

This shocking loss of wildlife urgently calls for us to examine our excesses and repair our ways. Dark-sky advocates are certain we can minimize the harmful effects of photopollution, light by light, without hindering human safety and commerce. The steps are simple and effective; they just need to become customary and commonplace. First, we can turn off our lights when we head for bed and install motion-sensors to illuminate our environs only where and when light is needed. We can replace high-wattage night-lighting bulbs with 15-watt or lower and choose shielded fixtures to keep light from pouring upward or leaking outward. Finally, we should opt for lighting with wavelengths of the warmer hues, since blue-rich lights (like LEDs) create more brightness and cause greater harm to wildlife and humans than any other color on the spectrum. Until dark-sky ordinances are publically adopted, each of these efforts—one household, one business at a time—will help ease the explosion of excess light that currently endangers our nights.

In an effort to protect the nightscape's fragile future, the US National Park Service officially monitors and reduces the impact of light pollution in its parks, providing us with some of the least tainted skies in the contiguous United States. To date, 18 parks and monuments have acquired certification as dark-sky destinations. In these sanctuaries of natural darkness, we can still stand under the starry dome of a primal night sky and contemplate its presence in life's ancient rhythms. And under the slow wheel of constellations, we can also rediscover night's indelible bond to human history and culture. For thousands of years we have used night skies to help us navigate sea and land, to time our treks and crops, and to hold mystery and imagery. Storied nightscales, filled

with moon, planets, stars, and darkness, are intricately woven into the very fabric of human place and process. Just as it is part of every living ecosystem, the night comprises for us a vast and cosmic heritage—it is up to us to ensure its future.

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Shades of Night

City Scape

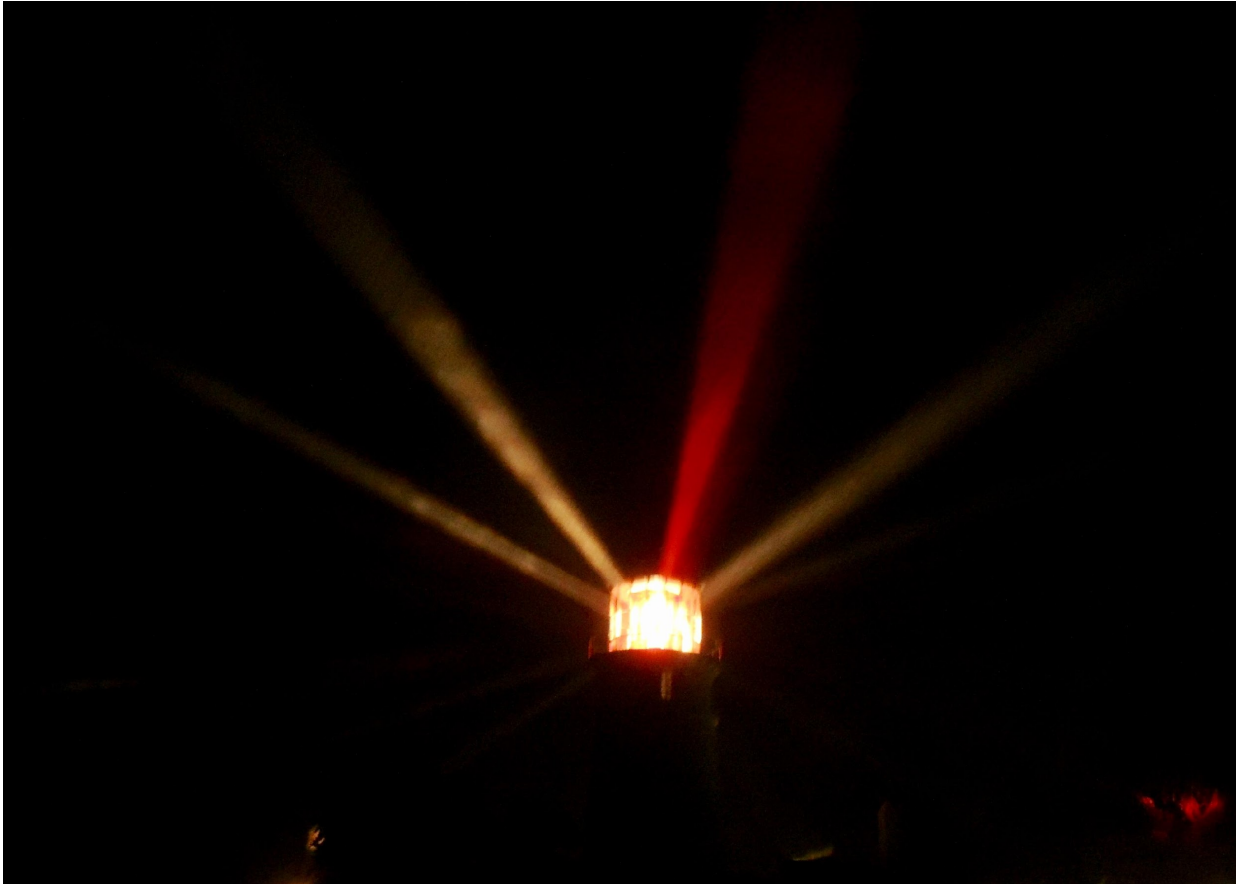
Downtown Portland



The Hawthorne Bridge spanning the Willamette River

Most of us experience night as a time that shines with street lamps, traffic, and neon signs. Colorful and bright, our artificial lights obliterate the darkness of our nighttime sky. An incandescent outpouring that chases away the stars.

Umpqua River Lighthouse
Umpqua Lighthouse State Park



I travel to Umpqua Lighthouse State Park at the behest of my friend, Heather. She doesn't tell me why, just, "You *have* to see that place at night!" After I eat dinner in my campground, I take a dark, rain-drenched walk to the lighthouse, just a mile up the curving road. A few minutes of steady plodding brings me to a rise, and I am suddenly met by an overhead whirl of rain-infused light, twenty-four beams in all, two white rays followed by one red. I watch as the revolving lighthouse lantern smoothly sends its signals out into the tumultuous dark, where the Umpqua River meets the sea. For 123 years, fewer ships have splintered and sunk, fewer mariners have suffered calamitous deaths. These rays of heritage and hope.

Moonrise

Nip and Tuck Road near Stanley, Idaho



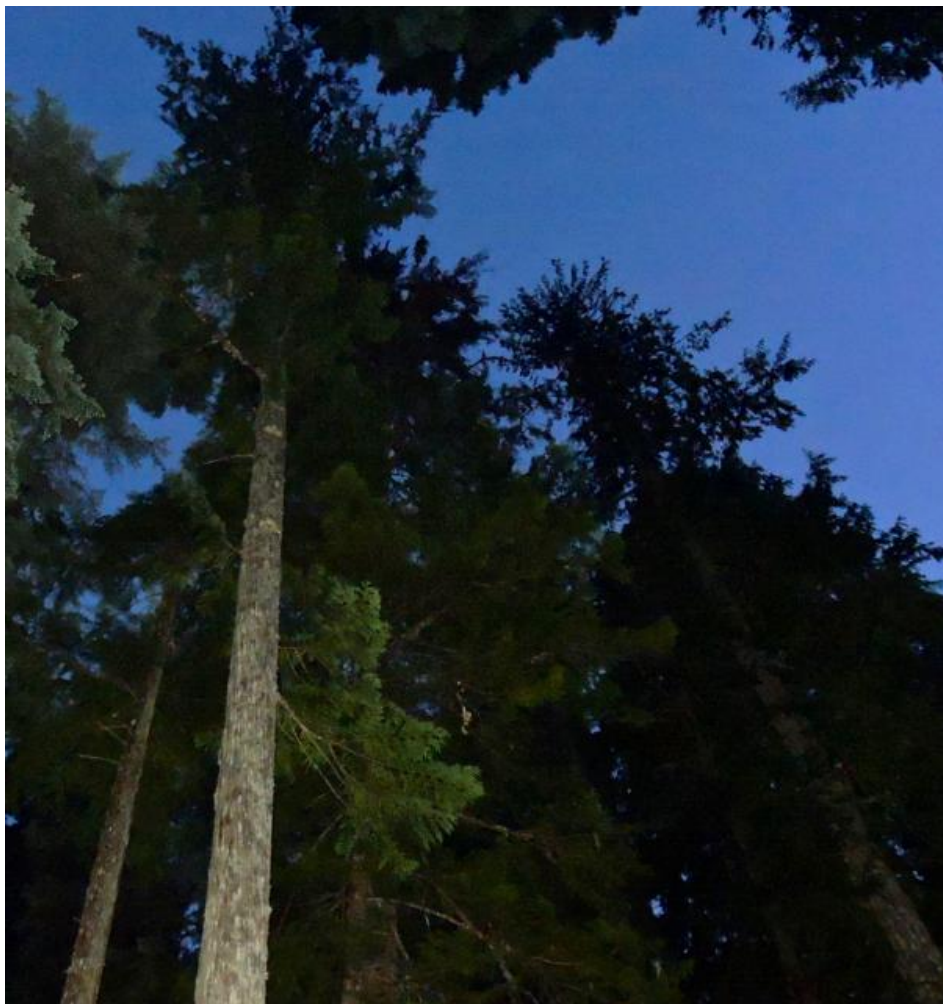
It's July after sunset in the foothills of Idaho's Sawtooth Mountains, and the birds are already roosting in sagebrush and pine. By midnight, it grows chilly, with no clouds to hold in the day's searing heat. Moon-glow and shadows coax gullies, hills, and solitary trees into sharp relief, stars invisible in the moon's bright halo.

Just before dawn, I'll hear the sparrows sing their *chip* songs and zoom low over the still-dark terrain. At daybreak, a pair of sandhill cranes will fly overhead, their complex call-and-response duet opening the wide, new day.

Dusk, Andrews Forest

Twilight is a memory-laden, heart-catching time. Ephemeral and fleeting, it's an ecotone¹ between the two halves of day, rich with tension between expectation and letting go. Trees replace green with gray before becoming silhouettes against the pale-lit atmosphere.

Early Romans used the word “crepusculum,” (from *creper*, meaning dusky or dark) for the enchanted pause that precedes nighttime. Crepuscular animals, like rabbits, beavers, and nighthawks, can often escape predation by foraging at twilight.



¹Ecotone: a combination of *eco*(logy) plus *tone*, from the Greek *tonos*, for tension. The zone between two major ecological communities

Starry Night
Andrews Forest

Night rarely falls. Instead, cool slabs of darkness slide upslope, and shadows rise up tree trunks until they reach the sky. In the Andrews Forest, a tall wall of conifers confines my sense of skyscape within a narrow canyon. As the evening goes to black, I discover companionship without words, beauty without color, and the abundance of spaciousness under a slow-flowing panoply of stars.



Slow dream of stars
Trees fringing the sky
like a riverbank

Waning Gibbous Moon

Andrews Forest



Field Notes, July 10, 2017: Tonight I see silver-white light high in the canopy. At eye-level, tiny glimmerings spark, sift, and vanish while the moon glides overhead and the Earth slowly rolls toward the waiting dawn.

Moonlight separates trunks from branches and needles from sky. But it glares too brightly for my dark-adjusted eyes. So I let the moon hide among branches, and try not to catch it full-on. Only two days past full, it's still round and generous. Under moonlight, the trees look more like trees, and less like an impenetrable wall.

August Night

Cabin Lake Campground, Central Oregon



The high desert is a place of spaces between. Between branches, between trees, between fiery days and toe-numbing nights. I see the crescent moon descending in the west as it follows the sun. It's August 24th, only three days after the solar eclipse. I study the moon's shadowed domain, already dwindling to reveal the classic crescent slice, which will grow thicker night by night.

At my campground site, the ponderosa pines hold the blackest night, their limbs and needles etched in meadow of sky. Compared to the west side of the Cascades, there's more wide-open space out here; more stars and stronger breezes blowing their cold-night chill onto the rolling land.

Venus Rising, Early Dawn

Cabin Lake Campground, Central Oregon



Morning hours feel like morning, despite their darkness. Is it my biorhythm that dictates the difference, or is there a distinctive quality after midnight that signals a beginning rather than an ending? I wonder: are the spring golden-greens of new leaves the same as the autumn golden-greens of finished foliage? The sunlight's angles are similar and the color schemes compatible, yet they diverge in the way they land in the heart. So, too, with dawn and dusk.

I watch Venus make a slow, rising arc in the eastern sky. As it glides from tree branch to treetop, the sky becomes washed of stars. Soon the coming dawn is heralded by unabashed, unleashed calls. Outbursts of pre-morning joy.

Mysteries of the Andrews Forest

Twilight lingers a while before merging with night in the Cascade foothills of early summer. Dinner is two hours behind me, yet only an innuendo of the night season hangs in the air. Songs of unknown birds flit back and forth above me, and a final flutter of hawk wings, probably Cooper's, confound the conifers at the side of the road. I've been in the Andrews Forest since mid-afternoon, and have already set up my tent, hiked a forest trail, and photographed roadside wildflowers in the fading light. It's just past 8 pm.

To prepare for the coming chill of darkness, I pull on a sweatshirt and strap on my light pack bulging with extra layers and wool cap. These are my protection. I usually head for my sleeping bag just as dusk goes gray, but tonight I'm gearing up to mindfully watch it sift, dissolve, and darken to night.

After a gravelly half-mile walk up the road, I step into a mature forest stand and sit on the soft, muted-green ground. A hollow resonance swallows up the snap/drop of small evening sounds in the cool gloom under towering trees. I watch and listen, breathing, blinking. Nothing follows nothing. The dense columns of ancient tree trunks aren't talking today. Disembodied bird-chirps float out from nearby boughs, and a jet hums overhead. Above the branches that hide the sky, an unseen nighthawk sends down its buzzy call. Although the nighthawk's sound is familiar to me, I can't place other songs I'm hearing. This adventure is already a humbling one; I have no names for most of what I'm seeing, hearing, and sharing my time with. Of course, they don't have a name for me either.

While the darkness gathers weight, I gaze into the tangled undergrowth.

Downslope I see broken branches and rocks that seemingly morph into a crouching cat, poised to pounce. I'm not prone to fearing wild animals, or to fantasizing danger where it isn't. Yet it's easy to transform a clump of limbs into a threatening pose. I'll only say I become more alert—and sympathetic to folks who fear the dark and the wild ones that stalk and spring. A few moments later, I look for my supposed "wildcat," and now see it as an overgrown rodent, a lot less threatening and a salute to my imagination. I'm ready to move on.

I walk farther up the road where the old growth is more pronounced, where I know there's a dead end and a calm sense of destination. Maybe the night will meet me there. My boots scuffing on gravel shatter the growing silence. Now there's only the road and me and the waiting forest.

I arrive at the grove of ancient Douglas fir giants, and find that I like this place even more than the 80-year-old tree plantation where my tent is set up, where my car with water and food is parked. It is an honor to sit among these thick-skinned, deeply rooted beings who have witnessed sky and mountains for over 300 years. It's discernibly darker now, the white bunchberry blossoms at my feet barely lighting up the forest floor with their moonlike glow. I watch them dull from silver to gray, moment after spacious moment.

I cannot help but compare this long, leisurely evening to the abrupt ones I experience during the opposite arc of the year. After a winter workday in Corvallis, I sometimes decide to squeeze in a quick hike on a forest trail just six miles north of town. Generally overcast and often drizzly, a restorative hike is often just what I need if I'm

able to escape my duties by 3:30 pm. There's nothing bright in western Oregon on a wet, winter afternoon. Due to clouds heavy with rain, you often can't locate the sun, though you know it's on its steady descent westward toward the ocean. A hike on a December afternoon is low-lit, lichen-draped, and moody—a good time to unpocket your problems one by one. But the pace needs to be brisk, for the unchanging dimness deceives you. By 4:15, night is already closing in, and quickly, too, since winter in western Oregon clings dearly to darkness. Too many times, I've emerged from trail to road almost too late as I finish my final quarter-mile to the parking lot. I unlock the car door exhilarated, heart beating hard, thrill-filled for having nearly lost the race to the blackening shadows.

But in the Andrews Forest on a late June evening, night doesn't obscure the trail until after 10 pm. I am in no rush. I have an armload of time to stroll back to my tent. Overhead, the first bold stars spark the pale indigo sky, and at ground level, individual trees melt into one. I'm surrounded on both sides by a barricade of black, not a familiar sight for me, but not a surprising one. I brush away a slithering sense of unease and throw on my windbreaker. My steps crunch at a steady, slow-but-sure pace. I want to be at the pullout where my car's parked before things get blacker still. I'm not going to bed yet, but I'm not going to be brave either.

My ears can hardly pick out anything because of my heavy booted feet, steady as a heartbeat. I think I hear the hint of a new sound, eerie and distant, off to my right. I stop, the sound stops; I walk until, there it is—another faint tone. I stop, and then walk again. This cat-and-mouse between silence and missed sound continues, until I again capture the low volume thing-of-a-sound. It's not an owl, not a grouse; all I know is what it's NOT. Not what I want to hear. It's completely unknown, unearthly, unsavory. It's a

muffled roar followed by stillness. An open throat with no consonants, an abbreviated bellow, a chorded haunt—and always with long pauses caught between. My steady graveled footsteps quicken and widen. Don't care if I stumble on a rock, I'm heading to my car, my tent, my home base. I hug my pack around me and I'm glad for my layers of sweater, sweatshirt, and windbreaker. They're all I have: layers of polyester and nylon, not fur, scales or spines. But I refuse to run. Running, I know, inspires swift pursuit-instincts from our predators, which are not the troubled hollow groans floating through the trees. They are the quiet unseen beings that I forgot to worry about until now.

I don't stop to listen anymore, though I keep looking over my shoulder to reassure any and all nocturnal inhabitants that I am *not* running; therefore, I am *not* prey. Time intersects with fear intersects with eternity, yet it doesn't take more than 10 minutes before I'm back at the car. I just lean against its solidity and listen, safe somehow, since after all, I always was. The sorrow-call drifts again and again into the gloomy dark under the star-lit sky, each call separated by a mountain of silence. No one answers. I stand, riveted in place, left to wonder and inwardly wander among the night's unknowns.

Long minutes pass before I relax enough to sit on the roadside, the terrain and wall of tree trunks bathed in opaque black. Cedars, Douglas firs, and hemlocks dominate; alders and underbrush fill in the gaps. A welcome patch of skyscape hangs narrow and ragged-edged above the treetops, individual stars shining silver in the young night. It's surprising to see the earliest bright pinpoints lose their command as fellow stars mutually outshine one another in the maturing night. Meanwhile, the Big Dipper slides slowly along the fringe of high branches. The crescent moon, barely a golden night-light, glimmers like water between scratchy conifer limbs. I am still listening; listening and

still, leaning hard into my question. What is the moaning sound-maker and why does it send out its call? But the outer silence continues, and I can now only hear the pulsing heartbeat in my head, nerve-wracking. How do you quiet your own rush of blood and surging nerves under this star-grizzled sky, the haunted unknown your only known companion? Even my thoughts take flight.

I, like so many of us, know myself through a constant river of thoughts, which pool into ruminations or rush toward conclusions. Who do I become, when, in the midst of night, my usual current of words and thoughts disappears? My blankness feels neutral in nature, bland at the core. Things seem to go topsy-turvy in the wild presence of night. I look up more than down, and the stars become my closest friends. I stay put instead of moving about, and let the course of night flow around me. It's my inactivity, my anchored surveillance that gives me a center, for if I move, I become peripheral to the shifting backdrop of feathered treetops and bare bend of gravel road. Though this shift may be barely perceptible, where am I without a personal center? I need a place from which to observe, to stand my ground. Without that arbitrary place, there's too much to lose. My way. My self.

Arms crossed over my chest, I continue leaning against my blue Versa, its doors unlocked, in case I need a ready cave. Grand bodies of stars wheel overhead like a primeval clock, and I study the gray gradations of the wooded night. A faint rhythmic sound starts up, close and breathy behind me. Unwanted pangs shoot through my gut. I swivel, listen, and cup my ears with my hands to capture more. The sound persists, an

almost inaudible throb in the thicket next to me, and I relax. Whatever it is, it hasn't pounced, and since it continues the low-toned huffing, the creature seems happy enough in my presence. The airy sound adds to the midnight ambience, and over the next hour I wonder if it could be an insect quietly churning out its mating song. A while later, the music of a barred owl floats in the distance. My blinks lengthen. It's time to call it a day.

So I gather my belongings and pick my way over roots and ferns to my tent. I settle on the leafy undergrowth to untie my boots and start inching myself into the tent's narrow entrance. My eyes brush over the ink-black ground at my feet and I notice a tiny fragment of pearlescent light. I move and blink, and yet the droplet of ghost persists. Curiosity shoves sleepiness aside, and I'm suddenly prone on the Earth, my face and nose in the leaves to get an eye-full of this miniscule luminosity. It moves! I'm watching a phantom! Soft-edged, no crispness anywhere, it undulates. It's bigheaded, and almost nobody, blue-white and aglow, weird and unbalancing. I don't believe it; I doubt its truth. I was already in a nether world—this only feeds my suspicion that dreams are the only real reason for darkness as black as this. Dreaming of a ghost, though?

I disbelieve my disbelief. I turn on my flashlight, but see nothing crawling in the blinding-bright light. Then, light off, I gaze down again. It's still there, the luminous rice-sized ribbon of life flowing as before on the night-black foliage. I will ask who this tiny creature is after I return home. A bioluminescent larva? If so, what is his life, his metamorphosed future?

More and more questions, and more mysteries to contemplate. This night has been long. I slip into my sleeping bag.

Months Later: September

A few months after my nightwatches in the Andrews Forest, I finally had a chance to mention the matter of my bioluminescent larva to noted expert, Dr. Chris Marshall. Chris, who curates the Oregon State Arthropod Collection, had just finished leading a group of science writers, myself included, through his labyrinth of arthropod display cabinets on the third floor of Cordley Hall at Oregon State University. A sizable guy with a generous sandy-brown handlebar mustache, he snared our attention with personal anecdotes featuring offbeat insects, effortlessly transporting us from humid South American jungles to frozen Oregon snowfields. His enthusiasm for the three million specimens in his care was infectious, and several of us lingered after his talk to grab a few more moments with the trays of bugs, beetles and butterflies while Chris divulged more details. I could tell that Chris's devotion to the diminutive was equal to his enjoyment of the ostentatious, so I figured he wouldn't mind helping me pin down a name for the little larva that had bewitched me in June like a midnight summer's dream.

As soon as the other writers said their good-byes, I told Chris about my luminous larva, and asked him what it might have been. He was quick with questions, "What month was this? What was the vegetation?" I described the twinflower groundcover where I'd spied the tiny wiggling larva next to my tent three months earlier. Already familiar with the Andrews Forest, Chris immediately had a couple of ideas. He led me to his office, actually more of a big-hearted nook overfilled with reference books, to show me images on his laptop. "It sounds like you saw a female larviform *Pterotus*; they're in the Andrews. Take a look."

The larva on his screen was shingled with angular edges, much more hickory-hued than my blue-white mystery. “The larva lights up here,” he pointed to the larva’s posterior. “It’s a Douglas fir glow worm.”

I shook my head. “Nope, this isn’t it. My little guy was super tiny, like a sliver of fingernail. And when I bent down to get a good look at him, his front end looked like Caspar the Friendly Ghost, you know, with a bulbous head.” I was feeling a little foolish, but Chris was receptive. “The glowing was in his head, not the tail. He was sort of undulating toward me, head-first, like a worm . . .”

Chris produced another flurry of clicks on his computer and suggested another possibility, an inconspicuous fly of the Mycetophilidae family. “Did you see any webs? Were there other larvae nearby?” He showed me another series of pictures. These looked more likely, since the squiggly creatures sported a bluish-white hue. But all the images displayed large gatherings of faint glowings, like constellations stuck in a messy web. “These live in decaying stumps and forest debris, not commonly on the forest floor. And I don’t think they would be found alone or in the Andrews.” He was doubtful, but not deterred. He said his colleague, Woody, had a lot of experience with this species. He would give him a call.

I sat down on a nearby folding chair, my notebook propped on my knees so I could scribble some notes. I heard Chris’s side of the conversation as the two expert colleagues volleyed questions back and forth. I was grateful they understood my genuine need to know. It wasn’t long before the phone exchange came to a close—and the news was hopeful. Woody had confirmed that members of the Mycetophilidae fly family

probably did inhabit the Andrews Forest. The larva likely belonged to the *Orfelia* genus, and would metamorphose to become a small, winged fungus gnat.

“A fungus gnat?” I looked at the image on the computer. It was anything but glamorous, just a bitty, nondescript fly. But I was pleased. At last I was learning more about my most subtle of nighttime acquaintances.

Chris was still cautious. “You said it was blue, right? *Orfelia* larvae are distinctly blue.”

“Well, it was more white than blue, kind of like the moon. But it was a lot bluer than the glow worms.” I could tell my answer wasn’t exactly persuasive.

While Chris prepared for his next meeting, he told me how the larvae’s lanterns attract insect prey, which get trapped in the *Orfelia*’s webby, rotting-debris habitat. Since this didn’t quite fit my verdant tent setting in the Andrews Forest, we agreed to entertain a healthy dose of uncertainty: my moon-drop larva *might* be a fungus fly gnat.

We were both satisfied. I left Chris and his tens of thousands of arthropod specimens, all but giddy as I reflected on the nondescript fungus gnat in its luminous larval form. I tried out its name, “*Orfelia*.” Its non-percussive presence flowed with me out the door.

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“You’re the one who spent the night in the shack? How did you *do* that?” Allie leaned toward me from the edge of her faux leather armchair. She had just realized I was the one who had spent a series of solo nights in the H.J. Andrews Experimental Forest earlier in the summer.

I was attending a September “meet-and-greet” with about a dozen Long Term Ecological Research (LTER) graduate students. It was just past noon, and everyone was casually seated in an offshoot of Richardson Hall’s lobby within arm’s reach of some enticing pizzas. Each of us was affiliated with the Andrews Forest through our research, and we’d just finished with introductions. My colleagues’ science-based fields of concentration were varied, ranging from soils and forest structure to carbon sequestration and stream ecosystems. In contrast, my humanities-based investigation was a place-based inquiry of the nightscape, comprised of firsthand encounters and reflective writing. So, at heart, the gestalt of our group was as well rounded as the thick doughy pizzas.

I hadn’t planned on being anywhere near the center of attention during this LTER gathering, but now all eyes were on me. “Actually, I didn’t sleep in the shelter, I used my tent. But yeah, I’m the one who spent nights there.”

Allie was a stream ecologist, confident, competent, and animated. She persisted, “Wasn’t it spooky? Jeez, I’m scared of the dark!”

I knew there wasn’t time for me to go into confessions of a mysterious moan floating through trees, or a larval glimmer flowing in midnight leaves, so I just took a few moments to describe the silence and the dark I experienced during my nightwatches in the forest. Everyone enjoyed imagining my nocturnal approach to the forest they all knew so well by day.

But it turned out Allie had an altogether different nocturnal story to tell, a tale about a late-summer adventure she’d shared with two fellow researchers, Lindsey and Cedar. By early September, the three of them had spent long, consecutive weeks doing riparian fieldwork in the Andrews Forest, and they were ready to spice things up. They

decided to undertake a trip by truck in the gloom of night to the emergency shelter where I had set up camp two months earlier. Their agreement to take on this venture after nightfall made things a little edgy, which is exactly what they were looking for. On a Wednesday evening at 8 p.m., the trio piled into a four-wheel pickup, windows down to provide a breeze, with Allie behind the wheel. Thirty-five bumpy minutes later, they arrived at the cabin's pullout. With a bit of bravado, according to Allie, the three intrepid friends walked the short trail past the outhouse, stepped inside the one-room cabin, and started probing its crannies and corners with the skittish beams of their flashlights.

Since I had prepared many meals in the cabin during my time in the Andrews Forest, I could easily picture what they saw inside: the sturdy wooden table, four wooden chairs, two cobwebby windows, bunk bed, kindling box, tiny wood stove, and rustic wall-to-wall kitchen countertop. Lindsey went to the right, wanting to explore the kitchen area, and Cedar and Allie strode straight ahead to inspect the kindling box. From this point onward, Allie's nighttime story swerved emphatically from the relative mellowness of my own Andrews Forest memories.

Allie and Cedar were kneeling at the kindling bin to check out the stash of outdated newspaper comics, and Lindsey was investigating the kitchen drawers, when suddenly, four loud thumps resounded through the cabin. Lindsey called out, "Allie, that's not funny—stop!" But Allie and Cedar thought it had been Lindsey. The three stared at each other, then scanned the cabin, alert. Four more thuds sounded—four solid thumps coming down from the roof. Whatever was stomping *right above their heads* was alarmingly large. And heavy. Fear slammed into them. Another clumping sound, and the three flew out the door. They leapt into the truck, sealed themselves inside, and Allie

again took the wheel. Gravel sprayed from the tires and the truck lurched forward. The vehicle rocketed on the rutted road, back toward the Andrews compound, everyone's senses primed. About five frantic miles down the road, an unknown thing brushed the truck's radio antenna; then a tapping sound on top of the cab—maybe from overhanging branches? But there were no low limbs hanging over the road: another communal bolt of fear!

All eyes were riveted on the road ahead; Allie rounded a bend. Two small animals suddenly appeared in the headlights, squarely in the truck's path. She rolled the truck to a stop, and the three adventurers stared at what, at first, appeared to be baby bobcats. But no, the tails were long . . . Unconcerned by the hulking truck, the furry kittens romped in the road. Before Allie and her companions could absorb their good fortune at witnessing such a sight, the kittens' mother emerged from the underbrush. Tawny, huge, and long-tailed, she sauntered toward her two babies. Cameras and iPhones captured the moment: a mother mountain lion and her two cubs, shining like royalty in the headlights, at home on the rocky road. When the kittens ventured toward the truck, the mother showed her teeth in a growling hiss (a convincing disciplinary tactic, according to Allie). In their own good time, the babies finally bounded back toward their wary mom. Countless photos later, it was time to head home. Allie inched the truck past the feline scene and quietly drove back to the compound. No more rush, no more fear. The three adventurers had crossed numerous thresholds that night and had ultimately arrived at awe.

Allie ended her story with a wonderful photo flourish. We all got to scroll through her cougar images on her phone, frame-able art, in my opinion. I admit it was impossible not to compare my interminably long evenings of starlight and stillness to Allie's

rollicking night packed with frights and sights. But, in truth, I left our group feeling even more satisfied than before, even more convinced of the infinite possibility inherent in the nocturnal world. A larva for me, a lion for Allie . . . each, an unexpected pearl from the open hand of the night.

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Within a couple of weeks, another pearl would be revealed to me.

It began as an easy-going occasion in my living room on a crisp September afternoon, with Les Beletsky's book, *Bird Songs*, on my lap. I was using the book's attached digital recorder to revisit the bird sounds that had textured my summer in the field. I started out with the ethereal songs of the thrushes and moved on to the raucous cries of Clark's nutcrackers and pinyon jays. Each familiar birdcall brought back fond memories of my summer days spent in the forests of western and central Oregon.

After mystifying my cat with back-to-back hoots of great-horned, screech, and barred owls, I found the section featuring my personal favorite, the common nighthawk. I pressed the audio button and listened to the buzzy, signature sound of the twilight forest: "Beezzzt beezzzt bzzt." But then. An abrupt, muffled roar. The quick, hoarse, booming sound pierced the marrow of my memory—it was the same eerie open-throated roar I had heard floating through the trees last summer! I pressed the audio button again and again, until I felt sure. The odd, punctuated sound did, indeed, match the weird bellow I had heard each nightfall in the Andrews Forest. But how could the most haunting noise I had heard all summer be created by the most congenial of my nighttime neighbors? I read *Bird Songs'* text to help make sense of what inherently felt so nonsensical, and finally I learned it had been a mating flight, and not a vocalization, that I'd been hearing all along.

The wild-rumble sound had apparently been caused by air rushing through the male nighthawk's down-flexed wings when he peeled out of his steep courtship dive.

Fortunately, on the final Friday of September, I had a chance to discuss my dubious discovery with Dr. Peter Marra of the Smithsonian Migratory Bird Center. He was on the OSU campus for a day and had a few minutes between meetings to talk to me. When I brought up the topic of nighthawks, he instantly lamented their decline: a discouraging 60% population drop over the past 50 years, mainly because of pesticides and habitat loss. He went on to reminisce about his moments in the field with hungry nighthawks foraging overhead and praised the deftness of their flight. Then I turned the topic to the sound of the male's courtship dive, and he nodded; he'd heard the booming, too. He gestured to his chest and said, "You can feel it." I shook my head and admitted I hadn't been close enough to feel any vibrations. But I'd misunderstood. Dr. Marra touched his palm over his heart and said it again, "You can *feel* it." Ah, yes, I now knew what he meant. I had felt it, too, each time and deeply.

That simple gesture and those few words confirmed what I needed to know. All those moments of eerie sounds by starlight, I had been hearing the primal beat of a three-ounce bird earnestly romancing the future, "Hear me! Choose me!"

I hope the ladyhawk said 'yes'.

The Total Eclipse of the Sun

Night Visits Oregon at 10:17 a.m. on the 21st Day of the 8th Month of 2017

When night showed up in the middle of the morning, we took notice—and great care—to welcome it. Conversations and vacation plans revolved around the totality well before its arrival. Specialized eyewear and lectures proliferated for weeks to help us greet our most highly acclaimed visitor of the year.

It was 9:05 on the morning of August 21st when my group of four reached the grassy top of Chip Ross Park on the outskirts of Corvallis. Our two good friends from Virginia, George and Lori, were spending a few days in Corvallis with Cub and me, expressly so they could witness the solar eclipse with us. An additional ten thousand people had been expected to clog our region's roads and restaurants for this event, but thankfully, only a fraction of the forecast numbers had materialized. Warm and thirsty from our uphill walk, we gulped down some water and unfolded our blankets between sprawling families and poison oak anchored on the south-facing slope where the dirt was thin and dry. The place was bustling with sky-watchers of all ages equipped with their cameras, eclipse glasses and ubiquitous cell phones—a picnic atmosphere filled with chatter and laughter. The usual jays and squirrels must have fled the scene, probably downhill where the oak groves were quieter. The folks who had decided to watch the eclipse from their backyards in town would, no doubt, observe more wildlife than we possibly could in this rural place peopled with so much restless energy.

But there was much to see and hear on Chip Ross Park's warm, mid-morning hilltop. There were teens in lounge chairs, kids in strollers, dogs on leashes, and drones in the sky. Cell phones all around buzzed and rang like crickets, sending out automated warnings of impending eclipse hazards. I quickly glanced through my cardboard eclipse

glasses, which, astonishingly, filtered all but .003% of visible light, and I noticed the moon had already taken its first tidy bite from the sun's upper-right rim. We had about an hour before totality, when the moon—400 times smaller and 400 times closer to us than the sun—would exactly mask the sun's disk and throw us into instant night. So we had plenty of time to stroll on the oak-fringed ridge. This is a trail where I usually see only five or six fellow hikers; today a couple hundred people were clustered on the slopes. Excited voices rippled the air and scores of expectant faces were already tipped toward the sun. We walked and we watched and we waited. I didn't mind the people, and I didn't mind the wait. They would help root me to this time, to this place, and to my humanity.

For weeks we'd been preparing for the continent's most celebrated guest of the season. Now we were perched on a mighty brink, knowing that once totality started, it would pass much too quickly. The moon's shadow would sweep toward us from the west at an astonishing speed of 2,240 mph, and as soon as the moon blotted out the sun, an abbreviated nighttime would suddenly darken our otherwise normal Oregon morning. But the fleeting curtain of night would last just over 1 ½ minutes before rushing northeast to cross 2500 miles of American landscape within a mere 91 minutes.

As we roamed along the hillside, we paused often to visit with friends and to peer up at the sky. The sun's disappearing act was smooth and nonchalant. And the people-watching was prime. We passed a gentleman scientist displaying artful patterns on his piece of white paper, impressive designs of small shadows created by his holey spaghetti strainer. The tiny pinhole shadows echoed the sun's metamorphosis from circle- to sickle-shaped as the moon swallowed it in ever-bigger bites. Under nearby trees, families

gathered around another fellow who quietly pointed out similar views of crescent-shapes cast by the overhanging branches of oak leaves.

After about 20 minutes of walking about, the four of us returned to our blanket for the remainder of the moon's pilgrimage, the sun now seeming to shrink at an ever-faster rate. Whenever we looked through our metal-filtered eyewear, it pitched everything into inky blackness except the amber crescent sun, which floated alone in a dark sea of sky. Around us, breezes increasingly chilled the air, the ambient light took on eerie tones of sepia, and the hillside took on a hush. The sun soon would vanish, but not before our friend George excitedly reported seeing shadow bands on the ground downhill from him. Caused by refracted sunrays passing through our turbulent atmosphere, these phenomena don't appear at every eclipse, and I didn't want to miss out on them. "*Where are they? Where?*" I checked all around me on the grass, but couldn't find anything unusual, nor did I really know what to look for. My urgency prompted a nearby teen to catch my eye; he calmly pointed to the space blanket at his feet. There, across the silvery rectangle, shadows snaked like horizontal heat waves. I knew I was lucky to see them, and I was mesmerized.

Meanwhile, I also kept glancing at the Coast Range to our west, where the moon's shadow would arrive a split second before reaching us. It was neither day nor night by now. Time hovered somewhere in between, and the entire hillside was inhabited by the suspense of "soon." Suddenly, the western mountains went dark, as though besieged by a storm. Then a collective gasp. I tore my gaze from the shadowed horizon and looked up to see the moon's perfectly synchronized moment with the sun. Totality had begun.

Field notes: All thoughts, all words, all worlds—gone. It's just me and a deep midnight eye ringed by silvery-white, mercurial light, where once there had been the sun. I'm caught by the geometry, the stark simplicity. It's the dream-phase of the moon, black side of a mirror, imperative beauty of a royal shield. It's the holy void, cosmic chasm pulling me in, carrying me weightless. Eternity meets the momentary. Time disappears.

Hundreds of thousands watching this grace, this primal ballet. We gaze as one, bewitched by the pitch-black resplendent calm, this all-holding lake of infinite black.

Unstoppable upwellings: newborn joy, gravity of grief, my late mother's lost memories, black holes and whale songs, neutrinos and waterfalls, all the things we still don't know, all beauty all earth all the universe all of us—this perfect day-night disk. Where we allow for mystery, where we allow for mistakes.

In this slice of timeless time, on a golden summer hilltop, we meet: the absolute and I, eye-to-eye.

The horizon flushed orange under the silver-haloed, disk-dark moon. Regrettably, I wasted precious seconds taking two photos, only one of which “worked,” well-aimed and well-exposed. In truth, it didn’t work at all. What had filled my eyes falsely appeared as a mere dot on the display screen. I abandoned my camera and concentrated on the scene above. A solitary spark emerged above the eclipse, unblinking and round: Venus, usually bleached invisible by radiant light on a normal sunny day. The stunning pageant above me appeared frozen in time, but I knew the moon was on the move, and it would be over all too soon. I was right. Without warning, a silver-white flare exploded from the moon’s dark left edge. Gasps and cheers erupted again. Sunburst and corona-circle merged, a fleeting “diamond ring.” In a blink, all eyes averted. It was already too bright for unprotected eyes. The total eclipse had come to a resplendent end.

As for the night? Where did it dwell during the 100 seconds of totality? To me, it resided in the pure-black new moon, the unreflective phase we never truly see or know. Twilight was what held it all afloat, a twilight that blushed pink at the horizon and cooled upward in rich indigo blue.

And the normality of day? It didn't return in fullness for a very long while, the eclipse's moment of magic reverberating again and again, long after the planetary spin carried us back to a familiar sun-lit day.

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The August 21st totality was a uniquely communal cosmic event. Months in advance, libraries and news outlets dispensed a flood of facts and images to acquaint the public with ecliptic parts and processes. It seemed there would be little room for surprise upon its arrival. But, in reality, most of us were beyond surprised; we were genuinely stunned during those fleeting moments of totality. The immediacy of first-hand experience swiftly dislodged our abstract preconceptions as we watched the astro-choreography above us. The eclipse's shadowy swoop into the midst of our summer day brought ineffable mystery squarely into our everyday lives. No amount of factual knowledge could hold our awe at bay—we made room for the unknowable.

Likewise, I believe we can, and we must, make room for the mystery of the nocturnal world. We can unlatch the door at dusk, drop our assumptions, and stay, watch, listen, and—above all—remain open to the voices, silences, and all the unexpecteds that live in the night. By entering the slowed-down darkness and letting our own appearances melt away, perhaps we can cultivate a relationship with the dark side of day and begin to comprehend the ancient give-and-take that has always breathed between nightscape and lifescape.

It was over ten years ago when I awakened to my first wolf chorus while camping in Idaho. Last summer, I heard my first nighthawk courtship, and met my first bioluminescent larva in a midnight forest. I will continue meeting the night in the coming

seasons, maybe on an alpine lakeshore or in a snow-covered meadow. Each meeting will be unlike any other. Woven together, they will help me know a greater piece of possibility.

Meeting the Night

All these solitary moments
 like wolves on the mountain ridge.
 Unrestrained, their heads thrown back,
 they sing alone together.
Just so, single notes bend to one.
First the mountain holds the chorus
 then the moonlight does.

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