The Tumamoc Hill Arts Initiative: A Portfolio of Site-Based Art and Writing Inspired by a History of Sonoran Desert Science

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A Context for Arts on Tumamoc

Paul Mirocha and Eric Magrane

Early on a recent May morning, artist Meredith Milstead set up her easel outside of the historic Desert Lab buildings on Tumamoc Hill and proceeded to paint the scene before her over a twelve-hour period, completing one painting per hour. A study of color and time, the act of making these paintings echoes the historical research on Tumamoc. Much of what is known about deserts comes from Tumamoc Hill, either through research at the site itself or through the impressive list of those—a who's who of desert ecologists—who have worked at the Hill over the years. It's not a stretch to claim that the modern field of ecology owes much of its beginning to the Carnegie Desert Botanical Laboratory established on Tumamoc Hill in 1903. Long-term study plots set up by these early ecologists comprise the longest-running vegetation-monitoring program in the world.

That some of the current activity on the Hill is in the form of art or poetry is a reflection of the growing awareness that scientific and artistic ways of knowing are not in opposition but can be, rather, complementary to each other. In a time when climate change has us facing increasing temperatures, drought, and wildfire here in much of the Southwest, and when increased acknowledgment that the disciplinary silos that have built up over the last couple of centuries are not up to facing such big questions alone, it is fitting that Tumamoc Hill is one of the sites that has embraced the role that artists and writers may play in the present, an epoch that many have begun to call the Anthropocene.

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Making distinctions between artistic and scientific practice often brings up questions about the nature of knowledge. One is the dichotomy where science searches for an objective truth that is universal and not dependent on the observer, whereas art is more comfortable in the subjective realm: embodied personal experience, moral and emotional focus. The distinction between the objective and subjective is a useful starting point, to be sure, but we don't want to replay this framing for too long. Rather, we'd like to present art and poetry as a form of inquiry that is valid in itself as a source of environmental knowledge.

Since 2011, Paul Mirocha has been artist-in-residence at Tumamoc Hill. He describes his role as an on-site ambassador for the Hill, facilitating the work of other artists and writers who are attracted to the site for their own reasons. "I'm inspired by the resulting community of independent, yet like-minded people, and it helps me think out my own work," Mirocha says. Embodying a kind of bioregional ethics and close engagement with place, the work in this portfolio complements a recent (2013) book, *This Piece of Earth: Images and Words from Tumamoc Hill,* which gathers poetry and art done on the Hill in the previous two years (http://TumamocSketchbook.com/this-piece-of-earth).

Artists and poets working on Tumamoc have a deep sense of the ecological and human history there. Kathleen Koopman examines a century of artifacts hinting at the everyday lives of Tumamoc's researchers. She catalogs found objects like a historian, yet is most interested in the ambiguity of these found objects, the stories that will never be known. Painter Meredith Milstead is developing a color palette specific to the light and times of day at the Desert Lab. It's a form of research into the subjective qualities of light that may play a subliminal role in how people feel about and form an attachment to a particular place. Paul Mirocha is rephotographing the Spalding-Shreve long-term study plots from an artist's point of view, learning the history of the plots, and keeping a field journal. Biologist and painter Barbara Terkanian spends enormous amounts of time with individual saguaros, observing how the passage of time and the local environment are recorded in the architecture of a particular cactus. Don't let the pretty pictures fool you.

All of the poets write on-site, using the Tumamoc library to access research reports by Desert Laboratory figures and interacting with Tumamoc scientists, walking the grounds and listening to lectures. D. L. Coleman uses the very language of research in his found poems about plants.

The artwork and poetry in this Tumamoc portfolio also intersect with a wide range of recent environmental and community art projects in Tucson and in the Sonoran Desert. Projects include *Ground/Water,* a 2012 book edited by Ellen McMahon, Ander Monson, and Beth Weinstein[1] that presents interdisciplinary art and science responses to the dry Rillito River in Tucson; the Poetic Inventory of Saguaro National Park, created and curated by Eric Magrane and featured in an issue of *Spiral Orb,* which gathered eighty poets and writers to write pieces addressing species at Saguaro National Park in conjunction with the 2011 Saguaro National Park and National Geographic Society BioBlitz;[2] *Rosemont Ours: A Field Guide*, a 2013 dance film by Kimi Eisele's New Articulations Dance Theater and filmmaker Ben Johnson that celebrates plants and animals that would be affected by a proposed copper mine in the Santa Rita Mountains; and *Lens on the Land,* a project spearheaded by photographer Josh Schachter, which gathers photography from the proposed mine site as well.[3] These are just a few of the projects around art and environment currently happening in the Tucson area. And one key thing these projects have in common, besides an underlying environmental and conservation ethic, is a specific object or site that artists gather around. This brings us back to the site of Tumamoc.

Mirocha describes the multiple facets of Tumamoc this way:

> A geologist will tell you that Tumamoc is an inselberg of volcanic rock remaining from eruptions between 20–30 million years ago. And it originally was formed near what is now the Santa Catalina Mountains. The Tohono O'odham call it *Cemamagĭ Do'ag*, "Horned Lizard Mountain." Lawrence Clark Powell, famed librarian and writer who lived in Tucson, called Tumamoc "Tucson's Acropolis." It's been called by various names, including "A Mecca for botanists," and "The Jerusalem of desert rats." The first thing a modern ecologist will say to you is "don't stray off the road." This is the world's first restoration ecology project. The nature here is to look at, to study, to appreciate, but not to exploit—not even to use. To an archeologist, Tumamoc is a mystery that would challenge Sherlock Holmes. Ruins of cultures living on Tumamoc go back 3,500 years, and at various times in prehistory, the Tumamoc hilltop was probably an important landmark, cultural focal point, and ceremonial ground. To the thousands of people who walk the road daily, Tumamoc is the best workout in town, a treadmill with a spectacular view. It's a place where one can stroll among

> grazing deer five minutes from downtown. Dig a little deeper and many walkers will confide that Tumamoc is also an emotional and spiritual sanctuary. Urban culture and ecological research co-exist on Tumamoc Hill. It is a safe haven for humans as well as other Sonoran Desert life forms, but the boundaries are clear: no one steps off the road without special permission.[4]

The art and poetry within this portfolio represent close attention to a particular site of great physical and imaginative importance to the Sonoran Desert. They embody a bioregional place-based and conservation ethic, one that the network of Next Generation Sonoran Desert Researchers is crucial in fostering. Networks are sustained by stories[5] and this portfolio offers vignettes of the many stories of Tumamoc Hill, a particular place in the Sonoran Desert that collapses time and in doing so offers both past insights and future inspiration for a mode of desert inhabitance in generations to come.

Painting Saguaros in the Field

Barbara Terkanian

Painting outdoors means traveling light. When I paint, I bring only the essentials: watercolors, paper, brushes, palette, a rag, and water. Once I find something (frequently a saguaro, *Carnegiea gigantea)* that can inspire a good painting, I sit down and get to work. I pull out a sheet of paper with margins penciled in, dilute some paint and make a brush drawing of what I see. Multiple washes of color are laid down over the initial brushwork to create textures, shadows, and nuanced colors. As the painting develops, relationships between its elements will shift and change, in sometimes unexpected ways. When the watercolor is finished (it's already dry) I slip it under my arm and head out.

I began painting saguaros once I realized that (a) I live in a saguaro forest, and (b) exceptional, even extravagant saguaros are scattered throughout it. Most of the saguaros I consider exceptional are big, but more interesting to me are their individual forms. A saguaro must grow where it germinates, and its form, with arms broken, twisted, or whole, is a record of its unique history. I paint portraits of these "outlier" cacti, rather than average ones (population means) or archetypical, unblemished specimens. Together, the paintings give a sense of how varied saguaro

Figure 1: Escarpment, photographed in progress on the north face of Tumamoc Hill. The photograph was taken from a point slightly to the left of where I was seated when I worked on this piece.

growth can be. They are a visual record, a two-dimensional, human-derived abstraction of what's out there.

I say "abstraction" because I don't think any human mind can grasp all of the changing intricacies of the chemical, physical, and biological forces within an ecosystem. Nor can a single format serve to integrate

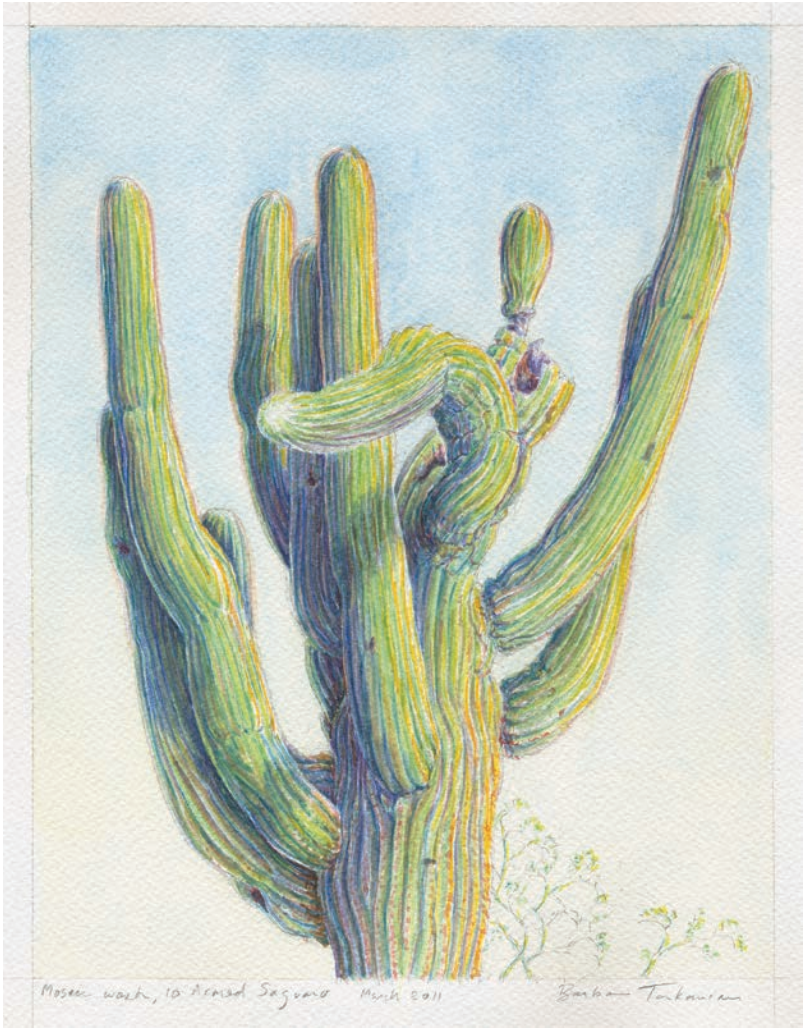

Figure 2: Mosaic Wash/Ten-Armed Saguaro. This plant is growing within the floodplain of a small wash near Tumamoc Hill. I most frequently find this bushy, "candelabra" type on flats or gentle slopes, often among creosote (Larrea tridentata). This plant lost one of its vertical arms in spring 2014.

and describe them all. So we practitioners specialize, creating abstract statements by transforming our observations into the formats we know. A visual artist's work speaks to the most trusted of our senses, sight. A scientist communicates through writing and the equally potent language

***Figure** 3: Semicrested Saguaro. Some saguaros develop a "crested" form. In crested plants, the top of the saguaro becomes fan-shaped, due to spreading, rather than vertical growth of the stem. The plant shown here is not truly crested, but it has some unusual growth patterns similar to crested plants. Regions along its main stem lack the strong vertical ribs seen in non-crested saguaros, and the tip of the plant has forked once, something crested plants do repeatedly. Typical saguaros do not develop forks; instead, they produce arms that emerge from the stem at 90° angles before beginning to grow upward. This plant's five arms show the typical growth pattern.*

of mathematics. Considered together, the efforts of scientists and artists make an informative mosaic, beyond the scope of a single practitioner.

As I work, I focus on making an honest statement, while minimizing the impact of my presence on the site and organisms (as do most field practitioners). Although I sit quietly, and direct my attention outwards, toward saguaros, nature intrudes. Lizards (*Urosaurus ornatus*) have hopped on my knee, cocked an eye at my face, and then gone about snapping up tiny insects on my clothing. Twice I've watched snakes (*Pituophis melanoleucus* and *Crotalus tigris*) crawl slowly away making apparently covert retreats. I've cocked an eye as white-throated swifts (*Aeronautes saxatalis*) flash overhead. Sometimes deer (*Odocoileus hemionus*) or coyotes (*Canis latrans*) pass around me at the extreme periphery of my vision. Once, a gray fox (*Urocyon cinereoargenteus*) did the same, stopping twice to stare at me. When I returned the next day to finish the painting, I found what looked like a fox dropping exactly where I had been sitting. Point taken (with amusement).

And that is the point. Nature interacts with us. Even the apparently insular act of observing transforms us because as we observe, we learn. I think this is a good thing. It means that we are not outside our ecosystem. We are in it, we are part of the experiment, and therefore we have a vested interest in the outcome. The more kinds of voices we can raise in support of a constructive outcome, the better.

Poems

Monique Soria

Catalina and Tumamoc

Millions of years ago
Santa Catalina lay
in a curve of repose
the way a woman lies on a bed, desire spent.
Catalina's curves dipped and spired
in every direction.
Her peaks sliced the clouds.

More than the sun or moon or stars
she loved the rain.
She wanted to applaud it,

to clap hands as in a child's delight.
In beats of time you can't even
imagine,
she set herself in motion,
her peaks moving,
sliding westward
to create an arm and a hand
and then millions of years later
another hand
cupped as if it were a horned lizard
hugging into the earth
to foil a predator.

The clouds never forgot that
Catalina loved the rain.
Her heart's desire
had moved mountains.
When it storms and lightning strikes,
her heart's desire echos
in thunderous applause.

Spring's Coming

Today the wind is
telling me that
spring is coming.
The cold only skims
my face and doesn't penetrate.

Today the sky is perfection blue,
a 360-degree artist's gradient
that begins and ends
with the white morning sun.

The bark of the
palo verde tree
is smiling.
The barrel cactus is patient
and hardly cares if

there's another freeze.
The ocotillo is impatient
to be green again
and looks forward to the
days of its orange blossoms.

Poem

Eric Magrane

Tumamoc: New Interpretation

Generations of researchers
in the stone walls. Landscape

is process, including within a landscape.

The new interpretive stands are ready,
waiting for their signs.

We interpret place and place interprets us.

Found Poetry of Tumamoc Hill

D. L. Coleman

My sources for these poems are the scientific reports and articles published by the first generation of scientists working at the Desert Laboratory. A paper is read and notes taken in the manner a student would while studying the literature. Important phrases are transcribed, underlined, or highlighted to ensure that a comprehensive summary of the research is created. These notes are further reduced to create a poetic abstract of the paper.

The Humid Mid-Summer

All of the conditions

are favorable for hundreds of species
that have hitherto shown no activity.
Snowy piles of cumuli
begin to be seen
on mountain summits
late in June.
Short showers
followed by longer ones
spread out over the plain
in fantastic patterns.
Millions of seedlings
spring into activity.
The entire face of the landscape
changed in appearance.

MacDougal, D. T. 1908.
The Course of Vegetative Seasons in Southern Arizona.
Plant World 11:189–201, 217–231, 237–249, 261–267

The Water Content of the Soil in the Dry Season

July 1, 1905.
The soil was air-dry
thoroughly baked.
Rain had not fallen since May 12.
The dry surfaces of Tumamoc Hill
crumble and compress beneath the feet.
The giant cacti were ripening their fruits.
Prickly pear also.
The creosote bush was covered with ripe fruits.
Ocotillo had lost their leaves
and stood as groups of gray, spiny wands.
The trees of palo verde had lost their leaves
showing the effects of drought.
Of the smaller plants
Encelia still held its own
and a small mallow
together with *Euphorbia*
were producing flowers

and seemed
perfectly vigorous.

Livingston, B. E. 1906.
The Relation of Desert Plants to Soil Moisture and Evaporation.
The Carnegie Institute of Washington Publication no. 50

The Relation of Desert Plants to Soil Moisture and Evaporation

Desert vegetation
desert soil
desert atmosphere
extreme xerophytism
centimeters of annual precipitation
meters of annual evaporation
extreme dryness
The problems here
concern the relations
between certain desert plants
and their physical environment
on the shoulder
of Tumamoc Hill

Livingston, B. E. 1906.
The Relation of Desert Plants to Soil Moisture and Evaporation.
The Carnegie Institute of Washington Publication no. 50.

The Mesa-Like Slopes

The long gentle slope
with an almost imperceptible grade
becomes steep as the ascent continues
up the hill.
Its soil
gravely or sandy
with but little loam
with a considerable amount of caliche
with relatively little capacity
for the retention of water.

Under these conditions
the perennial species
of the flood plain cease.
The creosote-bush
holding the ground
on the worst places.
Larrea claims
this ground
as its own.

Spalding, V. M. 1909.
Distribution and Movement of Desert Plants
The Carnegie Institute of Washington Publication no. 113.

Light and Color on Tumamoc Hill: A Painter's Pigmentary Perspective

Meredith Milstead

Tumamoc Desert Lab in Tucson, Arizona, often serves as an outdoor painting studio for my studies in color. I chose Tumamoc as a subject for its biological diversity and cultural and scientific significance.

During the spring of 2014, my work on-site, also called "plein air," developed into an evaluation of the changing light and color throughout the day from dawn to dusk. Chromatic change relates to the position of the sun in the sky and atmospheric conditions. Further processing of color by the eye and brain produces discrete phenomena such as simultaneous and successive contrast. This type of theory-based chromatic observation is referenced in late-nineteenth-century Impressionism and early-twentieth-century Post-Impressionism by artists such as Claude Monet and Vincent Van Gogh.

Color perception involves chemical and neurological processes requiring both conscious and subconscious interpretation. Because color is perceived this way, it has the power to influence both thoughts and feelings. I believe that color and light play an important role in integrating people and place. They combine to create an "imprint" on the psyche, memorable and familiar, like the smell of popcorn, or puppy breath.

Thus, my project goal was twofold: (1) to explore the connection

between the light and color of a specific place and the psyche and (2) to develop a painter's palette for Tumamoc, through which to express this connection. Because color is subjective it is necessary for a painter to go through the process independently. This focused and careful effort ensures that a stronger "imprint" will occur, thus tying the painter-participant to the place more intuitively.

To tune into my subject, I began by documenting the spring palo verde bloom. I set up to paint the same clump of trees nine times over the duration of the blooming period. During this process I learned that the lunar month which includes April is referred to by the indigenous Tohono O'odham as the "yellow moon" for the abundance of blooming yellow flora in the desert at this time. I titled this study *The Yellow Month*. It illustrates the connection of people to place though the color yellow.

Subsequently, fueled by my association with Tumamoc Sketchbook

Figure 4: The Yellow Month, 36 x 36 inches, oil on canvas board, April/ May 2014.

and Tumamoc Art Cafe discussions, I decided on a more focused approach for the next color study, *One Day on Tumamoc*. As the title suggests, I limited the work on this painting to one twelve-hour day. To obtain color data throughout the day I used a traditional artist's color wheel, which depicts the visible spectrum: red, orange, yellow, green, blue, indigo, violet and their combinations, red-orange, blue-violet, etc.,

Figure 5: One Day on Tumamoc, 36 x 48 inches, oil on canvas board, May 2014.

for a total of twelve colors. The wheel wraps the band into a circle with the addition of red-violet, which joins the longest and shortest wavelengths. The wheel format orients colors across from each other in complementary relationships. Complementary color relationships differ in contrast (light/dark) and temperature (warm/cool). I used only complementary color combinations plus white for *One Day on Tumamoc*.

Each panel describes the hourly dominant, "key" color and temperature of light on Tumamoc from 6 a.m. to 6 p.m. The intent here was to key each hour of the day to a spectral hue. I used the color wheel to find key colors. Variables such as clouds, pollution, and weather dramatically influence quality of light and color so it was necessary to complete this study in one day for consistency and flow.

To select the appropriate colors, I simply held the wheel up to a point of reference, the white roof of the Desert Lab building, and compared what I saw with what was available to choose from the wheel. As the sun rose and set, light reflecting off the roof of the Lab changed in hue and temperature. I documented this change every hour with a fresh canvas. By 6 p.m. I had used twenty-two different tube colors or pigments and produced twelve small canvases. Any painter who is concerned with color can use this method to find the hues which best describe a particular area or place.

After breaking down the day into twenty-two different pigments, I had a palette to use for the next study. My intention at this point was to use this twenty-two color palette in the production of a single painting that would capture the color and light essence of the Hill in springtime. However, because of the way sunlight warms, cools, and warms again in hue throughout the day due to heat and gathering pollution and the distance light waves must travel through the atmosphere, I felt it would be more appropriate to produce three paintings to document this change,

***Figure** 6: Three Lights of Tumamoc: Morning, Midday, Afternoon, 10 x 30 inches, oil, May/June 2014.*

each work reflecting the general placement of the sun in the sky: morning, midday, and afternoon. I laid out the twenty-two pigments to paint from, but by the end of the three studies had used only sixteen in varying amounts, thus reducing the palette (and making it easier to handle). See *Three Lights of Tumamoc*.

I have illustrated a process through which I can observe the light and color of a place and evaluate its effect on the psyche using myself as subject. I can repeat the process throughout the year, continuing to document Tumamoc's changing light and color, and I can compare Tumamoc to other regions where I perform similar experiments, to further evaluate their differences and further define Tumamoc's significant light and color signature or "imprint."

Found

Kathleen Koopman

I have been working with found objects for many years, creating assemblages, books, and collages with the random objects that I

Figure 7

gather. Detritus, rust, fragments and shards of paper, glass, ceramics, and unidentifiable parts of things long abandoned, discarded, and forgotten fascinate me; as a visual person these catch my eye and reveal many possibilities. I examine, handle, research, and then arrange these objects to tell a story or suggest a narrative, or simply in a dynamic pattern.

Assemblage is a process that spans many disciplines: art, music, archeology, philosophy, among others. Archeologists use the word *assemblage* to refer to a group of artifacts recovered from a single site, representing a particular time and place. My work explores the bridge

between science and art, using a methodical process while also visually stimulating memory, dreams, and imagination.

Working on Tumamoc Hill with other artists and poets inspired me and supported my explorations. This art "field work," far removed from the studio, created an emotional connection to the site. The history of a place emerged, revealing layers of history and memories, some strong and clear, traceable to various occupations of the Hill. Sometimes history is buried, faint and blurred. A theme running through my work is the passage of time and interpretations of what remains.

My initial goal was to produce assemblages of materials found in the modern middens at the edges of the Desert Laboratory at Tumamoc. After each day's finding, I carefully placed, described, and photographed each group. As the project developed, I began to be curious and invent guesses about when and why they were lost or discarded; questions arose, narratives emerged, some factual and some imagined.

I intended to build a visual/photographic record of artifacts drawn from a landscape, and then weave them together in various ways to stimulate artful perceptions of our memories, based on our individual histories and experiences. Time-modified objects: tools, hardware, food containers, bottles (scientific and beverage), remnants of work, leisure, and life, what people have owned and thrown away can speak eloquently of their lives and the society and times in which they lived. Creating the assemblages led to a closer look at the process, which opened up further investigation into the former inhabitants of the Hill.

I discovered a connection between my work and cabinets of curiosities. Dating from the sixteenth century, before the advent of museums as we know them, collections of odd, exotic, and natural objects were elaborately arranged and displayed in wooden cases and cabinets. They were an attempt to categorize and tell stories about the wonders and oddities of the world. These collections—groups of specimens, drawings, and ephemera from many disciplines—created an overlap between science and art.[6]

I was reminded of the work of archeologist Dr. William Rathje and a group of anthropologists who began working together in the 1970s at the University of Arizona. Rathje's graduate work in pre-Columbian archeology led to field studies of modern garbage and habits of disposal, and yielded data not available from other sources. He described how refuse can reveal much about humans, what they ate, what tools they used, what was disposable, how value was assigned. His studies of

"garbology" and archeology clearly overlap.[7]

While other artists were working on the broader landscape, I examined the minutia of the earth as it has accumulated and deteriorated over many years. This study captured a narrow slice of time, beginning in 1910 and ending in the 1960s. All objects from this site have been cataloged and carefully stored, and remain the property of Tumamoc.

On the following pages are photographs alongside poetic descriptions of the carefully arranged objects. They are not meant to be a strictly scientific documentation, but to connect disciplines as well as time and place. The practice of art mixes with archeology and anthropology; as an artist I can take subjective risks of interpreting things in a way that scientists may not be able to. The value of art is to fill in the gaps, the spaces between hypotheses and what scientists may never know. Hopefully this project will inspire new directions and possibilities for both artists and scientists.

Figure 8: Broken teacup from the Homer Laughlin factory in West Virginia. The pattern is called Yellowstone Medieval Rose, was introduced in 1920, and discontinued in 1935.

Figure 9: Award from the American Bowling Congress, dating from 1953–1954, during the United States Forest Service occupation. Embossed metal card; hardly decipherable is the line "achieved greatest average improvement." 3.5 x 2.125 inches.

Figure 10: United States Forest Service button, circa 1940–1950s. 1-inch diameter.

Figure 11: Found 9.4.13.

Found

On one of the first days of my collecting, Labor Day, 5:30 am, a light drizzle lit up the dump and its treasures.

Found: thirteen shapes, chosen for form, pattern, and variable stages of decay.

Thirteen round forms arranged in four rows.

Mostly jar lids, bottle caps, with a lamp wick holder, and a flange.

Note how deterioration through time creates patina, surface texture, subtle hues of rust.

Figure 12: Found 4.30.14.

Found 4.30.14

Off to the east behind building 800,
lost eyeglasses, trampled, forgotten.

To the west below,
rusty shards, jar lids, and coupling;
a piece of roofing, tiny spools, a vial;
a sea of broken glass, blue and green,
fragments of Kahlil, Hires, medicine bottle.

Strewn over the landscape, in perfect random order:
punched steel, plant tags, bands, large nail, a file,
a perfect lab slide—how did it survive?
Next to it, a used flashbulb, and
tubes of adhesive, scrunched.

The wonder of it all
lying undiscovered,
waiting for time to let me in.

Found 4.17.14

The mystery of the junk—so much of it, so precious!

Makes you wonder about these scraps of science,
tools and living, what is the story they tell?

Corners, edges, fasteners, lids, buttons and keys
reveal an indescribable place and time.

Rust, remains, add the patina of desert;
color survives, and the clues of the recent past on the Hill.

Arranged and organized, does it become cherished,
or do we simply notice what has been overlooked for so
long?

Figure 13: Found 4.17.14.

Spalding Plot 10: An Artist's Journal at an Icon of Ecology

Paul Mirocha

By convention sweet is sweet, bitter is bitter, hot is hot, cold is cold, color is color; but in truth there are only atoms and the void.
—Democritus

One Saturday in February 2013, Desert Laboratory ecologist Ray Turner led eight artists and writers off the Tumamoc Road, into the wild backcountry in search of Spalding plot 10. Ray held a historical 8 x 10 photograph of the place to guide us, matching clues on the horizon and nearby features to the photograph as we walked.

I had a photocopy of Volney Spalding's original field notebook with me, kept when he staked out nineteen long-term ecological study plots on Tumamoc Hill in 1906. (All numbered, except there was never a plot 13.) Then Spalding fenced in the whole Tumamoc Hill Desert Laboratory scientific reservation to protect these plots from trespassers, especially cattle and other domestic animals that chewed on native plants.

That simple act of setting boundaries turned out to have far-reaching implications. First, it turned this 860-acre plot into a laboratory, a special place that could be studied under controlled conditions, an earth observatory. The ten remaining Spalding plots now host the oldest plant- monitoring program in the world. As a result, Tumamoc Hill has become more than an ongoing research site—it's a bubble of Sonoran Desert wildlands preserved by several generations of scientists, allowed to return to its natural state through minimal interference.

Of course Ray had found Spalding plot 10 many times before. Its location had been forgotten until Ray and Glenton Sykes (son of Godfrey Sykes, of the Desert Lab staff) located it again in 1968 after decades of being lost to science.

We found a few large rusty nails still stuck along the plot's perimeter, spaced a meter apart, although some had mysteriously disappeared. Ray explained how botanists had used these nails long before digital surveying to make a grid of string across the 10-meter-square plot. Then, using a meter stick to measure smaller distances, they made detailed drawings showing stem location, canopy shape, and sometimes height, for each plant in the plot. I've admired these field sketches on grid paper as a form of art—although Ray wouldn't consider them so.

A quadrat like this was an exciting new tool for the turn-of-the-century botanists who were creating the new science of ecology. It's a small marked-off area that could be observed as a miniature world, then what is learned can be extended to the larger ecosystem, which is too large to study as a whole. More importantly, it allowed them to gather quantitative data, making a landscape into a laboratory, like those of the "hard" sciences like physics and chemistry.

We found the four stakes marking the corners and a fifth rebar stake off to the side, marking the official photo spot used for the repeat photograph that would accompany the map and plant data for each survey. Directed to avoid stepping inside the plot, we stood looking in, as if toward some sacred ground.

Figure 14: Spalding plot 10 from the photo stake. Photograph by Paul Mirocha.

Figure 15: Old nail grid marker and dry Pectocarya, Spalding plot 10. Photograph by Paul Mirocha.

Normally that Saturday morning, Tumamoc Hill would have hosted a group sketching-and-painting session. But doing mini field trips like this with Ray had occurred to me as a way of introducing artists to the most special places on the Hill where scientists have worked, probably some of the most carefully scrutinized places on Earth. After all, many of these artists had recently made their own sustained and intimate observations of the same landscape—and while their subjects were quite different from the scientists', I believe in the validity of "data" collected by scientist and artist alike, who must have found some overlapping inspiration there on that common ground.

I feel kinship with early desert ecologists like Volney Spalding and Forrest Shreve—and now Ray, who'd taken over the plots in 1957. I've always been impressed with the focused attention, almost affection—complex and rich—that these ecologists have lavished on this landscape. Maybe the most basic thing that we all have in common is a desire to pull on our boots, walk out the door, and take a good look around.

We had already visited plots 7 and 9 on previous Saturdays. Although Ray was long retired at nearly 86, I knew this still-active man would not need much convincing to explore Tumamoc, his "favorite place in the world," with us as guests.

That winter, the POG poetry group[8] was doing a writing project whose every piece was written on the Hill—so I had invited poets to the plot as well as visual artists. Some people chatted with Ray; an artist sketched; a photographer made some images. If nothing concrete came of this outing, the light and the air made it a beautiful chance to see normally off-limits parts of the Hill. The general feeling was quietly festive.

Later, I went back to plot 10. I applied for a research permit so I had official access to the north saguaro plot and the several Spalding plots nearby.

Plot 10 is out of bounds and out of sight from the lab buildings and Tumamoc Road, unusual in its proximity to a large city combined with the solitude it offers. Between 1,000 and 1,500 hikers walk the 1.5-mile paved Tumamoc Road to the Hill's summit daily—to exercise, to socialize, to simply enjoy nature. But they are only allowed to look at their surroundings from that 12-foot-wide road.

The site of the rebar stake marking the repeat-photograph site on Spalding plot 10 wouldn't normally attract a photographer or painter.

While the north slope of the plot gives a beautiful view of the Santa Catalina Mountains, a photo taken from the rebar stake angles west, mostly missing that stunning vista, the placement seeming to say, "All views are equal"—or, "All views are equally beautiful."

I would have at least included a saguaro in the plot. But Spalding purposely chose these sites randomly, ignoring aesthetics, excluding bias in favor of hard science. He required only that sites be at different elevations, on different slopes, facing different directions. Thus, the square area within this plot's stakes looked much like anything else nearby, maybe even less interesting.

Figure 16: Ray Turner measuring the height of a barrel cactus during a 2012 survey of the Spalding plots. Photograph by Paul Mirocha.

For me, that offered a challenge. Spalding's determination to discount obvious attractions is what attracted me here, though I could've picked any nearby place to draw. I was also intrigued that for more than a century, others—though not artists—had been so closely focused on the Spalding plots. They were the oldest monitored vegetation plots in the world. I wanted to participate in their mission, if I could.

Spalding and Shreve wanted to understand the Sonoran Desert, all 67,600,000,000 square meters of it. Shreve explored all four North American deserts, mapping and collecting data, helping define what a desert is—and each desert's distinctness. But one must set limits to get good work done. As the ancient Chinese *I Ching* says, "Unlimited possibilities are not suited to man; if they existed, his life would only dissolve in the boundless."

So we narrow our focus to a small window, like this 10- x 10-meter quadrat. With patience, we can see the whole desert within each of its parts. Similarly, while we can't really know humankind, we can try to know one person well. It's good advice: set limits, keep to them, and watch what happens inside them.

Over the year following our outing, Spalding plot 10 became a kind of waterless desert pondering pool for me, a sanctuary for the mind. Both window and mirror. Although the place was designed for a more logical purpose, it also seemed to encourage a very different approach to the world, one with a softer focus that included myself as the observer. Still, I wasn't going to make judgments or hasty conclusions—in fact I aimed to be present without ideas or theories. There is an objective discipline in art, just as one may sense some open-ended mindfulness and contemplation in Spalding and Shreve's methodology.

Quantitative, linear thinking was an excellent tool for the questions early researchers asked here: How long do desert plants live? How fast do they grow, how do they reproduce, how does each species react to the desert's extreme environment, how do plants interact with each other? Does the landscape change over periods exceeding human life spans, and if so, why?

The first Tumamoc ecologists keenly debated one particular question: After a disturbance, do plant associations always evolve toward an ideal final climax state? If so, is a plant community like an individual organism in which each species plays a role like a cell or organ? This was the theory of plant succession put forth by Frederick Clements, from Nebraska, probably the most well-known ecologist of his time. Although Clements also worked

with Shreve at Tumamoc for a while, Shreve had solidly disagreed with him, and data from the quadrats would prove Clements wrong.

Shreve asked other questions. *Are plant associations more loosely bound together, individuals going their own ways? How much change is just random? How long does an ecosystem take to return to the state it was in before humans and domestic animals interfered? Can we call that its "natural state"?* Shreve does.

Forrest Shreve surveyed the Tumamoc plots in 1928 and 1937, publishing his results in the journal *Ecology*. He acknowledged that there hadn't been enough time to make many conclusions about trends, but things did turn out to be more complex than ecologists in general thought they'd be, even in these simple-looking, sparse desert quadrats. Ecosystems didn't much resemble a super-organism. The desert has a way of destroying theories about it—especially those by humans from another place.

Shreve knew that. His papers in *Ecology* are descriptive, sticking to physical facts one could document, and impressively thorough. Everything, both interesting and banal, that was visible within the study areas is noted. Out of context, it reads like a government census report mixed up with a commentary on a sporting competition of some kind.

The data from the Tumamoc plots supported Shreve and others who favored the individualistic concept of plant succession. Rather than acting as a symphony, desert plants seemed to behave more like a hall full of soloists, each playing their own tunes, sometimes listening to the others, but not necessarily. "The lack of definite trends in the relatively small area that has been investigated is confirmation of our knowledge that these changes are controlled by a vast number of interacting conditions,"[9] Shreve wrote. Notice he used the words "our knowledge," not "our theories." Even writing to spite the super-organism theory, he was subtle and understated.

Shreve was more ahead of his time than he realized. A system controlled by a vast number of interacting conditions is called "stochastic"—that is, it's close to random and can be predicted only as a probability, like the weather. A stochastic process is best described by observing it after it's happened. Like life.

Modern theories have introduced the element of stochasticity into studies of vegetation dynamics.[10] Although the strict interpretation of the organismic theory is largely discredited, plant succession does occur. Its processes are still debated by ecologists today, but recent researchers find much the same patterns found in the Spalding plots: a large number

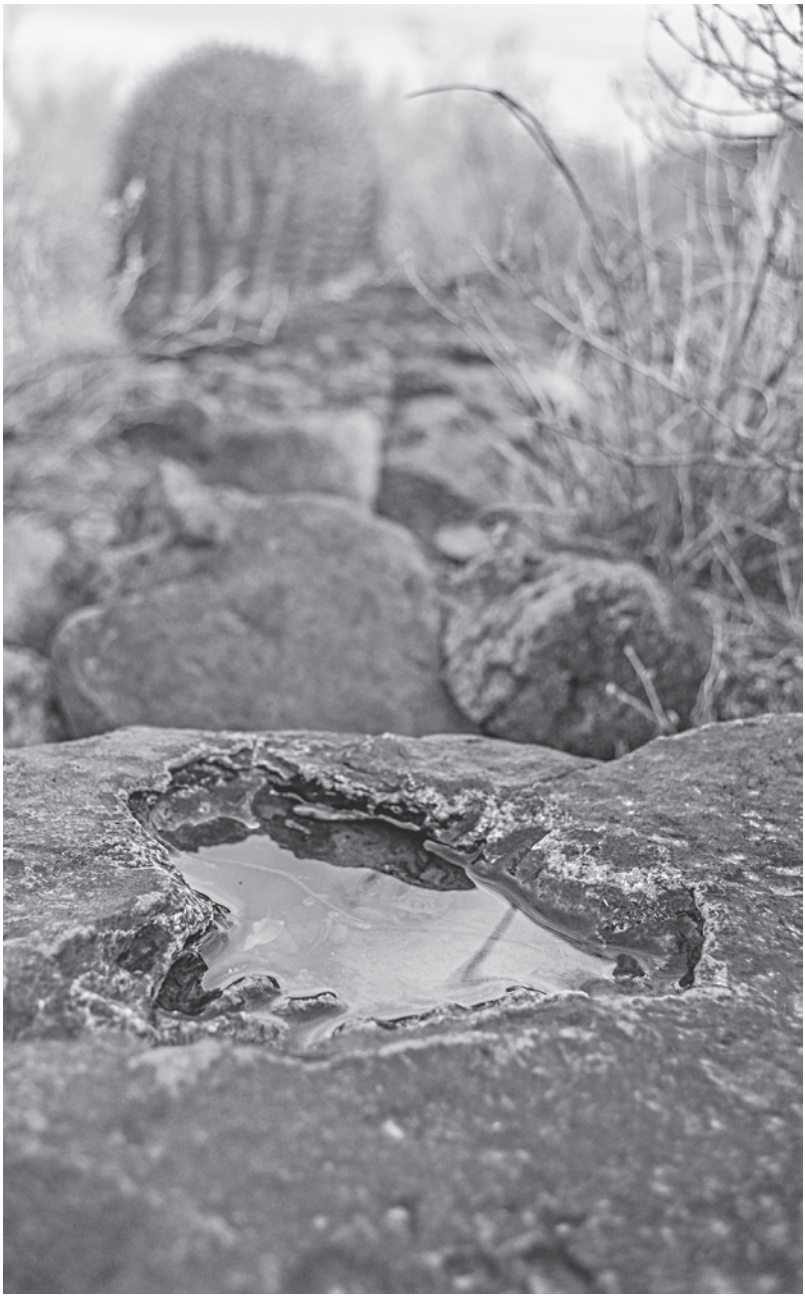

Figure 17: Rain-filled cupule in basaltic andesite, Spalding plot 10. Photograph by Paul Mirocha.

of factors influence plant succession, and even nearby sites can each go their own stubborn ways.

Desert nature writers like to point out to newcomers that the desert isn't the big, empty place it might appear to be. The Sonoran Desert, a naturalist will explain, is not far behind a rain forest in its species diversity.

But right now, sitting just outside the plot, I enjoy the sensations of big and empty. The stillness, the lack of clutter, the relative simplicity of my surroundings quiet the mind. Things move slowly here; thoughts can find the right spot, and with luck, might germinate like seeds. It's a relief to be away from the multiple images, messages, noise of the city, randomly accumulating, needing to be processed and filtered out, exhausting one's brain even without conscious attention. The constant messages are like a computer virus, taking up processor time. We don't even notice we've been attending to that until we step out of it. It takes time to let go of the chatter, like we're navigating a boat out of the rapids into a slow, lazy river. It's surprising when we arrive.

Not that it's silent here. Birds scream at each other, or at me; once, a Harris's antelope squirrel foraging in the plot chattered at me angrily. A bee buzzes past demonstrating the Doppler effect. And there are still sounds from civilization—from Anklam Road nearby, the freeway a half mile away, trains, the helicopters at St. Mary's Hospital just downslope. But the city is distant enough that its din doesn't dominate. In between the echoes of faraway motorcycle revs, I can hear my own heartbeat. Sometimes a breath of wind moves a branch, giving each plant a signature sound, most like a whisper.

Unlike the scientists here, I don't have decades to observe this plot; I sit for ten minutes, an hour, without expectations, just to see what happens in that period. Sometimes I don't even bring a camera, sketchbook, or notebook—they too can be distractions.

Staring at that same 10-square-meter chunk of earth—approximately the largest area that fits comfortably within one's peripheral vision—my questions are more general, less answerable than scientific inquiries.

What is a rock—or the world? Really. And what are we, in relation to a plot of ground like this? Why did someone throw pink paint on one of the saguaros by the road?

No answers come from the landscape. It's mostly rocks and soil, after all—the elements that desert plants must contend with. The bare bones of the world. To humans who once rode the historic wagon road passing nearby, it was the proverbial rocky ground.

When you focus exclusively on one rock, it starts to dissolve. And after a few minutes, one realizes that everything is moving with the sun. Shadows and points of light. The stakes marking the points of the plot invisibly trace daily and annual patterns on the ground. Cactus spines' shadows move mechanically over green skin. The whole desert is a vast sundial that marks time, solstices, equinoxes. Prehistoric Hohokam people clearly used Tumamoc rock art as a sun calendar to mark and probably celebrate the solstice and equinox points. Inexplicably, every morning during the week of the equinox, a shadow forms in the shape of a human profile and moves across the rocks in a nearby petroglyph site. It looks like the face on the buffalo nickel. Next year, the patterns will repeat with subtle variations due to weather and plant-growth changes. In the Catalina Mountains on the horizon, shadow slowly fills canyons and the light changes to yellow, orange, red as it dims.

Intentionally unmarked, the Tumamoc plots aren't obvious—casual visitors walk right past them. But we know they've been painstakingly mapped every decade for more than a century, generating mountains of data, each plot demanding attention, each individual perennial plant attended to and noted, just by us privileged observers. I like to imagine the plants enjoy the special attention. Still, these secret places seem to attract trouble. In 1968, Ray Turner chased away a huge telephone-company truck that had driven through plot 7, heading upslope toward plot 10, to replace the electric poles, which last about 45 years. There are a few invasive objects in the plot: a telephone pole; a USGS section marker; a stone upon which someone has chiseled, "JEO, (or Q?) 1968." One of Spalding's plots was washed away by a flood. Two others, no longer surveyed, reside in the front yard of a house on Anklam Road and in the vacant lot owned by a medical office plaza.

Wild animals can get through the fence and roam freely. There are usually two or three javelina wallows within the boundaries of plot 10, and mule deer droppings on trails crossing many plots. Spalding and Shreve considered them part of the natural state.

A few meters outside the fence, a rock is marked with ancient petroglyphs: a human figure, a zigzag line, and some concentric circles marked with dots in the four directions. People have been coming here for a long time.

Galileo, considered by many historians to be the first modern scientist, was very taken by a fragment surviving from the sayings of the ancient Greek philosopher Democritus. In this view, called Atomism, there are really only atoms moving, and the void. Galileo's interpretation of that

ancient idea made a new distinction: there are two layers to the world—primary qualities and secondary qualities.

Primary qualities—actually not qualities at all, but quantities—are definable by numbers and form the real world. Secondary qualities are what we perceive, existing only in the mind. Galileo wrote in *The Assayer,* "I think, therefore, that these tastes, odors, colors, etc. [secondary properties], so far as their objective existence is concerned, are nothing but mere names . . . so that if the perceiving creatures were removed, all of these quantities would be annihilated and abolished from existence."

That's why they're secondary.

By this measure, watching those shadows, admiring the scenery, listening to the landscape—no matter how sublime—all that has little to do with scientific knowledge. Even Plato warned against watching shadows. For a researcher, it might even be described as slacking off. Sensory perception is transitory, ephemeral, a layer of subjective fluff over physical reality that we must ignore in order to reach what's really there. Appearances are a mirage in which reality hides.

For many scientists, what's real should be the same to every observer, everywhere, repeatable by anyone. Besides getting in the way of reality, individual impressions, moods, opinions—they're too difficult to measure.

Yet all those secondary qualities are what artists and poets primarily focus on.

One day, bored with looking and listening, I turned to taste, chewing on some plants bordering plot 10, like the domestic animals that Spalding had banished.

Leaves of the brittlebush, *Encelia,* suggest a new vocabulary for a connoisseur of turpentine. The taste is interesting and complex, gets your attention immediately—zesty, angular, and large like frankincense smoke at a Catholic Mass. The flower is nurturing for a few seconds; then, with its aftertaste, it bites.

I spit out *Ambrosia, Encelia*'s less attractive cousin, a most inappropriately named plant, after a wild ride. Its taste is surprising, oily, doesn't let go. I drink from my canteen, but it doesn't cleanse my palate.

Then the *Lycium* leaves and annual *Pectocarya* combseeds are grassy and inviting—silky, lingering, and intellectually satisfying like salad.

I pop a stone into my mouth. Basaltic andesite. A hint of charcoal?

Even as a clear-thinking and pragmatic physical scientist, Shreve did allow a few aesthetic judgments about the Sonoran Desert to creep into his more popular writing. Once he wrote that the desert's natural

arrangement of plants looked like an "immense botanical garden"[11] because its variety of plant shapes and sizes, balanced-looking vegetation groupings, and large spaces between things creates a pleasing visual effect—as if some invisible, unknown landscape artist designed everything and a secret gardener maintains it.

It's true: the harmonies and proportions; the variety and contrast; the sense of distance, perspective, composition, color, lighting, lines, shapes all coming together—the elements we're taught to focus on in a painting class create matchless landscape effects to delight the eye.

Over the years, as plants dry up and reproduce anew, arrangements change but the overall impression remains: you are in the Sonoran Desert. The scene continually re-creates itself using the same themes and variations in infinite variety like a symphony playing for tens of thousands of years, never exactly repeating itself, yet always recognizable as a unique work.

While the Carnegie Desert Botanical Laboratory was set up primarily out of pure intellectual curiosity about deserts, Shreve later found he had to justify his research funding for its practical applications, "to make the desert feed and clothe and shelter us." At the same time, Shreve insisted that the area's beauty was also necessary: "Its broad vistas, rugged mountains, unique plants, and matchless coloring afford us some of the inspiration that life requires."

German scientist and explorer Alexander von Humboldt, often called the Einstein of the nineteenth century, influenced everyone from Charles Darwin to (much later) Forrest Shreve, Frederick Clements, and their colleagues who created the new science of ecology. In addition to scientists, Humboldt's work influenced several generations of artists and writers, notably Emerson, Thoreau, and Whitman and the Hudson River School of landscape painters.

In his ambitious lifework, *Cosmos*,[12] intended to describe the entire known physical universe, Humboldt intended both meanings of the ancient Greek word *Kosmos:* 'ordered,' as in governed by universal mathematical laws, and 'harmonious,' as in beautiful. Our word "cosmetics" comes from the same Greek root. Beauty is just as much an aspect of nature as is the law of gravity. Thus, when Humboldt arrived at a study site, he'd make a species list, collect samples, take measurements, almost obsessively record all possible data, then write a poetic description of the scene and finally draw it. Yes, he was an accomplished artist.

Through what I'll call artistic research, we learn to aesthetically appreciate a landscape in finer and finer detail—as a result, investigating

beauty. It's not always obvious at first; it takes time. Sometimes you have to draw something before you notice. Surely Daniel MacDougal and Arthur Coville, when they established the site of the first Desert Lab building in 1903, had the view of the Santa Catalina Mountains in mind. Each time I see it—watching the shadows move across the Catalinas from Spalding plot 10, late on a summer afternoon—the landscape's transcendent presence thrills, heals, redeems. Writer Ken Lamberton reveals agreement in his writings about his own limited view of the Sonoran Desert—his view from a prison window, through which he carefully observed twelve years of the desert's cycles[13]:

> Even during the longest, driest, most skin-cracking, lip-blistering foresummer, the saguaro produces fruit.

And if you look closely, watching the small things over the course of weeks, you see the saguaro buds grow and bloom, ovaries expanding into fruits, which split open—bright red food that attracts both birds and humans. Try to draw the process and you see the magic in every line. That beauty sustains us. From it I learn what I need to know.

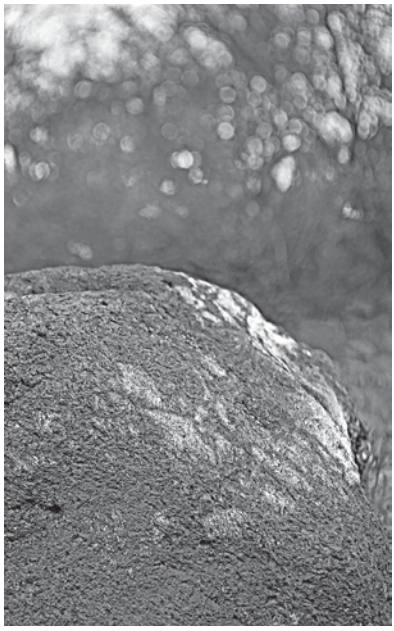

Figure 18: Ambrosia deltoidea Shadows no. 1, Spalding plot 10. Photograph by Paul Mirocha.

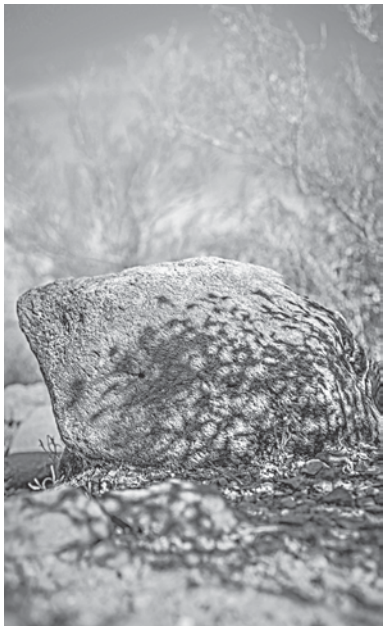

Figure 19: Ambrosia deltoidea Shadows no. 2, Spalding plot 10. Photograph by Paul Mirocha.

During my travels, Malaysian friends taught me a saying in Bahasa, *Tak kenal, tak cinta*. In English, you might say, "Don't know—don't love." By spending the time to pay attention, we learn to know a place. Knowing it, we form an attachment, develop a relationship. Knowing the science leads us to love better. We might then call it home.

Walking back from plot 10, up the hill toward the Desert Lab, following the prehistoric Hohokam summit trail that passes the plot—past the rock art, the numbered aluminum stakes next to each saguaro in the saguaro plot, the saguaros themselves—I try to summarize what I've learned from Spalding plot 10.

Nothing special. It's just a piece of the world. ✣

Acknowledgments

The Arts Initiative at Tumamoc Hill is truly a collaborative endeavor. At the Hill, gratitude goes to Michael Rosenzweig, director of Tumamoc: People and Habitats; Cynthia Anson, program coordinator; and Clark Redin, director of operations. Collaborators along the way include Cynthia Miller and Tucson's POG Poetry Group and the University of Arizona's Institute of the Environment and Sustainable City Project. Thanks to Tumamoc scientists Ray Turner, Owen Davis, and Ursula Basinger for taking us on expeditions into the Hill's backcountry and explaining their research. We'd also like to thank the Arizona Commission on the Arts for support of Paul Mirocha's 2014 Artist's Research and Development Grant, and the University of Arizona College of Science and Pima County, who cooperate in managing Tumamoc Hill.

Notes

1. Ellen McMahon, Ander Monson, and Beth Weinstein, eds. *Ground/Water: The Art, Design and Science of a Dry River* (Tucson: Confluencenter Beyond Boundaries Series, 2012).

2. In the introduction to the issue of *Spiral Orb* that features the Poetic Inventory, Magrane writes, "Mirroring the inventory form of the BioBlitz, in which the public joined scientists in doing species inventories within the park, the Poetic Inventory took another view at biodiversity: how do we, as *Homo sapiens—one* species among many—relate with other species?" See http://spiralorb.net/poeticinventory.

3. See http://rosemontours.com/ and http://lensontheland.com/, respectively.

4. See http://TumamocSketchbook.com/what.

5. *The Power of Narrative in Environmental Networks* includes a case study chapter on the Next Generation Sonoran Desert Researchers, and the importance of a shared place-based story/homecoming narrative in sustaining the network. See Raul Lejano, Mrill Ingram, and Helen Ingram, *The Power of Narrative in Environmental Networks* (Cambridge: MIT Press, 2013).

6. Patrick Mauries, *Cabinets of Curiosities* (London: Thames & Hudson, 2011).

7. William Rathje and Cullen Murphy, *Rubbish: The Archeology of Garbage* (Tucson: University of Arizona Press, 2001).

8. The POG initials suggest "Poetry Group." I think of them as "Poets on the Ground." (See http://www.gopog.org.)

9. F. Shreve and A. L. Hinckley, "Thirty Years of Change in Desert Vegetation." *Ecology* (1937) 18(4): 463–478.

10. James E. Cook, "Implications of Modern Successional Theory for Habitat Typing: A Review." *Forest Science* (1996) 42(1): 67–75.

11. Forrest Shreve, "The Desert Laboratory of the Carnegie Institution of Washington," *Progressive Arizona and the Great Southwest* (1929) 8: 11–12, 31–32.

12. Alexander von Humboldt's lifework, *Cosmos: A Sketch of a Physical Description of the Universe,* was written in five volumes between 1845 and 1862.

13. Ken Lamberton, *Wilderness and Razor Wire: A Naturalist's Observations from Prison* (San Francisco: Mercury House, 1999). Winner of the John Burroughs Medal for outstanding natural history writing, 2002.