INDIGENOUS FOOD SOVEREIGNTY IN THE UNITED STATES

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INDIGENOUS FOOD SOVEREIGNTY IN THE UNITED STATES

Restoring Cultural Knowledge, Protecting Environments, and Regaining Health

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To all those in the Indigenous Food Movement
And in honor of our ancestors who guide us

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FOREWORD

In Praise of Seeds and Hope

At this moment, when food systems are being shaken by drought and industrial poisons, and our Indigenous communities suffer the ravages of colonial food, the voices in this book, strong and rooted, come together to tell their stories, tell our stories. For the past twenty years, a renaissance of Indigenous food systems has flourished. This is indeed the time of prophecies. We are told that in this time of the Sixth Fire, we will go and find ourselves, our foods, our songs, and our way. This remembrance of our foods and ourselves will make us stronger. This book records those voices—the voices of remembering, of returning, and of the songs for new seeds. For indeed, seeds are promise.

When I was a young woman at Harvard University, my father came to me one day and said, "I don't want to hear your philosophy if you cannot grow corn." In the simplicity of those words is not only the story of my life but a ground truth. If we are unable to feed ourselves, we will not survive; and if we lose our whole being to our minds, policy work, and scholarly discussions, we will have lost

our direction. We need to strike a balance. Think of it this way: our ancestors navigated by stars, lakes, and trees; today, we navigate with a global positioning system. Due to pollution we can no longer even see many of the stars; that is, unless we return to the lands and the fields. Indeed, we must be conscious and work our way back to the soil. The soil and the seeds help us navigate the future. The chapters in this book seek to strike that balance between the documentation of history and the creation of policy versus the on-the-ground work and needs of indigenous communities.

Following the lead of my father, and so many others, I became a corn grower. First Ricardo Salvador gave me Bear Island Flint from the GRIN (Germplasm Resources Information Network) collection. I have seen the return of that variety—our seed from the island in the midst of Leech Lake Reservation—to gardens in our communities. I have seen even more varieties of *mandaamin*—corn, wondrous seed—return and flourish. Indeed, in a time of climate change, as described by Kyle White in this book, we have found that these seeds are resilient—never a crop failure, despite winds, droughts, and freezes. The corn has taught me hope, commitment, and a return to the craft of cooking—restoring hominy-making knowledge and recipes to our community. As my father surmised, corn teaches all of us.

At the first gatherings of Indigenous food producers at Slow Food International's Terra Madre event, we came to recognize our place in the international struggle of Indigenous peoples protecting and reclaiming the food the Creator gave us: our foods are who we are. Since then, and through subsequent Indigenous gatherings during which I have met many of the contributors to this book, our movement has grown and flourished as Indigenous food sovereignty takes root in our communities across Turtle Island. Our food and our future are related. And, with the emergence of the Turtle Island Association of Slow Food in 2016, we have taken our place at the international table of a movement for just, clean, and good foods worldwide. "You cannot say you are sovereign if you cannot feed yourself," Sugar Bear Smith of Oneida once said to me. *Clear and affirming.* We are the people growing and restoring the sovereign practice of food.

Despite the $13 billion corporate food industry, 70 percent of the world's food is grown by families, peasants, and Indigenous farmers. We are those people, and today when we return to our farms and our seeds, we take our place in history. In a time when agrobiodiversity has crashed and world food systems are filled with poisons, our seeds remain, and they return. These are our stories: stories of love and stories of hope.

Winona LaDuke in front of the Honor the Earth Bus, March 2018.
Photo by Elizabeth Hoover.

It is said that in the time of the Sixth Fire we will go looking for much of what was stolen or lost, and we will recover those songs, medicine bundles, and seeds. Then we will come into the time of the Seventh Fire. In that time it is said we will make the choice between a scorched path and a path that is green. The essential part of following that green path is how we return to living here on this land. At the center is producing our food again, feeding our people. That is how we reaffirm our covenant and agreement with the Creator. We are becoming the people who no longer import our food from across the country, hemorrhaging our tribal budgets, but instead exercise and affirm the power of our relationship with our food.

To those who have collected these stories, I am grateful. And to those of us who have found our corn, I say find your courage in those seeds that you plant. Because those seeds are about hope, promise, commitment, the future. And in returning to our seeds and fields we are able to fulfill our responsibilities to all of our relatives, whether they have wings, fins, roots, or paws. Food sovereignty is an affirmation of who we are as Indigenous peoples, and a way, one of the most sure-footed ways, to restore our relationship with the world around us. That is the story of this book. These are stories of heroes of the time of the Seventh Fire. I am grateful to be present at this time.

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ON INTIMACY WITH SOILS

Indigenous Agroecology and Biodynamics

Maíz y frijol seco; calabacita y calabaza—corn and dry beans; squash and pumpkin: these three companions, cultivated by Indigenous farmers across Turtle Island and Abya Yala for thousands of years, represent our collective biocultural heritage.[1] Alongside cilantro (coriander) and *alberjón* (sweet pea),[2] these seeds found their way into coffee cans and Mason jars that Margarita kept in a cupboard next to the old stovetop. I was ten when I asked my paternal grandmother why she kept these seeds: ¿*Por qué mamá*? She replied: *Porque la semilla es la memoria de la planta de cómo vivir bien en este lugar.* "Because the seed is the plant's memory of how to live well in this place."

TIERRA SANA

To my *abuelita*, seeds had memory and agency. She thought of seeds in a manner akin to what some social theorists today call "vibrant matter."[3] Indigenous farmers long have understood how people, seeds, *and* soil merge capacities

and grow together—we co-evolve.[4] With a little help from human hands, pollinators, soil, and water, seeds enact an evolving memory of lived experiences in agroecosystems—when to sprout; how much water to absorb and how to survive drought; how to adapt to ultraviolet radiation; when to blossom; how many cobs and kernel rows to develop, or how many peas or beans per pod; how to respond to other plants and insects; the amount of protein, starches, sugars, and amino acids to store in leaf, root, grain head, rhizome, or tuber; when to mature as viable seed or rootstock; and so on.

Awareness of seed memory was a vital element in my grandmother's path to a relational sense of self through place attachment. I believe her care of seeds encouraged a *re-membering* of the body by means of affiliation with the land immediately around her. The simple and elegant practice of crafting a "land-connected self" may allow persons to develop a deeper, more relational sense of place. This connection can generate healing in the convivial spaces of home kitchen gardens, crop fields, and kitchens. A mindful kindness toward the soil defined what it meant for her to be a good human being in relation to others. She believed that if you want good corn and beans, you first need good seed and healthy soil.[5] The same held for the soil of culture and for family and other social and ritual kinship relations like *comadrazgo* that were such a central part of our living social web back in the 1950s and early 1960s.[6] Margarita's love of soil was grounded in direct lived experience. She did her best to care for the soil in our yard while raising ten children of her own and me, her firstborn and orphaned *nieto*. I'll never forget the joy of eating tender *nopalitos* cut from her beloved cactus fence on the east side of our home. She scrambled these with fresh eggs gathered from chickens living in a roost my uncles built in the backyard next to the cactus fence.

My childhood home was in Laredo, Texas, located on the Rio Grande where the border violently intrudes on local cultural, social, and economic life. The border is, as Gloria Anzaldúa says, "an open [colonial] wound." In this divided borderland, Margarita's emotional attachment to land avoided the shallow sentimentality so common in settler colonial ideals of "nature appreciation." She didn't care for overly manicured city parks or Lake Casa Blanca State Park. She preferred, as I did, the Tamaulipan mezquital—the mesquite, prickly pear, *huisache* (sweet acacia), and devil's claw habitat surrounding our ranchería in the barrio known as El Three Points.

I believe my grandmother eschewed binary constructs. What was important for her was for us to embrace daily labor as an act of re-creation with, within, and

by courtesy of nature's amazing capacity for productivity. Margarita's intimacy with the land came from working directly with the soil in a regenerative and healing practice—she nurtured the soil to provide some beloved garden herbs, nopalitos, a few vegetables, corn, peas, and calabacitas. This produce did not by itself feed the family, of course, but it should not seem remarkable that Margarita achieved this sense of partnership with the soil despite being far removed from any ancestral lands. She refused to become a ghost of the primitive accumulation. Tending small patches of soil kept our sense of mindful respect for land, plants, animals, and water intact.

Margarita's relationship with seed and soil was an instance of mindfully embodied creativity. Her aim was to unleash the immediate use value of creative labor as an act of coevality with more-than-human beings and as a salve for healing colonial and diasporic wounds. She felt genuine sisterhood with other creatures and once sternly admonished one of her sons and me for hunting small birds with our BB guns. There were *remedios* for spiritual and physical ailments in the herb patch (*hortaliza*). Margarita's intimacies with soil, seed, and water are indicative of a worldview abiding by the principle of co-inhabiting with rather than dominating or developing a place. She practiced a niche-abiding presence based on respect for wildness—the Earth's self-willing agency in natural cycles of decay and renewal across seasons.[7] She gently imprinted these principles on anyone willing to pay attention.

Some years Margarita would instruct us to apply composted horse and goat manure to the backyard kitchen garden and have us spread it to other spots along the edible cactus fence or around the bountiful laurel bushes and twin sour orange trees in the front yard. For a time, we had a corral in the backyard with a rotating set of wild and trained mustangs, kept as part of an uncle's business. One of my chores was to tend that pile over the long, hot summer months all the way through *canícula* (the dog days). Rainfall is scarce in Laredo, so my grandmother would instruct me to sprinkle the pile with water and turn it over once every few weeks. Eventually, she would decide it was time to inspect the smelly, warm heap. Grabbing a clump of the dark compost from mid-pile to sniff, she used her nose and fingers to check its readiness for use. She wrinkled her nose to smell the clump and rubbed a bit of the dirt between her right thumb and left palm, feeling the texture. When she was satisfied the compost was ready, she would turn to us and declare, "'*sta listo*" (dropping the *e*). Sometimes she instructed my uncles to go fetch goat manure from the yard of a neighboring farmer named Amador. She would mix this with the horse

poop. She described the concoction as *para la tierra sana* (for the healthy soil). Whatever signs she was smelling and feeling for remain a mystery to me to this day, but her technique worked: the milpa, the flowering plants and bushes along the edges of the house and yard, the sour orange trees and laurel bushes out front, and the edible cactus fence on the east side of our parcel—they all flourished despite the dusty desert conditions of our barrio.

Perennial flowering companion plants in Mexican clay pots lined the edges of Margarita's garden and were also distributed across the rest of the yard in beds, including in the circular margin borders under the sour orange trees out front. She loved geraniums and roses, so there were a lot of those in clay pots she tended on the smooth cement-slab front porch, nested with and overflowing alongside aloe vera (we called it *sabila*). *Tulipán* (tulip) was another favorite garden plant. Grandmother would sow a row of cilantro mixed with chives and Native aromatic plants like the *yauhtli* (Mexican marigold, *Tagetes lemmonii*), which I was to learn much later is also called *hierba de las nubes* (herb of the clouds).[8] This decorative plant is widely planted across greater Mexico alongside maize because it has a pleasant scent, attracts beneficial insects like ladybugs, and fixes primary nutrients essential for good soil and more nutrient-dense food and medicinal crops.

My grandmother's work made the soil dark and crumbly. It was filled with life—sleek wet, writhing earthworms; busy, shiny black and red-orange stinky ants; velvety red mites; and those strange roly-poly pill bugs. I remember the sweet yet slightly musty smell of the earth. What I now understand were white mycelium clumps, an indicator of healthy soil, would sometimes be exposed as she prepared the ground to sow seeds. Life sprung up as she gently weeded, irrigated, and watched for the sacred corn-bean-squash triad to sprout and grow amidst floral profusion. I believe she helped plants work together so that they could be healthier. It took decades before I fully appreciated Margarita's soil intimacies: diversity and a gentle hand are keys to agroecological and cultural resilience.

My abuelita's intimate relationship with seed saving and soil health during my childhood years had a lasting influence on my way of being in the world. In my adopted home today, in the Rio Grande headwaters bioregion of south central Colorado, her lessons continue to inform my farming practices on a 181-acre acequia farm located on the 1844 Mexican Sangre de Cristo land grant, in a high alpine desert valley surrounded by fourteen-thousand-foot peaks. This high valley was a vital stretch of historic spring hunting territory for the Caputa bands

of the Ute Nation in what is now southern Colorado's San Luis Valley.[9] After the War with Mexico, the Caputa were violently driven out of their homeland by US Army troops stationed at Fort Massachusetts (Fort Garland) and forcibly resettled onto lands within the Southern Ute Reservation.[10]

In this chapter I offer some reflections grounded in my own intimacies with soil in a sacred landscape that is not my ancestral homeland. The Rio Culebra acequia commonwealth offers original instructions I seek to abide by as a displaced Indigenous person of German-Mexican and Mvskoke-Black-Irish heritage. Although my grandmother did not live to see us establish a farm school in this stretch of Ute high country, I wish to illustrate how the lessons she taught me resonate with Indigenous agroecological methods, or what modern advocates call biodynamic and permaculture principles.

These principles have deeper, more diverse roots than is acknowledged or understood by the most prominent modernist philosophers and groups associated with settler colonial sustainable agriculture movements and enterprises. This abbreviated missive is part of a larger project in which I seek to clarify how land ethics and soil conservation are political projects tied to struggles opposing the social, cultural, and environmental violence unleashed by settler colonial capitalist empires seeking control of the modes of human production and reproduction.[11] Indigenous resistance to enclosure and destruction of ancestral lands can proceed by our standing ground in solidarity with the ground we sow. As traditional Indigenous farmers, we can continue fulfilling our moral obligations to defend and regenerate this most vital of all the sources of right livelihoods by weaving together environmental wellness, spiritual integrity, cultural resilience, and community health. No matter where we are—for so many of us no longer inhabit ancestral ground—the work of regenerating soil health is a vital part of our decolonizing environmental justice and food autonomy work.

The first section of this chapter is a brief ethno-historiography highlighting some examples of Indigenous antecedents of modern biodynamic and permaculture principles. I include discussions of historic Mexica and contemporary Maya and P'urhépecha epistemic domains. I am interested in enunciating lessons from the study of ancestral and contemporary soil knowledge and stewardship practices as illustrative of Indigenous survivance.[12] The second section outlines eight principles I envision as germane to the elaboration of models of Indigenous agroecology. My articulation of this list is itself a decolonial act that seeks to disrupt and delink from the worldviews and politics enunciated by settler colonial sustainable agriculture advocates.

SURVIVANCE OF INDIGENOUS BIODYNAMICS

Rudolf Steiner (1861–1925) gets credit for "discovering" the principles of the dynamic biochemical qualities of soil, which he understood as a living organism or proper micro-ecosystem interacting with "cosmological" forces.[13] When Steiner was writing in the 1920s, it would have been difficult for him to know about the antecedent Indigenous sources of biodynamic practice. These sources of Indigenous knowledge were obscured to most of the world as a result of settler colonial acts of epistemic violence and deliberate erasures against multigenerational place-based cultures across the world.[14] Steiner's more modern interlocutors have deepened these acts of epistemic closure by presuming and fabricating the myth that biodynamics is somehow a uniquely European and neo-European (American and Australian) settler colonial modernist invention.[15]

A good contemporary example of deeper Indigenous sources—widely cited by scholars and soil tilth practitioners today—is *terra preta* (dark earth) in the long-duration rotation islands and agroforestry mosaics across the Amazon.[16] Other examples of resilient biodynamic agroecosystems include the famed *chinampas* (floating gardens) and *huertos familiares* (home kitchen gardens) of Mexico; the polyculture milpas of acequia farms in the upland valleys of the southern Rocky Mountains in Colorado and New Mexico; and the Three Sisters gardens of the Haudenosaunee nations of the northeastern United States and Canada. All these, and many more, are veritable storehouses and innovation hotspots of biocultural diversity and regeneration.[17] Deep soil knowledge, created over millennia by sustained Indigenous ecologies of place, is resurfacing across Turtle Island and Abya Yala as food sovereignty/autonomy projects take hold.[18] It is well past time for the biodynamics and permaculture discourses and movements to take notice of and reflect on the profound implications posed by the deeper Native sources across a broad range of agroecological knowledge, belief, and practice traditions.

A significant body of scientific research supports a relationship between soil quality and crop nutrient density, which in turn results in higher seed quality and preservation of agrobiodiversity.[19] There is also ample evidence of this understanding in the returning salience of interlinked fields of Indigenous knowledge of *ethnoedaphology* (Indigenous models of ecosystem processes in soil), *ethnopedology* (Indigenous classifications of soils), and *ethnobotany*, which I define as Indigenous knowledge of the soil biodynamic, nutritional, and medicinal properties of plants. This last epistemic triad embodies Indigenous

understandings and framings of the relationships among soil quality, companion planting and polycultures, and medicinal and nutritional properties of food crops and their wild and intermediate relatives and companion plants.

The Dualistic Quality of Companion Plants

After Spanish forced entry into Mexico, and the unfolding of a veritable ecological and cultural apocalypse, a group of Catholic Franciscan friars coordinated what they viewed as a massive salvage ethnography project. This involved the co-production of hybrid codex manuscripts with Native scholars who were often described as "unworthy servants" of the king and queen in the frontispieces of the manuscripts. These manuscripts combined Mexica (Aztec) glyphs, numerology, and related symbolic forms alongside Latinized Nahuatl and archaic Castilian and Latin narratives and nomenclature as part of an effort to preserve Mesoamerican knowledge of the medicinal properties of native plants. The plants were selected solely based on their ethnomedical properties.

What interests me is how Indigenous farmers have long found many of the same plants to be important companions in polyculture milpa agroecosystems. The dual value of these plants in ethnobotanical *and* biodynamic terms is verified by past and existing Indigenous agroecological practices. The colonial manuscripts, and indeed most discourse in the biodynamic and permaculture movements, overlook the dualistic quality of Indigenous companion plants; simply put, these plants are medicine for the body and the land (soil) and other plants that co-inhabit the agroecological landscapes in biochemical feedback loops.

The earliest effort by a European mind to explicate the soil knowledge of Mesoamerican farmers was that of Bernardino de Sahagún (1499–1590), a Franciscan missionary and early colonial-period "salvage" ethnographer. His chronicles of the Culhua Mexica imply the early adoption of what we would today view as biodynamic practices. Sahagún mentions the Nahuatl term *quauhtlalli*, which he translates as "[rotten] wood soil." In volume 2, chapter 12, section 3 of his *General History of the Things of New Spain* he writes:

> Hay otra manera de tierra fértil, donde se hace muy bien el maíz y trigo, *Uamanla quauhtlalli*, que quiere decir, tierra que esta estercolada con maderos podridos, es suelta, amarilla, y hueca.
>
> > There is another sort of fertile soil, in which corn and wheat flourish very well, they call it *quauhtlalli*, which is to say, earth which has been manured with rotten wood, it is soft, rich, and golden. (Translation mine)

This is similar to the oft-cited European practice of *Hugelkultur*, a German word meaning "hill culture" or "mound culture," which is often invoked in settler colonial discourses to illustrate the ancient European roots of biodynamics and permaculture.

Similar evidence is found in the famous *Códice Badiano* of 1552, also known as "The Little Book of the Medicinal Herbs of the Indians."[20] This is one among several colonial-era codices that hint at the importance of companion planting and soil knowledge in Mesoamerican agroecology. The book has descriptions of more than 250 plants with 187 illustrations. One noteworthy example is a sketch of water nettle, or *Atzitzicaztli* (*Urtica chichicaztli*). The notes accompanying this lovely sketch describe how the juice of nettle, ground with salt and mixed with urine and milk, can be poured into the nostrils to stanch a nosebleed. Not mentioned are various biodynamic properties of this plant, which Native campesinos view as having a "strong spirit."[21] Indigenous and traditional smallholder farmers use water nettle because it is known to promote the formation of humus in the soil. There is some evidence that when it accompanies corn-bean-squash intercropping, it suppresses bindweed.[22] Three common companion plants recorded in de la Cruz–Badiano are still widely used in the milpa agroecosystems of Mexico and the acequia farms in parts of the Southwest: these are yarrow (*Achillea millefolium*), lamb's quarters (*Chenopodium album*), and stinging nettle (*Urtica dioca*). All three are recognized and valued for their medicinal properties in our bioregion today.[23] All three are also listed as ingredients in contemporary certified biodynamic concoctions added to compost.[24] Similar examples of this dual quality can be discerned among dozens of the companion plants known to have been cultivated since well before contact times.

One recent study of farmers at the *tiangüis* (popular open-air markets) in Mexico verifies the continuity of applied Indigenous knowledge of companion planting, highlighting its value in optimizing the availability and renewal of organic matter in soil. In the tiangüis study, Miguel Escalona Aguilar explains that farmers' soil tilth focuses on multicropping with companion plants. This knowledge is ancient *and* contemporary; it is not static; this knowledge responds to territorial shifts and environmental changes. The goal of regenerating soil quality is achieved through a combination of on-site inputs with different types of plants available as cover crops, since both the temporal availability of organic matter and its actively shifting composition are enriched by such diversity.[25]

Farmers practicing traditional polyculture view plant diversity as a fundamental method for sustaining good anthrosols; that is, human-influenced

soils.[26] Our ancestral agroecologists understood the importance of protecting structural and species diversity in order to sustain what we today imagine as the chemical and biological constitution of good agricultural soils.

Epistemic Intimacies: Indigenous Soil Classification, Biodynamic Companions, and Ethics Instruction

The Mexica, like other Mesoamericans, developed a very sophisticated system of soil classification that, by some accounts, included more than sixty classes of soil.[27] Adopting knowledge from antecedent Mayan, Toltec, and other civilizations, the Culhua Mexica adapted sensible experience-based criteria for defining soils to determine their appropriateness for different uses, including being left alone in a state of relatively undisturbed wildness. Particular terms were adopted to identify the qualities of soils deemed arable or fertile: *atocpan* (lands with a deep topsoil horizon) and *atoctlalli* (lands composed of moist alluvium). It is unsurprising that these continue as categories designating soils that are appropriate for farming, as does the general category of *cuenchihu*, or *cuemitl*, meaning those soils classified as appropriate for being disturbed and supplemented or composted. This terminology conveys awareness of the potential for negative disturbance of soil as a result of misguided activities by farmers. It may also invoke ethical obligations to avoid abusive practices. The semiotics of Indigenous soil vernaculars suggest our soil knowledge remains connected to instruction in land-care ethics. This requires us to move beyond the settler colonial binaries associated with the ideology of human exceptionalism. The routine separation of the teaching of land ethics (soil intimacies) from instruction in soil science in the pedagogy of today's land grant universities illustrates a binary split in the Western paradigm and hints at why our survivance is so revolutionary.

Understanding the ethical dimensions of how people view and manage soil (ethnopedology) is only the beginning of a remapping of our Indigenous knowledge, belief, and practice complex. Yet these ethical concepts have not been explicitly addressed in the context of using companion plants to maintain and regenerate soil as a practice common to Indigenous agroecology. Based on my ongoing research, many of the 251 plants discussed in de la Cruz–Badiano for their medicinal properties were also valued, and are indeed still valued today, for their soil-enriching and allelopathic properties. A preliminary list of companion plants with dual ethnomedical and soil biodynamic/agroecological properties is presented in table 12.1. This list hints at the need for independent

Indigenous research on using these plants in biodynamic preparations to supplement compost and manure.

Beyond Deep History and the Mexica Fetish

Despite the importance of pre- and post-contact codices and testimonies, I wish to avoid giving the impression that the Mexica and Mayan civilizations and their heirs (contemporary Nahua and Maya communities) are the only sources of Indigenous knowledge of agroecology and specifically soil biodynamics. Antecedent and contemporary Indigenous communities across Mexico and the rest of the planet have soil TEK . We need not only to listen to but to enunciate these contemporary stories in acts of relational solidarity instead of ending inquiry with the clarification and celebration of ancient codices, as if Native soil knowledge were confined to some remote past.

In Mexico, a notable current form of Indigenous TEK is the soil classification–farming–ceremonial complex of P'urhépecha campesinos in Michoacán; I point to their historical and continued presence as peasant farmers in Colorado and other places north of the US-Mexico border.[28] These farmers continue to develop and transmit classification models and ecological knowledge across generations. They recognize five general classes of soil, or *echeriecha*, with two to five subtypes depending on location. The current soil classification system contains a total of seventeen soil subtypes.[29]

The highly nuanced criteria used to discern soil types (for example, based on gradations of color) and subtypes in the P'urhépecha model anticipate modern soil science by several hundred years. Unlike in modern research universities and land grant colleges, however, in the P'urhépecha community contemporary soil classification practices involve teaching and practical activities linked to collective and communal work organizations that are traditionally responsible for protecting and improving soil quality. Soil health is a matter of common property relations and moral obligations. P'urhépecha soil knowledge, alongside other domains of local ethnoecological knowledge (like agro-forestry), is shared and transmitted in conjunction with closely aligned ceremonial and agricultural calendar cycles. Soil conservation and regeneration practices and ethical instruction intersect and flow alongside the cycles of ceremonial life in the collective work of such place-making communities. Even in the internally colonized northern acequia communities, there are still vestiges of the ties among ceremony, agriculture, soil conservation, and irrigation. These ties are evident in the continued observance

TABLE 12.1

ETHNOMEDICAL AND BIODYNAMIC/AGROECOLOGICAL PROPERTIES OF SELECT COMPANION PLANTS IN TRADITIONAL MILPAS

Plant	Ethnomedical Values[a]	Soil Biodynamic/ Agroecological Propwerties[b]
Chamomile[c] *Manzanilla (Chamaemelum nobile)*	Tea has calming effect; sulfur content has antifungal properties; hay fever relief; anti-inflammatory; combats muscle spasms, menstrual disorders, insomnia, ulcers, wounds, gastrointestinal disorders; prevents rheumatic pain; reduces swelling of hemorrhoids.	Roots loosen compacted earth so that other plants can find nutrients and water. Preparation of flower "tea" helps unblock plant sap and prevents stress from excess heat/cold; adds sulfur and calcium to compost mixes; high in potassium. Stabilizes nitrogen within compost and increases soil life to stimulate plant growth.
Datura *Tolohua (Datura innoxia)*	Analgesic; narcotic effects used in setting broken bones, making incisions, and relieving painful bruises and other injuries. Anti-angiogenesis properties.	Leaf hexane extract has insecticidal potential. Facilitates phytoextraction of heavy metals from soil (e.g., excess cadmium, chromium). Grows in alkaline soils. Should not be grown alongside potato plants, as it can be a center of viral infections.
Lamb's quarters *Quelite (Chenopodium album)*	Astringent; upset stomach relief; prevents scurvy. Tea used to treat diarrhea.	Is useful as "trap crop" for leaf miners. Hosts beet leaf hopper. Restores healthy nutrients to the soil (except that phosphorous may not be bioavailable to plants for many years through green manure).
Laurel; Mexican bay leaf *Eca-patli (Litsea glaucescens)*	Bruised together in frigid water with other herbs and stones, then soaked in a neck wrap, it can relieve sore throats and head and neck pains.	Creates a supportive microclimate for shade-tolerant pulses and vegetables.

Source: Plants listed in the Martín de la Cruz–Badiano Codex of 1552.

[a] As narrated in the de la Cruz–Badiano Codex and contemporary accounts such as William Gates, *An Aztec Herbal: The Classic Codex of 1552* (Mineola, NY: Dover, 1939).

[b] Based on my ongoing research with multiple sources and field measurements at the Almunyah de las Dos Acequias.

[c] Introduced species that Indigenous farmers and agroecologists widely accept as a naturalized companion plant.

TABLE 12.1 *(continued)*

ETHNOMEDICAL AND BIODYNAMIC/AGROECOLOGICAL PROPERTIES OF SELECT COMPANION PLANTS IN TRADITIONAL MILPAS

Plant	Ethnomedical Values[a]	Soil Biodynamic/ Agroecological Propwerties[b]
Marigold *Yauhtli* *(Tagetes lemmonii)*	Ointment can be used to soothe sunburns, warts, bites, acne, and ulcerations; and to heal wounds, dry skin, and blisters.	Protects other plants by releasing a chemical that deters potentially lethal root-infesting nematodes. Chemical also reduces chances of fungal, bacterial, viral, and insect problems; attracts beneficial insects.
Papalo *Papaloquelite* *(Porophyllum ruderale)*	Soothes coughs, headaches; reduces flatulence after consuming legumes (beans, lentils).	Cold-hardiness contributes to protective cover and supports soil moisture, prevents hardpan, and attracts beneficial insects.
Purslane *Verdolagas* *(Portulaca oleracea)*	Leaves are rubbed on insect or snake bites; soothes boils, sores, pain from beestings; contains more omega-3 fatty acids than any other leafy plant; high in vitamins A, C, E, and B.	Creates humid microclimate for nearby plants; deep roots can bring up moisture and nutrients other shallow-rooted plants (e.g., corn) cannot reach.
Water nettle *Atzitzicaztli* *(Urtica chichicaztli; U. dioica)*	Ground with salt and mixed with urine and milk to stanch bleeding.	Promotes formation of humus in soil; suppresses bindweed; can be sprayed on sick or stressed plants as liquid manure.
Yarrow *Tlalquequetzal* *(Achillea millefolium cv.)*	Flowers and leaves are eaten or made into a tea-like drink; fresh leaves are applied to stanch bleeding wounds; treats gastrointestinal problems and fevers (infections); lessens menstrual bleeding; promotes circulation.	Preparation enhances crops' ability to absorb potassium in a balanced manner. Enables soil to absorb and retain silicic acid. Aids in the formation of quality plant proteins.

of the feast day of San Isidro Labrador, the patron saint of farmers, in northern New Mexico and southern Colorado acequia communities.[30]

How Continued Primitive Accumulation Disrupts Soil Intimacies

We face the long-duration effects of settler colonial–capitalist enclosures (primitive accumulation) on the health of the land and the degradation of our soil knowledge. These conditions reduce our autonomous capacities to renew and replenish our agroecological systems, skills, and practices, including our ceremonies. Contemporary Maya communities embody the continuity of soil classification and restoration practices, but their evolving soil vernacular reflects the inescapable need for us to consider myriad political-economic and ecological problems posed by the history and continuing violence of enclosure and displacement. In Hocabá, Yucatán, Maya farmers today continue to classify soil types into eleven distinct subclasses.[31] Their soil terminology is influenced by the long-term effects of structural violence unleashed by settler colonial dispossession and displacement of Native farmers from ancestral lands. Many of the concepts used in the Hocabá Maya soil class schema today reflect the marginal condition of the lands these farmers have been forcibly displaced onto for their subsistence plots (*sembrados*). There are now constant references to different types of "thin" or "shallow" soils and soils that are "too rocky" or "too steep." Many of these concepts defining poor-quality soils were rarely enunciated by past generations of farmers. The evolving language of soil is therefore reflective of Indigenous peoples' active engagement with changing environmental conditions, most of which have been imposed on them by colonizers and usurpers who stole the more fertile ancestral lands. Imagine how climate change (the sixth mass extinction) and other ecological catastrophes will influence our changing soil and other land health vernaculars.

This brief ethnohistoriography suggests it is insufficient to acknowledge and celebrate the deep roots, methods, practices, and ethics of Indigenous soil knowledge. We need to understand the conditions of disruption and change as defined and constrained by the specific bioregional qualities and environmental histories experienced by each place-based culture. Despite epochs of resistance, our soil intimacies are tempered and transformed by the forces of settler colonial-capitalist dispossession and displacement. The lesson I draw from the Hocabá Maya is that our soil knowledge today includes signifiers of the degraded condition of the reduced and marginal landscapes and watersheds we have been forced to inhabit and cultivate.[32] The land and water are gravely wounded, and Indigenous linguistic shifts reflect this fact. It is in this subaltern realm where we

may find especially poignant examples of hope for the resurgence of Indigenous biodynamic and related agroecological practices to heal the land, water, and people. This is not a lifestyle option or entrepreneurial opportunity in some newfangled farm-to-table touristic dystopia. Mapping our own soil-knowledge models across diverse bioregional landscapes remains an important task of our decolonization projects toward food autonomy by healing the soil and protecting our water to create la tierra sana.

THE RESURGENCE OF INDIGENOUS BIODYNAMIC AND PERMACULTURE PRINCIPLES

Indigenous principles of biodynamics and permaculture arose from place-based cultures and, in many places, associated diaspora communities who developed these over millennia *in and often forcibly out of place*. In the end, these principles are about a people's capacity for intimacy with more-than-human beings—the intimacy between people, land, water, the health of the soil, and all living beings sharing the biosphere. The integrated notion of soil-body health reflects principles of *relationality* that differ from Western epistemologies derived from the norms of *objectivity*.[33]

I encourage further discussion of the principles of Indigenous biodynamics and permaculture. How are these different from settler colonial principles? Underlying my opening contribution to this discussion is the idea that our ancestral lands have been appropriated and damaged. As a result, the land has suffered through the same conditions and effects of historical trauma and structural violence experienced by Indigenous peoples. From this location, our agroecological practices necessarily merge with the work of restoration ecology and the spiritual tasks of healing colonial wounds through our intimacies with soil, plants, animals, water, and each other. In this sense, the concept of permaculture is a more recent and limited Western analogue of the primordial fields of place-based, spiritually grounded Indigenous agroecologies. This immediately invokes an issue of social justice and a call for the restoration of Indigenous autonomy (including land and water rights claims), which makes our restoration efforts distinct from settler colonial movements whose starting point is sustainability and not Indigenous sovereignty.

The following eight principles can perhaps be viewed as a possible formulation of *relational practices* evident in multi-sourced Indigenous agroecologies:

1. *Spiritually grounded practical respect for extant landscape ecologies, including wounded lands*. As Indigenous farmers we engage ceremony

by working to repair and sustain the material and spiritual conditions of the social and cultural fabric of our communities and parent ecosystems. This is true of our respect for natural landscape qualities like contour intervals, as illustrated by *loma y bordo* [terracing] in milpas and huertos familiares [home kitchen gardens] across the upland zones of central and southern Mexico and as far north as New Mexico. The spiritual dimension involves acting with loving kindness toward the land and all our co-inhabitants, especially more-than-human beings. Recognizing the effects of the environmental violence of settler colonialism and capitalist enclosures, we perform actual service to the land by enriching and deepening soil horizons (removing rocks and adding tilth), actively repairing damage to "marginalized" lands, and protecting our native seeds and rootstocks while continuing to nurture their adaptability in a climatically chaotic world. Our spiritual practice thus becomes a moment in which we may embody "theory in the flesh," binding the well-being of our bodies to the well-being of the soil and other Earth life support systems as coeval partners.

2. *A preference for perennial and annual polycultures* and avoidance of monocrop systems. The principle of *agro-biomimicry* involves practices that create agroecosystems which mimic the environmental conditions of place by reproducing structural, species, and process diversity, including hundreds or even thousands of wild plants and relatives of cultivars, many with valued qualities as spiritual companions, as sources of medicinal substances, or as promoters of soil biodynamic qualities (see number 4). These plants are not weeds.
3. *Established patterns of multi-crop rotations with long-duration fallows*. Allowing soil to rest and regenerate tilth in order to sustain its biodynamic qualities is one focus of Indigenous agroecological practices. Rotations may often involve so-called green manure crops that fix nitrogen and facilitate regenerative processes in the soil (the practice of *frijol tapado* comes to mind). These practices abide by the extant bioregional qualities of each watershed and focus on "re-wilding" ecosystems and habitats that host our farming and gardening plots. These rotational cycles are often linked to ceremonial and community life event calendars. Recognizing the regenerative nature of their activities, Indigenous farmers produce a shifting mosaic of domesticated and wild plant associations that blur the boundaries between domestic crops,

other plants, and wild relatives and associated organisms. Many of us do not have enough land to practice long fallow periods, which is why intercropping and minimum tillage are important practices (see number 4).

4. *Intercropping with biodynamic and allelopathic companion plants*, including decorative flowers that attract pollinators and beneficial insects for natural pest control. Intercropping is also important for regenerative processes and further establishes the vital principle that diversity is the key to resilience in agroecosystems. This practice centers around a set of culturally important plants—the triad of corn-beans-squash plus the hundreds of companion plants present in traditional Indigenous polyculture milpas. Intercropping can occur within various resilient spatial strategies: linear rows, circular mounds, more random field dispersals, or multiple combinations and sequences thereof. Intercropping on top of mounded sheet layers is an important minimum tillage practice with the right cover crops (such as purslane).
5. *Classification (ethnopedology) and systemic care (ethnoedaphology) of soils*. Understanding the soil types of a given bioregion, and the native plants these favor, is an important step toward food sovereignty. We must work to support the emergence of appropriate place-based material and spiritual practices that include ethical instruction for healing the land and people. Soil is culture, and our elders' understanding of the land as a living organism is a central quality of the deep heritage we must support and teach to the next generations. We must also recognize soil classification as dynamic rather than static. Since anthrosols are transformed through biodynamic and regenerative practices, new soil classification models and ceremonies will surely emerge.
6. *Preparation and application of biodynamic soil treatments* (such as quauhtlalli). The uses of biodynamic preparations and soil treatments are especially vital for repairing damaged landscapes. They are also antecedent practices in our deepest heritage and right livelihoods. Beyond the corn-beans-squash triad is a vast field of knowledge of the allelopathic, medicinal, and biodynamic properties of hundreds of companion plants that can be mixed in potent, concentrated tinctures and compounds and applied to regenerate tired or damaged soils.
7. *Cognitive maps of frost, infiltration, and saturation topographies*. Each bioregion has qualities unique to the watershed—the biota, landforms,

local cultures, and environmental histories which run deeper than the exploits of settler colonial empires that remapped Native territories in acts of violent enclosure and displacement. As we "remap" our homelands, including the gardens, farms, wildlands, and watersheds of our bioregions, we can imagine various types of "storied landscapes," such as soils or areas susceptible to frost; areas where sub-irrigation water returns to in-stream flows or creates springs; or areas prone to the formation of marshy or wetland conditions. These maps will connect us to awareness of the niche-abiding patterns of co-inhabitation while nurturing habitat for wild plants with spiritual and medicinal qualities, since these often thrive in ecological niches that are part of this "storied" landscape.

8. "*Resilient co-inhabitation*," *an Indigenous analogue of adaptive management*. From the vantage point of Original Instructions, the biosphere itself provides the rules. Because these rules are subject to change, we require a constant set of adaptive practices in response to changes in the coupling of social and ecological systems.

Our Indigenous agroecological heritage dates back to well before the arrival of the currently fashionable, modern, and profitable advocates of biodynamics and permaculture. These principles are rooted in a deep agroecological heritage and patterns of ethical instruction that refuse to die out. All these and many more agroecological practices are results of long-established traditions of Indigenous knowledge, belief, and practice in the various centers of origin and diversification of native crop plants like maize. It is time for Indigenous water and land protectors to consider how these principles might inform their own autonomous projects toward strengthening food sovereignty, environmental wellness, and community health.

NOTES

1. *Maíz* is maize, or corn (*Zea mays*); *calabacita* typically refers to gray Mexican summer squash (*Cucurbita pepo*), both squash blossoms and tender squash. *Calabaza* may refer to any among a wide range of pumpkin varieties, generally but not exclusively *Cucurbita moschata* and including a vast range of northern winter varieties (*pepitas* are pumpkin seeds for roasting). *Frijol* can refer to any among thousands of unique local heirloom landrace varieties of the common bean (*Phaseolis vulgaris*); in our case, at home in Laredo, *pinto* is the more frequent name; in Colorado, *bolita*.

Among the Haudenosaunee, these three crops present an exceptional range of full-spectrum heirloom varieties with unique bioregional and distinctive landrace

parent lines. They have therefore long been known as the "Three Sisters." In the Haudenosaunee creation story the Three Sisters are celebrated and enunciated as significant cultural memes grounding the people in a distinct place-based or bio-centric worldview. Beyond the Northeast, Indigenous maize growers and protectors today have widely adopted the term *Three Sisters* since the plants are almost universally viewed as a triad of sacred companions at the center of Indigenous agroecological practices across many nations.

On the centrality of maize in the civilizations of Mexico and Mesoamerica, see Roberto Cintli Rodríguez, *Our Sacred Maíz Is Our Mother: Indigeneity and Belonging in the Americas* (Tucson: University of Arizona Press, 2014); Devon G. Peña, Luz Calvo, Pancho McFarland, and Gabriel R. Valle, eds., *Mexican-Origin Foods, Foodways, and Social Movements: Decolonial Perspectives* (Fayetteville: University of Arkansas Press, 2017), 313–41; 375–82. Indigenous stories and scientific discourses long have celebrated these three companion plants for their medicinal, biodynamic, and allelopathic properties. Among the few studies that have examined all three dimensions, see Jane Mt. Pleasant, "The Three Sisters: Care for the Land and the People," in *Science and Native American Communities: Legacies of Pain*, edited by Keith James (Lincoln: University of Nebraska Press, 2001), 126–34; Mt. Pleasant, "The Iroquois Sustainers: Practices of a Long-Term Agriculture in the Northeast," *Northeast Indian Quarterly* 6, no. 1–2 (1989): 33–39. A more recent Western scientific study of these companion cultivars and their wild relatives can be found in Salvador Montes-Hernández, Laura C. Merrick, and Luis E. Eguiarte, "Maintenance of Spanish (*Cucurbita* spp.) Landrace Diversity by Farmers' Activities in Mexico, *Genetic Resources and Crop Evolution* 52, no. 6 (2005): 697–707. These authors note "the ancestors of maize . . . and common beans . . . have survived until the present, and they occur usually in small populations, grow in sympatry with the domesticated forms . . . two cultivated squash species, *C. argyrosperma* and *C. moschata*, and the wild type *C. argyrosperma* ssp. *sororia* also grow in sympatry (698).

2. Coriander (*Oriandrum sativum* L.), among other aromatic herbs and spices like cumin and clove; and sweet peas (principally *Pisum sativum* L.), among other legumes, were introduced to Mexican cuisine and milpa farming in the mid- to late sixteenth century by settler colonists from Spain. Research on the introduction of these crops to Mexico shows that most have Middle Eastern or North African origins rather than Iberian or European ones. See George W. Hendry, "The Source Literature of Early Plant Introduction into Spanish America, *Agricultural History* 8, no. 2 (1934): 64–71.

3. On the Latourian concept of vibrant matter, see Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham, NC: Duke University Press, 2010). Bennett uses the term "vibrant matter" to refer to more-than-human beings, including landscapes and larger-scaled biophysical Earth systems, as "actants" with agency; this is a concept borrowed from Bruno Latour. Bennett views these more-than-human actants as having an a priori capacity to create the very matter of the world sans and within humanity, leading to changing conditions in how human beings come to experience and perceive variant forms of "nature." In a related vein, Julie Cruikshank recounts the voices of three Native women in the Yukon who "portrayed glaciers as conscious and responsive to

humans. Glaciers, they insisted, are willful, sometimes capricious, easily excited by human intemperance but equally placated by quick-witted human responses"; see Cruikshank, *Do Glaciers Listen? Local Knowledge, Colonial Encounters, and Social Imagination* (Vancouver: University of British Columbia Press, 2005), 8. The parallel to my grandmother's soil knowledge is that I cannot speak of the condition of the soil before our presence, but I can address the condition of the soil now as a quality of my present relationship to the land as a co-actant. Soil is vibrant matter effecting changes in how I relate to the ground I sow.

4. This seems true among all the domesticated species selected to avoid "shattering," which are plants that rely on our sowing, harvesting, selection, and seed-saving to reproduce, as suggested by Carey Fowler and Pat Mooney, *Shattering: Food Politics and the Loss of Genetic Diversity* (Tucson: University of Arizona Press 1990), 14–18.

5. There is a growing scientific literature to support my grandmother's insight that soil health is associated with higher nutrient density in cultivars. For example, see Alexandria Bot and José Benites, "The Importance of Soil Organic Matter: Key to Drought-Resistant Soil and Sustained Food and Production," FAO Soils Bulletin 80 (Rome: Food and Agriculture Organization, 2005), http://www.fao.org/3/a-a0100e.pdf; Donald R. Davis, "Declining Fruit and Vegetable Nutrient Composition: What Is the Evidence?" *HortScience* 44, no. 1 (2009): 15–19; Margo Malone, "Improving the Nutrient Content of Agriculture Crops through Community Ecology," Syracuse University Honors Program Capstone Projects 953 (2016), https://surface.syr.edu/honors_capstone/953; also see the citations in note 19.

6. Ritual kin relations through co-parenthood, or *comadrazgo/compadrazgo*, encompass a wide range of productive and reproductive labor activities and networking practices related to midwifery and related healing traditions, the cultivation of food and medicinal crops, and the care of soil. See, esp., Paloma Martínez-Cruz, "Survivor Woman." in *Women and Knowledge in Mesoamerica: From East L.A. to Anahuac* (Tucson: University of Arizona Press, 2011), 73–95; Irene Lara, "Latina Health Activist-Healers Bridging Body and Spirit," *Women and Therapy* 31, no. 1 (2008): 21–40.

7. On the difference I draw between "wildness" and "wilderness" see the essays in Gavin Van Horn and John Hausdoerffer, eds., *Wildness: Relations of People and Place* (Chicago: University of Chicago Press, 2017). Wildness encompasses the principle of "self-willing" land, an idea that resonates with Bennett's concept of vibrant matter and the Indigenous epistemic frame of "original instructions"; see Devon G. Peña, "The Hummingbird and the Redcap," in *Wildness: Relations of People and Place*, 89–99, esp. 91–95.

8. Ana María L. Velasco Lozano and Debra Nagao, "Mitología y simbolismo de las flores," *Arqueología Mexicana* 78, no. 2 (2006): 28–35. Among the several biodynamic substances produced by the Mexican marigold is alpha-terthienyl, a phototoxin extracted from root biomass. It has been shown to be extremely insecticidal against mosquitoes without affecting beneficial organisms like the ostracod, caddisfly, and *Physa* sp.; Anuj Kumar, Florence V. Dunkel, Matthew J. Broughton, and Shobha Sriharan, "Effect of Root Extracts of Mexican Marigold, *Tagetes minuta* (Asterales: Asteraceae), on Six

Nontarget Aquatic Macroinvertebrates." *Environmental Entomology* 29, no. 2 (2000):140–49, https://academic.oup.com/ee/article/29/2/140/341923. While Kumar and colleagues' study did not address the activity of the phototoxin in soil, it would seem the marigold may repel some insects besides mosquitoes, since other sources note its effectiveness in the control of nematodes; see Maureen Gilmer, "Marigold in the Control of Root-Knot Nematodes," *Orange County Register* (June 10, 2015), https://www.ocregister.com/2015/06/10/plant-marigolds-to-stop-root-knot-nematodes/.

9. The people who settled our acequia community and land grant included *genízaros* and direct descendants of marriages and captives with Jicarilla Apache, Diné, and Pueblo ancestors.

10. The Southern Ute Reservation is located due south of Durango and Pagosa Springs, Colorado, and encompasses an area of montane, riparian, and high desert life zones bordering New Mexico. It is about 150 miles due west of the San Luis Valley and the acequia communities of the Culebra watershed (Sangre de Cristo grant).

11. Peña, "Sodbusters and the 'Native Gaze': Soil Governmentality and Indigenous Knowledge, in *Mexican-Origin Foods, Foodways, and Social Movements*, 343–64. My reference to the governmentality of soil alludes to the idea that the Soil Conservation Service, which is now the Natural Resources and Conservation Service, has a history of imposing a governmental regime that narrowly manages soil conservation programs to serve large-scale corporate farming interests while ignoring and erasing Indigenous needs, knowledge, belief, practice, and traditions. This regime, involving both the soil conservation paradigm and the subjects (farmers) of the managerial regime, largely reflects neoliberal capitalist values.

12. See Gerald Vizenor, *Manifest Manners: Narratives on Postindian Survivance* (Lincoln: University of Nebraska Press, 1999). Vizenor conceptualizes survivance as "an active sense of presence, the continuance of Native stories, not a mere reaction, or a survivable name. Native survivance stories are renunciations of dominance, tragedy and victimry" (vii).

13. For the standard account of the origins of biodynamics, see Jane Hodges Young, "The Ancient Practice of Biodynamic Farming," *Northbay Biz: Napa, Marin, Sonoma*, July 2017, https://goo.gl/fwhL58. All the Indigenous civilizations of North America shared a concern for cosmological forces as pertinent to material conditions and livelihoods and predate Steiner's and other modern Europeans' visions in this manner.

14. For environmental anthropology or ethnoecology (the study of Indigenous knowledge of ecosystems), Harold Conklin's 1954 dissertation research, conducted in collaboration with the Hanunóo agro-forestry farmers in the Philippines, finally challenged the colonial gaze of anthropology writ large by respectfully re-centering local truth claims as conceptual and discursive elements of the culture analyst's own interpretive narrative; see Harold Conklin, *The Relation of Hanunóo Culture to the Plant World* (PhD diss., Yale University, New Haven, CT, 1954).

15. I have in mind here the work of notable interlocutors and permaculture advocates, a large number of them white Australian settlers; see Bill Mollison, *Permaculture: A Designers' Manual* (Berkeley, CA: Ten Speed Press, 1997); David Holmgren,

Permaculture: Principles and Pathways beyond Sustainability (Hepburn, Victoria, Australia: Holmgren Design Services, 2002); and Looby Macnamara, *People and Permaculture* (East Meon, Hampshire, UK: Permanent Publications, 2012). None of these advocates acknowledges or seriously considers the deeper Indigenous (or Aboriginal) bases of the methods, materials, and practices they advocate. This seems like a cautionary example of cultural appropriation without attribution and a faulty lack of relational solidarity with Native sources as living communities. The same is true of their ethical discourses: Holmgren, following Mollison's original declaration, lists three main ethical principles for permaculture practice: "Care for the earth; care for people; set limits to consumption and reproduction and redistribute surplus" (1). Obviously, these principles are widely recognized Indigenous concepts, customs, and practices. The carelessness with which these white authors outline their ethics and practitioner claims is illustrative of a form of epistemic violence and exemplary of the type of settler colonialist mindset I object to, especially since these advocates benefit from abstracting and obscuring Indigenous agroecological knowledge through commercialization and "professionalization." Mollison briefly pays tribute to the "aboriginal tribespeople of Australia" since "for every scientific statement articulated on energy . . . [they] have an equivalent statement on life" (2). I am working on an extended critique of settler colonialism and agroecology in assessing the prospects for "indigenizing" biodynamics and permaculture.

16. Bruno Glaser, Ludwig Haumaier, Georg Guggenberger, and Wolfgang Zech, "The 'Terra Preta' Phenomenon: A Model for Sustainable Agriculture in the Humid Tropics, *Naturwissenschaften* 88 (2001): 37–41, https://goo.gl/n82LH2.

17. D. Peña, *Mexican Americans and the Environment: Tierra y Vida* (Tucson: University of Arizona Press, 2005), 44–57, 81–87; Enrique Salmon, *Eating the Landscape* (Tucson: University of Arizona Press, 2013).

18. Examples of this resurgence include the work of groups like the Traditional Native American Farmers Association, Tesuque Farms Agricultural Initiative, and New Mexico Acequia Association in New Mexico; the Acequia Institute and the Sangre de Cristo Acequia Association in Colorado; Oglala Lakota Cultural and Economic Revitalization Initiative in South Dakota, in affiliation with the Permaculture Guild; the Indigenous Permaculture Convergence at the Woodbine Institute; permaculture design courses on dozens of Native American tribal reservations; numerous projects supported by the First Nations Development Institute; dozens of Indigenous projects like the Braiding the Sacred and Voices of Maize network of more than fifty Native corn growers and protectors; and Alianza Milpa.

19. An early work in this genre of scientific inquiry by Megan Ryan found that most organic farms are not biodynamic over the long term and have similar deficits to conventional farms. However, Ryan does not consider monocrop tendencies in industrial organics, which can create soil health deficits and eliminate wildlife habitat, or how polycultures can improve soil quality; see Megan Ryan, Is an Enhanced Soil Biological Community, Relative to Conventional Neighbours, a Consistent Feature of Alternative (Organic and Biodynamic) Agricultural Systems? *Biological Agriculture and Horticulture*

17, no. 2 (1999): 131–44. Another report found that the fertility of agricultural soils can be maintained over the long term only if plant nutrients removed are replaced in equivalent amounts and if added sources have a higher solubility than those present in the soil; see Holger Kirchmann Lars Bergström, Thomas Kätterer, and Olof Andrén, "Can Organic Crop Production Feed the World?" In *Organic Crop Production: Ambitions and Limitations*, edited by Kirchmann and Bergström (Dordrecht, Netherlands: Springer, 2009), 39–72. Results of one study support use of compost extracts as fertilizer substitutes or supplements, and provide testimonial reports on the growth-promoting effects of compost extracts and occasional superiority of biodynamic compost compared to untreated compost; see Jennifer R. Reeve, Lynne Carpenter-Boggs, John P. Reganold, and Will Brinton, "Influence of Biodynamic Preparations on Compost Development and Resultant Compost Extracts on Wheat Seedling Growth," *Bioresource Technology* 101 (2010): 5658–66, https://doi.org/10.1016/j.biortech.2010.01.144. A detailed study of tomato production examined issues related to healthier, more nutritious outcomes for humans rather than just soil and crop qualities. This meta-analysis of studies on the nutritive quality of tomatoes found that cropping production systems on organic or ecological farms that involved use of fertilizers such as compost, manure, and farmyard waste; minimal chemical pesticides; renewable, non-fossil-fuel inputs; and application of mulches and cover crops all had positive effects on tomato fruit quality and human health-related factors (e.g., density of absorbable lycopene factor). The authors conclude more studies and data are needed to understand how environmental conditions and production practices affect nutritive quality; how agroecological practices affect canopy characteristics and interfere with the effects of light, temperature, and carbon dioxide; and the role of genetic factors (decline of agrobiodiversity, e.g., heirloom alleles, is a serious problem). They also recommend assessing the effects of storage, distribution, and retailing practices (e.g., many packing houses spray supplemental ethylene gas to accelerate ripening). Finally, they point to cultural practices, like picking fruit before it is vine-ripened, which can affect taste and nutritive qualities. See Reza Ghorbani, Vashid Poozesh, and Surur Khorramdel, "Tomato Production for Human Health, Not Only for Food." in *Organic Fertilisation, Soil Quality, and Human Health*, edited by Eric Lichtfouse (Berlin: Springer, 2012), 187–226.

20. *Libellus de Medicinalibus Indorum Herbis* (or Aztec Herbal Manuscript) was composed in 1552 by the Nahua scholar Martín de la Cruz of an elite family from Tlatelolco and translated into Latin by Juan Badianus. The fact that this codex is named after the European translator rather than the Native Mexica author represents a continuation of the original act of epistemic violence that led to the production of the de la Cruz–Badiano, as I prefer to call it. The English translation I use here is William Gates, *An Aztec Herbal: The Classic Codex of 1552* (Mineola, NY: Dover, 1939 [2000]).

21. Rudolph Steiner observed that a compost prepared of stinging nettles is "like an infusion of intelligence for the soil" (100). See Steiner, *Agriculture* (1924 [1958]), published online in 2007, https://goo.gl/EJ2cho.

22. Evidence from experiments suggests some annual and perennial crops have shade effects on bindweed growth. These crops include companion plants in the milpa, such

as legumes (beans) and cereal grains like corn; nettle extract can be sprayed on bindweed; see Laurie Hodges, "Bindweed Identification and Control Options for Organic Production," *Historical Materials from University of Nebraska–Lincoln Extension* 48 (2003), http://digitalcommons.unl.edu/extensionhist/48.

23. For a comprehensive discussion of the medicinal herbs of the Southwest, see Michael Moore, *Los Remedios: Traditional Herbal Remedies of the Southwest* (Santa Fe: Museum of New Mexico Press, 2008). Introduced to Mexico by the Spaniards as a medicinal herb, chamomile (*Matricaria chamomilla*) is today another frequent companion plant in the acequia milpas of the southwestern United States. See Janmejai K. Srivastava, Eswar Shankar, and Sanjay Gupta, "Chamomile: An Herbal Medicine of the Past with a Bright Future, *Molecular Medicine Report* 3, no. 6 (2010): 895–901, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2995283/pdf/nihms250193.pdf for discussion of the biodynamic properties of chamomile associated with the presence of anti-inflammatory phytochemicals, including the flavonoids apigenin, quercetin, and patuletin. Among flavonoids, apigenin is the most promising compound for its medicinal properties; also see Sharol Tilgner, "Medicinal Uses of Herbs Used in Biodynamic Preparations" (Indian Trail, NC: Wise Acre Farms, 2000), goo.gl/RuAZnu. The three plants are all implicated in improving the uptake of essential micronutrients like zinc.

24. Steve Diver, "Biodynamic Farming and Compost Preparation," Alternative Farming Systems Guide *Appropriate Technology Transfer for Rural Advancement* (ATTRA), February 1999, http://www.demeter-usa.org/downloads/Demeter-Science-Biodynamic-Farming-&-Compost.pdf.

25. Miguel A. Escalona Aguilar, "Los tianguis y mercados locales de alimentos ecológicos en México: Su papel en el consumo, la producción y la conservación de la biodiversidad y cultura" (PhD diss., Servicio de Publicaciones de la Universidad de Córdoba, Spain, 2009), 51. See also Victor M. Toledo, "La racionalidad ecológica de la producción campesina," *Agroecología y Desarrollo* 5–6 (1992): n.p., http://www.clades.cl/revistas/5/rev5art3.htm; Victor. M. Toledo and Narciso Barrera-Bassols, *La memoria biocultural: La importancia ecológica de las sabidurías tradicionales* (Barcelona, Spain: Icaria Editorial, 2008), https://www.socla.co/wp-content/uploads/2014/memoria-biocultural.pdf; Moreno D. Escobar, "Valoración campesina de la diversidad del maíz: Estudio de caso de dos comunidades indígenas en Oaxaca, México" (PhD diss., Ciencias Ambientales, Universidad Autónoma de Barcelona, Spain, 2006); Miguel A. Altieri and Clara I. Nicholls, "Applying Agroecological Concepts to Development of Ecologically Based Pest Management Systems," in *Professional Societies and Ecologically Based Pest Management Systems* (Washington, DC: National Research Council, 2000), 14–19.

26. Miguel Altieri, *Agroecology: The Science of Sustainable Agriculture* (Boulder, CO: Westview Press, 1999).

27. Peña, "Sodbusters and the 'Native Gaze.'"

28. A former *mayordomo* (ditch rider) of the San Luis Peoples Ditch, the acequia that we use to irrigate our farm, has P'urhépecha campesino roots.

29. Pablo Alarcón-Cháires, *Etnoecología de los indígenas P'urhépecha: una guía para el análisis de la apropiación de la naturaleza* (Morelia, Michoacán, Mexico: Centro de

Investigaciones en Ecosistemas and UNAM, 2009), 53–54.

30. Sylvia Rodríguez, *Acequia: Water Sharing, Sanctity, and Place* (Santa Fe, NM: School for Advanced Research, 2007), 81–100.

31. Héctor Estrada-Medina, Francisco Bautista, Juan José María Jiménez-Osornio, et al., "Maya and WRB Soil Classification in Yucatan, Mexico: Differences and Similarities," *ISRN Soil Science* Article ID 634260 (2013), http://dx.doi.org/10.1155/2013/634260.

32. After observing the degraded condition of the soil on one neighbor's acequia farm, one of my mentors, Adelmo Kaber, remarked:

> Es puro garrero. Tenían un rancho muy bonito pero se lo robaron y ahora está aquí tratando de producir maíz pero es un garrero, no sirve la tierra, la debe de manejar con mas frijol, habas, y hasta alfalfa, para que le den fuerza a la tierra. Después, pue si bien, el maíz.
>
> > It is a pile of ragged clothes [*garrero*]. They had a beautiful ranch but it was stolen and today here he is trying to produce corn but it [the land] is a pile of ragged clothes, the land does not suffice, he should manage it with more beans, favas, and even alfalfa, so they can give life force to the land. Then, well okay, of course, corn. (Interview with the author, June 5, 2006, San Luis, Colorado)

33. For explication of the differences between relationality and objectivity as epistemological precepts, see Shawn Wilson, *Research Is Ceremony: Indigenous Research Methods* (Winnipeg, Manitoba: Fernwood, 2008).