

BRAIDING SWEETGRASS

INDIGENOUS WISDOM, SCIENTIFIC KNOWLEDGE,
AND THE TEACHINGS OF PLANTS



ROBIN WALL KIMMERER

"A great teacher, her words are a hymn of love to the world." —ELIZABETH GILBERT

ASTERS AND GOLDENROD

The girl in the picture holds a slate with her name and “class of ’75” chalked in, a girl the color of deerskin with long dark hair and inky unreadable eyes that meet yours and won’t look away. I remember that day. I was wearing the new plaid shirt that my parents had given me, an outfit I thought to be the hallmark of all foresters. When I looked back at the photo later in life, it was a puzzle to me. I recall being elated to be going to college, but there is no trace of that in the girl’s face.

Even before I arrived at school, I had all of my answers prepared for the freshman intake interview. I wanted to make a good first impression. There were hardly any women at the forestry school in those days and certainly none who looked like me. The adviser peered at me over his glasses and said, “So, why do you want to major in botany?” His pencil was poised over the registrar’s form.

How could I answer, how could I tell him that I was born a botanist, that I had shoeboxes of seeds and piles of pressed leaves under my bed, that I’d stop my bike along the road to identify a new species, that plants colored my dreams, that the plants had chosen me? So I told him the truth. I was proud of my well-planned answer, its freshman sophistication apparent to anyone, the way it showed that I already knew some plants and their habitats, that I had thought deeply about their nature and was clearly well prepared for college work. I told him that I chose botany because I wanted to learn about why asters and goldenrod looked so beautiful together. I’m sure I was smiling then, in my red plaid shirt.

But he was not. He laid down his pencil as if there was no need to record what I had said. "Miss Wall," he said, fixing me with a disappointed smile, "I must tell you that *that* is not science. That is not at all the sort of thing with which botanists concern themselves." But he promised to put me right. "I'll enroll you in General Botany so you can learn what it is." And so it began.

I like to imagine that they were the first flowers I saw, over my mother's shoulder, as the pink blanket slipped away from my face and their colors flooded my consciousness. I've heard that early experience can attune the brain to certain stimuli, so that they are processed with greater speed and certainty, so that they can be used again and again, so that we remember. Love at first sight. Through cloudy newborn eyes their radiance formed the first botanical synapses in my wide-awake, newborn brain, which until then had encountered only the blurry gentleness of pink faces. I'm guessing all eyes were on me, a little round baby all swaddled in bunting, but mine were on Goldenrod and Asters. I was born to these flowers and they came back for my birthday every year, weaving me into our mutual celebration.

People flock to our hills for the fiery suite of October but they often miss the sublime prelude of September fields. As if harvest time were not enough—peaches, grapes, sweet corn, squash—the fields are also embroidered with drifts of golden yellow and pools of deepest purple, a masterpiece.

If a fountain could jet bouquets of chrome yellow in dazzling arches of chrysanthemum fireworks, that would be Canada Goldenrod. Each three-foot stem is a geyser of tiny gold daisies, ladylike in miniature, exuberant en masse. Where the soil is damp enough, they stand side by side with their perfect counterpart, New England Asters. Not the pale domesticates of the perennial border, the weak sauce of lavender or sky blue, but full-on royal purple that would make a violet shrink. The daisylike fringe of purple petals surrounds a disc as bright as the sun at high noon, a golden-orange pool, just a tantalizing shade

darker than the surrounding goldenrod. Alone, each is a botanical superlative. Together, the visual effect is stunning. Purple and gold, the heraldic colors of the king and queen of the meadow, a regal procession in complementary colors. I just wanted to know why.

Why do they stand beside each other when they could grow alone? Why this particular pair? There are plenty of pinks and whites and blues dotting the fields, so is it only happenstance that the magnificence of purple and gold end up side by side? Einstein himself said that “God doesn’t play dice with the universe.” What is the source of this pattern? Why is the world so beautiful? It could so easily be otherwise: flowers could be ugly to us and still fulfill their own purpose. But they’re not. It seemed like a good question to me.

But my adviser said, “It’s not science,” not what botany was about. I wanted to know why certain stems bent easily for baskets and some would break, why the biggest berries grew in the shade and why they made us medicines, which plants are edible, why those little pink orchids only grow under pines. “Not science,” he said, and he ought to know, sitting in his laboratory, a learned professor of botany. “And if you want to study beauty, you should go to art school.” He reminded me of my deliberations over choosing a college, when I had vacillated between training as a botanist or as a poet. Since everyone told me I couldn’t do both, I’d chosen plants. He told me that science was not about beauty, not about the embrace between plants and humans.

I had no rejoinder; I had made a mistake. There was no fight in me, only embarrassment at my error. I did not have the words for resistance. He signed me up for my classes and I was dismissed to go get my photo taken for registration. I didn’t think about it at the time, but it was happening all over again, an echo of my grandfather’s first day at school, when he was ordered to leave everything—language, culture, family—behind. The professor made me doubt where I came from, what I knew, and claimed that his was the *right* way to think. Only he didn’t cut my hair off.

In moving from a childhood in the woods to the university I had unknowingly shifted between worldviews, from a natural history of

experience, in which I knew plants as teachers and companions to whom I was linked with mutual responsibility, into the realm of science. The questions scientists raised were not “Who are you?” but “What is it?” No one asked plants, “What can you tell us?” The primary question was “How does it work?” The botany I was taught was reductionist, mechanistic, and strictly objective. Plants were reduced to objects; they were not subjects. The way botany was conceived and taught didn’t seem to leave much room for a person who thought the way I did. The only way I could make sense of it was to conclude that the things I had always believed about plants must not be true after all.

That first plant science class was a disaster. I barely scraped by with a C and could not muster much enthusiasm for memorizing the concentrations of essential plant nutrients. There were times when I wanted to quit, but the more I learned, the more fascinated I became with the intricate structures that made up a leaf and the alchemy of photosynthesis. Companionship between asters and goldenrod was never mentioned, but I memorized botanical Latin as if it was poetry, eagerly tossing aside the name “goldenrod” for *Solidago canadensis*. I was mesmerized by plant ecology, evolution, taxonomy, physiology, soils, and fungi. All around me were my good teachers, the plants. I found good mentors, too, warm and kind professors who were doing heart-driven science, whether they could admit it or not. They too were my teachers. And yet there was always something tapping at my shoulder, willing me to turn around. When I did, I did not know how to recognize what stood behind me.

My natural inclination was to see relationships, to seek the threads that connect the world, to join instead of divide. But science is rigorous in separating the observer from the observed, and the observed from the observer. Why two flowers are beautiful together would violate the division necessary for objectivity.

I scarcely doubted the primacy of scientific thought. Following the path of science trained me to separate, to distinguish perception from

physical reality, to atomize complexity into its smallest components, to honor the chain of evidence and logic, to discern one thing from another, to savor the pleasure of precision. The more I did this, the better I got at it, and I was accepted to do graduate work in one of the world's finest botany programs, no doubt on the strength of the letter of recommendation from my adviser, which read, "She's done remarkably well for an Indian girl."

A master's degree, a PhD, and a faculty position followed. I am grateful for the knowledge that was shared with me and deeply privileged to carry the powerful tools of science as a way of engaging the world. It took me to other plant communities, far from the asters and goldenrod. I remember feeling, as a new faculty member, as if I finally understood plants. I too began to teach the mechanics of botany, emulating the approach that I had been taught.

It reminds me of a story told by my friend Holly Youngbear Tibbetts. A plant scientist, armed with his notebooks and equipment, is exploring the rainforests for new botanical discoveries, and he has hired an indigenous guide to lead him. Knowing the scientist's interests, the young guide takes care to point out the interesting species. The botanist looks at him appraisingly, surprised by his capacity. "Well, well, young man, you certainly know the names of a lot of these plants." The guide nods and replies with downcast eyes. "Yes, I have learned the names of all the bushes, but I have yet to learn their songs."

I was teaching the names and ignoring the songs.

When I was in graduate school in Wisconsin, my then husband and I had the good fortune to land jobs as caretakers at the university arboretum. In return for a little house at the edge of the prairie, we had only to make the nighttime rounds, checking that doors and gates were secure before we left the darkness to the crickets. There was just one time that a light was left burning, a door left ajar, in the horticulture garage. There was no mischief, but as my husband checked around, I stood and idly scanned the bulletin board. There was a news

clipping there with a photo of a magnificent American elm, which had just been named the champion for its species, the largest of its kind. It had a name: The Louis Vieux Elm.

My heart began to pound and I knew my world was about to change, for I'd known the name Louis Vieux all my life and here was his face looking at me from a news clipping. He was our Potawatomi grandfather, one who had walked all the way from the Wisconsin forests to the Kansas prairie with my grandma Sha-note. He was a leader, one who took care of the people in their hardship. That garage door was left ajar, that light was left burning, and it shone on the path back home for me. It was the beginning of a long, slow journey back to my people, called out to me by the tree that stood above their bones.

To walk the science path I had stepped off the path of indigenous knowledge. But the world has a way of guiding your steps. Seemingly out of the blue came an invitation to a small gathering of Native elders, to talk about traditional knowledge of plants. One I will never forget—a Navajo woman without a day of university botany training in her life—spoke for hours and I hung on every word. One by one, name by name, she told of the plants in her valley. Where each one lived, when it bloomed, who it liked to live near and all its relationships, who ate it, who lined their nests with its fibers, what kind of medicine it offered. She also shared the stories held by those plants, their origin myths, how they got their names, and what they have to tell us. She spoke of beauty.

Her words were like smelling salts waking me to what I had known back when I was picking strawberries. I realized how shallow my understanding was. Her knowledge was so much deeper and wider and engaged all the human ways of understanding. She could have explained asters and goldenrod. To a new PhD, this was humbling. It was the beginning of my reclaiming that other way of knowing that I had helplessly let science supplant. I felt like a malnourished refugee invited to a feast, the dishes scented with the herbs of home.

I circled right back to where I had begun, to the question of beauty. Back to the questions that science does not ask, not because they aren't

important, but because science as a way of knowing is too narrow for the task. Had my adviser been a better scholar, he would have celebrated my questions, not dismissed them. He offered me only the cliché that beauty is in the eye of the beholder, and since science separates the observer and the observed, by definition beauty could not be a valid scientific question. I should have been told that my questions were bigger than science could touch.

He *was* right about beauty being in the eye of the beholder, especially when it comes to purple and yellow. Color perception in humans relies on banks of specialized receptor cells, the rods and cones in the retina. The job of the cone cells is to absorb light of different wavelengths and pass it on to the brain's visual cortex, where it can be interpreted. The visible light spectrum, the rainbow of colors, is broad, so the most effective means of discerning color is not one generalized jack-of-all-trades cone cell, but rather an array of specialists, each perfectly tuned to absorb certain wavelengths. The human eye has three kinds. One type excels at detecting red and associated wavelengths. One is tuned to blue. The other optimally perceives light of two colors: purple and yellow.

The human eye is superbly equipped to detect these colors and send a signal pulsing to the brain. This doesn't explain why I perceive them as beautiful, but it does explain why that combination gets my undivided attention. I asked my artist buddies about the power of purple and gold, and they sent me right to the color wheel: these two are complementary colors, as different in nature as could be. In composing a palette, putting them together makes each more vivid; just a touch of one will bring out the other. In an 1890 treatise on color perception, Goethe, who was both a scientist and a poet, wrote that "the colors diametrically opposed to each other . . . are those which *reciprocally* evoke each other in the eye." Purple and yellow are a reciprocal pair.

Our eyes are so sensitive to these wavelengths that the cones can get oversaturated and the stimulus pours over onto the other cells. A print-maker I know showed me that if you stare for a long time at a block of

yellow and then shift your gaze to a white sheet of paper, you will see it, for a moment, as violet. This phenomenon—the colored afterimage—occurs because there is energetic reciprocity between purple and yellow pigments, which goldenrod and asters knew well before we did.

If my adviser was correct, the visual effect that so delights a human like me may be irrelevant to the flowers. The real beholder whose eye they hope to catch is a bee bent on pollination. Bees perceive many flowers differently than humans do due to their perception of additional spectra such as ultraviolet radiation. As it turns out, though, goldenrod and asters appear very similarly to bee eyes and human eyes. We both think they're beautiful. Their striking contrast when they grow together makes them the most attractive target in the whole meadow, a beacon for bees. Growing together, both receive more pollinator visits than they would if they were growing alone. It's a testable hypothesis; it's a question of science, a question of art, and a question of beauty.

Why are they beautiful together? It is a phenomenon simultaneously material and spiritual, for which we need all wavelengths, for which we need depth perception. When I stare too long at the world with science eyes, I see an afterimage of traditional knowledge. Might science and traditional knowledge be purple and yellow to one another, might they be goldenrod and asters? We see the world more fully when we use both.

The question of goldenrod and asters was of course just emblematic of what I really wanted to know. It was an architecture of relationships, of connections that I yearned to understand. I wanted to see the shimmering threads that hold it all together. And I wanted to know why we love the world, why the most ordinary scrap of meadow can rock us back on our heels in awe.

When botanists go walking the forests and fields looking for plants, we say we are going on a *foray*. When writers do the same, we should call it a *metaphoray*, and the land is rich in both. We need them both; scientist and poet Jeffrey Burton Russell writes that “as the sign of a deeper truth, metaphor was close to sacrament. Because the vastness

and richness of reality cannot be expressed by the overt sense of a statement alone.”

Native scholar Greg Cajete has written that in indigenous ways of knowing, we understand a thing only when we understand it with all four aspects of our being: mind, body, emotion, and spirit. I came to understand quite sharply when I began my training as a scientist that science privileges only one, possibly two, of those ways of knowing: mind and body. As a young person wanting to know everything about plants, I did not question this. But it is a whole human being who finds the beautiful path.

There was a time when I teetered precariously with an awkward foot in each of two worlds—the scientific and the indigenous. But then I learned to fly. Or at least try. It was the bees that showed me how to move between different flowers—to drink the nectar and gather pollen from both. It is this dance of cross-pollination that can produce a new species of knowledge, a new way of being in the world. After all, there aren’t two worlds, there is just this one good green earth.

That September pairing of purple and gold is lived reciprocity; its wisdom is that the beauty of one is illuminated by the radiance of the other. Science and art, matter and spirit, indigenous knowledge and Western science—can they be goldenrod and asters for each other? When I am in their presence, their beauty asks me for reciprocity, to be the complementary color, to make something beautiful in response.

THE THREE SISTERS

It should be them who tell this story. Corn leaves rustle with a signature sound, a papery conversation with each other and the breeze. On a hot day in July—when the corn can grow six inches in a single day—there is a squeak of internodes expanding, stretching the stem toward the light. Leaves escape their sheaths with a drawn-out creak and sometimes, when all is still, you can hear the sudden pop of ruptured pith when water-filled cells become too large and turgid for the confines of the stem. These are the sounds of being, but they are not the voice.

The beans must make a caressing sound, a tiny hiss as a soft-haired leader twines around the scabrous stem of corn. Surfaces vibrate delicately against each other, tendrils pulse as they cinch around a stem, something only a nearby flea beetle could hear. But this is not the song of beans.

I've lain among ripening pumpkins and heard creaking as the parasol leaves rock back and forth, tethered by their tendrils, wind lifting their edges and easing them down again. A microphone in the hollow of a swelling pumpkin would reveal the pop of seeds expanding and the rush of water filling succulent orange flesh. These are sounds, but not the story. Plants tell their stories not by what they say, but by what they do.

What if you were a teacher but had no voice to speak your knowledge? What if you had no language at all and yet there was something you needed to say? Wouldn't you dance it? Wouldn't you act it out?

Wouldn't your every movement tell the story? In time you would become so eloquent that just to gaze upon you would reveal it all. And so it is with these silent green lives. A sculpture is just a piece of rock with topography hammered out and chiseled in, but that piece of rock can open your heart in a way that makes you different for having seen it. It brings its message without a single word. Not everyone will get it, though; the language of stone is difficult. Rock mumbles. But plants speak in a tongue that every breathing thing can understand. Plants teach in a universal language: food.

Years ago, Awiakta, a Cherokee writer, pressed a small packet into my hand. It was a corn leaf, dry and folded into a pouch, tied with a bit of string. She smiled and warned, "Don't open 'til spring." In May I untie the packet and there is the gift: three seeds. One is a golden triangle, a kernel of corn with a broadly dimpled top that narrows to a hard white tip. The glossy bean is speckled brown, curved and sleek, its inner belly marked with a white eye—the hilum. It slides like a polished stone between my thumb and forefinger, but this is no stone. And there is a pumpkin seed like an oval china dish, its edge crimped shut like a piecrust bulging with filling. I hold in my hand the genius of Indigenous agriculture, the Three Sisters. Together these plants—corn, beans, and squash—feed the people, feed the land, and feed our imaginations, telling us how we might live.

For millennia, from Mexico to Montana, women have mounded up the earth and laid these three seeds in the ground, all in the same square foot of soil. When the colonists on the Massachusetts shore first saw Indigenous gardens, they inferred that the savages did not know how to farm. To their minds, a garden meant straight rows of single species, not a three-dimensional sprawl of abundance. And yet they ate their fill and asked for more, and more again.

Once planted in the May-moist earth, the corn seed takes on water quickly, its seed coat thin and its starchy contents, the endosperm, drawing water to it. The moisture triggers enzymes under the skin that cleave the starch into sugars, fueling the growth of the corn embryo that is nestled in the point of the seed. Thus corn is the first to emerge

from the ground, a slender white spike that greens within hours of finding the light. A single leaf unfurls, and then another. Corn is all alone at first, while the others are getting ready.

Drinking in soil water, the bean seed swells and bursts its speckled coat and sends a rootling down deep in the ground. Only after the root is secure does the stem bend to the shape of a hook and elbow its way above ground. Beans can take their time in finding the light because they are well provisioned: their first leaves were already packaged in the two halves of the bean seed. This pair of fleshy leaves now breaks the soil surface to join the corn, which is already six inches tall.

Pumpkins and squash take their time—they are the slow sister. It may be weeks before the first stems poke up, still caught in their seed coat until the leaves split its seams and break free. I'm told that our ancestors would put the squash seeds in a deerskin bag with a little water or urine a week before planting to try to hurry them along. But each plant has its own pace and the sequence of their germination, their birth order, is important to their relationship and to the success of the crop.

The corn is the firstborn and grows straight and stiff; it is a stem with a lofty goal. Laddering upward, leaf by long-ribbed leaf, it must grow tall quickly. Making a strong stem is its highest priority at first. It needs to be there for its younger sister, the bean. Beans put out a pair of heart-shaped leaves on just a stub of a stem, then another pair, and another, all low to the ground. The bean focuses on leaf growth while the corn concentrates on height. Just about the time that the corn is knee high, the bean shoot changes its mind, as middle children are wont to do. Instead of making leaves, it extends itself into a long vine, a slender green string with a mission. In this teenage phase, hormones set the shoot tip to wandering, inscribing a circle in the air, a process known as circumnutation. The tip can travel a meter in a day, pirouetting in a loopy circle dance until it finds what it's looking for—a corn stem or some other vertical support. Touch receptors along the vine guide it to wrap itself around the corn in a graceful upward spiral. For now, it holds back on making leaves, giving itself over to embracing the corn,

keeping pace with its height growth. Had the corn not started early, the bean vine would strangle it, but if the timing is right, the corn can easily carry the bean.

Meanwhile, the squash, the late bloomer of the family, is steadily extending herself over the ground, moving away from the corn and beans, setting up broad lobed leaves like a stand of umbrellas waving at the ends of hollow petioles. The leaves and vines are distinctly bristly, giving second thoughts to nibbling caterpillars. As the leaves grow wider, they shelter the soil at the base of the corn and beans, keeping moisture in, and other plants out.

Native people speak of this gardening style as the Three Sisters. There are many stories of how they came to be, but they all share the understanding of these plants as women, sisters. Some stories tell of a long winter when the people were dropping from hunger. Three beautiful women came to their dwellings on a snowy night. One was a tall woman dressed all in yellow, with long flowing hair. The second wore green, and the third was robed in orange. The three came inside to shelter by the fire. Food was scarce but the visiting strangers were fed generously, sharing in the little that the people had left. In gratitude for their generosity, the three sisters revealed their true identities—corn, beans, and squash—and gave themselves to the people in a bundle of seeds so that they might never go hungry again.

At the height of the summer, when the days are long and bright, and the thunderers come to soak the ground, the lessons of reciprocity are written clearly in a Three Sisters garden. Together their stems inscribe what looks to me like a blueprint for the world, a map of balance and harmony. The corn stands eight feet tall; rippling green ribbons of leaf curl away from the stem in every direction to catch the sun. No leaf sits directly over the next, so that each can gather light without shading the others. The bean twines around the corn stalk, weaving itself between the leaves of corn, never interfering with their work. In the spaces where corn leaves are not, buds appear on the vining bean and expand into outstretched leaves and clusters of fragrant flowers. The bean leaves droop and are held close to the stem of the corn. Spread

around the feet of the corn and beans is a carpet of big broad squash leaves that intercept the light that falls among the pillars of corn. Their layered spacing uses the light, a gift from the sun, efficiently, with no waste. The organic symmetry of forms belongs together; the placement of every leaf, the harmony of shapes speak their message. Respect one another, support one another, bring your gift to the world and receive the gifts of others, and there will be enough for all.

By late summer, the beans hang in heavy clusters of smooth green pods, ears of corn angle out from the stalk, fattening in the sunshine, and pumpkins swell at your feet. Acre for acre, a Three Sisters garden yields more food than if you grew each of the sisters alone.

You can tell they are sisters: one twines easily around the other in relaxed embrace while the sweet baby sister lolls at their feet, close, but not too close—cooperating, not competing. Seems to me I've seen this before in human families, in the interplay of sisters. After all, there are three girls in my family. The firstborn girl knows that she is clearly in charge; tall and direct, upright and efficient, she creates the template for everyone else to follow. That's the corn sister. There's not room for more than one corn woman in the same house, so the middle sister is likely to adapt in different ways. This bean girl learns to be flexible, adaptable, to find a way around the dominant structure to get the light that she needs. The sweet baby sister is free to choose a different path, as expectations have already been fulfilled. Well grounded, she has nothing to prove and finds her own way, a way that contributes to the good of the whole.

Without the corn's support, the beans would be an unruly tangle on the ground, vulnerable to bean-hungry predators. It might seem as if she is taking a free ride in this garden, benefiting from the corn's height and the squash's shade, but by the rules of reciprocity none can take more than she gives. The corn takes care of making light available; the squash reduces weeds. What about the beans? To see her gift you have to look underground.

The sisters cooperate above ground with the placement of their leaves, carefully avoiding one another's space. The same is true below

ground. Corn is classified as a monocot, basically an overgrown grass, so its roots are fine and fibrous. With the soil shaken off, they look like a stringy mop head at the end of a cornstalk handle. They don't go very deep at all; instead they make a shallow network, calling first dibs on incoming rain. After they've had their drink, the water descends out of reach of the corn roots. As the water goes deeper, the deep taproots of the bean are poised there to absorb it. The squash finds its share by moving away from the others. Wherever a squash stem touches soil, it can put out a tuft of adventitious roots, collecting water far from the corn and bean roots. They share the soil by the same techniques that they share the light, leaving enough for everyone.

But there is one thing they all need that is always in short supply: nitrogen. That nitrogen should be the factor that limits growth is an ecological paradox: fully 78 percent of the atmosphere is nitrogen gas. The problem is that most plants simply can't use atmospheric nitrogen. They need mineral nitrogen, nitrate or ammonium. The nitrogen in the atmosphere might as well be food locked away in full sight of a starving person. But there are ways to transform that nitrogen, and one of the best ways is named "beans."

Beans are members of the legume family, which has the remarkable ability to take nitrogen from the atmosphere and turn it into usable nutrients. But they don't do it alone. My students often run to me with a handful of roots from a bean they've unearthed, with little white balls clinging to strands of root. "Is this a disease?" they ask. "Is something wrong with these roots?" In fact, I reply, there's something very right.

These glistening nodules house the *Rhizobium* bacteria, the nitrogen fixers. *Rhizobium* can only convert nitrogen under a special set of circumstances. Its catalytic enzymes will not work in the presence of oxygen. Since an average handful of soil is more than 50 percent air space, the *Rhizobium* needs a refuge in order to do its work. Happily, the bean obliges. When a bean root meets a microscopic rod of *Rhizobium* underground, chemical communications are exchanged and a deal is negotiated. The bean will grow an oxygen-free nodule to house the bacterium and, in return, the bacterium shares its

nitrogen with the plant. Together, they create nitrogen fertilizer that enters the soil and fuels the growth of the corn and the squash, too. There are layers upon layers of reciprocity in this garden: between the bean and the bacterium, the bean and the corn, the corn and the squash, and, ultimately, with the people.

It's tempting to imagine that these three are deliberate in working together, and perhaps they are. But the beauty of the partnership is that each plant does what it does in order to increase its own growth. But as it happens, when the individuals flourish, so does the whole.

The way of the Three Sisters reminds me of one of the basic teachings of our people. The most important thing each of us can know is our unique gift and how to use it in the world. Individuality is cherished and nurtured, because, in order for the whole to flourish, each of us has to be strong in who we are and carry our gifts with conviction, so they can be shared with others. Being among the sisters provides a visible manifestation of what a community can become when its members understand and share their gifts. In reciprocity, we fill our spirits as well as our bellies.

For years, I taught General Botany in a lecture hall with slides and diagrams and stories of plants that could not fail to inflame the enthusiasm of eighteen-year-olds for the marvels of photosynthesis. How could they be anything but elated to learn how roots find their way through the soil, sitting on the edge of their seats waiting to hear more about pollen? The sea of blank looks suggested that most of them found this as interesting as, literally, watching grass grow. When I would wax eloquent about the grace with which a bean seedling pushes its way up in the spring, the first row would eagerly nod their heads and raise their hands while the rest of the class slept.

In a fit of frustration, I asked for a show of hands: "How many of you have ever grown anything?" Every hand in the front row went up, and there were a few halfhearted waves from the back from someone whose mother had an African violet that had died a withering death.

Suddenly I understood their boredom. I was teaching from memory, drawing on images of plant lives that I had witnessed over the years. The green images I thought we shared as human beings were not theirs, thanks to the supplanting of gardens by supermarkets. The front-row students had seen these things as well and wanted to know how such everyday miracles were possible. But most of the class had no experience of seeds and soil, had never watched a flower transform itself into an apple. They needed a new teacher.

And so now each fall I begin my class in a garden, where they have the best teachers I know, three beautiful sisters. For a whole September afternoon they sit with the Three Sisters. They measure yield and growth and get to know the anatomy of the plants who feed them. I ask them first to just look. They observe and draw the way the three live in relationship. One of my students is an artist, and the more she looks the more excited she becomes. "Look at the composition," she says. "It's just like our art teacher described the elements of design in studio today. There is unity, balance, color. It's perfect." I look at the sketch in her notebook, and she's seeing it like a painting. Long leaves, round leaves, lobed and smooth, yellow, orange, tan on a matrix of green. "See the way it works? Corn is the vertical element, squash horizontal, and it's all tied together with these curvilinear vines, the beans. Ravishing," she claims with a flourish.

One of the girls is dressed for allure that might work in a dance club, but not on a botany field trip. She has avoided any contact with the dirt so far. To ease her into the work, I suggest that she take the relatively clean task of simply following a squash vine from one end to another and diagramming the flowers. Way out at the young tip of the vine are orange squash blossoms as ruffled and splashy as her skirt. I point out the swollen ovary of the flower after it has been pollinated. Such is the outcome of successful seduction. Mincing carefully in her heels, she follows the vine back toward its source; the older flowers have wilted and a tiny little squash has appeared where the flower's pistil had been. Closer and closer to the plant, the squashes become larger, from a penny-size nub with flower still attached, to the full ripeness of

a ten-inch squash. It's like watching a pregnancy unfold. Together we pick a ripe butternut squash and slice it open so she can see the seeds in the cavity within.

"You mean a squash comes from a flower?" she says incredulously, seeing the progression along the vine. "I love this kind of squash at Thanksgiving."

"Yes," I tell her, "this is the ripened ovary of that first flower."

Her eyes widen in shock. "You mean all these years I've been eating ovaries? Blech—I'll never eat a squash again."

There is an earthy sexuality to a garden, and most of the students get drawn in to the revelation of fruit. I have them carefully open an ear of corn without disturbing the corn silk that plumes from the end. First the coarse outer husks are pulled away, then layer after layer of inner leaves, each thinner than the next until the last layer is exposed, so thin and tightly pressed to the corn that the shape of the kernels show through it. As we draw aside the last layer, the sweet milky scent of corn rises from the exposed ear, rows upon rows of round yellow kernels. We look closely and follow an individual strand of corn silk. Outside the husk it is brown and curly, but inside it is colorless and crisply succulent, as if filled with water. Each little strand of silk connects a different kernel inside the husk to the world outside.

A corncob is an ingenious sort of flower in which the silk is a greatly elongated flower pistil. One end of the silk waves in the breeze to collect pollen, while the other end attaches to the ovary. The silk is the water-filled conduit for sperm released from the pollen grains caught there. The corn sperm swim down the silken tube to the milky-white kernel—the ovary. Only when the corn kernels are so fertilized will they grow plump and yellow. A corncob is the mother of hundreds, as many children as there are kernels, each with potentially a different father. Is it any wonder she is called the Corn Mother?

Beans too grow like babies in the womb. The students are contentedly munching fresh pole beans. I ask them to first open a slender pod, to see what they're eating. Jed slits a pod with his thumbnail and opens it. There they are, bean babies, ten in a row. Each little beanlet is

attached to the pod by a fragile green cord, the funiculus. Just a few millimeters long, it is the analog to the human umbilical cord. Through this cord, the mother plant nourishes her growing offspring. The students crowd around to look. Jed asks, "Does that mean a bean has a belly button?" Everybody laughs, but the answer is right there. Every bean has a little scar from the funiculus, a colored spot on its seed coat, the hilum. Every bean does have a belly button. These plant mothers feed us and leave their children behind as seeds, to feed us again and again.

In August, I like to have a Three Sisters potluck. I spread tablecloths on the tables beneath the maples and stuff bouquets of wildflowers in canning jars on every table. Then my friends start to arrive, each with a dish or a basket. The tables fill up with trays of golden cornbread, three-bean salad, round brown bean cakes, black bean chili, and summer squash casserole. My friend Lee brings a platter of small pumpkins stuffed with cheesy polenta. There's a steaming pot of Three Sisters soup, all green and yellow, with slices of summer squash floating in the broth.

As if there wasn't enough to eat already, our ritual is to go to the garden together, once everyone arrives, and pick some more. The corn ears fill a bushel basket. The kids are delegated to shuck the corn while parents fill a bowl with new green beans and the littlest kids peek under prickly leaves looking for squash blossoms. We carefully spoon a batter of cheese and cornmeal into the orange throat of each flower, close it up, and fry it until it's crisp. They disappear from the plate as fast as we can make them.

The genius of the Three Sisters lies not only in the process by which they grow, but also in the complementarity of the three species on the kitchen table. They taste good together, and the Three Sisters also form a nutritional triad that can sustain a people. Corn, in all its guises, is a superb form of starch. All summer, the corn turns sunshine into carbohydrate, so that all winter, people can have food energy. But a human cannot subsist on corn alone; it is not nutritionally complete.

Just as the bean complements the corn in the garden, it collaborates in the diet as well. By virtue of their nitrogen-fixing capacity, beans are high in protein and fill in the nutritional gaps left by corn. A person can live well on a diet of beans and corn; neither alone would suffice. But neither beans nor corn have the vitamins that squash provide in their carotene-rich flesh. Together, they are once again greater than alone.

After dinner we are too full for dessert. There is a dish of Indian pudding and maple corncakes waiting for us, but we just sit and look out over the valley while the kids run around. The land below us is mostly planted to corn, the long rectangular fields butting right up against the woodlots. In the afternoon light, the rows of corn throw shadows on one another, outlining the contours of the hill. From a distance they look like lines of text on a page, long lines of green writing across the hillside. The truth of our relationship with the soil is written more clearly on the land than in any book. I read across that hill a story about people who value uniformity and the efficiency it yields, a story in which the land is shaped for the convenience of machines and the demands of a market.

In Indigenous agriculture, the practice is to modify the plants to fit the land. As a result, there are many varieties of corn domesticated by our ancestors, all adapted to grow in many different places. Modern agriculture, with its big engines and fossil fuels, took the opposite approach: modify the land to fit the plants, which are frighteningly similar clones.

Once you know corn as a sister, it's hard to unknow it. But the long ranks of corn in the conventional fields seem like a different being altogether. The relationships disappear and individuals are lost in anonymity. You can hardly recognize a beloved face lost in a uniformed crowd. These acres are beautiful in their own way, but after the companionship of a Three Sisters garden, I wonder if they're lonely.

There must be millions of corn plants out there, standing shoulder to shoulder, with no beans, no squash, and scarcely a weed in sight. These are my neighbor's fields, and I've seen the many passes with the tractor that produce such a "clean" field. Tank sprayers on the tractor

have delivered applications of fertilizer; you can smell it in the spring as it drifts off the fields. A dose of ammonium nitrate substitutes for the partnership of a bean. And the tractors return with herbicides to suppress weeds in lieu of squash leaves.

There were certainly bugs and weeds back when these valleys were Three Sisters gardens, and yet they flourished without insecticides. Polycultures—fields with many species of plants—are less susceptible to pest outbreaks than monocultures. The diversity of plant forms provides habitats for a wide array of insects. Some, like corn worms and bean beetles and squash borers, are there with the intent of feeding on the crop. But the diversity of plants also creates habitat for insects who eat the crop eaters. Predatory beetles and parasitic wasps coexist with the garden and keep the crop eaters under control. More than people are fed by this garden, but there is enough to go around.

The Three Sisters offer us a new metaphor for an emerging relationship between Indigenous knowledge and Western science, both of which are rooted in the earth. I think of the corn as traditional ecological knowledge, the physical and spiritual framework that can guide the curious bean of science, which twines like a double helix. The squash creates the ethical habitat for coexistence and mutual flourishing. I envision a time when the intellectual monoculture of science will be replaced with a polyculture of complementary knowledges. And so all may be fed.

Fran brings out a bowl of whipped cream for the Indian pudding. We spoon up the soft custard, rich with molasses and cornmeal, and watch the light fade on the fields. There's a squash pie, too. By this feast, I want the Three Sisters to know that we've heard their story. Use your gift to take care of each other, work together, and all will be fed, they say.

They've all brought their gifts to this table, but they've not done it alone. They remind us that there is another partner in the symbiosis. She is sitting here at the table and across the valley in the farmhouse, too. She's the one who noticed the ways of each species and imagined how they might live together. Perhaps we should consider this a Four Sisters garden, for the planter is also an essential partner. It is she who

turns up the soil, she who scares away the crows, and she who pushes seeds into the soil. We are the planters, the ones who clear the land, pull the weeds, and pick the bugs; we save the seeds over winter and plant them again next spring. We are midwives to their gifts. We cannot live without them, but it's also true that they cannot live without us. Corn, beans, and squash are fully domesticated; they rely on us to create the conditions under which they can grow. We too are part of the reciprocity. They can't meet their responsibilities unless we meet ours.

Of all the wise teachers who have come into my life, none are more eloquent than these, who wordlessly in leaf and vine embody the knowledge of relationship. Alone, a bean is just a vine, squash an oversize leaf. Only when standing together with corn does a whole emerge which transcends the individual. The gifts of each are more fully expressed when they are nurtured together than alone. In ripe ears and swelling fruit, they counsel us that all gifts are multiplied in relationship. This is how the world keeps going.