

Rooted in the World

Craig Holdrege

*Do you seek the highest, the greatest?
The plant can be your teacher:
what it is without volition
you can be willfully—that's it!*
— Friedrich Schiller

*This article is an excerpt from a chapter of the book *Thinking Like a Plant: A Living Science for Life* (Lindisfarne Books, 2013). The book is written as a practical guide for learning how to think the way nature lives. While this excerpt can stand by itself, we hope it piques sufficient interest to read the whole book.*

When an acorn falls onto the ground in the autumn, it comes to rest in a particular location. It may be eaten soon thereafter by a mouse. It may rot in the autumn rains. A squirrel might pick it up and carry it in its cheek to another part of the woods, dig a hole, and place it there. Even in this case the acorn's fate is still open—whether the squirrel digs it out and feeds on it in the winter, whether it decomposes, or whether it germinates and grows into an oak sapling.

Before germination, the life of the plant is encapsulated in the protective sheath of the seed (and in many cases, of the fruit as well). This stage is life held back—full of possibilities yet to be realized—until the seed gives up its encapsulated state and opens itself to the environment. The opening often has preconditions: there are seeds that need a period of dormancy before they will germinate; others need to germinate soon after separation from the mother plant, otherwise they die; some seeds need to go through a period of cold before germination, while others even need to experience extreme heat (fire) to allow

them to germinate. Whatever the specific and intriguing prerequisites may be for germination, the movement from the state of encapsulation to the actual unfolding and development of the seedling is a significant moment in the life of the plant. The plant's life can unfold only when it gives up being an object, when it grows out into and connects with the world in such a way that the world supports its further development. It cannot be a plant—which means to be a becoming being—unless it gives up its isolation and draws from the world.

Seeds are the most compact, solid, and, from an external perspective, the most self-enclosed, object-like stage in the life of the plant. Seeds are drier than other plant parts, and a key moment in the opening to the environment occurs when the seed casing allows water to penetrate into the seed, tissue swells, and the casing breaks open. The seed thereby forms a connection and continuity with the fluid environment. The water also allows its physiology to become active—what was solid as stored nutrients becomes fluid, and growth begins. Since water is the medium of active life processes, it is perhaps not surprising that the generative (meristematic) tissues of the plant consist of 80 to 90% water; even wood consists of about 50% water. (On average, only around 2% of the live weight of a plant consists of what was taken as dissolved minerals from the soil.)

Regardless of the position in which the seed finds itself in or on the soil, when it germinates the seedling begins to orient itself in the environment: the root grows downward into the soil and the shoot grows in the opposite direction, away from the earth into the light and air. In growing straight downward, a primary root orients toward the center of

the earth. We can imagine the taproots of all the plants on the planet as growing toward this center. So when the plant develops one pole in its roots that grow into the earth and another pole in its shoot that grows away from earth, it is placing itself into a huge planetary context. But it is also relating to its immediate, specific environment. Whether the seed germinates at all and how it develops depend on what it meets when growing out into the environment with its particular and ever-changing constellation of light, wind, moisture, animal life, soil consistency and chemistry, and so forth. As plant ecologist Walter Larcher remarks, “The process of emergence and the seedling stage represent a particularly sensitive period” in the life of the plant. (2003, p.312)

The foremost activity in early development is rooting—the plant connects with and anchors itself in the soil. The root of the bur oak seedling grows rapidly into the soil (see Figure 1).

Shoot growth follows. Root growth draws from the reserves of the past season that

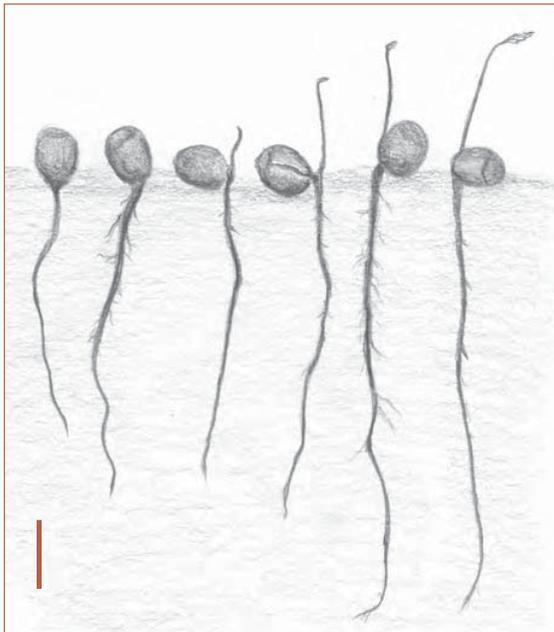


Figure 1. Bur oak (*Quercus macrocarpa*) seedlings, showing development following germination; scale bar = 1 inch. (after Holch 1931, p.268)

have been stored as nutrients in the seed. It is important, when trying to picture growing roots, to realize that roots grow near their tips and that roots grow throughout the life of the plant. The primary downward growth of the primary root is initiated immediately behind a protective cap at the tip, and the same is the case for the lateral roots that develop over time. So, in imagining the development of the rooting body, we have to picture generative activity at the periphery, in all the root tips. Just behind the tips, roots develop fine root hairs that are the active interface with the environment. These increase the surface of the roots immensely and take in water and dissolved minerals. In this way the plant establishes intimate contact with its soil environment.

Most plants not only open themselves to interaction with the soil directly but also join together with fungi to form a symbiosis that extends the plant’s life even farther into the soil environment. Through these mycorrhizal fungi, the roots’ absorbing surface for water and minerals is increased significantly and in return the fungi receive organic nutrients from the plant.

The roots are not only active in growth and taking up moisture and minerals; they also secrete into the soil substances such as acids, an activity that chemically alters the soil and allows the plant to access minerals it would otherwise simply pass by.

In growing upward into the light and air, the shoot-pole of the plant opens itself in a different way to different qualities of the environment. In contrast to the dense medium into which a plant roots itself, the shoot grows upward into the more rarified environment of light and air. In so doing it forms leaves that spread out as surfaces into this environment. Through its leaves the plant bathes itself in the light and air. The leaves have tiny pores—usually on the underside—through which air enters and departs. The air circulates through air-filled spaces in the leaves and

becomes part of the plant's "food." In the presence of light, the stems and leaves become green, and in greening they can utilize the light of the sun for the plant's growth and development. Through light, carbon dioxide from the air, water, and a small amount of dissolved minerals from the soil, the plant builds up its own body.

We should take a moment to appreciate this remarkable capacity of the plant. The plant can make its own living substance on the basis of light, air, water, and small amounts of dissolved minerals. What a contrast to our animal way of life, which demands we live from already existing plant or animal substance. How different it would be if, to have a meal, we could go out and expose ourselves to the sun for a number of hours while drinking lightly salted water! But that is not how we are organized; we are more enclosed from the immediate environment, while plants have

"an open form through which the organism in all its manifestations of life is directly integrated into its environment." (Plessner, 1975, p.219) By taking root in the earth, plants become in a way more dependent on their environment and more vulnerable than a roaming, self-mobile animal. But this dependency is the flip side of openness to the environment and the plant's ability to engage with that environment and to do what animals cannot, namely create, essentially out of air and water, living substance.

Figure 2 shows three representative bur oak saplings that grew in three different environments within a quarter of a mile of one another in Eastern Nebraska.

The soil was removed from the roots and the plants were drawn at the end of the first growing season. In all cases the soil was similar—"a fine silt loam known as loess." (p.263) The plant on the left (A) was growing at the top of a hillside that had previously been cleared for cultivation and subsequently supported some prairie grasses; the acorn from which this seedling grew was planted in an area free of vegetation. It grew rapidly and deeply in this sunny environment with the rich, relatively dry prairie soil. At the end of the season the roots had penetrated the soil to a depth of five feet. Other bur oak acorns were planted nearby in a moister and shadier oak-hickory forest that spread out along a southwest-facing slope (B). Here the tap root grew little more than a foot into the soil and formed proportionately fewer side roots. Finally, when the bur oak acorns germinated and grew in a darker, still moister linden (basswood) forest on a north-facing slope, they grew even more slowly and branched little (C). In all cases the above-ground part of the plants remained shorter than the rooting body. But above-ground growth was clearly correlated with root growth: the large-rooted plant also formed a longer main stem (what would become the trunk) with more leaves than the seedlings growing in the shadier, moister conditions.

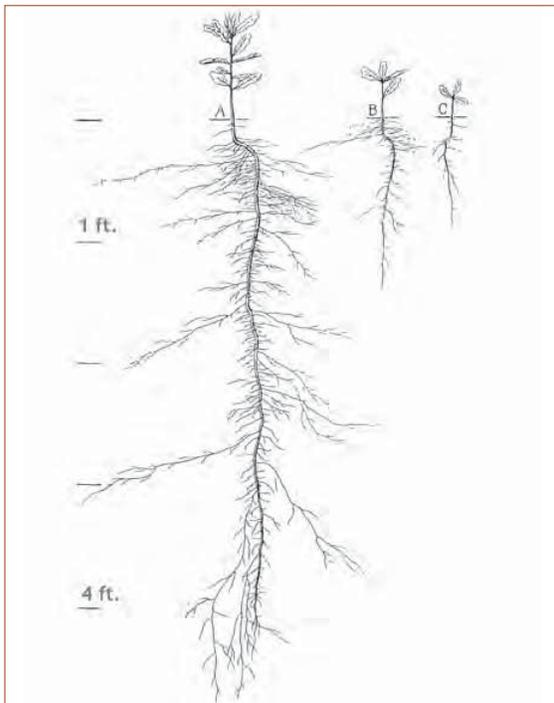


Figure 2. Three different bur oak (*Quercus macrocarpa*) saplings growing in different environments, shown at the end of the first season of growth. (after Holch 1931, p.274)

What this example shows vividly is that by living its life through connecting with a specific place in the world, the plant opens itself to the conditions of that place and interacts with them. Because the plant is an open, interactive being, the world it interacts with also becomes embodied in the plant's form and function. In opening itself to what comes to it from the environment and expanding out into that environment, it takes up an active relation to its surroundings, which then become the plant's environment. Place is not only the "location" that can be precisely defined in terms of longitude and latitude. For a plant, place is a web of relations that becomes manifest through the plant's life, substance, and form. The place-as-environment is what allows the plant—in a dynamic sense—to live; it is what the plant interacts with, it provides the plant with what it needs to live, and at the same time it is changed by the life of the plant.

Already in this brief consideration of plant germination and seedling development we see essential and intertwined qualities of plant life: how it embeds itself in a place; how it opens itself to the environment in which it grows; how it transforms itself as it develops from one state to a next while maintaining overall coherence of the organism; how plasticity allows it to develop in relation to particular environmental conditions; how it embodies the environment in its forms and functions; how it extends beyond itself as a bounded body (think of the mycorrhizal symbiosis) and is a member of a larger living context. Here I want to focus on how we can learn from the plant as a creature of place and from its remarkable openness to its environment in relation to the question: how can we as human beings develop a more living relation to the world?

Becoming Rooted—Perception

It seems as if the day was not wholly profane, in which we have given heed to some natural object. The fall of snowflakes in a still air, preserving to each crystal its perfect form; the blowing of sleet over a wide sheet of water, and over plains, the waving rye-field, the mimic waving of acres of houstonia, whose innumerable florets whiten and ripple before the eye; the reflections of trees and flowers in glassy lakes; the musical steaming odorous south wind, which converts all trees to windharps; the crackling and spurting of hemlock in the flames; or of pine logs, which yield glory to the walls and faces in the sitting-room—these are the music and pictures of the most ancient religion. — Ralph Waldo Emerson, from his 1844 essay "Nature" (1990, p.312)

For a plant, place is a web of relations that becomes manifest through the plant's life, substance, and form.

In these descriptions Emerson shows us that he has "given heed" to the world around him. Actually, to say "around" him is not correct. In perceiving these occurrences he was out with them and took them in; he participated in them. Only then could he describe his experiences of nature so specifically as moving, unfolding processes. In such meetings with the sense world, Emerson experienced something deep—the day is not "wholly profane," and he intimates an "ancient religion," a reconnecting with the roots of existence.

Most of us have experienced immediate and deeply enlivening meetings with the world—the smile of a young child; the rainbow arching across the light-bathed sky; the glowing red and orange clouds of a sunset; the waves building, breaking, crashing, and running up onto the beach. Such experiences are powerful and yet fleeting; we know ourselves to be affected by them—we have met something and been nourished by something greater than

ourselves. The experiences I have mentioned are special ones; they are not necessarily day-to-day occurrences. And yet, most of the waking day we are in the process of perceiving in some way or another.

But everyday experience becomes “merely everyday” and loses vibrancy inasmuch as it shrinks into intellectual thoughts, interpretations, biases, and categorizations of experience. Often we notice something only insofar as we already know it. I see a “dandelion,” but how much of its radiant yellow do I really take in and acknowledge? I see the “pond,” but I don’t notice the undulating waves or the reflections of the trees and the sky quivering on its surface and extending into its depths. In one important way our experience is deadened because our perception has narrowed to what we already know. The world becomes prosaic, a world of things that is scarcely alive with the music of a resounding world.

A plant opens itself to its environment as a prerequisite for unfolding its life. It puts itself out into the environment. This openness to the environment does not end once it has germinated and established itself as a seedling. The roots continue to grow and near the tips remain in active interplay with the environment. The leaves spread out, new ones develop, and interactions with light and air do not cease. As vital organs the roots and leaves don’t stop being open and close off from the environment, saying, physiologically, “We’ve had enough interaction.” Instead, the plant’s openness to the environment entails initial receptivity, the activity of expanding out and ramifying into the environment, and the ability to remain

Everyday experience becomes “merely everyday” and loses vibrancy inasmuch as it shrinks into intellectual thoughts, interpretations, biases, and categorizations of experience.

A prerequisite for gaining a living relation to the world as human beings is the ability to open ourselves through attentive perception.

receptive as it continues to interact with the environment.

These are also the fundamental gestures of human perception. When I am immersed in thought and then a pileated woodpecker hammers into a tree in the nearby woods, my attention is drawn out. I live for a moment in the sound and in its reverberation through the trees. In being in the sound I am receptive. In fact, at that moment there is no “I am here” and “the bird is over there.” There is simply the sounding in which I am participating. I am changed and grow richer through this experience.

I suggest that a prerequisite for gaining a living relation to the world as human beings is the ability to open ourselves through attentive perception. This living relation begins when we go out, actively and yet in the mode of receptivity, take in, and then engage with what we discover. In the process we become beings of place, even if we are on the move. We are attending to and taking in some of what the world offers up. In contrast, we are placeless when we are caught up with or consumed by ourselves, when we notice only what we have known before. If we want to open ourselves and root ourselves in the world in a living way, we need to develop pathways to get out into experience, to become more conscious of immediate experience, and to learn to work with our ideas in such a way that they do not place barriers between ourselves and the richness of the world.

So a key issue is: How can we become more open and remain open to the richness of the world? Can we learn from the plant a way of being and, to paraphrase Schiller, do willfully

what it does organically? This demands a kind of active wakefulness on our part to “be there.” Or we could say, developing presence of mind as a kind of peripheral attentiveness, a readiness to take in. This is no simple matter and certainly, for me, not a given. It is a skill to be developed.

Into the Phenomena

Many weeklong summer courses at The Nature Institute include plant study. One of the first observational exercises we carry out is the following. We go outside and I ask everyone—twelve to twenty participants—to look at a particular species of plant. I have selected the plant beforehand, one that is flowering and can be found easily in fields or along roadside edges. We walk around and see where it is growing. I ask everyone to take a few minutes, look at the plant and its surroundings, and then pick one specimen to bring inside. Back inside, we sit in a circle, each person with his or her plant. I give some guidelines for our observational process: We will go around the circle and each person will describe an observation of the plant. I request that descriptions be kept fairly brief, so that everyone gets a chance to share observations with the others. I ask that we try not to repeat what others have said, a suggestion that encourages mutual listening. I also request that those participants who may know botanical terms use them only if everyone else can follow the description. Finally, I say that we are not concerned here with explanations, causes, or models. We are not asking “why” questions; we simply want to take in and describe what the plant has to offer.

So we describe, moving from the bottom to the top of the plant. I will not try to reconstruct the whole process, but just give a few examples.

It is a cathartic practice to step out of everyday habits and simply give one’s full attention and time to something one would normally, at best, take in only at a glance.

A person is looking at the lower part of the stem and describes the clear transition between the whitish root stalk and the upright stem, which at its base is purplish and then turns green. Someone else describes the stoutness of the stem and the fine hairs that are mainly present along the slight vertical ridges running along it. Another person describes the oval shape of the lower leaves with their basically smooth margin, and notes the marked veins, especially visible on the leaf’s underside. You can imagine that with such detailed observations and descriptions, we are carefully attending to what can be seen, felt, and smelled on the plant. We might go around the circle

two or three times until we have a sense that we’ve attended to the different features of the plant. Such a process takes at least an hour if not more. Sometimes it will be continued the next day.

Although deceptively simple, this process yields many fruits. First, and perhaps foremost, it is a cathartic practice to step out of everyday habits and simply give one’s full attention and time to something one would normally, at best, take in only at a glance. It helps us realize that we almost never look at things in a careful and detailed way. How often we gloss over things! Moreover, we are impressed by the plant in all its detail, pattern, and variability. In one course we studied common milkweed, and one person wrote in her evaluation: “I always look at milkweed differently now. I had the profound experience that, even as a total novice in the life sciences, I could, through attentiveness to the natural world around me, come to know it better.” This can happen with the most inconspicuous weed. By looking carefully we take the plant seriously—we turn our unencumbered attention toward it. We see the plant as something in its own right and learn to value it for its own sake. As one course

participant remarked, “I will never walk past a daisy the same way!”

If we were to look at the plant from too narrow a perspective, this realization might well not occur. If we were interested, say, only in what medicinal properties a plant has, we could get a quick answer from an expert or a book. But we are not carrying out a question-and-answer session with the plant. Instead, we are taking the time to perceive, to dwell with the plant and its features.

In this exercise we also notice that there is no natural end to observing. There is—even if we don’t dissect, use microscopes, or perform biochemical analyses—always something more to see, smell, or touch. In this sense, the perceptual world has an endless richness of detail and pattern to disclose. It is only we who choose to stop perceiving at some point. For most people this discovery is a kind of “aha” experience. We get a glimpse of what the philosopher Maurice Merleau-Ponty calls the “hidden and inexhaustible richness” of the sense world. (1969, p.139) Reflecting on a weeklong course, a participant wrote: “Now I understand that the course is really about us, *Homo pretentious*, and the plants are what we work with because they’re accessible, compliant, free and easy, and yet perfectly capable of revealing Nature in full glory to all who care to look. One of my chief impressions of the week is that almost any small bit of Nature will do the job.”

Something else is remarkable in the process of group observation. We notice how differently people perceive and describe. Everyone in the circle realizes that, alone, he or she would not have seen nearly as much. Our senses are opened and directed in new ways by what others perceive and comment on. Some people have an ability to see more and more within a detail others don’t attend to, like the participant who never left the root,

The plant is a natural corrective for flights of fantasy or mere opinions. All we need to say is, “Look again. How is it really?”

even after we had gone around the circle four times. Or the person who noticed the different shades of green, or how the plant felt when she waved it back and forth as if in the wind. The plant reveals more and more of itself as different people make different discoveries. Knowledge arises in a community. Through such a process a learning community develops, and, in Goethe’s words, “The interest of many focused on a single point can produce excellent results.” (1995, p.12) The unique perspective each person takes truly enriches the whole.

What allows different perspectives to show their best sides is the fact that everyone’s attention is on a phenomenon about which people don’t have a great deal of pre-

knowledge (prejudices and assumptions). They can look in quite an open way. Even people who have studied botany have rarely looked at one plant for so long and in such detail. Also, it’s not about what we know from memory or our book learning, but about what we perceive *right now*.

Different people can have different perceptions, but these differences do not create separation; they enhance one another. We learn to appreciate the different ways people observe and describe. There may at times be need for clarification and more precise or accurate formulation, but that can all be achieved through recurring attentiveness to the thing itself and through mutual struggle to find ways to adequately express what we’ve perceived. The plant is a natural corrective for flights of fantasy or mere opinions. All we need to say is, “Look again. How is it really?”

This kind of observation exercise takes us into details and we attend to what is directly before us. A focus is chosen and is clearly circumscribed. As one course participant remarked, “Almost any bit of nature will do.” Although the chosen focus I’ve described is plants, we could (and sometimes do in our

courses) immerse ourselves in a rock, a section of a meadow, a cloud formation, or an insect. Everywhere we focus our attention on the natural world we will discover an “inexhaustible richness.”

In subsequent sections of the chapter I describe further ways “to get there from here,” most of which are based on adult education courses at The Nature Institute.

References

- Goethe, J.W. (1995). *The Scientific Studies* (D. Miller, ed. & trans.). Princeton: Princeton University Press.
- Emerson, R.W. (1990). *Essays: First and Second Series*. New York: Vintage Books.
- Holch, A.E. (1931). “Development of Roots and Shoots of Certain Deciduous Tree Seedlings in Different Forest Sites.” *Ecology*, 12, 259–298.
- Larcher, W. (2003). *Physiological Plant Ecology*. Berlin: Springer Verlag.
- Merleau-Ponty, M. (1969). *The Essential Writings of Merleau-Ponty* (A. Fisher, ed.). New York: Harcourt, Brace & World.
- Plessner, H. (1975). *Die Stufen des Organischen und der Mensch* [The Stages of the Organic and the Human Being]. Berlin: Walter de Gruyter.

Craig Holdrege, a biologist and educator, is the founding director of The Nature Institute in rural upstate New York (www.natureinstitute.org). He carries out research in Goethean phenomenological biology and gives talks, workshops, and courses in The Nature Institute programs as well as in other venues nationally and internationally. He is the author of books and many articles. Craig was a high school biology teacher in Waldorf schools for twenty-one years and has worked in Waldorf high school teacher education since the 1990s.