Phenomenon Illuminates Phenomenon
White Oak and Sugar Maple

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In all Nature Institute adult education courses we study natural phenomena and also the phenomena of thought. We attend closely to the morphology of a plant, to the way colors arise in a stream of smoke, to the flow of water in a creek, to the form of the cube that we build up in our imagination, or to the kinds of thoughts we apply when thinking about an organism. Often, after attending to a particular phenomenon for a while, we shift our attention to a different, but related phenomenon. In geometry we compare the cube with the sphere, or modify a construction and view variations in relation to each other. We practice different techniques of drawing the same thing: we draw the leaf as a "body" and then we draw the negative space around the leaf. We compare different plant species with each other or specimens of the same species that grow in different environments. We compare different plant communities and environments (e.g., meadow, woodland swamp, bottomland forest, upland forest). We have also compared a machine with an organism, a rock with a plant, a plant with an animal, or still water with flowing water.

It is often through comparison that the unique qualities of a form, a movement, or an organism begin to strike us. The character of meadow plants jumps out at us when we go into the woods and observe the herbaceous plants there (Holdrege, 2002). In all the work of this kind our experiences of the world grow when we allow different phenomena to illuminate one another. In this article I want to highlight this comparative approach and show how it helps us deepen our understanding of two tree species, the white oak (*Quercus alba*) and the sugar maple (*Acer saccharum*). In two Nature Institute summer courses we have carried out comparative studies of these two trees, and I will base my descriptions on that work while also drawing on studies of my own.

When you go out and explore the area around The Nature Institute, you can find and observe both species of trees at roadside and meadow edges. The white oak has a tan, scaly bark that becomes furrowed in larger, older trees. Free-standing white oaks are often broader than they are high. This has to do with the fact that the main trunk sends off numerous long and thick, horizontally oriented branches. It's hard to fathom the strength that allows such growth.

The wavy-lobed oak leaves are alternately positioned along the length of the end of a branch or on side branches. Near the base of a given branch the leaves are first fairly close to each other, then become more widely spaced, only to become tightly bunched (usually three to five leaves) near the tip of the branch. The leaf stalk is very short and thick. Near its base the leaf blade begins to spread out and then forms the oval-shaped lobes. The lobes have different sizes; generally the largest lobes are about two-thirds of the way out on the leaf. The leaf is usually longer than wide, although there are exceptions. In fact, the white oak leaves vary strongly along the course of a branch and even more strongly between individual trees. Another feature of

Fig. 1. Free-standing white oak (Quercus alba) in winter.

Fig. 2. White oak: end of a branch and a single leaf.

the oak leaf is that the surface of the individual leaf is often bowed and wavy, making it somewhat three-dimensional.

Now we shift our attention to the sugar maple. It has a gray bark that is generally smoother than the white oak's; with aging it becomes more irregular with long, rough, and wavy, streak-like bands of darker gray. A free-standing sugar maple's branches tend to grow in a flowing upward and outward reaching gesture, creating a conically formed crown.

The leaves of the sugar maple grow off long, slender side branches and are paired on opposite sides of the branch. Usually two pairs of leaves emerge from the end of each slender side branch. The individual leaf of the sugar maple has a long, sturdy—but not stiff—leaf stalk. It arches outward, and from it spreads the multi-pointed leaf blade (Figure 4). The leaf blade is about as long and wide as the leaf stalk. It is quite symmetrical, and the pointed lobes radiate out from the veins that originate at the base of the leaf blade. The leaf margin itself is smooth.

Already these initial observations show how different these two trees are from one another. However, as we learn more, the danger arises that we will get lost in all the details that these trees can show us. Do we see the oak or the maple in the midst of all their individual features? I always come up against this problem in research, and we experience it in our courses: after describing many details of a plant, we can feel like we have found many interesting things but have also lost something of the fresh sense of the plant. Likewise, in comparing two plants we can end up with a catalog of differences rather than something that speaks "white oak" or "sugar maple." There is no simple way around this problem. In fact, if we try to skirt it by avoiding analysis, we won't take in carefully enough what the phenomena have to reveal. So what can we do?

This is where the practice of what Goethe called "exact sensorial imagination" comes in (Goethe 1995, p. 46; Holdrege 2005). When we have observed, say, the leaf of a white oak carefully, we make the effort to form a vivid picture of it without having the plant in front of us. We re-create in our mind's eye an image of what we observed. It is not the point simply to produce a kind of photographic image, but rather to craft the image through inner movement so as to participate in the color, form, texture, and other qualities. If we can inwardly feel the solidity of the short leaf stalk, sense the undulating plane of the leaf that expands out into lobes, dwell in the leaf's particular shade of grayish green, then in this process of willful re-picturing the oak becomes part of us. We connect strongly with our perceptions and they become dynamic. A leaf is no longer just a finished form; in recreating the form in our minds, we fashion a movement that takes on form, just as in the developing organism all forms arise out of morphogenetic movements. The forms and colors can become gesture-like qualities.

The fruits of the regular practice of exact sensorial imagination show themselves in a number of ways. First of all, I often notice that I haven't observed carefully: how long is the leaf stalk in comparison with the leaf blade? Is the margin of the leaf actually smooth? I am motivated to go back out and observe and attend to the phenomenon again and more attentively. Second, the practice brings the phenomena I have observed to greater life within me; I don't feel so separate from them. They are no longer so distant from me, not so "over there." Third, I notice how after some time my observing itself changes—I begin to perceive forms, structures, and colors during observation more vibrantly. I can sometimes immediately participate in them and they begin to speak. And they speak more when I move back and forth in my observation and inner picturing between two contrasting phenomena—such as the oak and maple. This is why the comparative method is so helpful.

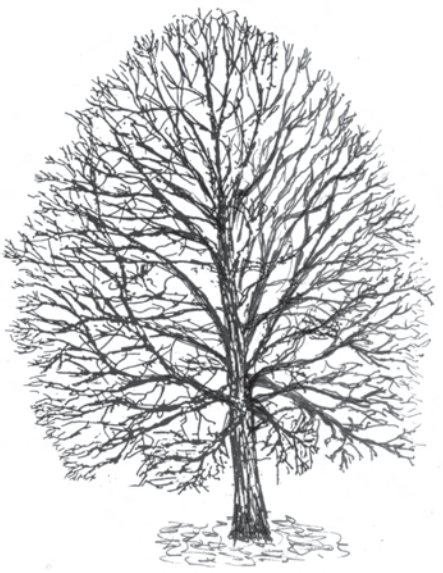

Fig. 3. Free-standing maple (Acer saccharum) in winter.

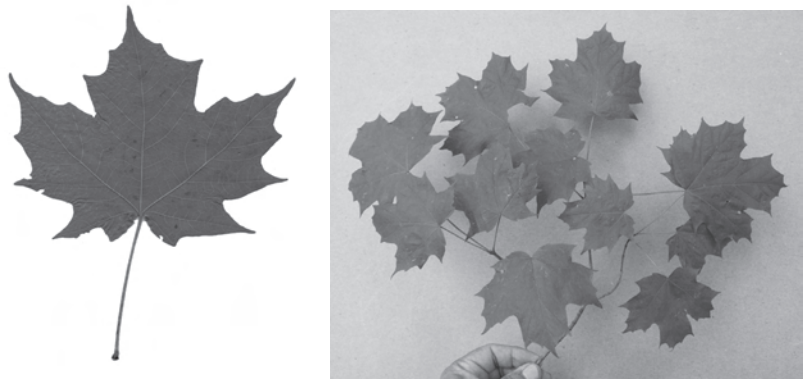

Fig. 4. Sugar maple: end of a branch and a single leaf.

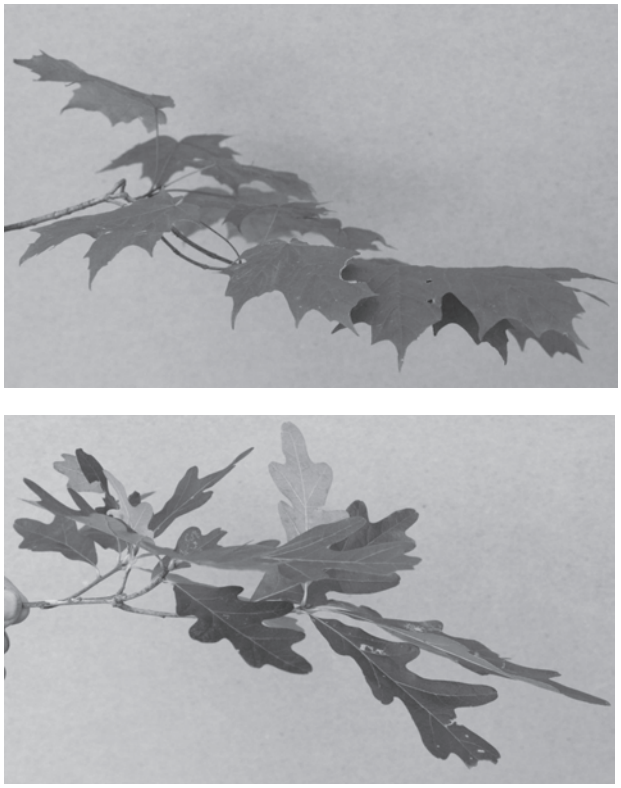

Fig. 5. End portion of branches of sugar maple (above) and white oak (below), viewed from the side.

In one particular Nature Institute summer course we were observing and comparing the end portions of the limbs of white oak and sugar maple. I requested that the participants re-picture what they had observed before we resumed our study the next day. When we returned to the tree limbs the next day there was a kind of "aha" experience for the group. We had noticed that the leaves of the maple spread out more or less in a plane and that they are fairly evenly spaced from one another. In other words, the totality of the leaves on the whole branch form a kind of "superleaf." This planar quality of individual maple leaf and leaf arrangement on a branch spoke all the more strongly when we looked again at the oak.

What a contrast: the oak leaves are bunched in tiers and irregularly spaced so that the end branches are less planar and more three-dimensional. And then we noticed that the surface of the individual oak leaf is also less planar; its surface undulates. In seeing these connections—which are only visible to the active and receptive mind's eye—we had the experience of beginning to meet the oak and the maple. As one participant remarked in a review of the course: "I found the tree leaf studies so amazing yet simple—I found practicing the inner transformations so helpful. Then there were the sudden revelations like the plane-like aspects of maple leaves and branches."

When you look up into the crown of a white oak you see much more sky than when you look up into the crown of a sugar maple. The sugar maple creates a relatively even, shady environment, whereas beneath the white oak the ground is dappled with patches of shade and bright light. The sugar maple is highly shade tolerant and can grow up, albeit slowly, within a dark forest canopy. The white oak not only lets more light reach the forest floor, but also needs more light to thrive (Niinemets & Valladares 2006; Canham et al. 1994).

Interestingly, when maple branches of a free-standing tree or of a tree at the edge of a forest are illuminated by

Fig. 6. Looking up into the crowns of a sugar maple (left) and a white oak (right).

direct sunlight for much of the day, they give up the planar tendency to some extent and grow more into three dimensions, just as oak branches in greater shade become more planar. Such observations bring awareness of the flexible, context-sensitive nature of organisms.

When you continue to study these trees, more features of their inner coherence become apparent. In the maple we perceive the extending outward of the long slim stalk and the symmetrical spreading into the finely formed, pointed lobes of the leaf blade. The clarity of form in the sugar maple is also expressed in the regular, opposite arrangement of the leaves and in the V-shaped branching pattern of the limbs: each year the terminal bud dies, so that two branches (originating from the pair of buds just prior to the terminal bud) form a V-shape, then grow further, branch again in a V-shape and so on.

This symmetry and clarity of expression contrasts with the oak's leaf, which is characterized by the flowing oscillation between lobing out and holding back in the spaces between the lobes. The leaf surface itself is wavy, and in texture the oak leaf is more leathery, the maple leaf thinner and more translucent. The dynamic, irregular lobing in the individual oak leaf is mirrored in the oak tree's leaf arrangement described above—many leaves grouped in three-dimensional bunches that form areas of concentration separated from other bunches by empty space. This is, you might say, a branch-level expression of the alternation of concentration and open spaces ("indentations") that we can see in the lobing of each individual leaf.

When we look at the fruits of white oak and sugar maple, the contrasting ways-of-being of the two tree species become even more apparent. The sugar maple has a light and symmetrical, winged fruit. The fruit dangles from a stalk and flutters in the wind. When released at maturity, it spins in an airy dance while falling in spirals to the ground. The acorn is formed out of a woody, scaled cup that holds a nut. The nut is formed in one year, overwinters, and then grows and matures during the second summer. The weighty acorn falls to the ground in the autumn. In the fruits, we see new expressions of the outward spreading, radiating, planar tendency of the maple and a tendency toward densification, three-dimensionality, and concentration in the white oak.

Fig. 7. Fruits of sugar maple and white oak.

Through this work we begin to see the unique expression of each species. We recognize how each species has a unified quality and, although we may not see this in all aspects, we at least get a glimpse of the organism as an integrated whole. This is an invigorating experience.

In his 1844 essay *Nature*, Emerson describes beautifully the significance of meeting the world through 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.

While many people are deeply moved by the grandeur of a sunset or a rainbow, it is less likely that we will be moved by seemingly insignificant phenomena that appear everywhere in nature. They can all too often become "mere facts" for us. It is clear that to see more than the profane in nature depends on our state of mind. Can we become so sensitive, receptive, and alive that the living qualities of nature speak to us? To move from a distanced to a participatory relation to things involves activity on our part and I have tried to describe this activity:

We go out to the plants and study them carefully; we activate our senses and dwell with the phenomena. We make our meeting with the plant more vivid, concrete, and connected with ourselves through practicing exact sensorial imagination. We oscillate between direct observation and re-picturing. When we have worked with one plant for a while, we engage with another. We carry the experience of the first plant with us. It can help us recognize the special features of the second plant. Through our comparing and contrasting, the plants mutually illuminate each other. The more intensively we have experienced one plant, the more the meeting with the next will tell us and it, in turn, will work back into our understanding of the first plant.

What is important is that we do not carry the picture we have formed of one plant as a kind of standard against which we measure the second plant. We don't judge one phenomenon through the other. Rather, we need to carry our experience as an illuminating gaze, as an enriched inwardness that allows us to see more in the world. So when I say that the method is to let phenomenon illuminate phenomenon, we can't forget that we ourselves are the mediators of this process. The quality and degree of illumination depends upon us—how closely we have studied the phenomena, how vividly we have connected with them and internalized them, and how able we are to let past experiences metamorphose into sources of illumination for revealing the qualities in the next phenomenon we study. Inasmuch as we work in this way, the profane veil that dulls our view of the world falls away.

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(continued from p. 7)

of Cry3Bb1 corn where farmers reported severe root injury. These larvae demonstrated in the laboratory that they were indeed more resistant to Cry3Bb1 than larvae taken from control fields where no injury was reported. Further, the resistance increased with the number of years the transgenic corn had been grown in these fields.

One strategy that is supposed to at least delay the onset of resistance is the interplanting of "refuge" fields between transgenic fields. This provides an opportunity for nonresistant insects from the refuges to interbreed with any that may be developing resistance from the Bt fields, thereby diluting the resistance. However, the researchers note that "a lack of compliance in planting of refuges has been documented among farmers that grow Bt maize in the United States." They also refer to other recent reports of resistance. "Typically there is a lag between the introduction of an insecticide and the first occurrence of resistance, which is then followed by a steady increase in the cumulative number of occurrences."

The strategy of the biotech seed producers will surely be to develop new and more powerful Bt crops. But this is an unsustainable strategy since it entails continually creating problems (new forms of resistance) by trying to solve them with the same means that caused them (new Bt crop varieties). This seems, unfortunately, to be the standard approach for modern, business-driven ways of dealing with complex problems. And to make matters worse, as scientist and biotech critic Charles Benbrook notes, "traditionally, about two-thirds of corn acres have not required an insecticide spray application."

SLT & CH

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