Brock's odyssey from biology to biological restoration

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by David Tenenbaum

Tom and Kathie Brock at their 140-acre Pleasant Valley Conservancy near Black Earth. (Photo by David Tenenbaum)

It's shaping up as a hot June day southwest of Black Earth, about 20 miles west of the Madison campus.

Even though the schedule calls for them to guide newcomers through the 140-acre Pleasant Valley Conservancy, Tom and Kathie Brock are each armed with a holstered spray bottle of herbicide.

They are equipped for a wild Midwestern shootout with invasive plants that have survived 15 years of restoration. Even while guiding a tour of the conservancy, this sharp-eyed pair has time to deliver a deadly spritz to these intruders.

To the carload of butterfly watchers arriving at 11 a.m., and to the sprinkling of hikers, birders and skiers who have come to love the conservancy, this subtle interweaving of wetland, oak savanna and prairies is an island of ecological sanity and beauty in Wisconsin's driftless area.

The Brocks are committed restorationists with deep roots at UW-Madison. Tom is a pioneering microbiologist and professor emeritus who moved to Madison in 1971 to become the E.B. Fred Professor of Natural Sciences. Kathie is a microbiologist who has taught at the university, worked in scientific publishing and volunteered for several environmental organizations.

As the wind caresses the prairie and the couple checks the survival of new plantings, Tom Brock's legendary career in microbial ecology is more remote than Blue Mound on the horizon. But when life is found in ever-more extreme conditions, his discoveries at Yellowstone National Park in the 1960s are invariably mentioned as the starting point for a new field of biology -- the study of "extremophiles."

When scientists try to plumb the origin of life, or speculate on the chance for life in space -- extremophiles are again at the center of attention.

In 1967, Tom Brock's name became inextricably linked with the demise of a key piece of conventional wisdom in biology, that life could not exist past about 70 degrees Celsius (158 degrees Fahrenheit).

The overthrow can be dated to 1964, when Brock, en route a lab in Washington State, stopped out of curiosity at Yellowstone National Park.

"I got out of the car," he says, "and by chance a ranger was giving a talk near a thermal pool. I saw all this color, and he said it was blue-green algae. I got interested right away."

Brock returned samples from the pool to his lab, and for about a decade he studied life in streams emanating from hot springs. No matter how hot, he found that essentially all of them had microbes. In 1967, Brock's article in the journal Science made an audacious claim: "It is thus impossible to conclude that there is any 'upper temperature of life.'"

That article sparked a revolution in microbiology and a wave of research into high-temperature organisms, says Stephen Zinder, a former grad student who now chairs the microbiology department at Cornell University. "His work in Yellowstone was truly pioneering; he was the father of thermophiles."

Notably, Brock discovered a bacterium he named Thermus aquaticus, which could grow at more than 70 degrees C. Parts of its metabolic machinery, including the enzyme Taq polymerase, needed to assemble strands of DNA, could tolerate boiling.

In 1989, Science named Taq polymerase its first "molecule of the year," because it enabled polymerase chain reaction, an essential tool for molecular biologists.

Once Brock proved illusory one of the supposed limits on life, microbiologists began finding microbes in environments that were extremely cold, acidic, alkaline -- even deep underground. Today, it's not wild-eyed to suspect that life could be common in the universe, even beneath the frozen surface of Jupiter's moons.

Tom Brock's contributions to science extended beyond microbial science in the field and lab. In 1970, he wrote a highly acclaimed microbiology textbook; royalties from the book have helped fund the Pleasant Valley Conservancy.

In 1980, the family bought the land, with its ridge, natural amphitheater and views of Blue Mound, as a weekend getaway. In 1990, while volunteering on a Nature Conservancy restoration, Kathie says she "realized that we could do restoration work like that on our land."

Now, they work three to five days a week on the land.

While the Brocks do hire some help for the heavy lifting, this is not how most couples envision retirement.

"This started out as a hobby, and it became a challenge," Tom Brock says. "I got interested from the scientific point of view, started some small research projects and have developed a lot of restoration techniques."

Both the Pleasant Valley website (http://PleasantValleyConservancy.org) and Tom's blog contain a wealth of detailed, practical advice for eradicating invasive trees, shrubs and herbaceous plants.

Although the goal is to restore the land to pre-settlement conditions, Kathie says the reasoning is more ecological than historical.

"If you are standing under a 250-year-old white oak, it should not have recent growth stretching up into its branches and killing it," she says.

Tom Brock notes with some irony that although he appreciated the quick pace of experiment in microbiology, his retirement is occupied by an experiment without a defined endpoint.

"In microbiology I liked the idea of getting results the next day," he says. "But when you are doing research in restoration, you have to think much longer-term."

Zinder, however, sees some logic to Brock's transition.

"Tom always had broad interests, as a writer, a major historian," Zinder says. And you can't stop him from working. He always has to take his restless intellectual energy and follow it."

To assure long-term protection, the Brocks have donated a conservation easement to the Prairie Enthusiasts, a Wisconsin land trust, and Pleasant Valley Conservancy is listed as a State Natural Area.

Why do they devote their lives to this hillside?

"We are putting the land back as it should be," says Kathie. "It should not have buckthorn and honeysuckle smothering it. The understory should be native plants. That's enough to keep us busy for the rest of our lives."