CHAPTER 34

THE ECOSYSTEMS IN MY LIFE

As soon as I could ride a bicycle, my close association with ecosystems began. An early favorite one was Pott's Quarry, which had filled with water when the operators hit a spring at the bottom. The area was not very productive because the sides were mostly steep rock. However, at the foot of the only cliff was a sizable rock ledge with shallow water and a good growth of vegetation. From the top of the cliff I could see about a dozen very large goldfish, which I never saw anywhere else in the quarry. A narrow, paved road was at the end of the area that was away from the town of Conshohocken where I lived. My favorite fishing spot was a rock promontory not far from the road. I could catch bluegill sunfish and, rarely, small bass. I always carefully unhooked each fish and returned it to the water. Optimistically, I expected to catch that returned fish again. Since Pott's Quarry water surface was only a few acres, I did everything a young boy with no fishing mentor would do. I circled the quarry pond and fished everywhere except the underwater ledge below the cliff, which was difficult to access. Except for one "bathing beach," which was occasionally occupied, I usually had the area to myself. My mother and father sometimes took me to a tiny beach down a steep hill not far from my favorite promontory fishing spot. I soon learned that some spots were great at some times and not others.

My other boyhood ecosystem was the Schuylkill River (pronounced SKOO-KILL, Dutch for "Hidden River"), which was badly polluted in the 1920s and 1930s. Only carp and small, brown catfish were in the section my uncle Alex Brown and I fished. The carp were large but not abundant. We caught them with balls of rubbery corn meal mixed with cotton. Chicken entrails were the bait *de jour* for the small catfish. I even built a small wooden boat to fish the river and was deeply offended when a local contractor offered to buy it so he could mix cement in it. "Still" fishing taught me patience – first, the long wait between nibbles and second, not to strike until the carp began its run.

When I was about 13, my family visited the Latshaws, relatives in Salt Lake City, Utah. My cousin Walter and I were taken to Yellowstone National Park with a scout troop. Since we were a few years older than the other scouts, we were allowed to trout fish on our own. We fished a large beaver pond with fly rods and dry flies. On my fist cast, I hooked a 10-inch, male brook trout, and I was "hooked" for life. The next day, both Walter and I came down with dysentery, and our families drove to Yellowstone to take us back to Salt Lake City.

As soon as I got a driver's license, I fished the upper reaches of Wissahickon Creek, a trout stream partly within the Philadelphia city limits. I also fished Valley Creek, a trout stream in Valley Forge National Park. I never hooked a trout at either place. I entered Penn State University at age 17, but had no transportation to access not-too-distant trout streams. In addition, World War II, three academic degrees, and my professional employment prevented me from fly fishing for trout for 21 years. I am thankful that summer employment at Rocky Mountain Biological Laboratory and the University of Michigan Biological Station returned me to trout streams for another 34 years, when I had to stop for health reasons. The trout streams of Colorado and Michigan are quite different, but I studied them and felt at home in each.

The Conestoga and Savannah Rivers

In 1948, I became a member of one of the two river survey teams studying the Conestoga River and some of its tributaries in Pennsylvania. The overall goal of the study was to develop a biological assessment of water pollution. At that time, the Conestoga was ideal for this purpose because much agriculture and some industry were situated in its drainage basin, along with some comparatively pristine areas. My assignment was to study the effects of pollution on protozoan communities (e.g., Cairns 1949). Professor Mary Gojdics, an experienced protozoologist, sat across from me at a long lab table and was very helpful to the novice who had to "run flat out" to maintain the desired pace. As a team, we had to finish each sampling area or station so everyone could begin on the next area/station at the same time. The bacterial, protozoan, and water samples were perishable – the other samples could be preserved for later study. In addition, the main books for identification of protozoans were in German (e.g., Kahl's *Tierwelt Deutschland* for ciliates and Pascher's *Susswasser Flora* for flagellates), although many reference books were in English. Of course, I had some language courses in college, but major, daily use of German was a new experience. I often had to work past midnight, although the teams did not do field work on weekends. I drew sketches of specimens I could not immediately identify and attempted to label them with a Latin name on the weekends. Sometimes I had to settle for the genus name with an "sp." after it. The primary benefit for me of summer 1948 was the development of a systems perspective – I was able to "see" the aquatic communities through the eyes of a bacteriologist, an

algologist, an invertebrate zoologist, an entomologist, an ichthyologist, and a chemist. I also learned to pay attention to organisms that were not my primary responsibility.

At the end of summer, I was offered the position of protozoologist on the single, permanent Academy of Natural Sciences Limnology Department river survey team, which lacked an ichthyologist. The entire team helped gather fish with seines, hoop nets, and by other methods. Ruth Patrick selected the study areas, but she was also running the Limnology Department and writing a massive volume on diatom identification. Funding switched from a single grant (for the Conestoga survey) to single grants for river surveys in various part of North America. These additional studies provided a broad, comparative perspective, but not the same "sense of place" that develops with substantive association with ecosystems.

The Savannah River was the next ecosystem in my life. I think my association with the river began when E. I. DuPont de Nemours and Company assumed responsibility for building and operating the Savannah River Plant. I believe the survey team began work there in 1950 (this is a guess) before major construction began. The first year, the team was on the river four times for two weeks each time. At that time, the Savannah River was not heavily used. For example, the mere sound of an outboard motor would cause the water moccasins to drop off the willow branches overhanging the river. Later on, as river traffic increased, the snakes just stayed on the branches. I worked on the river itself, as well as a tributary called the Upper Three Runs, until I left the Academy in June 1966 and was no longer associated with the survey crew. I can remember that the metal boat seats became too hot to sit on in summer unless we splashed water on them. The crew worked in winters sometimes so cold that small logs froze to our waders when we put them upon our knees to pick off insect larvae. We worked when sudden severe thunderstorms came up and the boom of the dredge boat suddenly looked like a lightning rod.

Although some of the Savannah River Site construction crew stayed in Augusta, the river survey crew stayed at the Plantation Motel in Allendale, South Carolina. The motel was on US Route 301, then a major north/south highway and, in this 1950 era, was the only modern motel in Allendale. The small dining room there served a typical breakfast and a dinner with only two entrees (fried chicken and ham). The only other food service in town was a Dairy Queen with hot dogs and hamburgers. This somewhat limited selection was tiresome for a two-week stay four times a year. Later, a Howard Johnson's came to Allendale. For lunch, the crew dined on "beanie weenies" from a can.

None of the crew took showers until every team member had returned since they might need some help. The crew dealing with perishable samples always returned to the motel early while the samples were still fresh. However, no team member ever stayed on the river alone. A 298-page publication detailed the data gathered through 1966 (Patrick et al. 1967). The experience was a superb one that I treasure.

Some years after joining the staff at Virginia Tech, I was invited to become a member of the Environmental Advisory Board of the Savannah River Site and served on it until 1993, during which time Ruth Patrick chaired the committee. In that service, my relationship with the Savannah ecosystem (including adjacent land) continued.

The Amazon River

After a few years of study of the Savannah River, the team began a study of the Amazon River (probably in 1954) to determine how well methods developed for North American rivers worked in South America. Before leaving on the survey, I collected a sample from the pool of the fountain at Logan Circle, which I could see from my office window. I placed a few drops on a microscope slide, and the first species I recognized was *Urocentrum turbo* – a very distinctive protozoan. When we arrived at Tingo Maria, Peru, to study what was then thought to be the headwaters of the Amazon, I repeated this exercise (without a fountain) and found *Urocentrum turbo*. I was not surprised. After all, I had used European protozoan keys for Conestoga Creek, the Savannah River, and other North American rivers, and Charles Darwin had already noted that protozoans had a cosmopolitan distribution.

We went from Tingo Maria to Iquitos, Peru, on the Brazilian border. The team was only on the Amazon River for over eight weeks (e.g., Patrick et al. 1966), but the experience was very valuable. The intensive study of a few ecosystems, combined with detailed but less intensive studies of a variety of other ecosystems, worked well for me, especially in a team context. I remember each riverine ecosystem well, although longer time spans enable a researcher to better evaluate episodic events such as droughts and floods.

Rocky Mountain Biological Laboratory (RMBL)

In 1961, Director Robert Enders invited me to teach a six-week course on the aquatic ecosystems unique to the western slopes of the Rocky Mountains. The class met for 1½ days each week, and the students usually took one other course (see Chapters 8, 29). Dr. Scottie Willey gave me a crash course in the local aquatic ecosystems. In the 13 years between 1948 and 1961, I had seen quite a variety of aquatic ecosystems, but not like the ones in the Rocky Mountains. I taught the aquatic course at RMBL in summers of 1962 and

1963, a stressed ecosystems course 1971, and a restoration ecology course from 1984 through 1994. The stressed ecosystems and restoration ecology courses involved terrestrial ecosystems about 60% of the time. At RMBL, my research did not lead to many publications. However, teaching placed me in a wide variety of ecosystems, as did hiking or fishing on non-teaching days.

These years at RMBL were an ecological/spiritual experience. When Jeannie and/or the children and I hiked, we rarely talked since it would have been a sacrilege most of the time. On the steep trails at 10,000+ feet, we did not stop breathing deeply to talk. When I was a boy on trips to Potts Quarry, I was usually alone and enjoyed the solitude and beauty. When I was engaged in gathering data in spots of beauty, enjoying it took second place. At RMBL, I had the perfect companion, Jeannie, for hiking and had no perishable samples to worry about. In addition, I was selecting the ecosystems that I visited rather than going to them because a grant or contract was involved. However, the problems encountered through grants and contracts were often at least as interesting as the research I could design, and sometimes even more interesting.

Although an in-depth association with an ecosystem is usually very rewarding, falling in love with an ecosystem can result in major pain and sadness as exponential population growth impairs many wilderness attributes and qualities. When our family visited RMBL in 1961, only a few non-RMBL cars per day went through on the narrow, dirt road. In our last year, 1994, the car and truck traffic on weekends produced an almost constant plume of dust over the road. Some special trails (e.g., the one to Copper Lake) prohibited motorized vehicles, as did one of our favorite all-day hike areas (Rustler's Gulch), so a satisfying wilderness experience was still possible. Many trails were too narrow for motorized vehicles, but not for mountain bikes. Most mountain bikers were considerate and courteous. If a group came by, the lead bikes would often tell us how many bikers were in the group. By the end of the time we were going to RMBL, trout fishing declined considerably in the stream section near a road, but generally improved markedly just a mile or two away from the road.

Even though Jeannie is gone and I cannot hike any of the trails we treasured, I can remember vividly many of the details of our favorite hikes and relive them. We hiked at least once each summer in Crystal Canyon to the tiny hamlet of Crystal. In 1961, when Heather was about 3, we drove the entire way in our trusty Volkswagen microbus. The ford at the top of the canyon wet the brakes of the microbus, so I asked the family to walk down to the Devil's Punch Bowl and reboard for the trip to Crystal hamlet. The microbus could not go back up the steep canyon slope, so we kept going beside the Crystal River to the town of Marble. From there, we took a paved road south to Route 50 to Gunnison, then Crested Butte, and then RMBL. That summer was the last time the entire family was at RMBL because Karen went to Colorado College at age 16 (we had been advised to get Karen away from the East Coast because of her asthma).

University of Michigan Biological Station (UMBS)

In 1964, I was invited to teach a course on free-living protozoans at the University of Michigan Biological Station (UMBS), which is located on Douglas Lake at the northern tip of the lower peninsula. The Station has 10,000 acres, including most of Douglas Lake, on its main campus. The area around UMBS has a rich variety of aquatic habitats: lakes, bogs, fens, swamps, streams, and wetlands. The Alfred Stockard Laboratory had good facilities for microscopy, plus a good chemistry lab for a field station. Most of my research was on microbial colonization of artificial substrates since I could get a sample from the lake to the microscope in 5-10 minutes. During the most productive part of the colonization research, I had the good fortune to have my colleague Bill Yongue, (e.g., Yongue and Cairns 1971) working with me. Later, Paul McCormick (e.g., McCormick and Cairns 1991) assisted me. Another piece of good fortune was having algologist Professor Rex Lowe, Bowling Green University, and his students in the laboratory next door. During the early portion of this research, we were able to confirm the MacArthur/Wilson equilibrium model (Cairns et al. 1969). Working with perishable samples requires time free from interruption (e.g., telephone calls, committee meetings), as well as good water chemistry facilities, so UMBS was ideal. Of course, during the two full teaching days each week, I had no hope of working with perishable samples.

The RMBL and UMBS studies have some strong contrasts. At RMBL, I tried to look at entire systems (Cairns and Pratt 1995), and, at UMBS, I worked toward an in-depth view of an aquatic ecosystem using the only group of organisms I could identify to species – protozoans. Since Protozoa have a cosmopolitan distribution, they are advantageous to use. Their chief disadvantage is that preserving entire communities is impossible. Their perishable nature leads to a concomitant disadvantage – huge amounts of time must be spent indoors while at the field station. However, each approach provides an interesting but incomplete view of an ecosystem.

The New River and Other Rivers of Western Virginia and West Virginia

Traveling down a white-water river provides a hydrological perspective not obtainable in any other way, especially if trips are made at high flow, low flow, and medium flow. Jeannie and I began this experience about

a year after we arrived at Virginia Tech (we were only 46). Our friends Alan and Gloria Heath told us where to buy a folbot (www.folbot.com) and suggested we get a copy of *Canoeing White Water: A Guide Book to the Rivers of Virginia and Eastern West Virginia* (Randy Carter, 1976, Appalachian Books). One of my first graduate students, Rip Sparks, and his wife Ruth actually assembled their folbot and joined us on white-water trips until Rip acquired the PhD in 1971. Jeannie and I continued white-water trips until about 1984 (age 61), but the number of trips per year had declined well before this time.

Terrestrial Ecosystems

Although much of my research involved aquatic ecosystems, in terms of total time spent in them, terrestrial ecosystems were dominant in my life. Shortly after arriving at Virginia Tech, Jeannie and I went on campus YMCA hikes every Sunday afternoon. In fact, Jeannie had charge of them for 12-15 years. The YMCA hikes were mostly on different parts of the Appalachian Trail, sometimes for an entire day. After we gave up white-water folboting on Saturdays, we hiked parts of the Appalachian Trail to decide where the YMCA hikes should go.

When we moved to another house on Bishop Road in 1971, we could ascend the hill behind our house and walk for miles on some regular trails and deer trials that we could follow. In 1999, the hill behind our house become too steep for Jeannie, but the Appalachian Trail was nearby, and Pandapas Pond, a nature preserve, had a variety of trails. Association with natural systems (I include second growth forests) was a spiritual experience, especially when I shared it with the companion I loved. Hiking the same trail several times weekly even heightened the benefits because of the awareness of the small changes that occurred continually in nature. Even after moving to a townhouse in the Warm Hearth Retirement Village in early 2000, we could hike daily on parts of the seven miles of trails then available or on the Huckleberry Trail that passed the edge of Warm Hearth's property. We kept hiking together until Jeannie had severe blood clots in her left lung in May/June 2001, which worsened her Alzheimer's and made transfer to the nursing home in the community essential. From then on, my hiking consisted of three trips daily from the townhouse to the nursing facility, for a daily total of nearly six miles. Jeannie could not understand why I was not with her all of the time. Except for time out for World War II, we had been together for 60 years. Under these circumstances, the loss of my companion was a defining moment in my life. I can do little without being reminded that Jeannie is no longer with me.

My retirement apartment allows me to see the edge of the Warm Hearth forest about 100 feet from my large living room window. I write at a small writing table next to a comfortable chair. I can use my large-wheeled walker to go about a mile on a paved path to the edge of Warm Hearth's property; from there, I can see the mountains Jeannie and I once hiked. Neither the view from my writing desk nor the view of the distant mountains provides the sounds and smells of walking through them, but they awaken memories of good times from the past. For nearly 40 years, I enjoyed hiking the Appalachian Mountains with Jeannie – I am grateful I had that experience!

"Other" Ecosystems

I have visited many ecosystems not mentioned here that made an enormous impression on me, but I did not experience them sufficiently to make them part of my life. After 1961, Jeannie accompanied me on practically all my travels. Five or six of those were working trips to Bermuda, where the base of operations was the Bermuda Biological Station. Among the areas visited was Beebe's Nonesuch Island. Dr. David Wingate was carrying out research on ecological restoration on Nonesuch to maintain the biota of Bermuda before it became extensively settled. My strong attachment to Bermuda was based on the quality of life, despite the dense population. However, local resources were far from adequate to maintain the then present population density. Tourism and military bases were a major source of income, but they required large amounts of fuel, food, and water. In the present economic downturn (e.g., 2008-2009), I cannot help but wonder how dependable these resources may be in the future. The financial system has been a significant source of income but is less resource dependent.

Sense of Place

Mary Price (personal communication) has told me a bit about a book she and Ian Billick (both of RMBL) are writing about sense of place. She also mentioned how much RMBL had changed since Jeannie and I had last been there (1994). I realize that sense of place depends on a continual, intimate relationship with the area. Components of the RMBL that Jeannie and I knew are still there – for example, our first cabin (O Be Joyful) and the other cabins we inhabited (except for our second, which was taken out by an avalanche). Copper Creek and Rustler's Gulch Trail remain, but probably have changed due to increased traffic and climate change. If I returned now, Jeannie would not be with me and I could not see the world through her eyes – and her view of the world transformed my view. I often discuss RMBL with the children, but we recall the historic RMBL that is a

joy to "revisit" as it exists in our minds – the students and the faculty have changed. One of the many online definitions of *sense of place* is "an intensely personal response to the environment, social and natural, which the individual experiences in daily life." Some definitions state: "those characteristics that foster a sense of authentic human attachment and belonging." My own definition focuses on a place that has a harmonious relationship between humans and the natural world. The Savannah River Site may seem an odd choice, but, at the time I worked there, little or no observable effects were evident in the Savannah River, and the terrestrial tract was mostly forested. Where we worked, except for part of the Upper Three Runs, we were more likely to see wildlife than humans (other than crew members, of course). When our children were young, they were strongly attracted to RMBL and UMBS. After the children left home, they were likely to visit Jeannie and me when we were at a field station, even though we were only there for eight weeks each year.

I disliked returning to the early ecosystems in my life years after I left them (e.g., White 2009). After World War II, we moved to Plymouth Valley (1949), and Pott's Quarry was only a few miles away. I had been told about the changes that had occurred and decided not to see what had happened to the favorite fishing spot of my youth. In addition, I went through Conshohocken to paint the outside and sand the floors of the inside of our gatehouse on Woodmont Road, but I never went down 6th Avenue to see the house I was born in. I was establishing a new sense of place and reconnecting with the old would have been trying.

As a family, our first sense of place occurred when we initially saw the gatehouse on Woodmont Road in Gladwynne, Pennsylvania. Jeannie knew, without even talking to me, that this house was our place. In retrospect, I believe that feeling was one of the most critical moments of my life – Jeannie and I had the same sense of place, which was based on the setting and people.

I also felt a sense of place at the Academy of Natural Sciences (ANSP) of Philadelphia, Pennsylvania. The building was very old, even when I worked there, but it had a strong connection to ecosystems and species that no longer existed. Coming in the back door from the parking lot, I was at one end of Dinosaur Hall, which had a huge skeleton of *Hadrosaurus foulki* (found in New Jersey), and I was reminded that it came from a different world than the one I lived in. The school children from South Philadelphia called ANSP the "dead zoo" – an apt designation since the exhibits were mostly, at that time, not alive.

When we moved to Lawrence, Kansas, we were leaving the area where we had lived most of our lives and where our families still lived. I was leaving the mentor (Ruth Patrick) who had introduced me to the research that was now my professional career. Jeannie was leaving the places of her childhood, and we were both leaving the gatehouse with surrounding woods – "our place." The move was less painful since, when we left, we were going to UMBS for the summer and where the family had already acquired a sense of place. The transition via UMBS was even more important than we realized since, when the research space at the University of Kansas was inadequate, we still had a sense of place – UMBS. We returned to UMBS the next summer and were "anchored" by our sense of place. When we left the University of Kansas in spring 1968, we drove to Blacksburg, Virginia, to a house we had never seen. After the moving van unloaded our furniture, we left immediately for UMBS – again connecting with our sense of place. A few years passed before we developed a sense of place in Southwest Virginia.

Developing a Sense of Place in a Humanized Ecosystem

I have followed Rene Dubos' description of a "humanized ecosystem" as one that is attractive to humans as well as wildlife. The hedgerows of France and the United Kingdom come immediately to mind. When we had to leave our house on Bishop Road in Blacksburg, Virginia, we left ten acres of sizable trees that almost touched the house and a 600-foot, gravel driveway. We saw deer almost daily, wild turkey frequently, raccoons too frequently, and foxes rarely. Piliated woodpeckers and many other bird species were common. We even once saw a wood duck perched in a tree beside our house. At the bottom of our hill was a wetland with spring peepers (small frogs). We had no lawn – a sensible feature since we spent summers at field stations. The children were correctly concerned that living on a steep hill, which sometimes had ice on the driveway, and experiencing multi-day power outages were not good when Jeannie's Alzheimer's began to worsen. We were early contributors to the Warm Hearth Foundation, so we were high on the priority list for acquiring a townhouse – in a setting of old trees at the end of a row of four attached townhouses, which was somewhat more private. By then, Jeannie's Alzheimer's had progressed so far that I could not tell whether the setting had any beneficial effect – I like to think it did.

I would rather be in any one of the ecosystems that were part of my life years ago, but I am blessed that I can see the edge of a forest and the large meadows with the Appalachian Mountains in the distance. This setting is enough to give me an inner peace.

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