The Cowles–Cooper Tradition under Murray F. Buell: A Personal Retrospective

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Introduction

Jean Langenheim’s description of her experience as a student and friend of Prof. William H. Cooper (Langenheim 2015) stimulated me to consider my impressions and recollections of Murray F. Buell’s research and graduate student mentoring program. Even more recently, Malcolm Nicolson contributed a description of Robert H. Whittaker’s role in the history of plant ecology (2016). These publications have enriched our understanding of how people and events have shaped ecology through its history. I offer this essay about Murray F. Buell in that same spirit. Given how circumstances differ as seen through different eyes, and how varied may be our individual recollections, it is important for me to emphasize that this essay—like Langenheim’s—is a personal perspective.

Murray F. Buell was not, in technical fact, a student of Cooper’s but came under Cooper’s influence while a graduate student with Butters (a plant morphologist) at the University of Minnesota in the late 1930s. Evidently, Cooper’s influence prevailed because Murray always represented himself as a plant ecologist in the Cowles–Cooper tradition. Sprugel (1980) described Buell as indirectly linked (because of Butters) through Cooper. Similarly indirectly linked with Cooper are F. E. Egler and R. W. Lindeman (White et al. 2010). Students of more or less the same generation directly linked with Cooper are R. R. Humphrey, H. J. Oosting, J. H. Langenheim, and R. Daubenmire. Murray received his Ph.D. and took his first position at North Carolina State in 1935. He moved to Rutgers University in 1947, where he remained until his retirement in 1971. He was President of the Ecological Society of America (ESA) in 1962 and received the Eminent Ecologist Award in 1970. He died in 1975, at 69 years of age, while on a field trip in New Jersey’s Pine Barrens, apropos, perhaps, of his fondness of fieldwork. The Murray F. Buell Award for best student presentation at the annual ESA Meeting was established in 1977 (Bormann and Pearson 1975). The Buell Award serves as our most lasting and meaningful commemoration to Murray’s career as a devoted teacher and mentor. Other tributes and remarks on Buell’s career appear in Crocomo (2014).

Learning with Murray

I joined Murray’s program at Rutgers in 1960 when Murray was 55 years old. I say “Murray’s program” but emphasize at the outset that Helen Foote Buell—his very discerning and sometimes more candid wife—was a vital part of that program. If one sat next to Helen during a discussion, one might hear a critical snippet that Murray might also be thinking but being too polite to say. Helen and Murray worked closely as a team in the education and training of “his” graduate students. Helen did not participate in formal courses, but was very much involved in the Buellian intensive seminar system; personal hospitality events in their unremarkable Middlebush, NJ home; and, sometimes, with thesis and dissertation writing problems. I can attest to the last from personal experience. Evidently, Murray did not think much of my MS thesis first draft because Helen buttonholed me and said, “Murray asked me to work with you on this. He said you were worth it.” Helen otherwise worked with Edwin Moul on his
phycological projects—a support position of the type held by many fine women scientists of the time. Also, she and Murray for many years coedited the Bulletin of the Torrey Botanical Society and their local outlet—the Hutchison Memorial Forest Bulletin (see more about Helen at http://www.caryinstitute.org/science-program/research-projects/buell-small-succession-study/about-bss/obituary-helen-f-buell).

Except for when he was in the field, I do not think I ever saw Murray wear anything but a charcoal gray suit. Helen likewise wore—in my memory—grayish dresses. I wonder, in retrospect, whether their conservative dress, restrained demeanors, and decidedly nonmaterialistic lifestyles were products of a Quaker background, the severe fiscal hardships they may have experienced in the 1930s, or a considered practice. I cannot remember any mention of literature, theater, or musical outings in their life. In these respects, the Buellian lifestyle was antithetical to that described by Langenheim for W.H. Cooper who she relates had a far-flung cultural life including serious musical proclivities.

The Murray and Helen team demonstrated total commitment to plant ecology. Their lives were filled by courses, graduate students, research, publication and editing, and maintaining relationships with environmental figures around the state and botanists of the New York City region. I do not think they ever did anything else besides care for an adopted female relative of about 50 years of age we only knew as “Mann,” and tend their vegetable garden. By now, their children, Sally and Peter, were out of the house. During my tenure at Rutgers (1960–1964), Murray mentored about ten graduate students in a given year, so there was always a critical mass of women and men to support his weekly lunch meeting (where he and Helen ritualistically skinned, then sectioned apples, to which they applied copious peanut butter); as well as his weekly Tuesday-night seminar (always with ice cream and chocolate sauce afterward); his quarterly seminars on “Contemporary Ecologists” at their home; and his 8-hour Saturday courses every fall semester.

His was a closely knit, multilevel program requiring full involvement by students as well as themselves. He led by example. While kind and congenial, Murray expected commitment of focus and time. When Norma (a fellow Buellian student) and I took an extended Easter weekend off to get married, he was not pleased because that would cause us to miss one of his all-day Saturday classes. Later, when I took my first position in Botany at the University of Minnesota in 1964, I recognized an equivalent pattern of commitment to the discipline by Donald B. Lawrence, Evile Gorham, and others. These may have been relics of Cooper’s influence at Minnesota, or just how things were in those days. Nowadays when I see dark laboratories in the evenings and locked doors on weekends, I reflect on how times have changed. I suspect that ecology faculty and graduate students may be as dedicated now as they were then, but the nature of graduate student education seems to have changed from time-consuming, collective, experiential activities to more solitary pursuits of unknown duration. This is not the place to pursue the causes and merits of this apparent change, or even how universal this change might be.

Professional affiliation was important to Murray, too. We were expected to become members of the Ecological Society of America as soon as we joined his program, and to follow its literature. When the American Institute of Biological Sciences was founded, Murray firmly encouraged us to join it as well. Murray was an influential leader at ESA and the Torrey Botanical Club when we were at Rutgers. I am sure that after receiving my Ph.D., I was personally treated with more respect by senior ecologists than I deserved on my own merits merely because I was Murray’s student. In modern parlance, Murray was “well networked” although the connections were based on a deep commitment to the field rather than a pragmatic career strategy.
While in graduate school, we were not particularly aware of being part of an ecological heritage. We did not think much more about Cooper and Cowles than many other ecologists although we were aware of Murray’s historical position, primarily through our readings in the plant geography course, but also in the quarterly “Contemporary Ecologists” seminar which analyzed the ideas and contributions of many ecologists including, incidentally, Robert H. Whittaker. In fact, it was in that context that I explored the contributions of Henry Chandler Cowles—by now not a very “contemporary” ecologist. In spite of these exposures, it seemed like decades before I fully appreciated the intellectual history behind my own education. We graduate students were self-centered—possibly necessarily so at that time of our lives. Aware mainly of our own desires for imminent importance, we were not as receptive to historical legacies as we might have been. Some things do not change in science.

The Cowles–Cooper school of plant ecology

What do I now perceive were the properties of what I will term the “Cowles–Cooper school” of ecology? Based on my reading of Cowles’ and Cooper’s writings, Langenheim’s description of learning under Cooper, and on my own experience, I propose the following seven properties for this school, some of which were doubtless shared by other groups. It is inevitable that I am superimposing my own perspective in recalling my Rutgers experience. Memories and interpretations by my cohorts would very likely differ.

1. A solid grounding in botany, especially plant physiology, taxonomy, and morphology;

2. A focus on vegetation (plant cover) with secondary attention to the nature of communities or ecosystems;

3. A geographic perspective on, and appreciation for, the floristic and physiognomic character of continental vegetation and its history, derived from experience;

4. An understanding of the physical environment in a spatial and temporal context;

5. A mental template (heuristic) of vegetation and ecosystems in a spatially varying landscape having continuous and discontinuous variation in environmental factors overprinted by historic events;

6. A pragmatic acceptance of the world as we perceive it, along with an absence of commitment to preconceptions of the nature of communities or vegetation;

7. A sense of reverence for nature and responsibility for its preservation.

What follows are my recollections of how these properties were evoked and promoted under Murray’s mentorship.

1) A solid grounding in botany

Our botanical training primarily came from formal courses augmented by conversations in the field. Rutgers courses were generally sound but often dated. Most outstanding, from my viewpoint, was the full-year taxonomy sequence taught by David Fairbrothers. He enthusiastically introduced us to phylogenetics,
population genetics and plant evolution while giving very challenging taxonomic assignments. Marion Johnson’s morphology course was very old-fashioned, but he introduced us to some paleobotany. Physiology courses were competent with particular strength in the area of mineral nutrition. Back then, the ascent of sap in trees was still not properly understood and the role of DNA was just appearing. Cowles would not have been surprised at the organization and even content of much of our curriculum, but he would have been surprised by some empirical discoveries and especially the new ideas about plant population genetics.

2) A focus on vegetation (plant cover species composition and form)

The focus on vegetation was tacit. We moved easily between community and ecosystem perspectives, but it seemed that most of our discussions were focused on vegetation. We did not take a plant ecology course, per se; the subject was wrapped within a two-semester sequence titled Bioecology, co-taught by Murray and Paul Pearson from the Zoology Department. As was Murray’s style, that course was taught all-day Saturday. This permitted some extensive field trips as well as introduction to a very broad range of ecological thought, some classical, but much of it contemporary. We visited abandoned fields, piedmont and mountain forests, and the sequence of coastal vegetation extending from the Pine Barrens to salt marshes and dunal complexes. In that course, we learned to sample vegetation with nested plots, and by point-quarter and line-intercept methods. Thus, we were equipped with standard ecological methods—skills that served me well through my entire career. Murray would expound on the phenomena before us, but preferred discussion. It was more his style to exploit questions from students. For example, as we trailed into a forest and passed a low spot covered with tall touch-me-nots and joe-pye weeds around skeletons of fallen trees, a student might make an observation. Then, Murray would respond as though he had never noticed this before, saying innocently, “Golly, you’re right. I wonder what’s going on here?” Then, we launched into a communal analysis of cause and effect.

The Wisconsin plant ecology school under John Curtis was in full swing at this time (Curtis 1959) and received much discussion in our Tuesday-night plant ecology seminars. Nicolson (2016) has provided a very fine exposition of the conceptual debates of the time. Murray brought “Mac” (Robert) McIntosh to Rutgers for a seminar on the philosophy of the Wisconsin school. We came to realize not only that Mac did not wear horns, but that the Wisconsin interests were more like ours than we suspected. That school was heavily quantitative and Gleasonian so that members sought continuous compositional change among “stands.” Contemporaneously, Robert Whittaker’s descriptions of Smoky Mountain vegetation (Whittaker 1956) portrayed vegetation as continuously varying but nevertheless generalizable via easily and usefully perceived portrayals of vegetation types on landscapes. Whittaker’s methods were cryptic (Nicolson 2016), but his end products made sense. Meanwhile, Clementsian devotees, mostly in the western United States, sought, mapped, and managed typal community units. Typically, proponents of strongly held points of view find what they seek. I do not know Murray’s own opinion on these views at the time, but to me it appeared that end products of all of these schools characterized parcels on a landscape that could reflect an indefinite degree of continuity or discontinuity.

It is important to note in passing that it was due to Murray’s open and genial nature that a stimulating teaching partnership was maintained with Paul Pearson from the Zoology Department. Paul’s and Murray’s Bioecology course, together with the fact that both departments contributed teaching assistants to the general biology course, led to a very friendly and collaborative relationship between the zoology graduate students and us. From our limited experience, Rutgers biology was a happy, congenial place.
3) A geographic perspective

The broadly geographic and intrinsically historical qualities of the Buellian perspective had two sources. The first was the extended field trip. These originated with H. C. Cowles who was renowned for his long teaching trips across the nation (Cassidy 2007). From Langenheim’s (2015) account, W. H. Cooper’s program may even have extended this tradition. The Cowles–Cooper school could not be accused of geographic provincialism. These experiences demonstrated vegetation as it was—not as it might be idealized in the classroom—with all the evidence of various kinds of disturbances—natural and human-caused—and of intrinsic patterns of change as plants grew and died. Evidence of fire, logging, drought, and the not-too-distant latest ice age were part of this school’s portfolio. Wide-ranging field experience surely was a central part of the Cowles–Cooper school of plant ecology. Today, such opportunities are largely precluded by the logistical, financial, social and even legal constraints of contemporary higher education.

I do not know the extent to which Murray led extended field trips prior to my time at Rutgers. I was told that he had done so previously but that a few years before my arrival in 1960, he had suffered a heart attack while on a trip up New Hampshire’s Mt. Washington. That event may have curtailed this kind of activity in the latter part of Murray’s career. There was, however, one long field trip in my Rutgers experience. Murray and Helen led the student corps on an extended camping trip down to the southern Appalachians in spring of 1962. It was an enchanting experience for us to view the magnificent variety of vegetation communities, the big trees, and the exotic-to-us plant species we had studied previously through two lenses. The first lens was through E. Lucy Braun’s idealized, Tertiary, Mixed-Mesophytic Forest (Braun 1950). The second lens was through Robert Whittaker’s visualization of a landscape organized (admittedly somewhat subjectively) into environmental zones (Whittaker 1956). Being in this hallowed land was such a thrill! As we traveled back northward, we visited one of nature’s most extravagant floral displays—the otherworldly Rhododendron and Azalea “gardens” in full bloom. I have a photograph from a campsite on Whiteface Mountain in Virginia of Murray sticking his finger in cool water after burning it on a coffee pot.

The second contribution to a broadly geographic and intrinsically historical character of Buellian science was Murray’s very rich plant geography course. This course was a virtual field trip in which we explored the historical and contemporary understanding of vegetation across North America. The course was primarily composed of student presentations with paper synopses—Murray rarely lectured. But it also included discussion of his 35-mm slides (to the extent Murray had them) of vegetation types and plants across the continent. For 8 hours, every Saturday, we participated in Murray’s virtual field trips, somewhat wistfully sensing the sun passing from east windows to west windows under blue skies of those beautiful fall days. We were enthralled, nevertheless, by the romance of space, time, migration, and evolution that are intrinsic to plant geography. I have a hunch that much of what attracted us to plant ecology was embodied in plant geography rather than in ecology itself.

4) Understanding the physical environment in a spatial/temporal context

To understand the relationship of plants with the physical environment, all of Murray’s students took a series of now quite outdated physiology courses (we heard about DNA for the first time), and also took a descriptive microclimate course. But much more importantly than these were the landscape-centered courses
we took in soil science with the redoubtable pedologist, John Charles Fremont Tedrow; and the geomorphology course we took from Peter Wolf. I rank these courses among the most influential experiences I, and presumably Murray’s other students, had at Rutgers. Both courses were field-oriented. The pedology courses involved participation in Tedrow’s priceless field trips; but they also involved our individually producing a soils map over an approximately 25-ha parcel of varying geology, terrain, and land ownership. There is nothing like field mapping to force one to understand the realities of environmental variation while avoiding aggressive farm dogs. I still have, and cherish, my mapping product from that experience.

Peter Wolf’s geomorphology course entailed lectures on geomorphic processes, but more importantly, two, weekend-long field trips. One extended from New Jersey’s Coastal Plain and Piedmont into Pennsylvania’s narrow belt of metamorphic Appalachians, across the Great Valley, into the Ridge and Valley Province, and up on to the Allegheny Plateau. In preparation for that trip, Wolf required us to purchase a formation boundary, surface geology map, and to color in the various formations for interpretation during the trip. At each stop, he would ask one of us to locate ourselves and to describe the structural geology that lay before us. Wolf’s second trip took us northward into glaciated terrain, up the Hudson River Valley; into the Berkshires; to the edge of the Adirondacks; eastward across the Taconic and Green Mountains; and back down through the Connecticut River graben and volcanic cuestas. What a vast experience!

I cannot overemphasize the importance of Tedrow’s and Wolf’s field trips on Murray’s students’ ability to interpret vegetation and ecological processes over expansive times and spaces. I contend they were central contributors to Murray’s way of maintaining the Cowles–Cooper approaches to plant ecology. We laughed when Murray told us that New Jersey was the best state in the Union for teaching ecology because, he said, we could see so much variability in such a short distance. In fact, this was not just rationalization for that small, urban state. He was arguably correct in his assertion. New Jersey and surrounding states provide an enormous variety—if not the drama of western landscapes—of geology, terrain, and biodiversity in a small area. Without leaving much of a carbon footprint, we could experience a wide-ranging environmental diversity, and then adapt that experience to just about any place else in North America.

Murray often taught a summer course, jointly with Tedrow and Wolf, named “geo-ecology.” Regretfully I did not take that course, but I believe it was another indication of how Murray thought in terms of relationships of geology, soils, and vegetation. Surely, this was a Cowles–Cooper legacy.

5) A landscape/historical perception of nature

I have already referred to a view of nature from a landscape perspective. Our sense was that the vegetation overlying the landscape was controlled by a mixture of varying environmental conditions and by past events, while always undergoing change, but at varying rates. I infer this was consistent with the Cowles–Cooper school point of view. Our attention to this perspective took a turn when Murray’s primary research as an NSF-funded investigation into whether the continuum nature of vegetation, as promulgated by the Wisconsin school, was manifested in New Jersey. Perhaps for the first time, Murray had a significant grant—an entry into the new age of federal funding. He funded several graduate students to explore this question using Wisconsin methods to characterize New Jersey’s mountain vegetation. This ongoing activity became a central focus for many of our seminars and debates. These debates were never
resolved because—in my view—the questions were conceptual/theoretical and not vulnerable to field testing. The nature of vegetation depended on one’s vegetational heuristic, needs, and wants. It was, as I have now come to frame the problem, perspectival (Reiners and Lockwood 2009). Robert McIntosh—a product of the Wisconsin school—understood this as well as anyone (McIntosh 1987).

I never knew what Murray concluded from his research effort but suspect he was a pragmatist, believing that sometimes vegetation change over a landscape was continuous where the environment was continuous (and no historical impacts intervened) and sometimes it was discontinuous where the environment was discontinuous and that chance always played a big role in what one would find at any particular location. At any rate, this exercise allowed him to obtain some numerical data on New Jersey vegetation that could be applied to his overview for the state (Robichaud and Buell 1974).

6) A pragmatic acceptance of the world as we perceive it

I posit a sixth ingredient on the Cowles–Cooper–Buell school as being a pragmatic acceptance of the world as we perceive it, evading any particular ecological idealization of the nature of nature. This kind of acceptance may seem unsurprising. We may assume that is true of all science. Alas, that is not the case. A close study of much of ecological thought indicates that we are mostly products of our education and experience. These factors burden us to varying extents with perspectival constructs that may be useful, but are not usually the whole truth (Reiners and Lockwood 2009). We seek ways to generalize about nature that may be helpful in forming broad descriptions and explanations, but—if overextended—become orthodoxies leading to errors in particular cases—when predictions really matter. On the other hand, to only see the world as a lot of special cases is not very high science, resembling what Lord Rutherford disparagingly described as “stamp collecting.”

While at Rutgers, we were aware of the current debates about the essential integration versus the singularity of communities, or of the overargued Clementsian–Gleasonian dichotomy (Keller and Golley 2000, Nicolson 2016). Similar debates ensued on the nature of ecosystems. As I recall many years later, we were more bemused than engaged by these debates, much like the fruitless nature–nurture debate. The Buell program seemed to fasten on to the spatially and temporally varying physical environment and vegetation in landscape contexts. We accepted that vegetative (and ecosystem) properties could be continuous or discontinuous and were likely to be changing for many reasons over multiple time scales. It is no surprise that such a flexible perspective arose naturally from a school that began with dunal studies (Cowles 1899). Fast-changing dunal systems make apparent the interactions of physical controls with plant and animal responses that have constructive and destructive phases. Through the history of the Cowles–Cooper school, the dunal system became an archetype that could be applied beyond local landscapes to whole regions like the Chicago area (Cowles 1901), or physiographic units like Isle Royale (Cooper 1913), or political units like the state of New Jersey (Robichaud and Buell 1974).

7) Valuing nature and responsibility for its maintenance

I believe that my student colleagues and I shared an appreciation of nature, thought it to be beautiful and intrinsically valuable, and that we were morally obligated to preserve aspects of the natural world (Reiners et al. 2013). These aesthetic and ethical values were as automatic as honesty, courtesy and observance of the law: they were our shared axiology. Fascination with, and a sense of beauty of, nature
was a large part of why we wanted to be ecologists. They were “givens” and not explicitly discussed. We assumed that Murray felt the same way. We knew that Murray had many working contacts with scientific and land-managing agencies in New Jersey, so there was an applications theme to his program. For example, my Master’s thesis was funded by the U.S. Geological Survey. Our work was meant to have more meaning than to tickle the fancies of academics like us.

But, there was one time during my tenure at Rutgers when this ethic was brought to the forefront so that our largely intuitive values were tested against reality. That event was the publication of Rachel Carson’s Silent Spring (1962). We discussed Carson’s revelations at length with unusual intensity. Her book opened our eyes so that we could see for ourselves how unperceptive we were to how the environment around us was being degraded, and what socioeconomic forces were bringing this about. The implicit became much more explicit. It became apparent that, as a land grant university, Rutgers included contingents that took the opposite point of view. The College of Agriculture was, in fact, aligned with chemical companies just as Carson said they were, and stood in opposition to her conclusions. At one point, Carson’s message was represented in a large, campuswide forum at which we were shocked to see the extent of rejection of her data and her values by authoritative figures in the university. I do not know what, if any, role Murray had in bringing about this moment of enlightenment, but it was a memorable event in our educations. In retrospect, I think it crystallized our commitment to the environment and opened our eyes to the degree to which it had been, and was continuing to be, harmed. This event was a precursor to the environmental movement and Earth Day to come much later. Our awakened awareness was a blessing, but at the same time a kind of curse, in that by removing the scales from our eyes, we entered a lifetime of painful enlightenment. Not only was our science to be useful to humanity, but it was now imbued with environmental responsibility and sociopolitical weight.

Closing

In my opinion, there was no Cowles–Cooper canon as there may have been for the Nebraska or Wisconsin schools, or for the E.G. and H.T. Odum school(s) of ecosystem ecology, or the Princetonian school of community structure. Instead, it was a flexible and pragmatic perspective evolved out of practice and field experience. Fortunately for me, this perspective easily lent itself to an ecosystem view of nature which overtly could take on many scales.

In spite of my ecosystem predilections, I especially prize the one opportunity I had to work in the field and to copublish with Helen and Murray (Buell et al. 1968). That occasion was particularly enhanced by its being carried out on Cedar Bog Lake—the site of Lindeman’s revolutionary work, inspired by William Cooper and Sam Eddy. Thus, I worked with my dear mentors under the shadow of William H. Cooper at an ecological “sacred place.”

I cannot document how successful Murray was in perpetuating the undefined Cowles–Cooper tradition in ecological practices. I know little about the careers of Murray’s other students aside from those of J. E. Cantlon, W. A. Niering, and F. H. Bormann (White et al. 2010 and a very few others). I only know my own case. Unlike most of Murray’s students, I was attracted to ecosystem ecology from my earlier undergraduate days at Knox College, and by the opportunity to work with George M. Woodwell (a student of H. E. Oosting) at Brookhaven National Laboratory for my dissertation. This led to a career
dominated by ecosystem-related questions. But the vegetation and landscape perspective I gained at Rutgers benefited me in so many ways. This perspective turned out to be a fine platform from which to ask energetics and biogeochemical kinds of questions, to address them in terms of temporal dynamics over varying space. Almost everything I have published was framed in those terms. Aside from that, I even published some purely vegetation ecology papers that Murray might have liked. The perspectives by which I perceived nature came from Murray’s courses and the wonderful field experiences I had with him and his colleagues at Rutgers University. So, I am claiming for myself a manifestation of the Cowles–Cooper intellectual genotype. Indeed, this legacy preadapted me for my most recent work in the philosophy of ecology in which J. A. Lockwood and I argue that “constrained perspectivism” is both descriptively accurate and normatively compelling (Reiners and Lockwood 2009).

By coincidence, I grew up in the Chicago area where Cowles developed his ecological style. Also by coincidence, I am writing this from our winter home in Tucson, where with a turn of my head, I can see Tumamoc Hill—a cradle of early ecological development in the United States (Kingsland 2008). As I close this essay, I realize that my career has allowed me to work over a broad range of environments: from tropical rain forest to alpine tundra, from the New Jersey Pine Barrens to Wyoming’s cold deserts. I like to believe that my involvement in wide-ranging ecosystems was enabled and stimulated by the Cowles–Cooper influence through Murray Buell. Along with the intellectual heritage I gained from Murray, though, I mostly think of him as an extraordinarily generous, kind, and gentle man who took me in and enabled me be what I am.

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