ESA HISTORICAL RECORDS COMMITTEE

(ESTABLISHED 1944)

NEWSLETTER

Resources for the history of the Ecological Society of America
and the history of ecology and allied sciences

No. 18 **July 2019**

Fifty Years Ago: Physiological Ecology Section Approved

Sharon Kingsland

The Ecological Society of America (ESA) approved the creation of a new section for Physiological Ecology fifty years ago, at its council meeting in August, 1969. In 1970, at ESA's annual meeting at Indiana University, the section was formally constituted, and in 1971 the section sponsored two symposia at the meeting at Colorado State University, one of which was devoted to the physiological ecology of arctic and alpine plants. W. D. Billings, an expert on that subject of plant adaptations to extreme environments, presided over the symposium, which included three speakers who were involved in the Arctic Tundra biome study of the International Biological Program: Jerry Brown, Larry Tieszen, and Lawrence (Larry) C. Bliss. The recent passing of Larry Bliss on July 7 prompts reflections on the development of physiological ecology in the decades after the Second World War, as well as some important changes in ESA that occurred during Bliss's career, and that he helped to bring about.

It might appear odd that a section on physiological ecology should have been formed this late, for ecology always had a close connection to physiology from its earliest days. A historical review of the field by Billings (1985) notes those early connections, but also charts the many obstacles that ecologists had to overcome to keep this field going during the early twentieth century. In the 1930s, money was scarce for ecological research and ecologists' attention focused more on practical problems in grassland and forest management, as well as conservation. The Second World War diverted scientists' attention to war-related research, but as Billings pointed out, several plant physiologists and agronomists were studying plant-environment relationships during the 1930s and 1940s in a way that helped boost ecological research as well. One important innovation of the postwar period was to design laboratory facilities that made it possible to do experiments on plants under controlled conditions.

Chief among those innovators in laboratory design was Frits W. Went, who built a modern climate-controlled laboratory for botanical research at the California Institute of Technology in 1949. The cost was just over $400,000, at that time an unprecedented amount for a biological laboratory. Formally named the Earhart Laboratory for Plant Research, it was informally known as a "phytotron," a term meant to evoke the cyclotrons of atomic physics. Went was interested in basic plant physiology, but also had keen interest in ecology. He assiduously promoted the construction of phytotrons around the world, in part to improve the rigor of ecological research, and thereby end the many controversies that arose

when scientists performed experiments under different conditions and then argued endlessly about divergent results.

The 1950s and 1960s saw enormous innovation in laboratory designs and instrumentation, all of which helped to strengthen and transform ecological science. Went's phytotron drew scientific visitors from around the world and sparked campaigns to build similar facilities in other countries. Major phytotron projects began in France, Australia, and the Soviet Union in the early 1950s, and by 1980 there were about thirty phytotrons worldwide. In addition to contributing to basic plant physiology, often with specific applications to agricultural problems, these centers also promoted the field of physiological ecology.

Advances included not just elaborate laboratories such as phytotrons, but use of less expensive individual growth chambers, as well as mobile laboratories for field research. Went himself built a mobile laboratory for desert research in 1956. The laboratory consisted of a combination truck and house-trailer. The house-trailer provided creature comforts for the scientists with a kitchen, stove, refrigerator, shower, and air conditioning, but also served as a laboratory with benches and instruments. The truck, with an electric generator, large water tank, and air compressor, provided power for the laboratory.

French scientists were especially quick to realize the need for a specially designed ecological equivalent to the phytotron. Building on the link between ecological studies of vegetation and physiological questions, the Plant Physiology Department at Montpellier, France, promoted the idea of building an "ecotron," described as a super-phytotron that had greater flexibility than the Caltech prototype. The designer and force behind this project was Frode Eckardt, a Danish physiological ecologist who was then head of the Montpellier Department. He had also worked in California with Frits Went in 1956-1957, and understood both the advantages as well as the shortcomings of Caltech's prototype.

Unfortunately, funding was not available when Eckardt proposed the idea in 1963. Although his ecotron was not built, Eckardt became a leading ecophysiologist and used climate-controlled chambers in his research, while developing innovative techniques for ecophysiological research. His particular concern was to bridge the laboratory-field divide, which involved taking instruments into the field for better measurement of environmental conditions as experienced by plants outside. Perseverance in the development of ecophysiology at Montpellier paid off much later: two scientific generations down the road the National Center for Scientific Research did finally build an Ecotron there, which opened in 2010 at the Centre d'Ecologie Fonctionelle et Evolutive.

Billings noted that increased focus on research at the intersection of physiology and ecology in the 1950s had an impact on the training of a new generation of ecologists. The centers of this research in the United States were Caltech, Emory, Wisconsin, Rutgers, and Billings' home institution, Duke University. Increased government funding was also becoming available for experimental ecological research. By the late-1950s, the National Science Foundation (NSF) was becoming more open to the idea of devoting funds to specialized research facilities, meaning facilities that were not found in every college and university. The traditional meaning of a specialized facility was a museum, marine station, or field station. With scientists like Went and others urging NSF to think more broadly, the phytotron and its zoological equivalent, the biotron, were added to the list of specialized facilities that NSF deemed

worthy of support. Duke University acquired its phytotron in 1970, when the Southeastern Plant Environment Laboratories (SEPEL) were created at Duke and North Carolina State University, with phytotrons in Durham and Raleigh, North Carolina.

At that time, Larry Bliss, who had been Billings' doctoral student in the mid-1950s, was on the faculty of the University of Alberta, Edmonton, where he was professor of botany and director of the university's Controlled Environment Facility. In 1969 Bliss also became director of the large, integrated ecosystem study that was part of the Canadian International Biological Program, a study of the arctic tundra ecosystem on Devon Island in the Canadian High Arctic. A related comparative ecology project was also being conducted on Devon Island, directed by James Teeri of Duke University, which included experimental work at the Duke Phytotron. As Billings remarked, "Without the knowledge and techniques of physiological ecology, the program in the various biomes would have been far less successful". He cited Bliss and Tieszen's synthesis volumes from their respective biome studies as examples of this fruitful synergy between ecosystem ecology and physiological ecology.

During his time in Canada, Bliss also became deeply involved in applied ecology, especially in connection with recent petroleum discoveries and the need to build pipelines to transport the oil. In 1970 Bliss wrote an essay on the importance of protecting the Arctic for the *Bulletin of the Atomic Scientists*, and used the opportunity to reflect more broadly on the environmental consequences of industrial development and our wasteful use of oil (Bliss 1970). In keeping with the message of the first Earth Day (April 22, 1970), Bliss argued that we must shift our philosophical outlook from being conquerors of nature to stewards of nature, and he hoped that the mistakes made in temperate regions would not be repeated in the Arctic.

Bliss recounted his research in relation to petroleum exploration in Canada in his later address as past-president of ESA (Bliss 1984), where he recalled the slow and difficult process of building trust between the petroleum industry and scientific experts. These efforts were largely successful, and the petroleum industry's support became crucial for scientific research. As Bliss noted, the research conducted during the International Biological Program "could not have been accomplished without the financial and logistical support of the petroleum industry. Twenty-two oil and gas companies participated in our basic and applied research."

As President of ESA in 1982-83, Bliss oversaw the creation of ESA's Washington Office, which had been discussed for many years, and which represented a crucial step in promoting the importance of ecological science in environmental policy. As Bliss noted in his address, creating this Office enabled the Society, for the first time, to act as a broker between agencies, federal departments, and industries seeking ecological advice, and the ecological expertise of ESA's membership. "Our voice is now being heard," he wrote. A couple of years earlier Arthur Cooper had devoted his past-presidential address to the question "Why doesn't anyone listen to ecologists, and what can ESA do about it?" (Cooper 1982). In his address, Cooper stressed the importance of creating a presence in Washington and laid out a plan for seeing it through. The hard work and determination of Cooper and others had finally borne fruit with the creation of the Washington office. Bliss ended his address urging the Society to build on this momentum, expressing the hope that "government at all levels and industry will want and seek our services." The news updates that we continue to receive from the Public Affairs Office remind us of how important the vision of these ecological leaders was forty years ago.

A note on ESA's historical records: ESA's archives at the Hargrett Rare Book and Manuscript Library, University of Georgia, include three boxes in the Lawrence C. Bliss collection. A digitized oral history of Bliss by Richard Fonda is part of ESA's Oral History project, also at the University of Georgia. Related oral histories of Arthur Cooper and Marjorie Holland are also in this collection.

Literature Cited

Billings, W.D. 1985. The historical development of physiological plant ecology. In Physiological ecology of North American plant communities, ed. B.F. Chabot and H.A. Mooney. Chapman and Hall, New York, pp. 1-15.

Bliss, L.C. 1970. Why we must plan now to protect the Arctic. Bulletin of the Atomic Scientists 26(8): 34-38.

Bliss, L.C. 1984. Address of the past president: Ecologists need to increase their involvement in society. Bulletin of the Ecological Society of America 65(4): 439-444.

Cooper, A.W. 1982. Address of the past president: Why doesn't anyone listen to ecologists; and what can ESA do about it? Bulletin of the Ecological Society of America 63(4): 348-356.

Updates from the University of Georgia Libraries

As part of the ongoing oral history project initiated by Dennis Knight in connection with ESA's centennial, Eva Stricker's most recent oral history of Jerry F. Franklin is now available at this location: http://russelldoc.galib.uga.edu/russell/view?docId=ead/RBRL416ESA-ead.xml

ESA's archives are held at the Hargrett Rare Book and Manuscript Library at the University of Georgia. The finding aid for that collection is online here:
http://hmfa.libs.uga.edu/hmfa/view?docId=ead/UA97-061-ead.xml

The Historical Records Committee has created Guidelines for archiving digital and paper documents, especially those relevant to the official business of the Society, including its sections, chapters, and committees. Those Guidelines are on the Committee's website:
https://esa.org/history/wp-content/uploads/2017/06/HRCArchivingGuidelines011717.pdf

The Hargrett Library houses other archival collections that are important for the history of ecology. Archivist Steven Armour informs us that two of their largest collections, the papers of Eugene P. Odum and Frank B. Golley, have now been fully catalogued. Information about the E. P. Odum collection is here: https://www.libs.uga.edu/hargrett/archives/uga97-045.html
The finding aid for the F. B. Golley Papers is here:
http://hmfa.libs.uga.edu/hmfa/view?docId=ead/UA02-040-ead.xml