Living with Ghosts at the Farlow Library and Gray Herbarium at Harvard

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My life at Harvard began officially when I was appointed Assistant Professor in Biology and Assistant Curator of the Farlow Library and Herbarium of Cryptogamic Botany in 1974. The phrase *cryptogamic botany* perhaps requires some explanation. In the world of Carl Linnaeus, the great namer of organisms and inventor of systems for arranging life forms, entities—living and dead—were placed in three Kingdoms. Minerals were non-living, animals moved, and plants were stationary. Plants were divided into two groups the phanerogams—with flowers and cones, etc.—and the cryptogams. Cryptogams are not to be confused with cryptograms. Cryptogams are spore producers with hidden reproductive organs; the group included ferns and fern allies (sometimes referred to as vascular cryptogams because of the internal structures they had to move water and carbohydrates), fungi, lichens, algae, and bryophytes. These days these organisms represent several kingdoms in the hierarchy of life including Plantae, Protista, and Fungi. The Farlow collection holds about 1.5 million specimens of non-vascular cryptogams. These represent the fungi, lichens, algae, mosses, and liverworts; the Farlow Library is equally large and rich. Upon arrival at Harvard I was thrown into this large and complicated collection having previous experience only as an assistant professor at the University of Puerto Rico and as a graduate student at Cornell University. Along with teaching, I was in charge of these world-renowned collections.

Luckily for me, there were two people who helped me at the beginning. Reed Rollins (1911–1998) was director of the Gray Herbarium, part of the Herbaria complex at Harvard, and had been on the search committee that brought me here. He was always available for consultation. At this time the Farlow was in transition and National Science Foundation funding was available to upgrade the collections. In support of this upgrade Rollins had brought to the Farlow Geneva Sayre (1911–1992), a bryologist recently retired from Russell Sage College. Sayre's work centered on collections and their documentation—where specimens came from, who collected them, when their names were published and how and by whom they had been studied. I owe her my ongoing interest in the material culture of museum collections and the people behind these collections.

Specimens in museums, herbaria, and fungaria document the biological diversity of the earth. Each of the 1.5 million specimens in the Farlow comes with a story. One might be looking at a particular lichen collection that was made by lichenologist Edward Tuckerman (1817–1886) on Mount Washington in New Hampshire. This is a large and robust specimen collected in 1848 from near the peak. One might ask: how did he get to

that spot in those early days? Who was with him? Since there was little literature on North American lichens, how did he identify his collection? Can one still find this species today near this sampled location? Why is there a Tuckerman's Ravine on Mt. Washington? This is but one example of questions raised as one works with collections. These are the stories of biology and history. Each specimen whether young or old has a story.

In the collection we have a potato leaf that was gathered in Ireland in 1845. The leaf is in the herbarium of Thomas Taylor (1786–1848) who lived in Ireland. He was a cryptogamic botanist who was particularly interested in bryophytes. The leaf is infected by *Phytophthora infestans* (a downy mildew), the organism that causes late blight of potato. This fungus-like organism (we know now that it belongs not in kingdom Fungi but among the protists) was the cause of the Irish potato famine. The famine not only led to the misery and migration of millions of Irish but also to scientific inquiry into the notion that fungi cause plant diseases. Taylor died in the famine having given up his work as a botanist to return to his earlier practice of medicine in order to aid those suffering during the famine. Each specimen has a story.

I have taught many courses at Harvard including about trees and forests and about fungi. The idea that there is a story behind specimens for me became a way to give students a framework in which to appreciate the topic at hand. When teaching about the organism that cause downy mildew, I often reflect on the work of William G. Farlow (1844–1919) who founded the Farlow Library and Herbarium. He was a student of Asa Gray (1810–1888), premier American botanist of the nineteenth century at Harvard, was trained in medicine at Harvard, but studied cryptogamic botany with Anton deBary (1831–1888), the famed German scientist. DeBary had worked out the biological life history of *Phytophthora infestans*. Farlow learned the techniques of working with these organisms in deBary's lab. Back home here in Boston Farlow began studying the downy mildew of our local grape. He applied the techniques he had learned with deBary but to this heretofore little studied pathogen of grape then known only in the Americas. Although not particularly damaging to the native grape, Farlow ruminated on the possible devastating effect this pathogen could have on European wine grapes. Within a decade the downy mildew had been introduced into Europe with devastating effect. We have the leaves that Farlow studied in the collection. How powerful to think about these events in which plants and pests were transported over the sea in voyages that took many days and contrast such events with the issues of pest introductions today. One can travel to practically any spot on the face of the globe within 24 hours and with that travel organisms can be along for the ride.

Specimens are more than artifacts of the world as it was. With modern technology one can extract DNA and use that DNA to look at taxonomic and phylogenetic placement. It is possible to trace through genetics the particular strain of a fungus that was present at a particular place and at a particular time. One of our lab members has recently done a study and was able to obtain useful genetic information from a specimen from 1807.

I have used several examples to help focus attention on my life as a curator and how deeply one can become involved in the study of specimens. As is often the case we live with those who came before us. Each time I work in the herbarium I am living with my forebears—I live with ghosts.