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Recently I was engaged in a casual conversation with Gertrude Fox, the author of the first article in this edition of Ecospirit. She asked me abruptly if I knew that the idea of ecology had originated with a woman. "That's news to me," I said. Always more than ready to supply information to interested people, she began telling me about Ellen Swallow Richards. I was amazed that I had never heard of a person of such influence and later found that most of my colleagues had not heard of her either. I concluded that an account was a necessary subject for this journal. I asked Gertie to compose such an essay for publication in Ecospirit and she gladly agreed to do so.

"Gertie," as we all soon learn to call her, is very nearly the reincarnation of Ellen Swallow whom a student described in 1908 as "a small woman with a thin face, very black eyebrows, and eyes that sparkled with life." The resemblance is not only physical, however, for many of Gertie's interests and achievements parallel those of Ellen Swallow. Much of Gertie's life has been spent as an active scientist. She has a degree in metallurgy and was employed for many years by Bethlehem Steel along with her husband, Sid, who also worked as a researcher. Like Ellen Swallow she has had an ongoing concern for water quality. Maintaining, monitoring and fighting for the purity of Monocacy Creek, a stream that runs through metropolitan Bethlehem, Pennsylvania, continues to occupy a major part of her time. She takes an active role in the ecological education of local school children, an action Ellen Swallow would be proud of. She is truly the person to make the name and achievements of Ellen Swallow known to our readers.

Following the wish of Swallow for a scientifically well-informed citizenry, we are including a brief history and detailed description of the holdings and services of the U.S. Department of Agriculture Library in Beltsville, Maryland. The article is written by another woman, Jean Bellows, who works as a research assistant in the Library. The scope of the holdings and services is surprisingly wide thanks to the liberal library policies described by Ms. Bellows. Of particular interest is the new research and reference collection on animal welfare. The fact that Ellen Swallow wrote a number of the early bulletins for USDA is of more than passing interest.

--Paul Larson

ELLEN SWALLOW, The Woman Who Founded Ecology by Gertrude Fox

She was a hundred years ahead of her time; the first person in this country to be concerned with pure water, pure air, proper use of soil, public health, nutrition and much more. A book by Robert Clarke, Ellen Swallow, The Woman Who Founded Ecology (Follett Publishing Co., Chicago; 276 pages, 1973) resurrects the accomplishments of this First Lady of Science, the founder of the environmental science "oekologie."

Ellen Swallow had more "firsts" than any other woman of her time. She was the first woman admitted to MIT, the first woman to receive a degree from MIT, the first female science faculty member at MIT or any other science school. At MIT she devised and taught courses in air and water pollution and sewage systems, particularly as they affected life in the home and in turn all of daily life. She championed the cause of women's rights, started the organization now known as the American Association of University Women, and founded the American Home Economics Association. Most importantly, however, she was the first to teach what we today call ecology.

She was born in 1842 on a farm near Dunstable, Massachusetts. She was a bright child with an early interest in the living world around her. She was devoted to living things and "at home, in her diary and at school she classified what she found and presented her observations." Growing up in Westford, Massachusetts, she keenly observed its topography, the flow of its streams, and the purity of its air. One day she would observe, "Air and Water are Food."

Ellen Swallow graduated from Westford Academy in 1863. Although her desire for knowledge was keen, there were no colleges for women in New England at that time and few anywhere in the world. In 1865 Matthew Vassar provided Ellen with an opportunity in Vassar College for Women. This experiment in education shocked the people of Poughkeepsie. Women "are too frail and delicate," "their nervous systems will not adapt to higher learning," "they should not be educated beyond their needs." Ellen was twenty-six years old when she enrolled as a third-year "special student" at Vassar.

Two people at Vassar influenced Ellen by engendering in her an excitement and enthusiasm for science: Maria Mitchell, the astronomer, and Professor A. C. Farrar, head of the Natural Sciences and Mathematics Department. Under Farrar she developed a love for chemistry. In the laboratory she analyzed everything "... from shoe black to baking powder." Her first love, the outdoors, provided the laboratory with fossils, rocks, soil, animal and plant life. Water, the vital source of all life, was of special interest to her. Upon graduating from Vassar, Ellen remarked, "My life is to be one of active fighting." This prophecy about her efforts to improve the quality of water and, in turn, the quality of life would prove true.

"I've quite made up my mind to try chemistry for a life's study and have been trying to find suitable opportunity to attempt it, but everything seems to stop short at a blank wall," she wrote in her diary. Merrick and Gray, a Boston chemical company with whom she had applied for a job, suggested that she try the "new Institute of Technology" in Boston. Ellen Swallow wrote for admittance and received this reply on December 14, 1870.

> My Dear Miss Swallow:
>
> The Secretary of the Institute, Dr. Kneeland, will notify you of the action of the corporation in your case at a meeting held this day. I congratulate you and every earnest woman upon the result. Can you come to Boston before many days and see me? I will say now that you will have any and all advantages which the Institute has to offer without charge of any kind. I have the pleasure of knowing both Miss Mitchell and Mr. Farrar of

Vassar. Hoping to have the pleasure of seeing you, I am,

Faithfully yours,
J. D. Runkle
President of the Institute[1]

Ellen could not believe her good fortune. "I have the chance to do something no one else ever did ... to be the first woman to enter the Institute of Technology, and so far as I know, any scientific school...," she wrote. Furthermore, she was admitted "without charge of any kind." What she did not realize was that she was being admitted on recommendation of the Faculty of the Corporation as a "special student in chemistry." Her admission was "only to be considered an experiment." In admitting her without charge, Ellen Swallow was taken on without any obligation on the part of the Institute. When Ellen learned later of her real status as an "experiment" and the real reason for her not being charged, she said that she would not have gone to the Institute if she had known this.

The Institute was known popularly as MIT. There was excitement in working in the "Universal Laboratory," the first of its kind in the world, and a vibrancy in teaching the newly emerging technologies. "Mining was a major field by which MIT hoped to connect with industry so -Ellen- studied mineralogy under Professor Robert Richards."

Boston, a world port and hub of commerce and culture, was the largest city Ellen Swallow had seen so far. The great museums and schools intrigued her. So, too, did Boston's horrors.

> She was shocked by things she saw on the way to school and around town. Filth, Disease, Suffering. She'd read about the excessively high rates of death and illness, the epidemics that ran through the city. Now she saw why. Horse wagons carrying uncovered food over dirty streets through pools of stagnant swill made of everything from animal waste, human spit, and garbage. Alleys were worse: open sewers. Indoors, many homes weren't much better." Sometimes less than half a city's children lived to be adults.[2]

In England in the mid-nineteenth century pollution of water was so bad that a Rivers Pollution Commission was formed. Following that lead with a new branch of science, water analysis, MIT's Prof. William Ripley Nichols tested Mystic Pond on the outskirts of Boston for pollution. Just two years before he had been opposed to having women students at MIT. Yet from all those at the college, it was Ellen Swallow whom he hired to carry on this water analysis. In his 1873 report to the Massachusetts State Legislature, he wrote, "Most of the analytical work has been performed by Miss Ellen Swallow ... I take pleasure in acknowledging my indebtedness to her valuable assistance by expressing my confidence in the accuracy of the results obtained." Her water studies helped make her a preeminent international water scientist even before her graduation.

In 1873, while Ellen Swallow was studying water in this country, Ernst Haeckel in Germany was studying the environment from the point of view of biology. He called his new approach to the environment "oekologie." When Ellen traced this word to its Greek origin, she found that "oik" meant "house." "Oek" meant "every-man's house" and "logy" pertained to the "knowledge of" that universal house. In other words the new science of oekologie dealt with the total environment. To Haeckel, however, oekologie was the science of life. To Ellen Swallow, oekologie was chemistry, the science of everything in the total environment.

In addition to her study of water, Ms. Swallow pursued studies of air and physics at MIT. She added mineralogy and earth science taught by Dr. Robert Richards to give a wider meaning to oekologie. Richards also had been an opponent of coeducation at MIT. It was Ellen Swallow's fluency with scientific German that helped

to change his mind. In the 1870's the best professional journals in mineralogy and mining were in German. In the laboratory "...Richards and Swallow become metallurgists and mineralogists together." As her Professor, Richards gave Ellen Swallow an ore supposedly containing vanadium to analyze. It was a newly found metal and difficult to detect with methods then known. After six months she was able to isolate .02 percent vanadium of which it had been said, "There is no more difficult metal to obtain." Richards was convinced that Ellen Swallow was a genius in the laboratory.

When Ellen Swallow received her Bachelor of Science degree from MIT in 1873, it was the college's first degree of any kind to a woman and probably the first science degree for any American woman. At the same time Vassar College awarded her a master's degree, based on her brilliant thesis on vanadium. Yet, what she really wanted was a Doctor of Chemistry degree from MIT. It was never to be. Many years later, Professor Emeritus Robert Richards said, "She wanted a Doctor's Degree more than anything else, but she had to give up the idea, one of her great disappointments in life.... She was treated for some time as a dangerous person.... It seems to me ...that some of the difficulties may have arose (sic) from the fact that the heads of the department did not wish a woman to receive -MIT's- first D.S. in Chemistry." Though disheartened, she decided to repay her debt of "no tuition." She stayed to finish her innovative water research, to learn what more she could at the Institute and to keep the door open for other women to enter the field of science.

With clever maneuvering and without pay, Ellen Swallow convinced MIT and some public-spirited donors (her own $1,000 donation included) to establish the famous Women's Laboratory at MIT. In November 1876, twenty-three women, most of them teachers, began training for careers in science through chemistry at MIT. The MIT men generally went into industry and government. The first women, however, found their ways into schools and colleges, initiating and improving the teaching of science. Thus, Ellen Swallow had a direct impact on the teaching of science at a time when America would begin to show international scientific and technological supremacy.

On June 5, 1875, Ellen Swallow married Robert Richards, professor of mining engineering and head of the new metallurgical laboratory. For their honeymoon they went to see the mines in Nova Scotia--with his entire class. On their way back from the honeymoon they met a friend in Boston in the company of some fashionable women. "The ladies were shocked. They refused to believe they'd just seen a Vassar graduate, let alone a bride, returning with a couple of dozen males from a wedding trip." The honeymoon was the first of many scientific trips, including one over the North Pole by ship. Other trips were to Europe, Canada, Mexico, Alaska, the Caribbean and across this country to every major city. Ellen Swallow became one of the most traveled women of her time.

Ellen and Robert lived at 32 Eliot Street, Jamaica Plain, a Boston suburb. Together they made their house a prototype of a healthful house. The house was an extension of Ellen's research on air, water, sewage and food. Her kitchen became the first home testing laboratory, wherein she furthered consumer and environmental sciences. Everything coming into the going out of her house was examined and scientifically tested, approved or exposed.

In 1893, at the request of the Massachusetts state government, Ellen Swallow Richards opened the Rumford Kitchen at the World's Columbian Exposition in Chicago. The kitchen was credited with innovative designs and the first public use of nutritional information. For her accomplishments in nutrition she won the praise of America's medical schools. Later she introduced the use of nutritional information in factories, hospitals, asylums and jails. Following this success she became the impetus for a major reform in American education that eventually

spread around the world. Her definition of oekologie now encompassed home ecology. During its formative years this new branch of science went by a variety of names: Household Science, Housekeeping, Domestic Economics, Home Science and Household Economics. All brought the applied sciences into the home. As the new science spread, it began to touch on various other disciplines--art, history, anthropology, sociology, esthetics, economics, physiology, hygiene, mathematics, chemistry, physics and biology.

Ellen Swallow Richards became the first president of the American Home Economics Association in 1908. At her lectures she blamed women's ignorance for the unsanitary living conditions, poor nutrition and poor health in the homes. "Our educational system unfits girls ...for their life.... Scientific facts are taught without relation to everyday life." She had a right to speak, for she had taught sanitary chemistry, sanitary engineering, air analysis and the chemistry of water and sewage at MIT. In 1903 she taught "Chemistry of Air Supply," "Chemistry of Water Supply and Waste Disposal," "Industrial Water Analyusis," and "Air, Water and Food Analysis."

When she died in 1911, Ellen Swallow Richards was well known for the many new pathways she had been the first to travel; pathways by which women could now enter science. She authored First Lessons in Mineralogy. She was elected to membership in the American Institute of Mining Engineers for writing (1877) "A New Method to Determine Nickel in Phrrhotites and Mattes." Her findings in analyzing the rare mineral samarskite led to the eventual discovery of samarium and gadolinium. She was acclaimed internationally for her studies on titanium, lead, copper, samarskite and vanadium. Her analysis of copper ore from Canada led to the discovery of a nickel deposit at Coppercliffe. Between 1882 and 1911 she wrote eighteen books. A few of the titles indicate the wide range of her environmental concerns: Food Materials and Their Adulterations; Sanitation in Daily Life; Conservation by Sanitation; Guides for Science Teaching; The Art of Right Living; The Dietary Computer, and Euthenics - The Science of Controllable Environment, a Plea for Better Living Conditions as a First Step Toward Higher Human Development.

Ellen Richards' environmental movement was not entirely successful. She tried hard to bring all of the diverse disciplines of oekologie into one multifaceted science about the environment, but failed. Food and consumerism rather than environment and education dominated the movement. While everything was connected and interrelated for her, the special interest groups in education, consumerism and nutrition did not agree. Clarke says that a major part of the problem was that most of her oekology followers were women and too few were scientists. She suffered great professional and personal disappointment between 1895 and 1900 because her reforms had gone too far and too fast.

Undaunted, however, she began the study of how humanity relates to its environment, both physically and socially. She sought to explain how the poor quality of the physical environment related to the poor social environment. Any assessment of the cause of poverty "immediately finds itself involved in the public health movement," she said. Soon her new environmental studies became the social science of Euthenics. Her goal was the reduction of human suffering. While pure scientists charged that she had deserted science for sociology, she stood firm on the synthesis of the studies of environment, health and behavior in order to bring a new era in human development and environmental improvement.

Despite some setbacks, Ellen Swallow Richards, the woman who founded ecology, was recognized in her time. Smith College in 1910 gave her an honorary Doctor of Science degree; the doctorate that MIT had denied her. We, today, have lost her to history. We do not know her as a woman, as a scholar, nor as an eminent scientist who correctly prophesied one hundred years ago

the future of our environment. In losing her, we all have lost something very valuable. We need to remember her wisdom, follow her recommendations and generate concern for man's future with as active a life as she led.

I first heard of Ellen Richards when I entered Simmons College in Boston as a freshman in 1935. Because I was a science major, I was told that it would be a good idea for me to join the Ellen Richards Science Club for science majors. My curiosity was immediately aroused. Who was Ellen Richards? Since then I have pursued my study of her--a study that has proven both exciting and worthwhile. I have read about her at the MIT Institute Archives, poured over photographs of her and Dr. Robert Richards at the MIT Museum and Historical Collections, read her precious correspondence in the Archives, visited her house at 32 Eliot St., gone to see the bronze plaque of her face in a corner of MIT's old chemistry building and rejoiced when I learned that the City of Boston has an elementary school named for her.

Ellen Swallow Richards is one of my heroines. She has shaped my life and in part made me who I am. Get to know her. If you do, you will have a better understanding of the wide scope of today's environmental problems. Her vision of oekologie can be a tool for human and biological enhancement through a multidisciplined ecology.

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[1] Robert Clarke, Ellen Swallow, The Woman Who Founded Ecology (Chicago: Follett Publishing Company, 1973), p. 24.

[2] Clarke, op. cit., p. 33.

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Ellen Swallow Richards Archival Materials at the MIT Institute Archives

Photographs of Ellen Swallow Richards and Her Laboratories at the MIT Museum and Historical Collections

The author thanks the professional staffs at both the MIT Institute Archives and the MIT Museum for their assistance in locating the Ellen Swallow Richards archival materials.

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Notes on Industrial Water Analysis: A Survey Course for Engineers. New York: John Wiley & Sons, 1908

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THE NATIONAL AGRICULTURAL LIBRARY - Beginning and Today
by Jean Bellows

The U.S. Department of Agriculture was established in 1862 during the tenure of Abraham Lincoln. The first section of the Organic Act of 1862 spells out the directions of the new department in general terms as follows: "The general designs and duties of which shall be to acquire and to diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of the word, and to procure, propagate and distribute among people new and valuable seeds and plants."[1] Issac Newton, the first Commissioner of Agriculture, was to receive $3,000 to serve as the leader and organizer of the fledgling department. There is no mention in the Organic Act of a library per se, but Section 3 does state the need to collect and preserve information in the following statement. "It shall be the duty of the Commissioner of Agriculture to acquire and preserve in his department meaning his office all information concerning agriculture which he can obtain by means of books, and correspondence, and by the collection of statistics"[2] etc.

The Commissioner was directed to submit a yearly report detailing the state of the art in agriculture, the accomplishments of the year's research and/or other programs and the statistics of production. The first report includes a series of "should do" statements. The one that refers to information-gathering states that the department should establish a library and a museum. What happened to the idea of a museum is not clear even though there are rather specific suggestions regarding the types of things to display and how to display them. On the other hand the library became a reality containing about 1,000 volumes. It is interesting to note that so many of the guidelines states more than a century ago still guide the structure of USDA and the National Agricultural Library as well.

The first report to Congress from Mr. Newton contains a section detailing the activities that should be pursued by a departmental library. In this library "the most valuable works would gradually accumulated by exchange, gift and purchase, forming a rich mine of knowledge." Later on in the first report the Commissioner elaborates on the information gathering activities that took place during the first year of the Department's existence. "Information from every available source both at home and abroad has been laboriously sought for, and is now being obtained, which, in due time, when properly classified will be disseminated."[3] It is not clear what portion of the approximately $60,000 of that first year's operating budget went towards the gathering of information, but, obviously, it was considered a very important activity--as it remains today!

Over the years the Library grew and became known as the National Agricultural Library (NAL), one of the three national libraries. NAL is in good company with the National Library of Medicine (NLM) whose collection stresses the human health and medical sciences, and the Library of Congress (LC) whose collection is to serve Congress and to be a respository for many of the U.S. published documents. The NAL was physically located in Washington D.C. until about 25 years ago when the collection of a quarter of a million volumes was moved over a three month period to a 14-story building located on a portion of USDA's Beltsville Agricultural Research Center in Beltsville, MD. About 10 miles from its old location in Washington, DC.

The early directives have been carried out to the extent that the 1,000 volumes have grown to 1.9 million and the scope of the collection is as broad or broader than the original conception of Mr. Newton. The subject areas presently in the collection range from the school lunch and WIC programs through veterinary science, including such diverse topics as nutrition, food quality, production, processing, transportation, economics of all areas of food production, animal and plant

physiology and diseases, pests, equipment used in food production, aspects of rural life, animal health and welfare, regulatory, issues, and agricultural trade. While the list is longer, it provides the reader with an idea of the far ranging aspects of the documents in the current collection at NAL. A separate rare book collection has many volumes that predate the formation of the Library's collection including early botanical illustrations, plantation and farm diaries, horticultural treatises and veterinary practices manuals. The gift and exchange directives are still in effect as well. Currently 60% of the incoming material are acquired through gift and exchange agreements with exchange partners all over the world. The exchange partners send the institutions publications and NAL's staff send them USDA published documents. As a result the collection has documents from many countries in the world in more than 50 languages. Researchers in countries where libraries have been ravaged by natural political disasters often use NAL as a source of national literature. Truly, the NAL collection has become a "rich mine of knowledge."

At this time the collection includes subscriptions to about 26,000 journals and the monographic collection increases by about 15,000 volumes annually. It is also not unusual for individuals or institutions to donate whole collections as well to the library.

The original librarians probably dealt with books, maps and the results of the emerging science/art of photography. The types of materials collected today, however, include the products of newer technologies including film strips, films, posters and electronic media such as computer software, video cassettes, laser discs and CD ROM.

A very large collection of non-printed materials is the Forest Service Photo Collection. This collection dating from 1898 began with the personal collection of Gifford Pinchot who was the first Commissioner of the Forest Service. Mr. Pinchot required his forestry agents to include photographs, and good documentation, in oversight reports from the field. The results of the interest in "catching a moment on film" is a fascinating set of photos of many aspects of the rural and public land activities and the people who lived at the turn of the century. The collection has been widely used by publishers, artists, reseachers and historians. The browsing collections include 60,000 captioned black and white prints and 55,000 slides. Visitors may browse in the self-service files. Circulating photographs are loaned for a period of two months.

How is the collection made available today as directed by the past? NAL provides many mechanisms for utilizing its collection, and believe it or not, many services to the general public are still free as in Newton's day. Since the various services may be of special interest to the reader, I will elaborate on them.

AGRICOLA (AGRICultural OnLine Access) is a bibliographic database that is produced at NAL and dates back to 1970. It consists of records for literature citations of journal articles, monographs, theses, patents, software, audiovisual materials and technical reports relating to all aspects of agriculture. Until 1984 AGRICOLA primarily reflected NAL's holdings, but as a result of several cooperative agreements, materials from other institutions are included with reference to the provider. Over 5,000 incoming journal titles are scanned for articles relevant to agriculture and supporting life sciences. U.S. publications and materials from foreign countries that are not referenced in other databases are included. The emphasis is on research oriented materials and with few exceptions it does not include articles published in popular and trade journals. The magnetic tape format of the database is marketed through NTIS (National Technical Information Service). The database vendors DIALOG and BRS currently offer AGRICOLA through their online service. The database is identified as files 10 (1980 to the

present) and file 110 (1970-1980) on DIALOG and CAIN (1970-present) on BRS. A hard copy of the tape is titled the Bibliography of Agriculture and is published by Oryx Press. The Bibliography of Agriculture predates the 1970 electronic format as it was started in 1942. Photocopy service for cited articles is available on a cost recovery basis from NAL for those things that cannot be found in the state land-grant institution, private university or public libraries. Documents may be used by anyone on the premises but do not circulate to non-USDA personnel except through inter-library borrowing (ILB). Copy machine are available to the walk-in public.

Reference services are available through mail, telephone and on-site visit. Since a large volume of requests fall into a limited number of subjects, information centers covering 12 general subject areas have been organized in a separate unit called the Information Centers Branch. Each center is headed by a staff member with subject expertise who is available to answer reference requests, help walk-in patrons utilize the collection in the specific subject area, request materials for purchase, produce subject area bibliographies and be available to give seminars or write papers about the services of the centers. The Information Centers Branch includes the following centers: Agricultural Marketing and Trade Information Center, Alternative Farming Systems Information Center, Animal Welfare Information Center, Aquaculture Information Center, Biotechnology Information Center, Critical Agricultural Materials Information Center, Family Information Center, Fiber Information Center, Food and Nutrition Information Center, Food Irradiation Information Center, Horticulture Information Center and Rural Information Center.

NAL is also exploring other ways to disseminating information more efficiently. Currently various electronic formats such as full text documents on laser videodisc, AGRICOLA on CD ROM, AGRICOLearn (an interactive video disc for self instruction on learning to search AGRICOLA) and expert advisory systems are being explored. A text digitizing project is in experimental stages.

As you can see, the National Agricultural Library is still trying to carry out the policies set in motion a century ago. I wonder what Abe would say?

For more information you may contact the following:

Special Photo Collections Office
National Agricultural Library
Beltsville, MD
301-344-3876,

Reference Branch
Room 111
National Agricultural Library
Beltsville, MD
301-344-1204

Information Centers Branch
Room 304
National Agricultural Library
Beltsville, MD
301-344-3704

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[1] Rasmussen, Wayne D. Agriculture in the United States: A Documentary History. Random House, 1975, Vol. 1, 614.

[2] Ibid; 615.

[3] Ibid; Vol. 2, 1007-1008.

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