Wetlands are an important natural resource in the biosphere. Traditional terms used to describe wetlands are marshes, bogs, and swamps. Early European settlers considered these areas as wastelands and did not appreciate their values. For a number of years, many of these areas were drained and used as farmland, since these lands were found to be productive. Over a 200-yr time span (1780–1980), the lower 48 states lost an estimated 53% of their original wetlands. In the midwestern farm belt states, over 14.5 million ha of wetlands have been drained since European settlement (Dahl, 1990). The values and functions of wetlands include: groundwater recharge, water supply, floodwater storage, sediment trapping, pollution control, and wildlife habitat (Mitsch and Gosselink, 1986). The environmental and socio-economic benefits of wetlands are now recognized, as evidenced by our national policy on wetland protection and preservation. In May 1977, President Carter issued Executive Order no. 11990, Protection of Wetlands, which became official policy of many federal agencies. The most significant federal law affecting wetlands is the Clean Water Act of 1977 (P.L. 95-217), Section 404 jurisdiction, which protects wetlands by requiring a federal permit for draining and filling. The federal agencies involved in protecting wetlands include: the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Department of Interior, and the U.S. Department of Agriculture—Soil Conservation Service.

Wetlands are complex ecosystems that are poorly understood relative to terrestrial and aquatic systems. Difficulties in characterizing wetlands reach beyond the problem of variability associated with natural systems, owing to the fact that wetlands frequently are situated in the landscape between terrestrial and aquatic systems and therefore possess characteristics of both. Wetlands function as important links between the terrestrial and aquatic systems by serving as sinks, sources, and transformers of nutrients and chemical contaminants, and thus have a significant impact on downstream water quality and ecosystem productivity.

Since there are different types of wetlands, a single definition cannot be used to adequately characterize these ecosystems (Cowardin et al., 1979). At present, the legal definition used by the U.S. Army Corps of Engineers in regulating wetlands is: “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions”.

However, the single feature that most wetlands share is soil that is at least periodically inundated by a rising water table or flooding.

The three major components of wetlands are water, vegetation, and soils. Wetland research has traditionally been centered on vegetation, wildlife, and systems ecology. Past studies of wetland processes and system functions have given little or no attention to soil-related processes or the role of soils in wetland ecosystems. The soils component is often ignored. For example, a recent report by the National Academy of Sciences entitled “Restoration of aquatic ecosystems: Science, technology and public policy” failed to include the role of soils in overall functioning of wetlands (National Research Council, 1992). However, this report identified key issues needing to be addressed in protecting and preserving wetlands from a biological point of view. Unfortunately, even the National Academy of Sciences failed to include a soil scientist on the committee responsible for evaluating the science, technology, and public policy related to the restoration of wetlands and this limitation is seriously reflected in the report (National Research Council, 1992). Too often, the policies made on wetlands at the national and international levels have minimal input from soil scientists. At present, three professional societies address wetlands-related issues, but none have clearly focused on the role of soil scientists. For example, the Society of Wetland Scientists primarily serves biologists working with wetlands, while the American Society of Limnology and Oceanography primarily addresses issues related to lakes and ocean environments. The Ecological Society of America also addresses wetlands at the ecosystem level, but with little focus on soils-related issues.

Increased emphasis on the importance of wetlands at local, state, and national levels demands thorough study of all components of wetlands, including soil. Soil scientists are already actively involved in several research areas related to wetlands and need a proper forum for publishing the results and for discussing major wetlands-related issues. Soil scientists and must play a major role in research areas such as: (i) hydraulic soil character- ization and delineation, (ii) wetland biogeochemical processes, (iii) agronomic aspects of wetlands, (iv) use of natural and constructed wetlands for water treatment, (v) influence of wetlands on global climatic change, and (vi) other environmental and ecological impacts. For example, the role of soils is a major consideration when wetlands are used as sinks for pollutants. The ability of wetlands to retain or release pollutants is affected by the physical, chemical, and biological characteristics of associated soils. Attempts at quantitative evaluation of the assimilatory capacity of wetlands for pollutants have been inadequate due to the traditional mass-balance or empirical black-box approach taken by wetland researchers. By overlooking the processes involved, such models are of limited value and their usefulness is often restricted to the systems from which they were derived. Similar concerns were expressed by Wetzel (1991) on research and educational programs in limnological sciences. There
is great need for research on the internal and external processes that dictate wetland system function. During the past five decades, soil scientists have defined many of the concepts in physical, chemical, and biological processes functioning in upland soils, and these principles can often be readily applied to wetland soils as well. Such research will provide excellent opportunities for interdisciplinary study, not only within the soil science subdisciplines but among ecological and aquatic related disciplines as well.

Soils-related research with wetlands has significant scientific gaps; thus, basic and applied research conducted in this discipline will provide critical information to understand these systems and to advance our knowledge of scientific concepts. The information generated by soil scientists will be of great value to state and federal agencies involved in the management of our nation's wetland resources, including the answers to key questions related to water quality. Recognizing the importance of wetlands, both Florida and Louisiana have committed resources at their land-grant universities to develop research programs in wetland sciences. At the Louisiana State University, the wetland Biogeochemistry Institute was established primarily to study soil processes in wetlands. At the University of Florida (UF), wetland soils research is a major thrust area of the Soil and Water Science Department. At UF, faculty from various soil and water science disciplines (soil mineralogy, soil genesis and classification, soil and water chemistry, soil and aquatic biology, soil physics, and hydrology) are actively involved in wetlands research. Other examples of universities having wetlands programs include: Duke University, University of Michigan, The Ohio State University, North Carolina State University, and North Dakota State University. Other institutions have also recognized the importance of wetland science and are in the process of establishing research programs in this area. Due to limited availability of soil scientists trained in wetlands, the majority of soils-related wetlands research is currently being conducted by scientists who do not have formal training in soil science.

Soil scientists have made significant research contributions relating to soil–water–plant relationships in wetlands; however, few professionals within or outside ASA-SSSA have recognized their contributions in this area. One important reason for this lack of recognition is the fact that any wetlands-related papers published in ASA-SSSA journals are dispersed among several divisions and therefore lose their specific (wetland-related) impact. For example, during 1991 about 60 wetland-related papers presented at the ASA-SSSA annual meeting were dispersed in several divisions of SSSA and ASA Division A-5 (Environmental Quality). Recognizing this problem, Division A-5, along with several divisions of SSSA, cosponsored a symposium on wetland soil processes and water quality at the 1992 Annual Meetings of ASA-SSSA-CSSA held in Minneapolis, MN. A total of 18 invited papers and 50 volunteered papers were presented during a 3-d period. Symposium sessions were attended by about 200 to 250 people per session, indicating much interest in this subject matter. This symposium attracted several nonsociety members to both attend these meetings and give presentations.

To address the growing need for an established forum for wetland soil scientists, at the 1992 Annual Meeting the SSSA Board of Directors approved creation of a provisional Division S-10 for wetlands soils. The primary objectives of Division S-10 are to: (i) provide a common forum whereby wetland soil scientists can discuss major research issues and future directions, (ii) communicate effectively with other professional societies on the role of soil science in wetlands, (iii) attract new members from other disciplines to the society, (iv) provide a common base for publication of wetland-related research, and (v) provide national and international leadership in this area. In support of this division, the SSSA Journal and the Journal of Environmental Quality have established sections on wetlands. These two journals provide a more clearly defined outlet for publication of wetland soils research and associated environmental issues.

Soil science departments within the land-grant institutions have education and research programs in areas related to natural resource management and water quality. But very few land-grant institutions include wetlands and related anaerobic processes in their programs. In its traditional role, the soil science profession has served their clientele effectively over the last half century in meeting the demands and needs of agriculture. As the need for effective natural resource management increases, especially in wetland management and protection, land-grant institutions face the challenge to expand their traditional programs and train young scientists in this new area. Soil science curricula should address issues related to wetlands, especially in courses such as soil genesis and classification, soil chemistry, soil biology, and hydrology. Soil scientists can use their experiences in upland systems to develop a fundamental understanding of the mechanisms in the soil and the root zone of wetlands environments and establish the role of soil science in evaluating the overall functioning of wetlands. Through teaching and extension programs, soil scientists can transfer their basic research for application in solving real-world problems. This can be accomplished through a systematic integration of teaching and research at the undergraduate, graduate, and postdoctoral levels and training professionals through extension programs (Wetzel, 1991). This information will be extremely useful to ecologists attempting to understand the functions of these systems and ecological engineers concerned with designing wetlands for water quality improvement.

National attention on wetlands protection and preservation is not short term; it will be with us for the foreseeable future. We believe that the members of SSSA should explore these opportunities, and be prepared to meet the accompanying challenges. If we do not meet this growing need in wetland science, the soil science component of this subdiscipline will be permanently lost to other professions. We emphasize that soil scientists have a unique opportunity to take a leadership role in wetland science and to affirm the role of soil science within this emerging subdiscipline.

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References


