Improving the Quality of the Agricultural Environment in the United States: A Management Information System

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Previous mass-scale agricultural and farming practices in the United States have typically used technological and chemical applications, to increase output for supporting a growing population. While this appears to have contributed to greater prosperity, it has also led to deterioration in environmental quality and to the emergence of disabling and dangerous diseases. It is argued in this paper that this is the main reason why Environmental Quality Management in agriculture and farming has become critical for quality of life and perhaps even human survival. This paper describes the relationship between agriculture and environmental pollution and summarizes the impact of agriculture and farming on the physical environment, in the United States. Based on this analysis, an Agricultural Environmental Quality Management System (AEQMS) as well as a Database Management Information System (DBMIS), both of which are designed to assist and guide the implementation of an Agricultural Environmental Quality Management System (AEQMS) in the United States.

Introduction

Janke and Freyenberger (1997) reported that mass scale agricultural and farming practices in the U.S in the past decades with its technological and chemical emphasis have significantly increased output for supporting a growing population at the expense of the deterioration of the environment and the emergence of many disabling and killer diseases in the U.S. This is where the need for Environmental Quality Management in agriculture and farming industry has become critical to our survival and quality of life (13). Most of the environmental quality researches in the past primarily focused on the integrated study of contaminants, soils, sediments and pollutants in the air, and in the marine environment, and their implications for risk evaluation, management strategy development and deployment. Largosen (2007) also reported that most of the environmental quality research in agriculture and farming in the past decade, focused on environmental contamination by dangerous substances such as biocides, and pesticides and their impacts on air pollution (on nitrogen and ozone layers), on sensitive vegetation, and crop production, and on ecology and public health (11).

Agriculture and environmental pollution

Agriculture has long been recognized as a major source of pollution and in many countries. International Chamber of Commerce (2004) reported that in many countries, farmers have to get an approval of their management practices in order to avoid conflicts with environmental quality (10). Christopoulou, Polyzos, and Minetos (2007) presented a rising concern about the adverse effects of peri-urban deforestation which have been taking place in many countries due to shortages of developable space near urban areas. Forest and peri-urban forest usually help adjusting extreme temperature conditions in

urban areas. Peri-urban forests also hold great aesthetic, economic, recreational and health values to the society and have many positive effects on the human physical and spiritual health. Above all, peri-urban forests offer protection to people, buildings and infrastructure from natural disasters such as soil erosion, flooding, avalanches, and land slides (5). Enserink, and Koppenjan (2007) reported that China with large number of populations, its rapid economic growth and inefficient use of natural resources lead to excessive pollution and rapid depletion of its natural resources., and that its government has already put forth a number of environmental policies and legislations to protect the environment in order to produce a more sustainable growth (8). Makame(2007) reported that majority of people in Zanzibar still cook using traditional stoves which consume a great deal of wood to the extent of deteriorating forest resources (12).

Until now, very little attention has been given to developing cause and effect relationship between environmental factors and quality management. Some regions of the world have experienced extremely rapid development while such progress has been lacking in the rest of the world. It is widely believed that public participation contributes to better projects, better development and collaborative governance. Lagrosen (2007) advocated that in order to implement environmental quality, management, personal skills, commitment and high goals are required by individuals (11). Thus, environmental performance is becoming an increasingly important determinant of the commercial viability of agriculture. Designing policies, programs, and practices to manage agriculture's impact on the environment in rural, suburban, and urban settings is one of the most important and difficult challenge facing policymakers, scientists, educators, and farmers. Agricultural production can improve as well as can deteriorate the environment . Agriculture can offers a charming rural landscape with wildlife surroundings but also can ruin the land by soil erosion, loss of wetlands and use of excessive pesticide Baylis, Rousser, and Simon(2003) advocated that in order to minimize environmental damages and to continue beneficial practices, farmers and mass scale agricultural producers must develop a balanced approach to limit market incentives and place emphasis on environmental issues (3)

Impact of Agriculture on the Physical Environment in the United States

Agriculture is the largest and highly resource-concentrated industry in the U.S. Agricultural lands are located in remote and sparsely populated areas, almost one-half of the American population live in a region which is at least 25 percent agricultural, and more than two thirds f American live in counties where agriculture encompass at least 10 percent of the land. Even in metropolitan counties, almost one-third of the population lives in counties composed of at least 25 percent agricultural land (14). In fact, many State and local governments have developed programs that provide incentives to preserve farmland near populated areas. The landscape amenities offered by some types of agricultural land use open spaces and visual prospects that are increasingly valued by growing suburban populations (14). Norman, Janke, and Fryenberger (1997) reported that over half of the land in the adjacent 48 States of the U.S. and over three quarters of freshwater extractions are dedicated to agricultural operations. The expansive nature of agriculture in the past decades resulted in widespread environmental impacts on surface

and groundwater quality, air quality, fish and wildlife habitats, species diversity, and land characteristics. The way agricultural land is handled is liable to affect human health, recreational activities, and general well-being Agriculture is a primary source of nutrients in impaired surface waters. Nornan, Janke, and Fryenberger (1997) also reported that nutrients are the leading cause of water-quality impairments in lakes and estuaries and the third leading cause in rivers siltation. The most frequently detected herbicides in surface waters include several triazines (atrazine, cyanazine, and simazine), acetanilides (metolachlor and alachlor), and 2, 4-D. These are among the most commonly used in current agricultural practices in the U.S. (13).

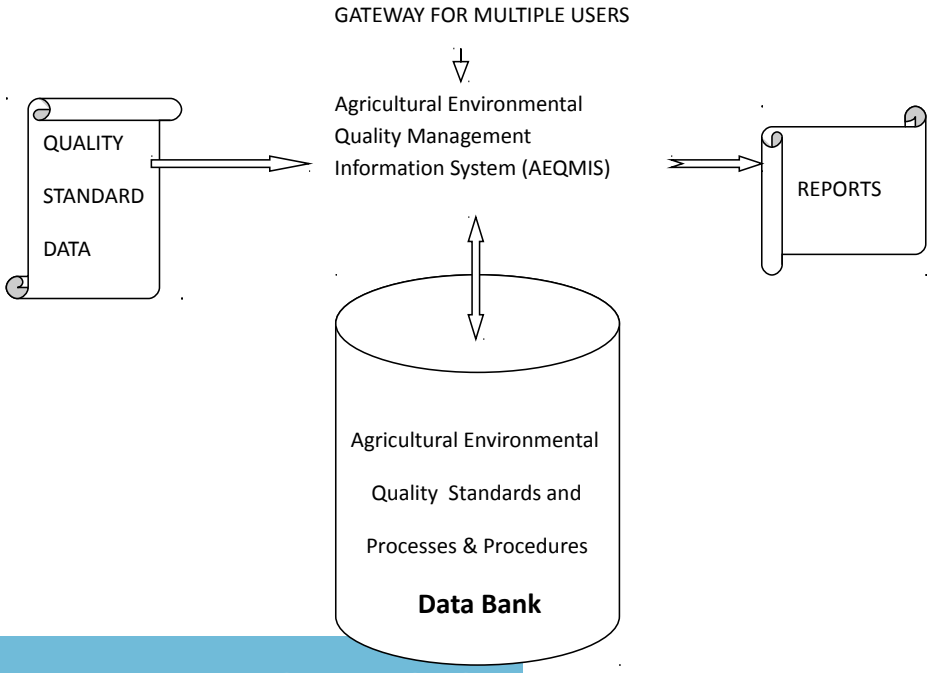
The drinking water of an estimated 50 million people in the United States comes from ground water that is potentially contaminated by agricultural chemicals (13). From its 1988-90 survey of drinking water wells, the EPA found nitrate in more than half of the 94,600 community water system wells and in almost 60 percent of the 10.5 million rural domestic wells. Levels exceed minimum recommendations in 1.2 percent and 2.4 percent of the community and rural wells, respectively (14). Ground-water levels are declining from 6 inches to 5 feet annually beneath more than 14 million acres of irrigated land (6). Ground-water overdrafts tend to permanently increase pumping costs, lead to land subsidence (which compacts the aquifer's structure), and can cause saltwater intrusion (12).

Soil particulate and farm chemicals are also carried in the air we breathe. The highest concentration of commonly used agricultural herbicides, triazine and acetanilide, has been found in the areas where they are used most frequently and in the highest amounts (14). Habitat loss associated with agricultural practices on over 400 million acres of cropland is the primary factor depressing wildlife populations in North America. Papapodopol and Nolan (2008) reported that modern farming methods brought about dramatic reductions in many species, including cottontail rabbits and ring-necked pheasants (15). Annual wetland loss fell from the 458,000-acre average of the mid-1950's through the mid-1970's, to a 290,000-acre average between the mid-1970's and mid-1980's. Wetland losses often reduce biodiversity because many organisms depend on wetlands and riparian zones for feeding, breeding, and shelter. Agriculture is thought to affect the survival of 380 of the 663 species listed federally as threatened or endangered in the United States (15). This is where the need for Environmental Quality Management in agriculture and farming industry has become critical to our survival and quality of life. Bandyopadhyay and Contractor presented a framework for developing an Agricultural Environmental Quality Management System (AEQMS) which involves Input Control, Process Control, and Output Control by use of Quality auditing using various standards and protocols in the various stages of agricultural and farming practices. in the U.S. (3). In order to implement this AEQMS, a Data Based Management Information System (DBMIS) must be developed for collecting and properly storing numerous quality standard data related to agricultural and farming inputs, processes and procedures, outputs, waste disposal and recycling in a databank, for retrieval by the users such as quality auditors and for generate reports such as compliance reports for agricultural environmental management.

A model of such a DBMIS for AEQMS is presented in figure 1. The Agricultural Environmental Quality Management Information System (AEQMIS) presented in figure 1 is a Data Base Management Information System which may use indexing method for storing various agricultural environmental quality standard data in the data bank, retrieving, and manipulating data for practicing and quality auditing purpose and for generating compliance and other types of reports. This system will also have a protocol enforcing with user ID and password for multiple users and the databank must be continuously updated with new data as they occur.

This AEQMIS may not only help implementing AEQMS but also help farmers in developing good management practices in agricultural and farming in the U.S. EPA standards for controlling pollution of soil, water and air may be incorporated in the AEQMIS along with other local and state requirements. With the development of ISO14000 for environmental quality, AEQMIS may be implemented globally in the future for providing sustainable agriculture around the world.

Figure 1. The Proposed Model



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