

An Overview of the Aquatic Plant Control Research Program

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ABSTRACT

The U.S. Army Corps of Engineers (CE) Aquatic Plant Control Research Program (APCRP) is the Nation's only federally authorized research program directed to develop technology for the management of non-indigenous aquatic plant species. The APCRP is designed to provide effective, economical, and environmentally compatible methods for assessing and managing problem aquatic plants that interfere with the valued uses of the waterways of the United States. Research efforts are currently focused on the development of advanced management strategies and applications for the submersed aquatic plants, hydrilla (*Hydrilla verticillata* (L.f.) Royle) and Eurasian watermilfoil (*Myriophyllum spicatum* L.). The APCRP is committed to the development, transfer, and implementation of aquatic plant management technologies, and will continue to lead the Nation in the future.

Key words: aquatic plant management, aquatic plant ecology, biological control, chemical control, hydrilla, Eurasian watermilfoil.

PROGRAM HISTORY

During the late 1880's and early 1890's the non-indigenous aquatic plant, waterhyacinth (*Eichhornia crassipes* (Mart.) Solms), rapidly infested the waters of Florida and Louisiana. The expanding populations of waterhyacinth obstructed commercial river traffic, leading Congress to approve the River and Harbor Act of 1899. This act authorized the U.S. Army Corps of Engineers (CE) to remove waterhyacinth in the navigable waters of Florida, Louisiana, Texas, Mississippi, and Alabama. Thus, initial responsibilities for aquatic plant management by the CE were established in 1899.

By the mid-1940's, another non-indigenous aquatic plant, alligatorweed (*Alternanthera philoxeroides* (Mart.) Griseb.), had infested the waters of the southeastern United States. In view of the magnitude of this new aquatic plant problem, Congress revised the River and Harbor Act in 1958 (Section 104, Public Law 85-500). This newly approved act authorized the CE to proceed with a comprehensive project for the control and progressive eradication of alligatorweed, in addition to waterhyacinth and other noxious aquatic plants, in the waters of Florida, Louisiana, Texas, Mississippi, Alabama, North Carolina, South Carolina, and Georgia. In recognition of the value of scientific research to solving problems, Congress at the same time included provisions for research

directed toward the development of the most effective and economic control methods. This project, known as the Expanded Project for Aquatic Plant Control, was initiated in 1959 for a five-year period.

In 1965, a report on the results of the Expanded Project was submitted to Congress recommending that the "project" approach should be expanded to a nationwide "program." As a result, Section 302 of the River and Harbor Act of 1965 (Public Law 89-298) authorized the CE to provide an expanded program of research directed toward the control and progressive eradication of waterhyacinth, alligatorweed, and other noxious aquatic plants in the waters of the entire United States.

In early 1975, the CE Headquarters designated the U.S. Army Engineer Waterways Experiment Station (WES) in Vicksburg, Mississippi, as the Corps' lead laboratory for aquatic plant research. The Aquatic Plant Control Research Program (APCRP) was established with responsibility for the management of the National research program. Today, activities of the APCRP are conducted under the Center for Aquatic Plant Research and Technology (CAPRT) at the WES. The CAPRT was established in August 1993 to provide administrative leadership, coordination, and facilitation of all aquatic plant research and transfer of technology.

PROGRAM IMPLEMENTATION

The APCRP is the Nation's only federally authorized research program for aquatic plant management, and is nationally-recognized as the leader in aquatic plant management research and technology development. The research program is designed to provide effective, economical, and environmentally compatible technology for the assessment and management of aquatic plant problems of major economic significance in waters of the United States. The transfer and implementation of technologies developed under the APCRP are provided through a variety of media (e.g., user manuals, instruction reports, journal articles, technical notes, information bulletins, field demonstrations, computer-based information systems, simulation tools, and technical workshops and training courses). The coordination of research and technology development is continuous, and maintained with a national network of cooperators from other Federal agencies, state agencies, local governments, universities, national and regional organizations, and private industry.

For more than 20 years the APCRP has provided research and technology development in the areas of: 1) chemical, biological, mechanical, and integrated control; 2) ecological studies; and 3) simulation and modeling. Presently, the major focus of the program is on the management of the

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non-indigenous submersed aquatic plants, hydrilla and Eurasian watermilfoil. Research efforts are organized into four separate, but technically integrated, technology development areas: Biological Control; Chemical Control; Ecological Assessment; and Management Strategies and Applications.

TECHNOLOGY DEVELOPMENT

Biological Control

In the Biological Control technology development area of the APCRP, techniques are being developed that incorporate biological agents in the management of non-indigenous aquatic plants. Biological agents are acquired through domestic and foreign exploration. A portion of the work for importation and quarantine of "introduced" biological agents is being accomplished through a Cooperative Agreement with the U.S. Department of Agriculture, Agricultural Research Service.

Presently, Biological Control research is focused on the development of techniques that utilize insects, microbial pathogens, or a combination of the two, in the management of hydrilla and Eurasian watermilfoil. Insect biocontrol studies involve the identification of potential insect agents, development of appropriate release and establishment procedures, and evaluations of effectiveness. Plant microbial studies involve the identification, evaluation, and formulation of endemic and exotic pathogens.

Chemical Control

Research in the Chemical Control technology development area of the APCRP is directed toward the development of methods to improve the use of aquatic plant herbicides and plant growth regulators. A primary objective of this research is to evaluate lower herbicide use rates, resulting in application techniques with reduced application costs and improved environmental compatibility. Currently in the Chemical Control area, techniques are being developed to ensure species-selectivity and improved delivery of herbicides to target plants. A cooperative relationship with the chemical industry and the U.S. Environmental Protection Agency has been established to facilitate information transfer.

The species-selective properties of various aquatic herbicides are being evaluated to allow for the removal of non-indigenous aquatic plants, while minimizing the impacts on native aquatic plants. Advanced aquatic herbicide delivery systems are being evaluated for use with existing and new herbicide formulations to improve submersed application delivery and maximize the efficacy on target plants, while providing improved environmental compatibility.

Ecological Assessment

The Ecological Assessment technology development area provides the basic knowledge required to understand the biology of aquatic plants and their role in the aquatic environment. Research in this area is designed to allow for a better understanding of the growth and spread of problem aquatic plants under various environmental conditions. This knowledge is essential for designing aquatic plant manage-

ment plans that are both effective and environmentally compatible. In addition, research on the establishment of native plants is being conducted. Present studies focus on environmental factors influencing plant propagule production and success, establishment of desirable native aquatic plants, environmental factors influencing plant invasions, and effects of aquatic plants on habitat conditions.

Studies on environmental factors influencing propagule production and success focus on the effects of key environmental variables on the number, size, and growth of plant propagules. Ongoing evaluation and development of techniques for establishing native aquatic plants will provide guidance to natural resource managers for successfully establishing diverse communities of desirable native aquatic plants. Investigations of aquatic plant invasions presently focus on environmental factors related to invasion success. In combination with the foregoing efforts, studies directed ultimately toward ecosystem restoration presently focus on the effects of different types of aquatic plants on habitat conditions.

Management Strategies and Applications

Activities in the Management Strategies and Applications technology development area are directed toward integration and adaptation of technologies to the needs of aquatic plant management; for example, integrated use of herbicides and pathogens is currently being evaluated to determine possible additive, synergistic, or antagonistic relationships in aquatic plant management. An aquatic plant management "strategy planner," currently under development will soon provide a CD-based information system that contains all available APCRP simulation models. As part of the "strategy planner" an expert system for aquatic plant identification and various types of control will be provided. In addition, hyperlinked textual information on aquatic plant ecology, sampling, and evaluation will be made available.

CONCLUDING REMARKS

Since 1975, the staff and researchers of the APCRP have developed a research program that is recognized as the National leader in all areas of aquatic plant research and technology development. The continued spread of non-indigenous aquatic plant species to new areas and the introduction of new non-indigenous aquatic plants demands that research continues to provide effective technology for aquatic plant management. For the foreseeable future, the staff and researchers of the APCRP are committed to lead the Nation in the development of technologies needed for the consistent management of non-indigenous aquatic plant species. Technology development and transfer will be continued for chemical, biological, and integrated controls, as well as for ecosystem restoration and the establishment of native aquatic plants.

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