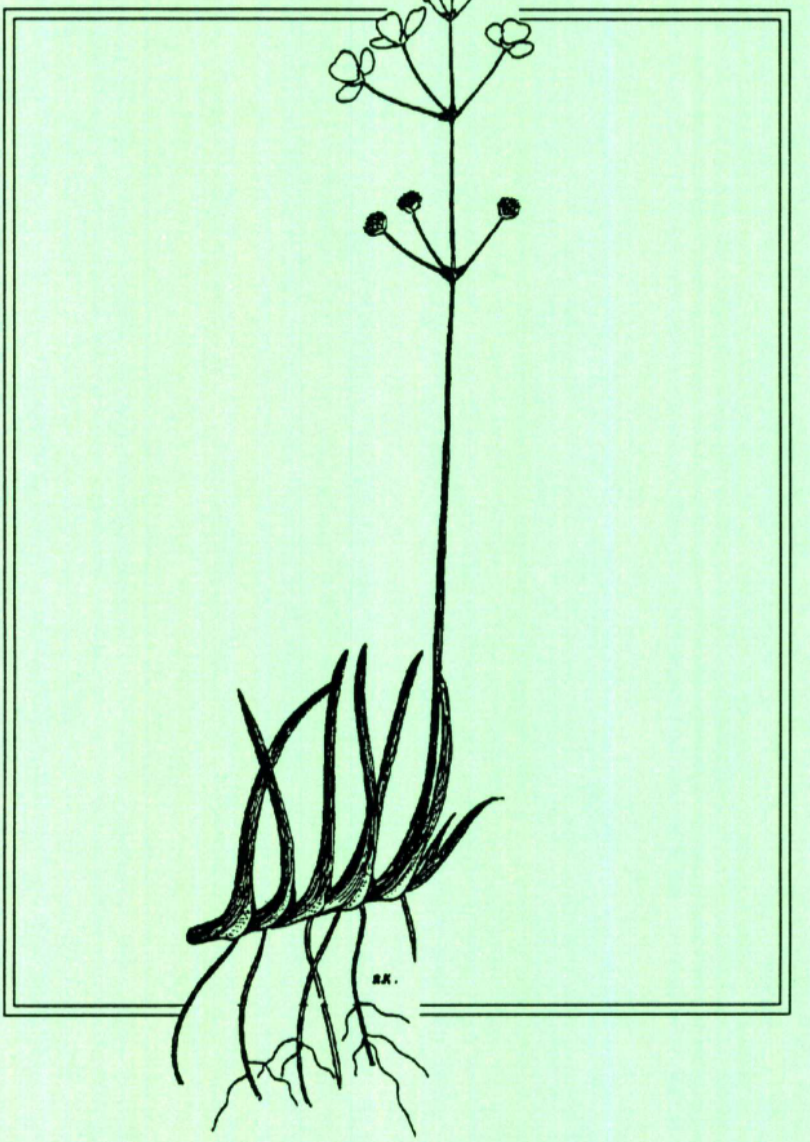
# RECOVERY PLAN

*Kral's Water -Plantain*



U.S. Fish and Wildlife Service

# KRAL'S WATER-PLANTAIN

## (*Sagittaria secundifolia*)

## Recovery Plan

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for the

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Approved: _____
Regional Director, U.S. Fish and Wildlife Service

Date: August 12, 1991

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect the listed species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes with the assistance of recovery teams, contractors, State agencies, and others. Objectives will only be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints. Recovery plans do not necessarily represent the views nor the official positions or approvals of any individuals or agencies, other than the U.S. Fish and Wildlife Service, involved in the plan formulation. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species' status, and the completion of recovery tasks.

Literature citation should read as follows:

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# EXECUTIVE SUMMARY

Current Species Status: The only known remaining population of Kral's water-plantain (Sagittaria secundifolia) is in the Little River system in northeast Alabama and northwest Georgia. Another population (Town Creek in northeast Alabama) is believed to have been extirpated due to siltation from disturbed slopes. This species is extremely vulnerable due to its restricted range and to siltation from disturbance of the watershed for silvicultural, residential, agricultural, or mining purposes. The species is listed as threatened without critical habitat.

Habitat Requirements and Limiting Factors: This rare aquatic plant typically occurs on frequently exposed shoals or among loose boulders in quiet pools in rocky streams. Adverse habitat conditions include excessive siltation and stream turbidity, dry streambeds, eutrophication, and extensive shade.

Recovery Objective: Delisting.

Recovery Criteria: Sagittaria secundifolia may be considered for delisting when viable populations have been documented in three or more river basins within the Cumberland Plateau and within three or more tributaries of each river basin; the viability of each population has been confirmed through periodic monitoring for 15 or more years; and populations and supporting habitat in each river basin have sufficient long-term protection so that the species no longer qualifies for protection under the Endangered Species Act.

Actions Needed:

1. Protect populations and habitat.
2. Initiate a monitoring program.
3. Determine habitat characteristics and conduct life history studies.
4. Determine habitat management needs and techniques.
5. Preserve genetic stock.
6. Reintroduce population(s) within historic range.
7. Develop public awareness program.

Total Estimated Cost of Recovery: Specific measures and costs associated with some recovery tasks are only determinable after completion of others. Implementation of tasks, for which cost estimates can be made, total $147,000, when projected over a 15-year period.

Date of Recovery: Delisting should be initiated in 2015 if recovery criteria have been met.

TABLE OF CONTENTS

# I. INTRODUCTION

## Taxonomy and Description

Kral (1982) described Sagittaria secundifolia, a member of the water-plantain family (Alismataceae), from material collected by Cusick in 1972 from the Little River in DeKalb County, Alabama. It is a submersed to emersed aquatic perennial arising from a stiff elongated rhizome up to 10 centimeters (cm) (4 inches) in length. The leaves are of two types, depending upon the velocity and depth of the water it inhabits. In swift shallows, the leaves are linear, rigid, and sickle-shaped; in quiet, deep waters, the leaves are longer and more quill-like. Separate male and female flowers are produced on a stalk, 10-50 cm (4-20 inches) long. The petals are inconspicuous in the female flowers; however, in the male flowers, they are white and 1.0-1.5 cm (0.4-0.6 inches) long. The fruit consists of a cluster of achenes approximately 2 millimeters (mm) (0.08 inch) in length. Sagittaria secundifolia is distinguished from other species in the "graminea" complex of Sagittaria by its stout, elongated rhizome, hairy filaments, linear leaves and spreading or reflexed sepals (Kral 1982, 1983; Whetstone 1988). Kral's water-plantain (Sagittaria secundifolia Kral) was determined to be threatened in a final rule published on April 13, 1990 (U.S. Fish and Wildlife Service 1990).

## Distribution and Ownership

The species has been collected from the Little River (Cherokee and DeKalb Counties, Alabama and Chattooga County, Georgia), a tributary to the Coosa River; and from Town Creek (Dekalb County, Alabama), a tributary to the Tennessee River (Kral 1982, Whetstone 1988, Whetstone et al., 1988). Approximately 40 percent of the habitat in Little River is owned by the Alabama Power Company, and 20 percent by the Alabama Department of Conservation and Natural Resources (DeSoto State Park). The remainder is in private ownership. Extensive surveys of other river systems with apparently suitable habitat in northeast Alabama and northwest Georgia have been unsuccessful at locating additional populations (Whetstone 1988).

## Reproductive Biology

Little is known about the life history of Sagittaria secundifolia. The species is clonal and reproduction is primarily asexual. Flowering has been observed only in areas of direct sunlight and at a water level that allows emergent leaves (Whetstone 1988). Although infrequent, flowering occurs from May into July and intermittently into the fall (Kral 1982, 1983).

## Habitat

This taxon typically occurs on frequently exposed shoals or rooted among loose boulders in quiet pools up to 1 meter (3.3 feet) in depth. Plants grow in pure stands or in association with various submergents including Potamogeton, Najas, and Myriophyllum, and emergents such as Justicia americana, Lindernia, and Polygonum. The immediate banks are often dominated by shrubs including Alnus, Rhododendron, Kalmia, Lyonia, and Ilex. Sphagnous seeps are frequent

with Carex, Rhynchospora, Eriocaulon, Panicum, Xyris, and Rhexia among the common genera present. The stream bottoms are typically narrow and bounded by steep slopes. Extant populations occur on underlying formations of Pottsville Sandstone. Unconsolidated substrates in the area are too sparse to be classified as soils (Kral 1982, Whetstone 1988). Two endangered plants, Sarracenia oreophila and Ptilimnion nodosum, and several candidate plants, (Cuscuta harperi, Coreopsis pulchra, and Allium speculae), occur in associated habitats at several sites.

## Current Status and Population Size

The Town Creek population of Sagittaria secundifolia has not been found again since it was first discovered (despite searches) and is believed destroyed (Kral 1982, 1983; Whetstone 1988). Currently, the species is only known to occur in the Little River drainage system (Figure 1). Eight of the 12 local populations studied by Whetstone (1988) were found in pools and/or in riverine areas with partial canopy coverage. The number of plants ranged from 5 to 40 individuals. The remaining four local populations were found on shallow shoals and supported 75 to several hundred plants.

Sexual reproduction increases genetic variability which enables species to adapt to changing conditions. Many of the sites supporting local populations are in less than optimum conditions for flowering; therefore, it is important to maintain high quality habitat to encourage reproduction by sexual means.

## Reasons for Listing

A major threat to this species is the elimination or adverse modification of its already limited habitat. Clearing of the adjacent watershed for silvicultural, residential-recreational development, surface mining, or agricultural purposes poses a significant threat for this species. These activities contribute to water quality degradation by increasing stream turbidity and siltation from erosion (Kral 1983, Whetstone 1988). Similar impacts likely caused the loss of the population and much of the suitable habitat in the Town Creek watershed (Kral 1982, 1983). The Little River population may be adversely affected by eutrophication from garbage dumping and leaking sewage systems. Large quantities of human coliform bacteria were present in water samples taken at several sites along the Little River (Whetstone 1988). Eutrophication increases the presence of filamentous algae, which clings to individuals of Sagittaria secundifolia. Extreme water turbidity and dense filamentous algae decrease the amount of light available to the plants for growth and flowering.

A small number of sites occupied by Kral's water-plantain are used as fords and are often a center for recreational activity, subjecting them to damage by off-road vehicle traffic. Impoundments exist over large areas of presumed suitable habitat in the Little River and may have destroyed undocumented populations. Four large impoundments exist along a 5-mile stretch of the West Fork of the Little River and two impoundments are present below the Georgia locality on the East Fork. The impoundment of Lake Weiss in Cherokee County, Alabama, in the 1960's, flooded apparently suitable habitat along Yellow Creek and several miles of the Little River. In the past, dams along two creeks

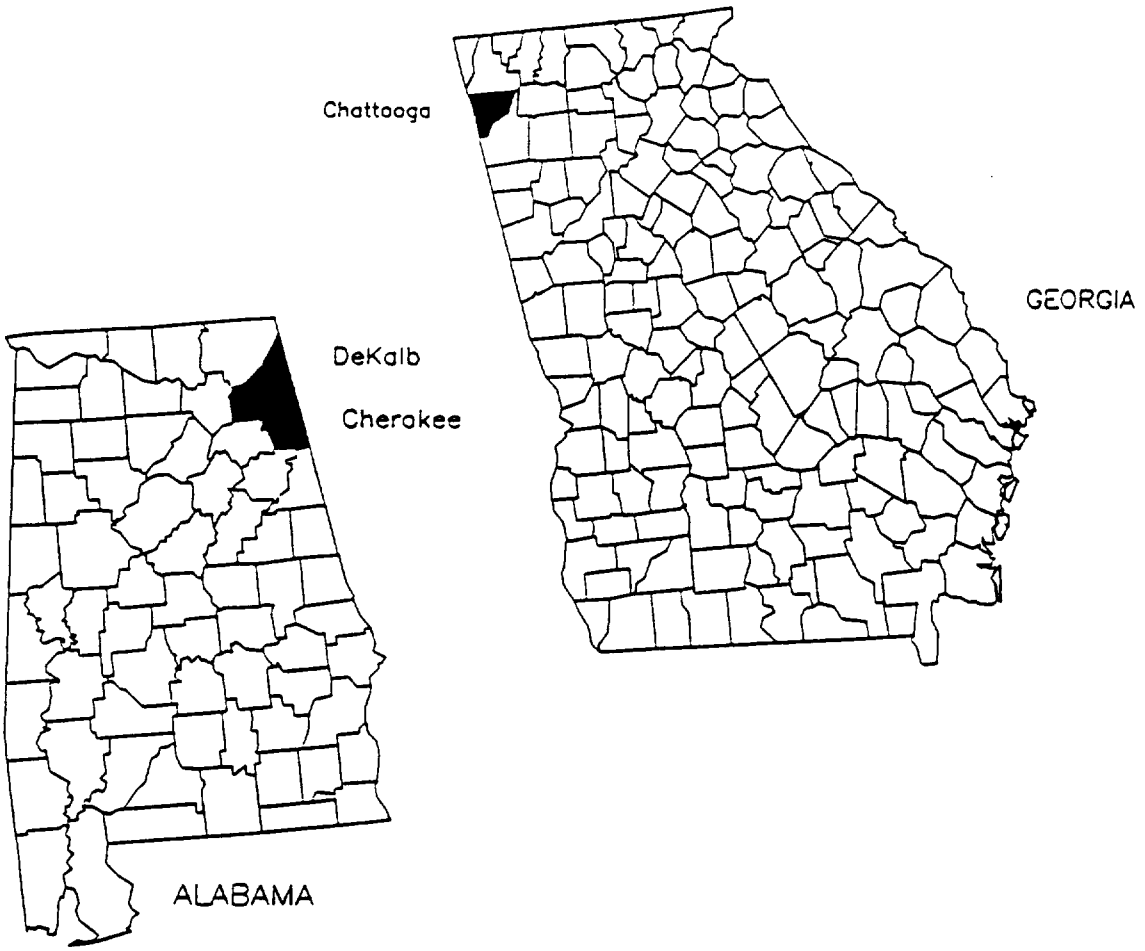


**Figure 1. Distribution of Kral's water-plantain**

which flow into the Little River have broken and flooded portions of apparently suitable habitat (Whetstone 1988). Cracks and leaks have been observed on the dam above DeSoto Falls and a portion of a dam near the Georgia population has deteriorated (Whetstone 1988). Thus, several existing populations are threatened by apparently unstable impoundments that could break and eliminate or degrade populations and suitable habitat by scouring the bottom and uprooting individual plants.

Approximately 33 percent of the habitat and associated local populations would be destroyed if a proposed hydroelectric impoundment is constructed on the Little River. In addition to flooding several local populations and changing stream flow dynamics, associated construction would cause excessive siltation and further degrade water quality (Whetstone 1988). However, the Little River site is presently viewed as the least desirable site for this impoundment from an economic and environmental standpoint, according to Alabama Power Company personnel.

Conservation Measures Taken

The Georgia Department of Natural Resources is aware of this species in Georgia and is monitoring it through the Department's Freshwater Wetlands and Heritage Inventory program.

The Alabama Power Company has been informed of the presence of this plant on land they own. They have informally agreed to protect the species on their property and work toward its recovery.

Alabama's DeSoto State Park personnel are aware of Kral's water-plantain in the Park and are committed to protecting it, along with the other natural resources. They are working with the DeKalb County office of the Alabama Department of Health to sample water at various points within the Little River system. Any pollution sources that may exist will be documented and their causes determined and corrected. The waters of the Little River within the State Park have been designated as Outstanding Natural Resource Waters. Such a designation will help to justify maintenance of high quality aquatic habitat within the system consistent with applicable State and Federal requirements (Tim Haney, DeSoto State Park, personal communication, 1990).

## II. RECOVERY

### A. Objective and Criteria

Sagittaria secundifolia should be considered for delisting when the following conditions have been met:

(1) Viable populations have been documented in three or more river basins within the Cumberland Plateau and within three or more tributaries of each river basin;

(2) each population has been found to be viable through periodic monitoring for 15 or more years; and

(3) populations and supporting habitat in each river basin have sufficient long-term protection that the species no longer qualifies for protection under the Endangered Species Act.

A viable population is a reproducing population of sufficient size and genetic variability to sustain itself in perpetuity. The number of individuals necessary and the quantity and quality of habitat needed to meet these criteria should be determined as one of the recovery tasks.

These recovery criteria are preliminary and may be revised on the basis of new information.

### B. Narrative Outline

#### 1. Protect populations and habitat.

The first step in the recovery process should be to protect the existing population from any present or foreseeable threats. Protection should be initiated for all occupied sites within the Little River basin, currently the only extant population known. The long-term protection of populations in different tributaries of three river basins is considered to be essential to the recovery of this species. Protective measures should be applied to the entire watershed of each river basin supporting the plant to provide for maintenance of high quality aquatic habitat at occupied sites and at sites where it may colonize.

1.1 Contact landowners and negotiate protection. Landowners of all occupied sites should be contacted and encouraged to protect Kral's water-plantain on properties they own or manage. The plants are located on private and State-owned lands. Some level of protection should be initiated for all sites; however, first priority should be given to those sites supporting the largest and most vigorous colonies on relatively unaltered habitat. Landowner contacts can be initiated with the assistance of the State Heritage Programs and The Nature Conservancy field offices. Protection efforts, exclusive of Section 7, may include land donations, fee acquisitions, conservation easements, short-term

leases (conservation agreements), or other methods. Short-term protection methods should be viewed as interim steps toward more permanent protection methods; however, short-term strategies may be the only alternative if private landowners are not agreeable to, or monies are not available for, more permanent protection measures.

1.2 Search for additional populations. Past surveys of other river systems for this species have been unsuccessful at locating additional populations. However, a thorough, systematic search for new populations is needed, focusing on drainage basins within the Cumberland Plateau in Alabama, Georgia, and Tennessee.

Potential habitat should be identified by an investigation of the habitat of the known population for common ecological characters and indicator species, followed by a thorough examination of geologic, topographic, or other maps. The extant population occurs on underlying formations of Pottsville Sandstone with unconsolidated substrates too sparse to be classified as soils. Searches should be carried out when the species is most visible and for a minimum of two field seasons. All apparently suitable habitat should be documented as the field search for additional populations progresses.

2. Initiate a monitoring program. A monitoring program should be established to track population trends, identify adverse habitat conditions for and threats to the extant population, and evaluate effectiveness of recovery efforts. Any new populations discovered should be included in the monitoring program.

2.1 Determine size of population(s). The extent and precise location of plants in the Little River system should be determined through intensive surveys. Each occurrence should be plotted on large-scale maps or aerial photos with appropriate reference points. The total area occupied by the plants (approximate square meters) and/or the number of individuals should also be documented for each site.

2.2 Establish permanent plots and monitor. A sampling methodology should be devised and implemented to monitor and document changes. Plots and/or transects may be used to monitor parameters, such as the number of individual plants per unit of area, amount of flowering and fruiting, as well as appropriate microsite conditions (water level, light intensity, competition). In addition to the measurement of selected specific population parameters, general weather conditions and any disturbances, threats, or other adverse conditions should be noted.

Population parameters should be sampled, via the established plots as described above, annually (perhaps biennially after the initial few years) for at least a 15-year period.

3. Determine habitat characteristics and conduct life history studies. An understanding of this species' ecology and life history is essential to determining what factors limit its distribution and viability. Information gained will aid in evaluating potential threats and contribute to the effective management of populations and their supporting habitat.

3.1 Characterize habitat. The extant population should be investigated to develop an aquatic habitat profile for the species that includes all applicable water quality and quantity parameters. Acquisition of basic aquatic habitat data will allow an assessment of the species' susceptibility to habitat degradation. Light should be measured and overstory coverage estimated at selected sites. A complete list of associated species should be compiled for each site by visiting each several times during the growing season.

3.2 Determine life history characteristics. Life history information is essential to understanding the dynamics of the population and critical to determining minimum viable population parameters. Information may be obtained through field observations and/or laboratory studies.

3.2.1 Study aspects of sexual and asexual reproduction. This species appears to flower infrequently and is believed to reproduce primarily asexually via rhizomes. Parameters of sexual reproduction should be investigated (i.e., breeding systems, pollination biology, seed set). An assessment of the longevity and viability of its rhizomes is needed as such is important to understanding this species' long-term survival. Some of this information may be gathered from permanent plots to be established under Task 2.2.

3.2.2 Investigate additional life history characteristic. Observations should be made throughout the growing season to determine this species general life cycle (i.e. bud development, anthesis, seed set). Additional information should be gathered on seed dormancy, longevity and viability; germination requirements; and seedling establishment.

3.3 Determine parameters of a viable population. The long-term survival of the species will be ensured only if a sufficient number of viable populations are protected. The components of a viable population which need to be determined include minimum number of individuals, extent and quality of habitat, the number of populations, and their geographical spacing. The amount of genetic variability within populations, and the species as a whole, is also important in assessing minimum viable population parameters. Genetic variability should be determined accordingly. Information gained from other recovery tasks, specifically Task 3.2, will be essential in completing this task.

4. Determine habitat management needs and techniques, implement if necessary. Maintenance of high quality habitat may require application of management techniques to maintain conditions necessary to support vigorous populations of Kral's water-plantain. Ideal habitat conditions for this species are largely unknown; however, the more vigorous subpopulations are located in areas of direct sunlight and at a water level that allows emergent leaves. A few sites are located in shaded situations and the plants appear less vigorous.

   Alleviation of problems related to water quality degradation, (i.e., algal growth) can probably best be addressed by identifying the cause (Tasks 2.2 and 4.1) and then taking appropriate corrective actions (Task 4.4).

   4.1 Determine causes of water quality degradation. Investigate the causes of water quality degradation in watersheds occupied by Kral's water-plantain as the basis for implementing corrective actions.

   4.2 Conduct habitat management technique experiments. Experiments should be designed to evaluate the effectiveness of active management. Long-term effects should be determined through observations of permanent study plots over many years (see Task 2.2). Changes in associated vegetation should be noted in addition to the response of the target species. Management techniques to experiment with include removal of overstory and competing vegetation by mechanical or manual means for selected sites.

   4.3 Prepare individual site management plans. Make use of findings from the above research (Task 4.1) to determine the best way to maintain each local population. Prepare individual site management plans and implement if necessary to maintain viable populations.

   4.4 Take corrective actions. Any adverse conditions or threats noted in Tasks 2.2 and 4.1 should be further investigated as necessary and corrective action planned and implemented in coordination with other interests as appropriate.

5. Preserve genetic stock. Protection of the gene pool should be accomplished through seed bank storage.

   5.1 Establish seedbank. Seed should be collected from all natural populations at the appropriate time (as determined through Task 3.2.1). Some seed should be stored in a long-term storage facility and tested for viability every few years. These activities should be conducted under the guidance of the Center for Plant Conservation.

6. Reintroduce population(s) within historic range, if deemed necessary. Sagittaria secundifolia is presently known only from one drainage system. If, after extensive surveys, no new populations in other drainage systems are located and secured, it may be necessary to reintroduce it to sites within its probable historic range to decrease this species' vulnerability to extinction and to enhance its potential for recovery.

   6.1 Identify reintroduction sites within historic range. Suitable habitat for reintroduction should be identified through Task 1.2. Sites should possess the same habitat characteristics as the known population (determined through Task 3.1), be within probable historic range (Coosa and Tennessee River basins within the Cumberland Plateau), and be secured as outlined in Task 1. The number and location of reintroduced populations should be determined after suitable habitat has been identified and should be done in a manner that contributes to the recovery objective. If reintroduction should prove necessary, the first site for consideration should be Town Creek, because the plant has previously been collected from that watershed. Another priority consideration is to establish populations on public lands.

   6.2 Reintroduce and monitor populations. The appropriate method for reintroduction (seed, seedling, rhizomes) and time to plant will be determined through information gained in species' life history studies (Task 3.2). After reintroduction, population(s) should be monitored periodically to determine viability and management needs.

7. Develop public awareness program. Public support is an important part of the recovery process. Articles could be written and an interpretative display could be established at the Birmingham Botanical Gardens. All public education attempts should keep the precise location of sites occupied by Kral's water-plantain confidential, carry a strong conservation message, and note who to contact if additional populations are discovered.

   Governmental agencies, conservation organizations, and private landowners should be kept informed and encouraged to assist in recovery activities for this species.

C. Literature Cited

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Whetstone, R.D., C.L. Lawler, L.H. Hopkins, A.L. Martin, and C.C. Dickson. 1988. Kral's water-plantain, Sagittaria secundifolia Kral (Alismataceae), new to Georgia. Castanea 52:313-314.

## III. IMPLEMENTATION SCHEDULE

Recovery Action Priorities

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in species' population/habitat quality, or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to meet the recovery objectives.

Acronyms Used

ADEM - Alabama Department of Environmental Management
ANHP - Alabama Natural Heritage Program
CPC - Center for Plant Conservation
DCNR - Alabama Department of Conservation and Natural Resources
FWE - Fish and Wildlife Enhancement
GNHI - Georgia Natural Heritage Inventory
TNC - The Nature Conservancy

IMPLEMENTATION SCHEDULE

| PRIORITY # | TASK # | TASK DESCRIPTION | TASK DURATION | RESPONSIBLE PARTY | | | COST ESTIMATES ($K) | | | COMMENTS/NOTES |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | USFWS | | | | | | |
| | | | | Region | Division | Other* | FY 1 | FY 2 | FY 3 | |
| 2 | 1.1 | Contact landowners and negotiate protection | 2 years | 4 | FWE | ANHP GNHI TNC | 3 | 3 | | |
| 3 | 1.2 | Search for additional populations | 2 years | 4 | FWE | ANHP GNHI | 12 | | | |
| 2 | 2.1 | Determine size of population(s) | 1 year | 4 | FWE | ANHP GNHI | 3 | | | |
| 2 | 2.2 | Establish permanent plots and monitor | continuous | 4 | FWE | ANHP GNHI | 4 | 4 | 4 | |
| 2 | 3.1 | Characterize habitat | 1 year | 4 | FWE | ANHP GNHI | 5 | | | Partially accomplished under Task 1.2 and 2.2 |
| 2 | 3.2.1 | Study reproductive biology | 3 years | 4 | FWE | | 3 | 2 | 2 | May be done with Task 2.2 |
| 2 | 3.2.2 | Obtain additional life history information | 3 years | 4 | FWE | CPC | 3 | 3 | 3 | May be done partially done under Task 2.2 |
| 3 | 3.3 | Determine parameters of a viable population | 1 year | 4 | FWE | | 5 | | | |
| 2 | 4.1 | Determine causes of water quality degradation | 1 year | 4 | FWE | ADEM DCNR | 15 | | | |
| 3 | 4.2 | Conduct habitat management technique experiments | 5 years | 4 | FWE | | 3 | 3 | 3 | |
| 2 | 4.3 | Prepare individual site management plans | 1 year | 4 | FWE | | | | 3 | |
| 2 | 4.4 | Take corrective actions | continuous | 4 | FWE | | | | | Cost to be determined. |

| IMPLEMENTATION SCHEDULE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RESPONSIBLE PARTY | | | COST ESTIMATES ($K) | | | |
| | | | | USFWS | | | | | | |
| PRIORITY # | TASK # | TASK DESCRIPTION | TASK DURATION | Region | Division | Other* | FY 1 | FY 2 | FY 3 | COMMENTS/NOTES |
| 2 | 5.1 | Establish seedbank | continuous | 4 | FWE | CPC | 5 | | | |
| 2 | 6.1 | Identify reintroduction sites within historic range | 1 year | 4 | FWE | ANHP | | | | Partially accomplished under Task 1.2 |
| 2 | 6.2 | Reintroduce and monitor populations | continuous | 4 | FWE | ANHP | | | | Implement if deemed necessary. |
| 3 | 7.0 | Develop public awareness program | continuous | 4 | FWE | ANHP<br>CPC<br>TNC | 1 | 1 | 1 | |

* Other agencies' responsibility would be of a cooperative nature or projects funded under a contract or grant program. In some cases, contracts may be let to universities or other individuals.

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