Swamp Pink
(Helonias bullata)

5-Year Review:
Summary and Evaluation

USFWS NJFO

U.S. Fish and Wildlife Service
New Jersey Field Office
Pleasantville, New Jersey

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swamp pink (*Helonias bullata*)

1.0 GENERAL INFORMATION

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1.2 Methodology Used to Complete the Review:

This review was prepared as an individual effort with input from Service Field Offices, State agencies, and other species experts. A draft of Section 2 was provided for technical review to all Field Offices and Natural Heritage Programs in the species' range, and the New Jersey Division of Land Use. Geospatial analyses were performed using ESRI ArcMap version 10. Except as necessary to provide context, information presented in the recovery plan (USFWS 1991) or previous the review (USFWS 2008) is not included in this review. Some of the literature cited herein was published prior to the last review, but was not known to the Service at that time.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review: June 8, 2011 (71 FR 33334-33336). Endangered and Threatened Wildlife and Plants; Initiation of 5–Year

Reviews of Nine Species: Purple Bean (*Villosa perpurpurea*), Clubshell (*Pleurobema clava*), Roanoke Logperch (*Percina rex*), Swamp Pink (*Helonias bullata*), Northern Riffleshell (*Epioblasma torulosa rangiana*), Flat-spired Three-toothed Land Snail (*Triodopsis platysayoides*), Puritan Tiger Beetle (*Cicindela puritana*), Dwarf Wedgemussel (*Alasmidonta heterodon*), and Bog Turtle (*Clemmys muhlenbergii*).

1.3.2 Listing history

Original Listing
FR notice: 53 FR 35076-35080, Determination of *Helonias bullata* (Swamp Pink) to be a Threatened Species
Date listed: September 9, 1988
Entity listed: Species (monotypic genus)
Classification: threatened

1.3.3 Associated rulemakings: None.

1.3.4 Review history: The 1991 recovery plan includes an assessment of the species status. A previous 5-year review was initiated April 21, 2006 (71 FR 20717-20718) and signed October 28, 2008 (USFWS 2008).

1.3.5 Species' Recovery Priority Number at start of 5-year review: 7C

1.3.6 Recovery plan or outline

Name of plan or outline: Swamp Pink (*Helonias bullata*) Recovery Plan
Date issued: September 8, 1991
Dates of previous revisions, if applicable: Not applicable

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate? No, the species is a plant; therefore, the DPS policy is not applicable.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

_X_ **Yes**

____ **No**

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

___ Yes

_X_ No

Since the 1991 recovery plan, intensive survey efforts have revealed many new occurrences of swamp pink, State and Federal regulatory programs have changed, and substantial bodies of literature have been published regarding swamp pink biology, impervious surface, the sensitivity of swamp pink to habitat degradation, and climate change (USFWS 2008), and new information has become available regarding flooding by beaver and woody vegetation encroachment.

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

___ Yes

_X_ No

All five listing factors were addressed in the recovery plan, but new information has become available regarding the severity of some threats (*e.g.*, herbivory, indirect habitat degradation from off-site development). In addition, climate change was not considered (USFWS 2008).

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

Although the recovery criteria have not been revised since first published in 1991, the general nature of threats to swamp pink described in the recovery plan have not changed significantly in light of current information. Therefore, measuring progress toward these criteria is a useful means to track recovery, until such time as a determination is made whether the criteria require revision. According to the recovery plan, swamp pink will be considered for delisting when the following conditions are achieved (quoted in italics).

Condition 1. *Permanent habitat protection is secured for those occurrences that: (a) are ranked as "A" or "B" according to the quality specifications in Appendix B (which follow The Nature Conservancy's ranking system* [and which reflect both habitat conditions and population size/vigor]*), or (b) are representative of the species' range-wide distribution, or (c) are representative of habitat or genetic diversity. . . . Habitat will be considered permanently protected when: (1) adequate acreage is secured through acquisition or easement by government agencies or conservation organizations with primary responsibilities for resource protection; (2) sites on public lands are formally designated as protected areas; and (3) preserve*

designs and/or management stipulations, based on definitive research results, are in place for each site (USFWS 1991).

An estimated 103 of approximately 250 known extant occurrences of swamp pink (41 percent) are at least partly on public or otherwise protected land (Table 1). Of these 103 occurrences, 35 are ranked A or B (14 in New Jersey, 4 in Delaware, 13 in Virginia, 3 in North Carolina, and 1 in South Carolina). More than half (35) of the 68 A- or B-ranked populations are at least partly on protected land. Available information is insufficient to assess which if any of these 103 occurrences meet the criteria in the recovery plan to be considered "protected," specifically that adequate acreage is secured, swamp pink habitat is formally designated as protected, and preserve designs or management plans are in place. Table 1 shows that the numbers of extant, A- and B-ranked, and at least partly protected swamp pink occurrences have all increased since the last review. These increases are attributed to several factors – discovery of several new populations (many of them small, but at least one of them A-ranked); inclusion of outplanted populations in Georgia; surveys of several previously unranked populations revealing them to be A- or B-ranked; updated/expanded GIS layers of public lands; and reorganizations (lumping and splitting occurrences) of the Natural Heritage Program databases in several States.

Preservation efforts continue. Easements have been obtained in vicinity of the Stony Run population, Maryland. Unfortunately, this population remains in decline due to offsite impervious surface, and at another Maryland site the landowner has terminated cooperation with the Service to manage swamp pink (McCarthy pers. comm. 2011).

In 2009, the Service held a meeting of the major land trusts active in New Jersey to discuss priority swamp pink habitats for acquisition. After working with the Service on a development plan protective of their A-ranked swamp pink site, the Camden County College Board of Directors voted in 2010 to place a permanent conservation easement on the entire 80-acre parcel supporting the species. The Service is currently working with the New Jersey Department of Environmental Protection (NJDEP) to target acquisition of swamp pink habitat with Natural Resource Damage funds from a south Jersey landfill. NJDEP has also applied to the Service for Endangered Species Act Recovery Land Acquisition Grants to purchase swamp pink habitat but has not been awarded funds for swamp pink to date. The NJDEP Green Acres Program is pursuing a purchase of swamp pink habitat in Cumberland County involving multiple adjoining landowners.

The previous swamp pink review included analysis of which additional occurrences (other than A and B-ranked sites) meet the recovery criteria because they are representative of the species' range-wide distribution, habitat diversity, or genetic diversity (USFWS 2008). Updated information for priority sites meeting these criteria is presented below, where available.

Table 1. Summary of swamp pink occurrences

	1991						2007						2011					
	Historic	Extant	A or B	%	Protected	%	Historic	Extant	A or B	%	Protected	%	Historic	Extant	A or B	%	Protected	%
NY	1	0	na	na	na	na	1	0	na	na	na	na	1	0	na	na	na	na
NJ	68	71	29	41	14	20	76	140	22	16	46	33	76	153	25	16	57	37
DE	8	15			3	20	16	19	5	26	4	21	16	26	18	69	6	23
MD	2	5			0	0	2	7	1	14	2	29	3	9	2	22	1	11
VA	0	22			14	64	0	43	15	35	33	77	0	41	16	39	30	73
NC	0	8			3	38	2	16	6	38	5	31	2	16	6	38	5	31
SC	0	1	1	100	1	100	0	1	1	100	1	100	0	1	1	100	1	100
GA	0	1			0	0	0	1	0	0	0	0	0	4	0	0	3	75
total	79	123	<56	<45	35	28	97	227	50	22	91	40	98	250	68	27	103	41
Historic = Presumed extirpated based on:																		
	age of last-observed date (50-150 years) AND/OR																	
	absence of plants at most recent site visit(s) (usually within 5-20 years)																	
Extant = Still in existance based on presence of plants at most recent site visit (usually within 5-20 years)																		
Protected = Extant occurences of any rank located at least partly on public or otherwise conserved land.																		
Delaware occurences were recently reorganized (McAvoy pers. comm. 2011), and also reflect McAvoy (2011).																		
Virginia occurences were reorganized since the last review (Milholden 2011).																		
Totals from 2007 do not include 2 occurences in Georgia that were outplanted as a recovery effort. Totals from 2011 do include 3 outplanted Georgia occurences.																		

Budd Lake Bog, New Jersey. This northern-most population in the range (B-ranked) is protected on State preserve land, although some of the buffer area is on private suburban parcels. The site is monitored regularly by volunteers and appears stable. In 2008, minor impacts occurred to the edge of the population from maintenance of an existing powerline right of way (ROW). The Service, the volunteers, and the power company are working together to conduct future ROW work in a manner that protects swamp pink.

Pink Beds, North Carolina. This population is by far the largest in the southern Appalachians, and is located on lands owned by the U.S. Forest Service (USFS). Anecdotal observations over the past several years suggests that the population may be relatively stable, but most observations are coarse (with discrete sites ranked as containing either 100s, 1000s, or 10,000s of rosettes) and therefore only likely to detect substantial changes in the population. Given the size and overall extent of this population, the USFS has focused on mapping the distribution of the species first rather than counting or estimating abundance. Working from historical maps generated in the 1980s and 1990s, the USFS has been attempting to relocate some 16 discrete locations depicted by one or more sources. As of 2011 the USFS reported that approximately half of these locations had been searched for but only one found. However, this could be due to inaccuracies of the historical maps rather than extirpation. The Pink Beds are now estimated to consist of at least 14 discrete subpopulations, collectively estimated to contain tens of thousands of rosettes. USFS considers invasive species and beaver as the most immediate threats (Wells pers. comm. 2011).

Watson-Cooper State Heritage Preserve, South Carolina. This site is the only known swamp pink site in South Carolina and is nearly as far south as the Georgia populations. This B-ranked population is well-protected, with State biologists conducting regular surveys and habitat management as required. Surveys indicate the population is stable or increasing (Bunch pers. comm. 2011).

Commissioner's Rock Bog (aka James Bog, Scaly Mountain Bog), Georgia. Commissioner's Rock Bog is the only naturally occurring swamp pink population in Georgia, and the southern-most in the species range. This population has been critically imperiled for years by off-site agriculture. The site was last visited in September 2011 when a total of 155 rosettes in 10 patches were observed. These appeared to be primarily vegetative, connected by thick rhizomes, and there was no evidence of flowering. The last observed flowering of swamp pink at this site was in 2008. Clearing of woody vegetation around swamp pink clumps had been done in November 2006, resulting in the proliferation of rosettes in some clumps by 2007. No flowering occurred in 2007, and the flowering in 2008 was extremely limited. No flowering took place 2009-2011. As of 2011, the site was overgrown with woody vegetation. The area around each patch was hand-cleared during the September visit. The water table at this site was drastically lowered by historic ditching, therefore the micro-habitats containing swamp pink are relatively dry in addition to being overgrown and shaded. Other rare species that were previously known from this site are now extirpated. Swamp pink at this site seems somewhat resilient but is decreasing overall. A few patches have disappeared, but vegetative vigor of most of the remaining patches is noteworthy. Active management of this population had subsided for at least the last five years. Population mapping was planned for winter 2012. Woody vegetation management is needed, and silt fencing needs to be re-installed between the old pastures and the

bog to prevent further sedimentation. Siltation and ditch depth measurements should be resumed (Radcliff pers. comm. 2011).

Condition 2. *Regulatory protection is sufficiently strong at the Federal, state, and/or local levels to ensure continued rangewide conservation of viable populations and their habitat (including an adequate buffer zone) after the protection afforded by the Endangered Species Act is withdrawn* (USFWS 1991).

New Jersey

Swamp pink is State-listed as endangered under the New Jersey Endangered Plant Species List Act (N.J.A.S. 13:1B-15.151), which only establishes a list. All protections for State-listed plants are conferred through a variety of other State laws. In addition to providing habitat for 61 percent of all extant swamp pink occurrences within the nation's most densely populated State, New Jersey is distinct for its State-assumed wetland permitting program and for its State-wide regulation of flood plains and stormwater management. Nearly 40 percent of New Jersey's swamp pink sites are further protected by regional land-use regulations (*e.g.*, Highlands, Pinelands, Coastal Zone). See USFWS (2008) for a summary of these regulatory programs; only those programs that have changed since the last review are discussed below.

Applicable State-wide, the Flood Hazard Area Control Act (N.J.S.A. 58A:16A-50 *et seq*.) regulates activities in flood plains. Implementing regulations state that the NJDEP will not approve any regulated activity that is likely to significantly and adversely affect State-listed species or their current or documented historic habitats (N.J.A.C. 7:13-8.1(b)3 and 10.6(d)). These protections apply to State-listed plants regardless of a species' status under the ESA. The Flood Hazard Control Act regulations underwent major revisions in late 2007. Among the changes is the establishment of a 150-foot-wide riparian buffer (measured from top of bank) around habitat for certain aquatic threatened and endangered species, including swamp pink. This buffer extends one mile upstream, including tributaries. Protection of these riparian zones brings the State regulation of riparian areas up to the standards recommended by Dodds (1996), specifically 150-foot buffers around streams and tributaries that feed directly into the wetlands supporting swamp pink. However, these new regulations do not apply to any segment of water that has a drainage area of less than 50 acres, if there is no discernible channel or connection to a regulated water by a channel or pipe (N.J.A.C. 7:13-2.2(a)3). This provision excludes many poorly defined headwaters that directly support swamp pink, or that drain to swamp pink habitat (Kunz pers. comm. 2011).

At the time of the last review, NJDEP had proposed changes to the State's Surface Water Quality Standards (N.J.A.C. 7:9B-1.4 and 1.15). Among other changes, the NJDEP proposed to classify as Category One anti-degradation status those waters that support certain Federally and State-listed aquatic wildlife species. The Service recommended extending this designation to waters supporting swamp pink. The NJDEP's proposed changes were adopted (as of the April 4, 2011 version of the rules), but without the addition of swamp pink.

As of the last review, NJDEP was considering changes to its rules regulating water withdrawals to protect listed species. However, efforts to control the impacts of water withdrawals through

New Jersey's water allocation program have largely been nullified by court decisions. The courts have found that these efforts conflict with the language of the Freshwater Wetland Protection Act (FWPA), which limits other entities from imposing additional wetland protection requirements. Based on these decisions, Torok (pers. comm. 2011) understands that applications for new or increased water withdrawals are no longer undergoing any wetland or endangered or threatened species impact analysis. NJDEP has also been unable to regulate water withdrawals directly under the FWPA. The NJDEP's Division of Land Use Regulation has received informal legal guidance that it cannot regulate such activities if the pumps are placed outside of the wetlands and regulated wetland buffers. This issue remains under discussion within NJDEP (Torok pers. comm. 2011).

Last updated in July 2008, the New Jersey Water Quality Management Planning Rule (N.J.A.C. 7:15) integrates Federal, State, regional, and local land use planning to control point and nonpoint sources of pollution, with counties acting as planning agencies to prepare Water Quality Management Plans. These rules limit new sewer service in "environmentally sensitive areas," which are defined to include threatened and endangered wildlife habitats as well as Natural Heritage Priority Sites. Although this restriction does not specifically extend to listed plants, several swamp pink occurrences are included in Natural Heritage Priority Sites and therefore receive protection from new development under these circumstances (Kunz pers. comm. 2011).

Arsenault (pers. comm. 2011) has found that lack of current survey and monitoring data can undermine existing regulatory protections in New Jersey. Montgomery (pers. comm. 2011) has found that State regulations protecting swamp pink are not always fully implemented or enforced in New Jersey's Pinelands Area. However, in general, New Jersey has the most protective and comprehensive set of State regulations protecting swamp pink. Although not able to address populations that are already in decline from existing development or from illegal activities, New Jersey's regulations are generally effective in minimizing habitat degradation from new developments. However, it will be many years before biologists can determine if this present-day set of regulations is truly adequate to prevent declines in swamp pink populations from land currently being developed.

In 2009, the New Jersey Division of Land Use Regulation (DLUR) added a Consulting Botanist to its small staff of threatened and endangered species specialists. Swamp pink tasks occupy about half his time, including surveys, literature reviews, application reviews, and following up on reported violations (Kunz pers. comm. 2011). This new position has substantially increased the ability of DLUR to fully implement and enforce the various State laws and regulations that protect swamp pink. This position will be vacated July 1, 2012, and it is not clear if the vacancy will be filled.

Other States

Delaware's endangered species law (Delaware Code Annotated Title 7 Sections 601 to 605) does not include any legal protections for plants or their habitats (George 1998; McAvoy pers. comm. 2011). Delaware has some laws and regulations related to wetlands, streams, upland buffers, stormwater, groundwater, and water quality. Under these regulations, streams and wetlands are

afforded 25-foot buffers, but these are insufficient to protect swamp pink (McAvoy pers. comm. 2011).

Swamp pink is State-listed as endangered under the Maryland Nongame and Endangered Species Conservation Act (Annotated Code of Maryland 10-2A-01 to -09) and implementing regulations (Code of Maryland Regulations 08.03.08). However, the law prohibits take of listed animals only (George 1998). Wetlands supporting swamp pink are regulated as wetlands of special State concern and are afforded a 100-foot upland buffer. This buffer requirement has been in place since 1991 (McCarthy pers. comm. 2011). Maryland's 100-foot upland buffers are not sufficient to maintain the groundwater-fed hydrology of the wetlands that support swamp pink (McCarthy pers. comm. 2011). Maryland's Stormwater Management Act went into effect October 1, 2007 (MDE 2012). These new State regulations will require new developments to more closely mimic natural hydrology, and should reduce impacts to swamp pink habitat from new developments (McCarthy pers. comm. 2011).

Swamp pink is State-listed as endangered under the Virginia Endangered Plant and Insect Species Act (Chapter 39 Section 3.1-1020 through 1030, as amended). The law prohibits take of listed plants from public lands and carries criminal penalties as a misdemeanor (George 1998). Virginia has no land-use regulations that apply to endangered or threatened species, and neither State nor local regulation of stormwater or groundwater are sufficient to protect swamp pink (Smith pers. comm. 2007).

Swamp pink is State-listed as threatened under the North Carolina Plant Protection and Conservation Act (Sections 106-202.12 to .20), which prohibits take without consent of the owner with penalties up to $2,000 (George 1998). The law primarily regulates commercial trade in listed plants, and is not intended to prohibit destruction of plants or habitat associated with otherwise legal activities including development. State or local regulation of stormwater or groundwater offers minimal protection for swamp pink, either through limitations on the State statutes or lack of adequate enforcement (Wells pers. comm. 2007).

Swamp pink is State-listed as threatened under the South Carolina Nongame and Endangered Species Conservation Act (S.C. Code Ann. Sections 50-15-10 to -90) (George 1998). State regulations prohibit collection of any plant from State-owned land without written permission. The only swamp pink population in South Carolina is located on State land, and is well-protected (USFWS 2008).

Swamp pink is listed as threatened under the Georgia Wildflower Preservation Act (Georgia Code Ann. Section 12-6-170 -176), which prohibits unauthorized take of plants from public lands and carries criminal penalties as a misdemeanor (George 1998). There are no buffer requirements (Radcliff pers. comm. 2011). Without habitat protections, the only naturally occurring swamp pink population in Georgia has shown sharp declines from habitat degradation caused by offsite agriculture (Radcliff pers. comm. 2011).

Regulation of Wetlands

In 1993, after publication of the swamp pink recovery plan, New Jersey became the only State in the species' range to assume the Federal regulation of freshwater wetlands under Section 404 of the Clean Water Act (33 U.S.C. 1344 *et seq*.) (CWA). Regulatory jurisdiction for all wetlands supporting swamp pink was assumed by the State, eliminating Federal authorization by the U.S. Army Corps of Engineers (Corps) and thereby also removing the protections afforded by Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq*.) (ESA). To avoid the loss of Service review under the ESA, a Memorandum of Agreement (MOA) was signed by the Service, the NJDEP, and the U.S. Environmental Protection Agency (EPA) concurrent with State assumption to serve as a functional equivalent of Section 7 consultation. See USFWS 2008 for more information on the protection of swamp pink under the State-assumed program.

Throughout the other six states in the range, wetlands supporting swamp pink continue to be regulated primarily by the Corps and the EPA under Section 404 of the CWA. Prior to issuing permits, the Corps consults with the Service pursuant to Section 7 of the ESA.

Over the past decade, interpretations of Supreme Court rulings have removed some waters from Federal protection and caused confusion about which waters and wetlands remain protected (USEPA 2011). (See USFWS 2008 for a discussion for the likely impacts of curtailed Federal wetland jurisdiction relative to swamp pink.) In April 2011, EPA and the Corps released draft guidance to clarify protection of waters under the CWA. The final guidance is now undergoing Federal interagency review. The intent of the guidance is to provide more predictable and consistent procedures for identifying waters and wetlands protected under the CWA (USEPA 2011). If adopted, the new guidance will be evaluated with regard to swamp pink habitat during the next status review.

Condition 3. *As necessary, representative genotypes are established and maintained in cultivation at plant breeding facilities* (USFWS 1991).

In 2000, the Service signed a Memorandum of Understanding with the Center for Plant Conservation (CPC) to further the conservation of North American plants. The CPC is a network of major botanical institutions. The CPC oversees the National Collection of Endangered Plants, which stores plant material in case a species becomes extinct or no longer reproduces in the wild. See USFWS (2008) for a summary of the swamp pink cultivation programs at CPC member institutions New York Botanical Garden (NYBG) and Atlanta Botanical Garden.

The NYBG has about 50 small plants, the progeny of swamp pink salvaged from New Jersey in the early 1990s following a severe habitat disturbance. The propagation methods at NYBG involve collecting seed as it turns very dark in color (almost black) but is still attached to the ovary. The seeds are sown immediately in a seed pan with a light covering. Germination is around 95 percent within two weeks. Seedlings from this point take a very long time (several months) to produce a second leaf. Then they are transferred into individual pots. The NYBG will feature swamp pink in its new Native Plant Garden with interpretive signage, and includes

swamp pink in its student programs (Payne pers. comm. 2011). NYBG also expects to collect seed from Fort A.P. Hill in Virginia. The Department of Defense (DoD) is working with CPC to enable botanical gardens to hold plants collected from DoD sites in an effort to preserve the genetic diversity of rare and endangered flora (Payne pers. comm. 2011). Swamp pink plants of Virginia and New Jersey origins will be maintained separately at NYBG (Payne pers. comm. 2011).

Arsenault (pers. comm. 2011) reports that there are many private growers propagating swamp pink from garden-collected seed. This plant is very easy to grow if planted immediately when seed is shed (Arsenault pers. comm. 2011, USFWS 2008).

Novy (pers. comm. 2011) was involved with planting swamp pink in an artificial bog garden at Rutgers Gardens, New Brunswick, New Jersey. These plants were sourced from propagated materials from Gloucester County, New Jersey. Novy (pers. comm. 2011) also helped the Great Swamp Watershed Association add to their swamp pink planting in a wildlife conservation area in Morris County, New Jersey. These plants were the surviving progeny grown at Rutgers University from plants salvaged in Salem County after habitat was destroyed in the early 1990s (Novy pers. comm. 2011) (*i.e.*, same source as the NYBG plants).

Swamp pink plants at the New England Wild Flower Society's Garden in the Woods set copious amounts of seeds. Research has found that germination drops off sharply if the seeds are allowed to dry out after they have been collected, although some of them may germinate as many as nine months after collection. Research has also shown that the seeds should not be covered with the germination medium after sowing and that the best germination was achieved by placing each flat of freshly sown seeds in a tray of water. Seedlings appear approximately three weeks after sowing and are sensitive to any disturbance until they have attained a reasonable size. The plants need three to five growing seasons to mature, and some may not bloom for several more years. This information could give valuable clues to conservation, including implications for small populations of only one or two blooming plants and a few seedlings. Thus, work on endangered plants in a botanic garden can help biologists manage wild populations. Furthermore, swamp pink cultivators have developed the techniques to propagate a particular genotype for return to the wild should that be deemed advisable, and have built up a reserve collection in case of catastrophe (Brumback 1986).

Brumback (1986) emphasizes that raising endangered plants in a botanic garden (*ex situ* conservation) is not a substitute for protection of natural habitats (*in situ* preservation). Rather, botanic gardens should emphasize to their visitors that preserving habitat is the single most important way to preserve a species, and that the role of a botanic garden is to complement, not to substitute for, preserving plants in the wild. Gardens can play significant roles by conducting research on the reproductive biology and potential of endangered plants, as well as by creating valuable reserve collections that could be used for reintroduction should biologists deem it necessary to do so. Perhaps the most important role for gardens is educating the public, who ultimately determine public policies regarding endangered species (Brumback 1986). Brumback's (1986) assertions regarding the role of botanical gardens in the conservation of swamp pink are consistent with the Service's *Draft Recommendations for the Responsible Propagation of Swamp Pink*, which is currently under review by a number of growers.

There are three introduced populations of swamp pink in Georgia that were established using seed from the original population at Commissioner's Rock Bog and propagated at Atlanta Botanical Garden. These "safeguarding" sites were created in suitable habitat within the Chattahoochee-Oconee National Forest where mountain bog restoration projects are ongoing. The three sites are Keener Bog (Rabun County), Coopers Creek Complex (Union County), and Hale Ridge Bog (Rabun County). Approximately 300 swamp pink plants have been outplanted. Survival of original outplantings will be assessed in 2012 when the safeguarding sites are inventoried and the outplantings are mapped. Overall, most introduced populations seem to be stable with increasing viability as the project sponsors fine-tune their adaptive restoration efforts (Radcliff pers. comm. 2011).

In October 2011, evidence of seedling recruitment was seen at Keener Bog. In May 2010 USFS cleared woody vegetation surrounding some mountain bogs in order to open up the transitional ecotones between the bogs and the surrounding uplands. In October 2010 a flowering stalk was observed on a large rosette of swamp pink that had been outplanted in the early 1990s. Until the area was cleared to allow ample sunlight, no flowering had been observed. One year later, in 2011, seedlings were observed adjacent to this same plant. This is the first evidence of sexual reproduction for this species in Georgia's outplanted populations (Radcliff pers. comm. 2011).

2.3 Updated Information and Current Species Status

2.3.1 Biology and habitat

2.3.1.1 New information on the species' biology and life history:

Sterling (1980) provided a detailed description of the carpel anatomy in swamp pink and several related species. Takahashi and Kawano (1989) provided a technical description of pollen in swamp pink and several related species. Tanaka (1997b and 1997c) provided technical descriptions of numerous floral and vegetative parts in swamp pink and several related species.

Working at five swamp pink sites in southern New Jersey, Scagnelli (2006) tested the pH of water in piezometers, and reported pH levels from 4.13 to 5.71, which is fairly acidic.

Laidig *et al.* (2009) characterized site hydrology, substrate, topography, tree-canopy cover, and hydrologic regimes associated with swamp pink at two colonies located along small streams in the New Jersey Pinelands and assessed the potential impact of simulated water-level reductions on the species and its habitat. Over the 2-year study period, surface-water levels at the two colonies fluctuated by 11.9 and 27.9 cm. Sites were characterized by muck substrate and variable topography with steep-sided hummocks in and along stream channels. Tree canopy cover above the two colonies was 36 and 9 percent less than canopy cover in the adjacent forests. A pronounced difference in water levels associated with swamp pink plants compared with water levels associated with points where the plant was not present suggested that swamp pink was not uniformly distributed at the sites in relation to water table. Swamp pink clusters, composed of groups of individual plants, were typically associated with the emergent portions of hummocks in and along the stream channels. Based on measurements at 958 clusters, the 2-year median

water level at the two sites was 7.9 and 10.9 cm below the base of the clusters. More than 90 percent of the total cluster area at both sites was associated with water levels between 5.0 (submerged) and 19.9 cm (exposed). The greatest total cluster area was associated with water levels between 5.0 and 9.9 cm, which may be the optimal water-level range for swamp pink. A relatively small simulated water-level drawdown of 15 cm exposed more than 30 percent of the cluster area at both sites to extreme hydrologic conditions, which we defined as the water level beyond which less than 10 percent of the total existing swamp pink cover occurred at our sites (*i.e.*, greater than or equal to 20 cm below the base of the clusters). A larger simulated water-level reduction of 30 cm exposed all or nearly all of the cluster area to extreme conditions. Simulated impacts on habitat were less pronounced for smaller drawdowns because losses of suitable habitat (*i.e.*, habitat that occurs within the 10th and 90th percentiles of measured water levels associated with swamp pink) were countered by dewatering of habitat that was previously submerged. The extent to which this dewatered habitat can compensate for losses in suitable habitat depends upon the potential for swamp pink to colonize the dewatered habitat. The hydrologic relationships described in this study may inform restoration efforts for this species and provide the basis for assessing potential impacts to swamp pink sites that are subjected to hydrologic variation.

2.3.1.2 Abundance, population trends (*e.g.* increasing, decreasing, stable), demographic features (*e.g.*, age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Many biologists familiar with swamp pink and its habitat suspect at least a few swamp pink occurrences remain undiscovered in New Jersey (Arsenault pers. comm. 2011; Hogan pers. comm. 2011; Kunz pers. comm. 2011), Delaware (McAvoy pers. comm. 2011), Maryland (McCarthy pers. comm. 2011), and Virginia (Applegate pers. comm. 2011; Townsend pers. comm. 2011). No additional naturally occurring populations are suspected in Georgia (Radcliff pers. comm. 2011).

Indeed, several new populations have been documented since the last review. All of the increase in New Jersey's number of occurrences (13) was due to new discoveries, though most of these populations are very small. Two previously known, but unranked, New Jersey occurrences were found to be A- or B-ranked. Three new occurrences were recorded in the Maryland Natural Heritage database, including an A-ranked population.

However, reports from field biologists and volunteers indicate that far more populations are declining than stable or increasing. In 2011, Brown *et al.* (2012) monitored nine swamp pink "colonies" (within three different Element Occurrences) at Fort A.P. Hill in Virginia. Relative to previous surveys, five colonies were declining, three colonies were increasing, and one colony showed no change (no plants observed). In contrast, Townsend (pers. comm. 2011) believes swamp pink populations in Virginia are generally stable. McAvoy (2011) found many Delaware populations in decline. Kunz (pers. comm. 2011) has observed a number of occurrences in New Jersey exhibiting substantially smaller populations sizes than those recorded during surveys in the late 1990s. These observations from New Jersey are echoed by Torok (pers. comm. 2011) and volunteer monitors, and supported by the analysis in Section 2.3.1.2 of USFWS (2008). In

recent surveys, Kelly (pers. comm 2011) found one population improving, two stable, seven declining, and seven for which he could not determine a trend. A long-term study of two adjacent populations (A- and B-ranked) in Camden County has found steep declines in rosette density, number of leaves per rosette, and leaf length since 1998 (CH2MHill 2011).

McCarthy (pers. comm. 2011) has observed a dramatic decline in Anne Arundel County populations since the late 1980s at all sites. Declines in Cecil County populations are likely due to hydrologic changes from gravel mining, but site access for surveys is limited. No site in Maryland is fully protected, and the future of this species in that State is bleak. Reintroduction of plants into the habitats that previously supported swamp pink would not be advisable due to the extensive changes in the surrounding landscape that will continue to degrade those habitats (McCarthy pers. comm. 2011).

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (*e.g.*, loss of genetic variation, genetic drift, inbreeding, etc.):

Fuse and Tamura (2000) conducted a phylogenetic analysis of the plastid *mat*K gene in swamp pink and many related species. Novy (pers. comm. 2011) is finishing a study of swamp pink genetics from New Jersey populations.

2.3.1.4 Taxonomic classification or changes in nomenclature:

Taxonomic authorities have reassigned swamp pink to a different family in the Order Liliales. Starting with the first version in 1998 (APG 1998), and continuing through the current (third) version (APG 2009; Stevens 2012), the Angiosperm Phylogeny Group (APG) has recognized the Family Melanthiaceae (Order Liliales). Within the Melanthiaceae, Stevens (2012) recognizes five tribes including Helionadeae (*i.e.*, Heloniadeae, with Helonieae treated as a synonym by Zomlefer *et al*. [2001]). Before this change, swamp pink was generally considered a member of the lily family (Liliaceae) (USFWS 1991), although some authors had placed *Helonias* in the separate Melanthiaceae family as early as 1802 (Zomlefer *et al*. 2001).

There have been at least two alternative circumscriptions to the APG's recognition of Heloniadeae as a tribe in the family Melanthiaceae.

1. The "melanthoid" genera have often been placed as a subfamily within Liliaceae (Zomlefer *et al*. 2001).

2. Some botanists have suggested elevating the various Melanthiaceae tribes to family status (Zomlefer *et al*. 2001; Utech 2002). Under this system, the tribe Heloniadeae would become the family Heloniadaceae.

These taxonomic groups have undergone a complex and controversial history (Takahaski and Kawano 1989; Zomlefer *et al*. 2001; Utech 2002). In addition to fluctuations in its familial assignment, the composition of the genus *Helonias* has also been questioned, as discussed below.

Based on comparative carpel anatomy, Sterling (1980) concluded that the genera *Helonias*, *Heloniopsis*, and *Ypsilandra* make a natural tribal grouping and should perhaps be considered alone as the Helonieae. Based on the similarity in vascular anatomy and carpel morphology, Utech and Kawano (1981) conclude that *Helonias* and *Heloniopsis* should be classified the same tribe, contrary to suggestions by earlier authors.

As reported in USFWS (2008), Utech (1978; 1980) concluded that floral and somatic karyotype similarities between swamp pink and *Heloniopsis orientalis* support the position that both species should be maintained in the same tribe. Utech (1980) went further to state, "*One might even argue for congeneric status.*"

Based on pollen morphological evidence, Takahashi and Kawano (1989) supported the suggestion by Utech and Kawano (1981) that *Helonias* and *Heloniopsis* be maintained in the same tribe. Pollen morphology further supported the inclusion of *Ypsilandra* in this same tribe, as the three genera are closely related to each other and share distinctive pollen features (Takahashi and Kawano 1989). These authors went further, regarding *Helonias*, *Heloniopsis*, and *Ypsilandra* as congeneric. Although Takahashi and Kawano (1989) noted that a more thorough taxonomic account was needed (*i.e.*, to verify congeneric status), Kawano had considered the three genera (*Helonias*, *Heloniopsis* and *Ypsiandra* [*i.e.*, *Ypsilandra*]) to be congeneric as early as 1980 (Kawano and Masuda 1980).

As reported in USFWS (2008), Tanaka (1997a) concluded that regarding *Helonias*, *Heloniopsis* and *Ypsilandra* as congeneric seemed appropriate, but noted that comparison of many other characters was necessary to clarify fully the relationship among the three groups. Tanaka later examined characteristics of the pistils and stamens (1997b) and other floral and vegetative parts (1997c), as well as evolutionary factors and geographic distribution (1997d). Based on these studies, Tanaka (1998) concluded that the ten species in these three genera should be reduced to nine species all in the genus *Helonias*. Tanaka (1997d) considers swamp pink as the most primitive member of the group, with all the other species (which occur only in Asia) regarded as swamp pink's descendants. Speciation may have occurred as ancestral plants migrated south from the Arctic in response to a cooling climate since the end of the Eocene (Tanaka 1997d).

Based on genetic evidence (the plastid matK gene), Fuse and Tamura (2000) concluded that Tanaka's reduction of *Heloniopsis* and *Ypsilandra* to *Helonias* is unnecessary.

Although familiar with Fuse and Tamura (2000), Zomlefer *et al*. (2001) listed the genus *Helonias* as including *Heloniopsis* and *Ypsilandra*. (Note that the genetic and taxonomic work of Zomlefer *et al*. (2001) did not directly involve any of these 3 genera; this paper's reference to *Helonias* was provided as context for their work on other Melanthiaceae tribes.) Citing Tanaka (1998), Takhtajan (2009) listed *Helonias* as including *Heloniopsis*, and placed it in the tribe Heloniadeae (family Melanthiaceae). However, Takhtajan (2009) broke with Tanaka (1998) to include *Ypsilandra* as a separate genus in the same tribe.

Utech (2002) noted that that Tanaka had merged *Heloniopsis* and *Ypsilandra* into *Helonias*, but concluded that these three genera are distinct based on the molecular evidence of Fuse and Tamura (2000). Breaking with the conclusion in Utech (2002), Kawano *et al*. (2007, with Utech

as third author) adopted the merger of *Heloniopsis* and *Ypsilandra* into *Helonias*, placing the merged genus in the family Liliaceae.

Weakley (2010) continued to describe *Helonias* as a monotypic genus, but noted the suggestion of Takahaski and Kawano (1989) that it may be congeneric with *Heloniopsis* and *Ypsilandra*. Weakley (2010) suggested the segregate family Heloniadaceae may be more appropriate. Although familiar with Tanaka (1998), Hsu *et al.* (2011) retained *Helonias*, *Heloniopsis*, and *Ypsilandra* as separate genera. Stevens (2012) continues to list *Helonias*, *Heloniopsis*, and *Ypsilandra* as separate genera in the family Melanthiaceae. The Plant List (2012) lists *Helonias bullata* as the only accepted species in this genus, and classifies the various "*Helonias*" species renamed by Tanaka as synonyms for species of *Heloniopsis* and *Ypsilandra*.

Combination of *Helonias* with any other genus could affect the recovery priority assigned to swamp pink (using the criteria in 48 FR 43099). However, resolution of the taxonomic uncertainties discussed above is not a conservation priority for swamp pink because there is no controversy regarding the validity of *Helonias bullata* as a species. In addition, swamp pink is completely isolated geographically from all its closest living relatives. All other closely related species occur only in Asia.

2.3.1.5 Spatial distribution, trends in spatial distribution (*e.g.* increasingly fragmented, increased numbers of corridors, etc.), or historic range (*e.g.* corrections to the historical range, change in distribution of the species' within its historic range, etc.):

On a county basis, there have been no changes in the species range since last review (Table 2).

2.3.1.6 Habitat or ecosystem conditions (*e.g.*, amount, distribution, and suitability of the habitat or ecosystem):

As part of a comprehensive evaluation of the hydrologic and ecological effects of potential groundwater pumping from the Kirkwood-Cohansey aquifer, Zhang *et al.* (2011) applied empirically determined hydrology-vegetation models to develop geographic information system (GIS)-based landscape models for three study basins in the New Jersey Pinelands, using the results of Laidig *et al.* (2009) and other studies. The modeling suggests that the area dominated by wetland species will decline in area with increased groundwater withdrawal due to the predicted drop in the water table. Some findings from this study suggest that swamp pink habitat is particularly vulnerable to lowering of the water table. First, cedar and hardwood swamps which are at the wetter end of the water table gradient are predicted to show the greatest percent declines in area. Second, the landscape modeling suggests that at the higher levels of groundwater withdrawal, the decline of wetland area will be especially severe in the upper headwaters of the basins, with a modeled 'retreat' of existing wetlands to a narrower streamside corridor.

USFWS (2008) examined patterns of outright loss of forested wetlands (*e.g.*, filling, clearing, draining) that likely contributed to the historic decline of swamp pink. Although not specific to swamp pink, Elmore and Kaushal (2008) examined a related aspect of habitat loss – stream burial. In a Maryland study area, these authors found 20 percent of all streams were buried, with

that figure as high as 66 percent for the highly urbanized Baltimore City. Smaller headwater streams were more extensively buried than larger streams, and this difference increased with increasing impervious surface area (Elmore and Kaushal 2008). Burial of headwater streams may partly explain the loss of swamp pink from more urbanized portions of its range. (See USFWS 2008 for a full discussion of habitat degradation.)

2.3.1.7 Other: None.

Table 2. Counties with extant occurrences of swamp pink

	County	2007	2011
New Jersey	Atlantic	5	6
	Burlington	10	13
	Camden	28	29
	Cape May	13	13
	Cumberland	14	14
	Gloucester	13	17
	Middlesex	1	1
	Monmouth	10	10
	Morris	2	1
	Ocean	24	30
	Salem	20	19
Delaware	Kent	4	3
	New Castle	1	1
	Sussex	14	22
Maryland	Anne Arundel	4	5
	Cecil	2	3
	Dorchester	1	1
Virginia	Augusta	21	21
	Caroline	16	14
	Henrico	5	5
	Nelson	1	1
North Carolina	Ashe	1	1
	Henderson	2	2
	Jackson	1	1
	Transylvania	12	12
South Carolina	Greenville	1	1
Georgia*	Rabun	2	3
	Union	1	1
Total		229	250
* 2007: 1 each in Rabun and Union Counties due to outplanting.			
2011: 2 in Rabun County and 1 in Union County due to outplanting.			

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

Only new information since USFWS (2008) is presented below.

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Hogan (pers. comm. 2011) considers invasive species and erosion primary threats in Camden, Salem, and Atlantic Counties, New Jersey, and has observed more erosion associated with off-road vehicles since 2007. Arsenault (pers. comm. 2011) finds stormwater and illegal fill primary threats in Camden and Salem Counties, New Jersey. Kunz (pers. comm. 2011) considers upstream development and subsequent stormwater discharges and excessive groundwater withdrawals two of the primary threats to swamp pink in New Jersey.

Torok (pers. comm. 2011) knows of one population that has been extirpated by stormwater discharges in the past few years, and several other showing significant declines and habitat degradation. Although even highly disturbed populations can persist for many years, some are succumbing to extirpation. He continues to consider the dual effects of impervious surface – stormwater discharges and a lowered water table – as the primary threats to swamp pink in New Jersey (Torok pers. comm. 2011).

The establishment and spread of invasive plant species is a constant threat in Delaware, as is the lack of upland buffers (McAvoy 2011). McCarthy (pers. comm. 2011) considers habitat degradation the primary threat to swamp pink in Maryland, resulting from residential and commercial development and gravel mining.

Based on 2010 surveys of nine A- and B-ranked colonies in Fort A.P. Hill, Virginia, Applegate (2010) reports that invasive species are a minor threat in some locations. Townsend (pers. comm. 2011) finds habitat degradation the primary threat to swamp pink in Virginia, resulting from housing and other development, damage to seepage habitats through water table lowering, and gravel mining.

Radcliff (pers. comm. 2011) considers habitat degradation and fragmentation the primary threats to swamp pink in Georgia. Specific threats include the conversion of habitat to farmland and pasture; pollution runoff and sedimentation into wetlands; and ditching and draining of wetlands.

In one effort to reverse habitat degradation, Camden County Soil Conservation District (McGee and Williams 2011) prepared a Watershed Based Implementation Plan for the Big Timber Creek watershed. This watershed supports 17 swamp pink populations in New Jersey. The Plan identifies impairments, issues and concerns, and recommends strategies, solutions and ideas to be adopted in a Regional Stormwater Management Plan. Various of Best Management Practices, including both planning and structural measures are recommended in the plan. Retrofits and renovations of stormwater infrastructure to enhance ground water recharge and improve surface water quality are identified as priorities, as are design standards in riparian areas. Preparation of the plan makes the Big Timber Creek watershed eligible for State and Federal non-point source

pollution control funding. The Camden County Soil Conservation District and the Service plan to move ahead to propose and implement priority projects identified in the plan.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

During summer 2012, a volunteer intern from the NYBG Professional Horticulture Program is meeting with swamp pink growers to learn more about their activities and encourage a dialog with the Service. Her preliminary contacts have not turned up reports of recent collection from the wild, but this work has been underway for only about a month at the time of writing. In general, collection is considered only a secondary threat to swamp pink.

2.3.2.3 Disease or predation:

Many field biologists report that herbivory pressure on swamp pink from white-tailed deer (*Odocoileus virginianus*) is increasing.

Deer herbivory is a threat to both populations in the Blue Ridge Parkway in Virginia and North Carolina (Ulrey 2007). In contrast, Applegate (2010) reports that minimal evidence of deer browse was observed during 2010 surveys of nine A- and B-ranked colonies in Fort A.P. Hill, Virginia. Observations from recent surveys in Delaware suggest that three populations may have been extirpated due to deer eating the plants (McAvoy 2011).

Arsenault (pers. comm. 2011) considers deer a primary threat in Camden and Salem Counties, New Jersey. Deer are a major threat in Camden County, and to a lesser extent also in Salem County, New Jersey (Hogan pers. comm. 2011). Hogan (pers. comm. 2011) has observed more deer browse since 2007, and is working on deer fencing projects at two Camden County populations.

Based on work at three south Jersey populations, Dodds (pers. comm. 2011) concludes that the contribution of deer predation to the decline of the species may be much for substantial than previously believed. In her opinion, the swamp pink's ability to make and store energy well beyond the typical growing season is critical to its survival, allowing it to compete for light which is a limited resource on the floor of the swamps that it inhabits. Maintaining its leaves throughout the winter months allows the species to continue photosynthesis after the deciduous plants have shed their leaves and the taller herbaceous vegetation has died back for the year. Unfortunately, this characteristic also makes it easier for the deer to find the plants during a period when food is limited and little else is green. Dodds (pers. comm. 2011) believes that deer browse during this critical period reduces a plant's capacity for growth and flowering the following spring, and that repeated browsing incidents can cause the demise of a rosette.

Kunz (pers. comm. 2011) considers deer browse one of the primary threats to swamp pink in New Jersey. He has regularly observed a pattern where the bulk of remaining healthy plants are isolated to the interior of the wetland. Plants that persist along the edges of the wetland are few and generally small if present at all. He postulates that herbivory by deer is responsible for the extirpation, low numbers or small size of swamp pink plants situated on the periphery of such

wetlands, speculating that deer prefer not to navigate the wetland interiors with deep organic substrates and move on to new areas to forage. Kunz (pers. comm. 2011) has also observed herbivory of swamp pink where adjacent vegetation has not been browsed at all and there is no browse line in the forest understory. He therefore suspects that deer may actually have a preference for swamp pink in relation to its vegetative associates.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

See Section 2.2.3, Condition 2. No State laws prohibit the collection or destruction of federally or State-listed plants on private lands with permission of the landowner, although some restrict possession, commercial trade, or collection of State-listed plants from public land. Although it offers no special protections for State-listed plants, New Jersey's FWPA regulates "*destruction of plant life which would alter the existing pattern of vegetation*" within freshwater wetlands.

Outside of New Jersey, State laws do not prohibit destruction of swamp pink or its habitat incidental to an otherwise lawful activity. In New Jersey, prohibition against such "incidental take" is afforded to State-listed plants in certain geographic areas (*e.g.*, Highlands, Pinelands, Coastal Zone). However, over 60 percent of New Jersey's swamp pink occurrences are outside these areas, and are afforded incidental take protection under the FWPA only due to the species' status as a federally listed species (*i.e.*, through the interagency MOA discussed above).

2.3.2.5 Other natural or manmade factors affecting its continued existence:

See USFWS (2008) for a discussion of climate change.

Beaver (*Castor canadensis*): Many field biologists report that hydrologic impacts on swamp pink from beaver activity are increasing.

During 2011 surveys, Brown *et al.* (2012) found two of nine swamp colonies impacted by beaver on Fort A.P. Hill, Virginia. During 2010 surveys, four of nine A- and B-ranked colonies were showing negative impacts from beaver activity (Applegate 2010). Applegate (pers. comm. 2011) finds the primary threat to swamp pink in Fort A.P. Hill, Virginia is colony impairment/loss (hydrologic inundation) due to beaver activities. Land managers have increased their efforts to maintain culverts to preclude flooding (beaver-mediated pipe obstructions).

McAvoy (pers. comm. 2011) finds that the primary threat to swamp pink populations and habitat in Delaware appears to be from beaver activity, *i.e.*, dam creation and subsequent flooding. During recent surveys in Delaware, habitat for four populations had been eliminated due to flooded conditions from beaver activity. The high swamp edges where swamp pink typically occurs were found to be completely inundated. In addition to the sites where beaver damage was recently documented, another site, determined extirpated in 1997 was also lost to flooded conditions from beaver (McAvoy 2011).

Laidig (pers. comm. 2011) considers beavers one of the primary short-term threats to swamp pink populations in the New Jersey Pinelands. Beaver activity is a suspected cause of declines at

one site. Beaver are being managed to reduce flooding at one south Jersey population within a transmission line right-of-way.

Woody Vegetation Encroachment: Several sites in the southern Appalachians are considered threatened by the encroachment of woody vegetation. Radcliff (pers. comm. 2011) considers this a primary threat in Georgia.

At Commissioner's Rock Bog in Georgia, woody vegetation control in 2006 resulted in the proliferation of rosettes in some clumps (Radcliff pers. comm. 2011). The Watson-Cooper Heritage Preserve in South Carolina also receives woody vegetation control (Bunch pers. comm. 2011).

One site managed by The Nature Conservancy in Henderson County, North Carolina showed a slight increase in 2010 after modest canopy thinning was conducted in an attempt to stimulate flowering; this population has exhibited a near total lack of flowering in recent years. While the modest increases in rosettes suggest a positive response to increased light levels, the near lack of flowering reduces the likelihood that these "new" rosettes represent seedlings. Although subtle, the response of this swamp pink population is consistent with the working hypothesis in the southern Appalachian. Specifically, it is believed that a lack of disturbance mechanisms is leading to encroachment of woody vegetation in southern Appalachian bogs, which in turn is leading to decreased flowering and recruitment in rare plant species like swamp pink (Wells pers. comm. 2011).

In two populations on National Park Service land (Blue Ridge Parkway in Ashe County, North Carolina and Nelson County, Virginia), skunk cabbage (*Symplocarpus foetidus*) was clipped in an attempt to increase light levels and stimulate flowering, starting in 2005. In the small Ashe County population, plant size (number of rosette leaves) subsequently increased through 2007. In the larger Nelson County population, plant size did not noticeably increase, but flowering did increase in 2006 and 2007 (Ulrey 2007).

2.4 Synthesis

Although significant taxonomic uncertainty surrounds the composition of the genus *Helonias*, as well as its familial assignment, these issues are of minimal conservation concern to swamp pink due to its clear status as a valid species and its geographic isolation from any closely related species. Habitat degradation from offsite development, mining, and other activities (*e.g.*, through hydrologic change, sedimentation, invasive species) remains the primary threat to this species. Browsing by deer and flooding by beaver are significant emerging threats. In the southern part of the range, overly dense woody vegetation is depressing rosette size and vigor and flowering rates in many swamp pink populations.

A substantial amount of survey work has been completed since the last review (Georgia, South Carolina, Pink Beds North Carolina, Fort A.P. Hill Virginia, Maryland, Delaware), or is underway (New Jersey). New occurrences continue to be discovered though most are very small. Most field biologists working on swamp pink concur that the general trend in most

populations is one of declining plant counts and vigor, and reduced habitat quality and size. Incremental progress on habitat acquisition and watershed-based protections is being made.

Few regulatory changes have occurred since the last review. Proposed new EPA and Corps guidelines on Federal wetland jurisdiction could have widespread implications for the protection of swamp pink under Section 7 of the ESA.

Propagation of swamp pink is an area of active interest by many in the conservation, horticulture, and commercial garden trade communities. The Service is reaching out to form new partnerships in this arena, with the goal of promoting responsible practices and a conservation ethic.

3.0 RESULTS

3.1 Recommended Classification:

____ **Downlist to Threatened**
____ **Uplist to Endangered**
____ **Delist** (*Indicate reasons for delisting per 50 CFR 424.11):*
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X_ **No change is needed**

3.2 New Recovery Priority Number: 7C (no change)

Brief Rationale: The overall magnitude of threat to the continued existence of swamp pink is moderate based on the relatively high number of known populations spread across a large geographic area weighed against the pervasive nature of virtually all categories of threats, which have brought about documented populations declines and local extirpations. All known threats are imminent, and, in fact, ongoing; however, many threats bring about population declines slowly, affording time for intervention. Despite ongoing taxonomic controversy, swamp pink continues to constitute a monotypic genus, and continues to be in conflict with construction or other development projects.

3.3 Listing and Reclassification Priority Number:

Reclassification (from Threatened to Endangered) Priority Number: ____
Reclassification (from Endangered to Threatened) Priority Number: ____
Delisting (Removal from list regardless of current classification) Priority Number: ____

Brief Rationale: Not applicable.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The following recommendations remain generally unchanged from USFWS (2008).

Revaluate Recovery Criteria in Light of New Information

- Conduct a population viability analysis (PVA) with cautious assumptions about collection, herbivory, beaver activity, woody vegetation encroachment, and climate change.

- Use the results of the PVA to determine the importance and viability of C and D-ranked sites, and to determine if the recovery criteria need revision (particularly the number, type, and conditions for "protected" sites).

Monitor and Track Recovery

- Develop criteria to determine which populations are representative of the species' range, habitat, or genetic diversity, and identify those specific occurrences.

- Develop a rapid assessment protocol to map and rank occurrences with minimal effort, expense, and disturbance in a consistent way across the range. Use the protocol to rank and map 20 percent of sites each year (*e.g.*, a five-year cycle), using volunteers where possible. Make sure the information is entered in Natural Heritage Program databases. Track element occurrence ranks and plant numbers over time.
  Progress Since the Last Review: USFS is developing new methods to consistently monitor the Pink Beds. Fort A.P. Hill, Virginia has adopted a cycle of monitoring 20 percent of their colonies each year. Extensive surveys have been completed in Maryland and Delaware, and are underway in New Jersey. The New Jersey Field Office issued recommended survey methods for counting "rosettes" versus "clumps." Element occurrence ranks are being tracked over time as part of the five-year reviews.

Watershed-Level Protection

- Conduct a study to look for correlations between buffer width and changes in population size and vigor.

- Develop Best Management Practices to protect swamp pink habitat, and encourage their adoption by Federal and State regulatory agencies, local governments, and public and private landowners.
  Progress Since the Last Review: Best Management Practices have been posted on the New Jersey Field Office web site, and reflected in the Big Timber Creek Watershed Implementation Plan.

- Incorporate swamp pink in watershed planning, especially where multiple occurrences are clustered in small watersheds. Examples of watershed planning activities may include identifying priority areas for acquisition or conservation easements; mapping groundwater recharge areas; mapping up-gradient areas of steep slopes or highly erodable soils; and

seeking protections through surface water quality standards, development design standards, or regulation of flood plains or stormwater management.
Progress Since the Last Review: The Big Timber Creek Watershed Implementation Plan has been completed.

Site-Specific Protection

- Work with public and private land trusts to acquire and manage important sites and buffers, prioritizing A and B-ranked sites and sites identified as representative of the species' range, habitat, or genetic diversity.
  Progress Since the Last Review: The New Jersey Field Office held a meeting with major land trusts in 2009 to discuss priorities for swamp pink habitat acquisition. Several acquisition efforts are in progress.

- Continue to seek landowner agreements to protect swamp pink on private lands where outright acquisition is a low priority or is not feasible.
  Progress Since the Last Review: Camden County College (New Jersey) has moved to protect its A-ranked population.

- Work with restoration groups to halt or reverse declines at impacted sites. Seek out new funding sources, such as those for non-point source pollution control or preservation of lands important to water supplies.
  Progress Since the Last Review: The South Jersey Land and Water Trust is working on deer fencing at two sites. Under a State permit condition, cooperators are working on a restoration plan for a population on a south Jersey golf course. These efforts include the Partners for Fish and Wildlife (PFW) Program. DLUR has brought several other restoration opportunities to light, and PFW plans to pursue these as long as landowners are receptive.

- Continue to protect swamp pink sites through various regulatory processes as necessary and appropriate.
  Progress Since the Last Review: Ongoing.

Propagation

- Pursue long-term seed storage at CPC member institutions.

- Investigate the need, feasibility, methods, and opportunities for reintroduction of plants. Support research on propagation and genetics. Investigate how swamp pink colonizes new habitat under natural conditions to determine if natural dispersal is precluded in developed areas and could be augmented by reintroductions consistent with the Service's propagation policy.

- Develop partnerships with horticultural groups to learn more about the amount and origin of swamp pink in cultivation and trade for ornamental gardens. Work cooperatively with these partners to develop a statement of principles for responsible cultivation and trade of swamp pink.
  Progress Since the Last Review: The New Jersey Field Office has prepared "Draft Recommendations for the Responsible Propagation of Swamp Pink." Following review by other Service offices and Natural Heritage Programs, this draft document was distributed to numerous entities involved in swamp pink propagation. During summer 2012, a volunteer intern from the New York Botanical Garden Professional Horticulture Program is meeting with swamp pink growers to learn more about their activities and encourage a dialog with the Service. The draft document will be finalized upon completion of her internship project.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of SWAMP PINK (*HELONIAS BULLATA*)

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: Not applicable

Review Conducted By: Wendy Walsh, New Jersey Field Office

APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 12/30/14
Field Supervisor, New Jersey Field Office, Fish and Wildlife Service

Cooperating Regional Director, Fish and Wildlife Service

__X__ Concur _____ Do Not Concur

Signature _____ Date 12/3/14
for Regional Director, Region 4, Fish and Wildlife Service