

Golden Sedge (*Carex lutea*)

**Five Year Review:
Summary and Evaluation**



USFWS Photo by Dale Suiter

**U.S. Fish and Wildlife Service
Southeast Region
Raleigh Ecological Services Field Office
Raleigh, North Carolina**

FIVE YEAR REVIEW

Golden Sedge (*Carex lutea*)

I. GENERAL INFORMATION

A. Methodology used to complete the review

At the time of the last Five Year Review for *Carex lutea* (completed December 18, 2009), very little information had been published on the species. Since that time, several new peer reviewed publications and two monitoring reports have been completed. The information used to prepare this Five Year Review was gathered from peer reviewed scientific publications, status surveys, data from the North Carolina Natural Heritage Program (NCNHP) and personal field observations. In addition, since the completion of the last Five Year Review for *C. lutea*, critical habitat has been designated for this species (USFWS 2011) and the Recovery Plan has been completed (USFWS 2014). This review was completed by the lead recovery biologist for *C. lutea* in the Raleigh, North Carolina Ecological Services Field Office. The recommendations resulting from this review are a result of thoroughly assessing the best available information on *C. lutea*. Comments and suggestions regarding this review were received from peer reviewers within and outside of the U.S. Fish and Wildlife Service (Service). A detailed summary of the peer review process is provided in Appendix A. No part of the review was contracted to an outside party.

B. Reviewers

Lead Region:

Kelly Bibb, Southeast Region, Ecological Services, Atlanta, GA, 404-679-7132

Lead Field Office:

Dale Suiter, Raleigh, NC Ecological Services Office, Raleigh, NC, 919-856-4520 extension 18

C. Background

1. FR Notice citation announcing initiation of this review:

March 25, 2014 (79 FR 16366)

2. Species status:

We have learned a lot about *Carex lutea* since the 2009 Five Year Review. Studies have been published on soils where the species grows and we have found the species growing in habitats where it was previously not known to occur. Great strides have been made in protecting *C. lutea* sites and seven of the eight known populations are at least partially protected. Over 80 percent of designated critical habitat is in conservation ownership by the State of NC or The Nature Conservancy (TNC). Long term monitoring plots have been established by the NC Botanical Garden (NCBG) and four years of monitoring data have been collected from most of those plots. While no new populations have been discovered since 2009, the known spatial extent of several populations has been expanded significantly as the result of additional survey work in forested areas

that were previously considered poor habitat. Further, more sites are protected now than ever before. Based on four years of monitoring data and great strides in the protection of *C. lutea* sites, we believe that the status of this species is currently stable. We hope to continue with the annual monitoring of several populations in order to better understand population trends.

3. Recovery achieved

Carex lutea = 3 (50 to 75% of species recovery objectives achieved)

4. Listing history

Original Listing

FR notice: 67 FR 3120

Date listed: January 23, 2002

Entity listed: Species

Classification: Endangered

5. Associated rulemakings:

Critical habitat for *Carex lutea* was designated in March 2011 (76 FR 11086) (USFWS 2011).

6. Review History: *Carex lutea* was named a distinct species in 1994 and listed as endangered in 2002. Compared to other federally listed species, there has been little research conducted on *C. lutea*. The first Five Year Review for *C. lutea* was completed on December 18, 2009. The only status survey for *C. lutea* was completed in 1996 with an update in 1998. Several *C. lutea* sites have been monitored in recent years.

7. Species' Recovery Priority Number at start of review: *Carex lutea* has been assigned a recovery priority number of 8 on a scale of 1 (highest) to 18 (lowest), indicating a moderate degree of threats or impacts, a high potential for recovery and a taxonomic status of full species. The recovery priority number is based on guidance provided in 48 FR 43098.

8. Recovery Plan or Outline:

The Recovery Plan for *Carex lutea* was completed in May 2014 (79 FR 29200).

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy

The Endangered Species Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing DPS to only vertebrate species of fish and wildlife. Because the species under review is a plant, the DPS policy is not applicable and will not be discussed further.

B. Recovery Criteria

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

Yes. The Recovery Criteria outlined in the recovery plan (USFWS 2014) are listed below.

***Carex lutea* will be considered for reclassification from endangered to threatened status (downlisting) when:**

1. There are 10 protected *C. lutea* sites in the wild that are distributed across the range of the species. [Note: Recovery sites will be considered permanently protected when they are placed under a conservation easement or other binding land agreement and a management agreement and are ranked as an A or B population by the NCNHP. See Appendix C of the Recovery Plan for additional information about the rank specifications for *C. lutea*.]
2. On each of the 10 *C. lutea* sites, for at least 5 years, any non-native plant species that have the potential to displace *C. lutea* are maintained at or below 10 percent of total number of species and at or below 10 percent cover (volume).
3. All 10 *C. lutea* sites demonstrate stable or increasing population trends for five consecutive years.
4. Habitat management plans are actively being implemented for at least seven of the protected sites.
5. A prescribed fire regime has been developed and is being conducted at all sites to mimic historical frequency and timing (the frequency will be determined through recovery actions in this plan).

We define “protected” to mean the site has been fee simple acquired and put into long term conservation by a local or State agency or a conservation easement or other binding land agreement has been placed on the site by a landowner that shows a commitment to its conservation in perpetuity and it is represented in a Center for Plant Conservation (CPC) approved seed bank. In addition, each site should have a management agreement/plan developed. Prescribed fire should be part of the agreement/plan and implemented regularly. These plans should include monitoring, according to protocols developed collaboratively by the Service, NC Department of Agriculture and Consumer Services (NCDACS), NC Department of Parks and Recreation (NCDPR), TNC and other interested parties and should occur annually at each protected site. Each site should contain an A or B ranked occurrence (according to ranking criteria established by the NCNHP). For downlisting to be considered, at least seven of the 10 protected sites should be “A-ranked” occurrences. The remaining three sites can be either “A or B-ranked” occurrences.

***Carex lutea* will be considered for removal from the List of Endangered and Threatened Species (delisting) when:**

1. There are 15 protected sites in the wild that are distributed across the range of the species. [Note: Recovery sites will be considered permanently protected when they are placed under a conservation easement or other binding land agreement and a management agreement and are ranked as an A or B population by the

NCNHP. See Appendix C of the Recovery Plan for additional information about the rank specifications for *C. lutea*.]

2. On each of the 15 *C. lutea* sites, for at least 5 years, any non-native plant species that have the potential to displace *C. lutea* are maintained at or below 10 percent of total number of species and at or below 10 percent cover (volume).
3. All 15 *C. lutea* sites demonstrate stable or increasing population trends for ten consecutive years.
4. Habitat management plans are actively being implemented for all protected sites and are showing evidence that actions are proving effective for this plant.
5. A prescribed fire regime is being conducted at all sites to mimic historical frequency and timing (which will be determined through recovery actions in this plan).

We define “protected” to mean the site has been fee simple acquired and put into long term conservation by a local or State agency or a conservation easement or other binding land agreement has been placed on the site by a landowner that shows a commitment to its conservation in perpetuity and it is represented in a CPC approved seed bank. In addition, each site should have a management agreement/plan developed. Prescribed fire should be part of the agreement/plan and implemented regularly. These plans should include monitoring, according to protocols developed collaboratively by the Service, NCDACS, NCDPR, TNC and other interested parties and should occur annually at each protected site. Each site should contain an A or B ranked occurrence (according to ranking criteria established by the NCNHP). For delisting to be considered, at least 10 of the 15 protected sites should be “A-ranked” occurrences. The remaining five sites can be either “A or B-ranked” occurrences.

Carex lutea sites have been lumped into eight Principal Element Occurrences (EO) (see Site Names in Appendix B). Of these eight Principal EOs, five are in full and two are in partial conservation ownership by state government agencies and TNC. Seeds from five populations have been placed in long-term storage in the Center for Plant Conservation’s seed bank at the NCBG. All but one site indicates the vegetation is mostly native with no signs of invasive species. At least six of the sites have some level of ongoing monitoring. Management and fire management plans have been developed and implemented for at least half of the population centers. In general, good progress has been made toward *C. lutea* conservation. Preliminary monitoring and general field observations indicate that most of the populations are at least stable, if not increasing or at least larger than initially thought to be.

2. Adequacy of recovery criteria.

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

Yes, the recovery plan was completed in 2014 and addresses these topics appropriately.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

Yes, the recovery plan was completed in 2014 and addresses these topics appropriately.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. 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:

This species was only discovered new to science in 1991 and named a distinct species in 1994 (LeBlond et al. 1994). Further, its growth habit as a clumping perennial makes quantitative surveys very difficult. The NCBG initiated a monitoring program for this species in 2009 (Kunz 2015). A total of 41 quadrats in 10 plots were monitored annually between 2010 and 2014. Approximately 200 individual plants were tagged and tracked over time. Relative abundance was also tracked over time. While additional monitoring will be necessary to determine long term population trends, other useful information was determined from this study including: 1. The number of culms and the number of reproductive individuals does not correlate with the number of individuals in a population and fluctuate with an unknown ecological factor. 2. The recognition that all populations should be actively managed, preferably with fire, to maintain and improve habitat for *C. lutea*. 3. Field observations indicate that spring fires temporarily suppress flowering but the overall effects on the habitat are likely beneficial to the species. Kunz (2015) also suggested that “the timing and frequency of fire in *C. lutea* populations should be varied.”

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

According to genetic analysis by Derieg et al. (2008, 2013), *Carex lutea* maintains the highest levels of genetic diversity observed in North American populations of section *Ceratocystis* taxa. Growth habit and genetic data both point to typical levels of inbreeding in *C. lutea*. Because *C. lutea* contains a high degree of population differentiation (about 40% of the genetic diversity maintained at the assayed loci is due to differences among populations), the extirpation of a single population could impact levels of genetic diversity for the entire species (Derieg et al. 2008). Derieg et al. (2008) indicate that maintaining habitat quality is likely one of the most critical aspects of managing the species. The data provide strong evidence for the protection of all distinct populations of *C. lutea* in order to maintain genetic diversity and avoid increasing pressures of inbreeding depression.

c. Taxonomic classification or changes in nomenclature:

There have been no changes to the taxonomic classification or nomenclature since *Carex lutea* was named a distinct species in 1994. *Carex viridistellata* was named a new species in 2013 and is considered to be very closely related to *C. lutea*; however, *C. viridistellata* is only found in Indiana, Michigan and Ohio (Derieg et al. 2013).

d. 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.):

All known populations of *Carex lutea* occur in the Northeast Cape Fear River watershed in Pender and Onslow counties, North Carolina. Since the completion of the last Five Year Review in 2009, biologists have expanded the extent of known *C. lutea* at the McLean Savanna Preserve, Sandy Run Savanna, Watkins Savanna, Haw's Run and Shaken Creek Preserve (Kunz 2015). These *C. lutea* populations are considerably larger than previously thought. See more information about these discoveries in the habitat section below.

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

The area supporting the *Carex lutea* populations is located in the Black River Section of the Coastal Plain Province, and within the Northeast Cape Fear River watershed.

Carex lutea is found in very wet to saturated to periodically shallowly inundated soils. The largest populations are found in the wet to saturated ecotones of savannas and hardwood forests. At a few sites, the plants are most abundant in wet to saturated soils adjacent to drainage ditches, and in the saturated to shallowly inundated ditches themselves. While ditches are not natural habitat for the species, they serve as surrogate, but not high quality, habitat. The occurrence of *C. lutea* plants in ditches is likely due to the wetter soils of the ditches, and/or the washing of seeds into the ditches from adjacent microhabitat. *C. lutea* occasionally occurs in very wet soil in areas of savanna habitat characterized by an open to absent canopy, suggesting that its abundance in the savanna/wet hardwood ecotone is strongly influenced by hydrologic conditions as well as by edaphic and/or light conditions. Taggart and Long (2012) found that mean pH values for the topsoils within three *C. lutea* populations were strongly (4.7) to moderately (5.7) acidic.

Carex lutea habitat has been historically classified as Very Wet Loamy Pine Savanna as described in Schafale (2012). It is the natural community type formerly referred to as the Pine Savanna (Very Wet Clay Variant) by Schafale (1994). Plant community structure is characterized by an open to

sparse canopy dominated by *Pinus serotina* (Pond pine), and usually with some *P. palustris* (Longleaf pine) and *Taxodium ascendens* (Pond cypress). The shrub layer typically is sparse to patchy, with *Morella caroliniensis* (Evergreen bayberry), *Cyrilla racemiflora* (Ti-ti), *Ilex glabra* (Inkberry), *I. myrtifolia* (Myrtle holly), and *Vaccinium fuscatum* (Hairy highbush blueberry). Juvenile *Acer rubrum* var. *trilobum* (Carolina red maple) and *Nyssa biflora* (Swamp black gum) are often present. The herb layer is dense and dominated by combinations of *Ctenium aromaticum* (Toothache grass), *Sporobolus pinetorum* (Carolina dropseed), *Muhlenbergia expansa* (Savanna hairgrass) and several *Rhynchospora* taxa (e.g., *R. pinetorum* (Small's beakrush), *R. latifolia* (Broadleaf whitetop sedge), and *R. thornei* (Thorne's beakrush)). *C. lutea* also frequently occurs in the ecotone formed by the Pine Savanna community and adjacent Nonriverine Wet Hardwood Forest (LeBlond et al. 1994).

Since the completion of the last *Carex lutea* Five Year Review, the known extent of populations at several sites has been expanded through additional survey work and discoveries. Thornhill and Krings (2012) and Kunz (2015) found *C. lutea* growing in areas of deep shade under closed canopy Coastal Plain Small Stream Swamp Forests and the furrow rows of old pine plantations. However, dense shrub and undergrowth layers likely decrease the presence and health of *C. lutea* populations. It was previously thought that *C. lutea* was found only in open savannas and ecotones that contain more sunlight than swamp forests. Although *C. lutea* plants have been found in these additional habitats where they were previously unknown, they are considered part of those populations because they are in close proximity to the known plants. According to NatureServe's separation distance criteria, subpopulations of plants occurring within 2 kilometers of each other are considered part of the same population (Natureserve 2015). No new populations have been discovered since the last Five Year Review was completed, only expansions of previously known populations.

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

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

As mentioned in the previous Five Year Review and the new Recovery Plan, *Carex lutea* is threatened by fire suppression and the ecological succession (competition and/or shading by woody species) associated with areas that are not burned as often as they were historically (USFWS 2014). Ironically, fire suppression practices negatively impacted two populations when the NC Forest Service plowed a portion of a power line in order to expose mineral soil and create a fire plow line to contain the Juniper Road Fire in 2011 (Taggart 2015). While one site has shown some recovery, no

plants have been observed at the other site since the incident occurred. Habitat destruction, resulting from development, also threatens *C. lutea*, but to a lesser degree than the other factors listed above as many of the populations are in conservation ownership. For example, over 80 percent of designated critical habitat is in conservation ownership (either by the State or TNC). Sites located within road and utility rights-of-way are threatened by herbicide use or mowing during critical growth periods. While the recovery plan listed timber operations such as harvesting, bedding and ditching as threats to the species, we know that timber operations to varying degrees have occurred at all *C. lutea* sites at some point in the past. While the species seems to do best in open habitat, more research is needed to determine the effects of timber operations on *C. lutea*.

Carex lutea sites are currently protected by the NCDPR (Neck Savanna, Watkins Savanna and the Sandy Run Savannas, including the Cooley's Meadowrue Powerline Site and the Pine Plantation Survey Site). Haws Run Mitigation Site, is owned by the NC Department of Transportation (NCDOT) and is scheduled to be transferred to NCDPR (State Parks) in 2015 (J. Hauser, NCDOT, pers. comm., April 16, 2015). NCDPR is already involved in some of the management and monitoring at the preserve. The Southwest Ridge Savanna site, is owned by the State of North Carolina and managed by the Wildlife Resources Commission. Shaken Creek Savanna and McLean Savanna are owned by TNC. The population, Maple Hill School Road Savanna, remains threatened due to lack of protection and may already be destroyed. Observations in 2012 indicate that a large portion of land in the vicinity of this population has been converted into a blueberry farm.

b. Overutilization for commercial, recreational, scientific, or educational purposes:

There is currently no evidence to suggest that *Carex lutea* is being overutilized for commercial, recreational, scientific or educational purposes.

c. Disease or predation:

As mentioned in the previous Five Year Review, disease and predation are not known to be factors affecting the continued existence of *Carex lutea* at this time, though a small amount of predation is known to occur naturally in the wild. R. LeBlond (pers. observ.) noticed grazing damage to *C. lutea* plants at The Neck Savanna by unidentified herbivores. The grazed plants subsequently produced flowering culms. The long-term effects of grazing have not been measured but there is no evidence to suggest that it is a threat to this plant. Insects occasionally feed on the developing seeds, but this does not appear to be significant or to be a threat to this species.

d. Inadequacy of existing regulatory mechanisms:

Because of its federal endangered status, *Carex lutea* is protected on federal lands; however, there are no known populations on federal lands.

Carex lutea is listed as state endangered by the North Carolina Plant Protection and Conservation Act of 1979 (North Carolina Code Article 19B, § 106-202.12). This act provides limited protection from unauthorized collection and trade of plants listed under that statute. However, the statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities.

Since *Carex lutea* typically occurs in areas that are most likely considered jurisdictional wetlands by the U.S. Army Corps of Engineers (Corps), permits for wetland alterations (Section 404 of the Clean Water Act) have the potential to adversely impact this species and its habitat. If Section 7 consultation is not properly completed, the action conducted under a permit for wetland alteration could have the potential to adversely impact this species and its habitat. It is the responsibility of the federal permitting agency to address potential impacts to federally protected species that may occur as a result of the issuance of a Clean Water Act permit. There are some wetland impacts that are exempt from the Corps permitting process if they meet certain criteria found in the CFR Title 33, Section 323.4 of the Clean Water Act. Areas that are part of an established and ongoing farming, silviculture or ranching operation may be exempt from permitting requirements under the Clean Water Act if they meet the CFR conditions. While these are legal activities, they still may allow impacts to federally protected species on these properties and will not be required to consult due to the absence of any federal involvement. Activities which bring an area into farming, silviculture, or ranching use are not part of an established operation, but may be authorized by other federal programs such as Natural Resource Conservation Service. Some areas of land where federally protected species occur may not meet the three criteria for a Corps regulated wetland and may also not require a Corps permit for impacting these areas, therefore removing the federal nexus and permitting review process.

According to J. Blanchard (NC State Parks, pers. comm., August 18, 2015), the areas at Sandy Run Savannas that contain *Carex lutea* (with the exception of the area under a Duke Energy power line that crosses NC 50) have been dedicated by the State under the NC Nature Preserves Act. Dedicated lands are considered to be in their highest and best use when retained as natural areas. As such, they are protected from development of any kind which protects the entire habitat, not just the species.

e. Other natural or manmade factors affecting its continued existence:

No other natural or manmade factors affecting the continued existence of *Carex lutea* are known at this time.

Since the completion of the last Five Year Review, the Recovery Plan for this species identified invasive species as having the potential to negatively affect the habitats where rare species such as *Carex lutea* are found. Cogon grass (*Imperata cylindrica*) was introduced to the United States in 1912 and is found in longleaf pine plant communities throughout the southeast. A population of cogon grass was found in Pender County in 2012 (Glen 2012). Cogon grass is listed as a federal noxious weed by the U.S. Department of Agriculture and a state noxious weed by the NC Department of Agriculture and Consumer Services (NCDACS 2015). Given its growth habit and habitat preferences, *I. cylindrica* could displace native species such as *C. lutea*, however, it has not yet been observed at any of the known *C. lutea* sites. The *I. cylindrica* site in Pender County is approximately 18 miles northwest of the nearest *C. lutea* population.

The NCBG has collected *Carex lutea* seeds from five of the eight population centers. Some seeds were used for germination trials while others were placed in long term storage to be used for future research and/or restoration projects (Kunz 2015).

Small population sizes likely diminish the resiliency of *Carex lutea* occurrences to stochastic disturbances, and the lack of redundancy across the landscape leaves the species at greater risk of extinction due to potential extirpation of these vulnerable occurrences. Other threats to the species include extended drought that may be exacerbated by the installation of drainage ditches.

In summary, the most important factors that justify its endangered status are related to its extreme rarity due to high habitat specificity and narrow range of distribution. Within this small known range, habitat destruction is an important threat due to the inadequate regulatory mechanisms to protect listed plants on private lands. Habitat for *Carex lutea* is threatened by fire suppression. *C. lutea* sites located within utility rights-of-way are threatened by herbicide use or mowing during critical growth periods. Until recently, another important factor affecting the status of *C. lutea* was the fact that nearly all populations were on privately owned land. However, most populations are now protected on State or private conservation lands. *C. lutea* is not overutilized or over-collected and disease and predation are not a problem for this species. State and federal laws provide some protection for this species. Invasive species are not a threat to its habitat at this time, but could be in the future.

D. Synthesis

All known and extant *Carex lutea* populations occur in sandy soils overlying coquina limestone deposits. They are all located in the Black River Section of the Coastal Plain Province and within the Northeast Cape Fear River watershed. Some sites have been lightly to extensively disturbed by plow lines or surface impacts associated with past clearing, and *C. lutea* has successfully colonized or re-colonized some disturbed areas. While new populations of *C. lutea* have been found since listing, the general distribution of the species has not changed and all populations are located in Onslow and Pender Counties, North Carolina. With such a small number of populations, NatureServe and NCNHP have assigned *C. lutea* a Global Rank of G2, indicating that the species is imperiled globally because of rarity or factors making it very vulnerable to extinction. In recent surveys, *C. lutea* plants were found in areas that receive less sunlight than what was expected for this species to thrive.

Threats to *Carex lutea* include fire suppression and the associated ecological succession such as competition and/or shading by understory woody species. The construction of fire suppression lines may also negatively impact this species. Herbicide use threatens sites located within utility rights-of-way. Of the eight known populations of *C. lutea*, five occur on properties that are completely in conservation ownership, two are in partial conservation ownership and one occurs on privately owned land and may have been destroyed by the conversion to a blueberry farm. While conservation ownership is very important to the protection of the species, fire management is a critical component to their long term viability.

No new populations of *Carex lutea* have been found since the completion of the last Five Year Review in 2009, but new subpopulations were discovered at Shaken Creek Preserve and surveyors found plants in heavily shaded areas adjacent to known sites where the species was previously not known to occur, expanding the size of those populations. The Service designated critical habitat for *C. lutea* in 2011 and completed a Recovery Plan for this species in 2014. The NCBG, the CPC repository for this species, collected seeds from several populations in recent years and stored them for future research, reintroduction projects and a safeguard to extinction. Due to the small number of populations and threats to the species such as the lack of prescribed fires at some sites, the potential destruction or modification of habitat at privately owned sites, we believe that *C. lutea* is somewhat less threatened with extinction now than it was at the time of listing, but it still meets the definition of endangered under the Endangered Species Act. In order to be considered for reclassification from endangered to threatened, we need to see three more *C. lutea* sites protected (for a total of 10 sites) and ensure that management plans have been prepared and implemented, including management by prescribed fire, for all 10 protected sites. In addition, known populations need to improve and expand so they can be ranked A or B by the NCNHP. A summary of the progress toward recovery is included in Appendix B.

III. RESULTS

- A. **Recommended Classification:**
 X No change is needed

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

A prioritized list of recommendations for future actions that will contribute to the recovery of *Carex lutea* include:

- conduct surveys for additional populations, especially in shady areas where it was previously thought the species did not occur,
- protect as many populations as possible,
- develop site specific management and prescribed burn plans for each site and encourage land managers to implement management plans,
- continue long term monitoring that was initiated by the NCBG to assess population trends, reproductive success and threats,
- conduct additional research on general life history and biology of the species,
- conduct research to determine the effects of various timber operations on this species,
- develop and implement an education and outreach program to help partners and local landowners, and
- identify potential sites for introducing new populations of the species.

V. REFERENCES

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**U.S. FISH AND WILDLIFE SERVICE
FIVE YEAR REVIEW OF GOLDEN SEDGE (*CAREX LUTEA*)**

Current Classification Endangered
Recommendation resulting from the Five Year Review

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Review Conducted By Dale Suiter, Fish and Wildlife Biologist

FIELD OFFICE APPROVAL:

Pete Benjamin, Lead Field Supervisor, Fish and Wildlife Service

Approve Tom Augspurger / Acting FS Date 8-24-2015

APPENDIX A

Summary of peer review for the Five Year review of Golden sedge (*Carex lutea*)

A. Peer Review Method:

A draft copy of this Five Year Review was emailed to botanists with the NC Natural Heritage Program (NCNHP), NC Plant Conservation Program, NC Botanical Garden (NCBG), NC State Parks and TNC. Reviewers provided comments by email or using track changes on the original document. Some reviewers were chosen based on their knowledge of *Carex lutea* and are very familiar with the habitats where the species occurs and the threats to its long term survival while other reviewers are familiar with the flora of eastern North Carolina where the species occurs and they are also familiar with state and federal regulations, plant conservation issues and the threats to rare species.

B. Peer Review Charge:

Peer reviewers were asked to provide written comments on the information presented in our analysis of *Carex lutea* and to provide comments on the validity of the data. Peer reviewers were asked not to provide recommendations on the legal status of the species.

C. Summary of Peer Review Comments/Report:

In general, the peer reviewers provided positive feedback and some specific comments. Michael Kunz with NCBG provided clarification and summary of the long term monitoring project conducted by NCBG. He also reminded us that the powerline site on Williams Road which is considered part of The Neck Savannah population is still privately owned. He suggested clarifying that ditches are not high quality habitat but suitable surrogate habitat for *Carex lutea*. Laura Robinson with the NCNHP suggested that we change the phrase "population center" to Principal Element Occurrence for consistency between the main part of the document and Appendix B. In addition, she suggested a future action item about considering sites for introductions and provided information about the current management at the Watkins Savanna site. Angie Carl with TNC expressed concerns about language in the draft document that said "timber operations such as harvesting, bedding and ditching" were threats to the species. We modified the final version to acknowledge the benefits of opening the forest floor to sunlight but also express our concerns about destructive forestry methods. Under "Recommendations for Future Actions," we suggested that research be conducted to help us better understand the effects of forestry practices on this species. Jon Blanchard with NC State Parks provided more detailed information on the populations that occur on NC State Parks property.

D. Response to Peer Review:

The primary author was in agreement with all comments and concerns received from the peer reviewers and tried to address every comment as appropriate in the final document.

APPENDIX B
Summary of progress toward the recovery of Golden sedge (*Carex lutea*)

Principal Element Occurrence	Site Name	Conservation/ Ownership	Seed Banked	Native:Invasive 90:10	Stable or Increasing	Management Plan Implemented	Regular Fire Management	NHP Rank
5	Watkins Savanna	Partially, NCDPR/Private	Yes	Most likely	Monitored but unknown	No	Yes, partial	B
7	Haws Run Mitigation Site	Yes, NCDOT/NCEEP	Yes	Most likely	Monitored but unknown	Yes	Yes	B
10	Maple Hill School Road	No, Private	No	Unlikely	Possibly destroyed	No	No	C?
11	Southwest Ridge Savanna/Ashes Creek	Yes, NCWRC	No	Most likely	Impacted by fire plow, monitored by Taggart (2015)	Unknown	Unknown	C
15	Sandy Run Swamp and Savannas	Yes, NCDPR	Yes	Most likely	Monitored but unknown	Yes	Yes	D
18	The Neck Savanna	Partially, NCDPR and Private	No	Most likely	Possibly decreasing	No	No	A
21	Shaken Creek Savanna	Yes, TNC	Yes	Most likely	Monitored but unknown	Yes	Yes	A
24	McLean Savanna	Yes, TNC	Yes	Most likely	Monitored but unknown	Yes	Yes	A