

# **Papyrus (*Cyperus papyrus*)**

## **Ecological Risk Screening Summary**

U.S. Fish and Wildlife Service, March 2023

Revised, April 2023

Web Version, 3/14/2024

Organism Type: Flowering Plant

Overall Risk Assessment Category: Uncertain



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## **1 Native Range and Status in the United States**

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### **Native Range**

From Daoud-Bouattour et al. (2010):

“*Cyperus papyrus* is distributed in tropical central Africa at the upper parts of the White Nile, from where it penetrates westward into Lake Tchad and the Niger region.”

“It has recently been confirmed as being native in Israel.”

From Juffe (2010):

“Its [sic] is quite common throughout Africa and can occur in very dense populations. In Egypt it has been limited to one sub-population at the Umm Risha Lake in Wadi Natroum.”

POWO (2023) lists *Cyperus papyrus* native to Angola, Burundi, Central African Republic, Chad, Congo, Egypt, Ethiopia, Gabon, Gambia, Guinea, Ivory Coast, Kenya, Liberia, Madagascar, Malawi, Mozambique, Namibia (Caprivi Strip), Rwanda, Sudan, Tanzania, Uganda, Zambia, Zaire (Democratic Republic of the Congo), and Zimbabwe.

Additionally, Popay (2014) lists *Cyperus papyrus* native to the Republic of Congo and Côte d'Ivoire.

Juffe (2010) lists Mauritania as part of the native range of *Cyperus papyrus*.

## **Status in the United States**

According to Popay (2014), *Cyperus papyrus* has been introduced and is invasive in Florida, Hawaii, and Puerto Rico. It's listed as introduced in California and Louisiana.

From Popay (2014):

“In Hawaii, *C. papyrus* has been found as an abundant and naturalized alien in several national parks, including the Waimanu National Estuarine Sanctuary on Hawaii (State of Hawaii, 1984), the Nounou Forest Reserve on Kauai (State of Hawaii, 2015) and the Kawai Nui Marsh on Oahu, Hawaii's largest remaining wetland, covering 335 hectares, and an important habitat for endangered native waterbirds as well as migratory birds; *C. papyrus* has been identified as invasive here, forming several dense stands (US Army Corps of Engineers, 2008).”

There is evidence of *Cyperus papyrus* being sold online through multiple vendors under various common names such as Egyptian Papyrus, Nile Queen, and Giant Papyrus (Florida Hill Nursery 2023).

## **Regulations**

No species-specific regulations on possession or trade were found within the United States.

## **Means of Introductions within the United States**

From Popay (2014):

“Spread of the species to other continents – North America and Australasia, for example - came much later, as the result of people deliberately transporting plants or seeds for ornamental or potentially useful purposes.”

## Remarks

No additional remarks.

## 2 Biology and Ecology

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### Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2023):

Kingdom Plantae  
Subkingdom Viridiplantae  
Infrakingdom Streptophyta  
Superdivision Embryophyta  
Division Tracheophyta  
Subdivision Spermatophytina  
Class Magnoliopsida  
Superorder Lilianae  
Order Poales  
Family Cyperaceae  
Genus *Cyperus*  
Species *Cyperus papyrus*

According to WFO (2023), *Cyperus papyrus* is the current valid name for this species.

### Size, Weight, and Age Range

From WFO (2023):

“Rhizomatous perennial. Culms 100–500 cm [3-16 ft] by 20–40 mm, trigonous, smooth. Leaves reduced to bladeless sheaths. [Involucre] bracts up to 12, the longest 5–10 cm long. Inflorescence simple to compound, 20–35 cm diam., primary branches numerous (up to 200 or more), [...] 10–30 cm long; secondary branches up to 2 cm long, spikes more usually in sessile clusters.”

From Popay (2014):

“No reports seem to be available on the longevity of individual plants of papyrus but presumably since they seem to be able to reproduce indefinitely by vegetative means some of the clonal plants now found in permanent lakes and rivers in Africa may be exactly the same plants that were present hundreds of years ago.”

### Environment

From Popay (2014):

“Duke (1983) says that *C. papyrus* requires annual rainfall of 10-420 cm [...] pH of 6.0–8.5.”

“*C. papyrus* grows in [...] freshwater areas of river estuaries and on freshwater lake margins where it is native [...]”

From Juffe (2010):

“In Eastern Africa this species is found in the low and medium lands of Burundi: between 774 - 1,600 m above sea level. [...] The plant is widespread in Kenya from 450 – 2,100 m above sea level.”

## Climate

From Popay (2014):

“[...] persist [...] in subtropical and tropical climates in countries to which it has been introduced.”

“[...] annual [air] temperatures of 20–30°C [...]”

“[...] plants of *C. papyrus* can apparently tolerate a few degrees of frost. The plants are more or less dormant in winter and as long as the rhizomes are protected from freezing the old culms will be replaced by new ones in the spring (Archer, 2004).”

## Distribution Outside the United States

### Native

From Daoud-Bouattour et al. (2010):

“*Cyperus papyrus* is distributed in tropical central Africa at the upper parts of the White Nile, from where it penetrates westward into Lake Tchad and the Niger region.”

“It has recently been confirmed as being native in Israel.”

From Juffe (2010):

“Its [sic] is quite common throughout Africa and can occur in very dense populations. In Egypt it has been limited to one sub-population at the Umm Risha Lake in Wadi Natroum.”

POWO (2023) lists *Cyperus papyrus* native to Angola, Burundi, Central African Republic, Chad, Congo, Egypt, Ethiopia, Gabon, Gambia, Guinea, Ivory Coast, Kenya, Liberia, Madagascar, Malawi, Mozambique, Namibia (Caprivi Strip), Rwanda, Sudan, Tanzania, Uganda, Zambia, Zaïre (Democratic Republic of the Congo), and Zimbabwe.

Additionally, Popay (2014) lists *Cyperus papyrus* native to the Republic of Congo and Côte d'Ivoire.

Juffe (2010) lists Mauritania as part of the native range of *Cyperus papyrus*.

## Introduced

Popay (2014) lists *Cyperus papyrus* as introduced to Africa (Algeria, Ghana), Asia (India, Indonesia, Singapore, Sri Lanka, Syria, Taiwan, Thailand), Europe (Italy, Spain), North America (Costa Rica, Mexico), South America (Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Venezuela), Australia, and New Zealand.

Additionally, POWO (2023) lists *Cyperus papyrus* as introduced to Cuba, Jamaica, Juan Fernández Island (Chile), Nansei-shoto (Japan), Sicily (Italy), Trinidad-Tobago, and the Leeward and Windward Islands of the Caribbean. Beentje and Lansdown (2018) list *Cyperus papyrus* as also being introduced to El Salvador. Juffe (2010) lists *Cyperus papyrus* as introduced to Mali, Niger. GBIF Secretariat (2023) lists as introduced in Seychelles, Libya, and Laos.

From Verloove et al. (2020):

“In Gran Canaria [Canary Islands, Spain] this species [*Cyperus papyrus*] grows in a pool in Santa Brígida where it is persisting since several years. In 2019, however, the pool was cleaned and all plants except a single culm were removed.”

*Cyperus papyrus* is listed as both native and introduced in these countries according to various sources: Benin, Botswana, Cameroon, Jordan, Mauritius, Nigeria, Palestine, Réunion, Senegal, South Africa (Juffe 2010; Popay 2014; Beentje and Lansdown 2018; GBIF Secretariat 2023; POWO 2023)

## Means of Introduction Outside the United States

From Popay (2014):

“Egyptians and their trading partners may well have been responsible for introducing papyrus plants to the Middle East, southern Europe and other parts of Africa.”

“Sudd mats as well as young floating papyrus mats can form and be dispersed by wind and wave action; they then may join existing mature stands elsewhere or establish new populations along formerly unoccupied shorelines (Osborne, 2012; Terer et al., 2014, 2015).”

“Most long-distance transport of this species, either as entire plants or as seed, has indubitably been by human activity, although the dispersal of seeds attached to the feet or plumage of water birds is possible and may account for dispersal from one water body to another (Rooney, 2013).”

“Escape from introduced populations is quite possible, especially if small populations in botanical and domestic gardens are not adequately contained and garden waste is disposed of improperly.”

“This method of spread [intentional introduction] is the most likely, both from one country to another and within a country. *C. papyrus* has been introduced to and is popular as a showy ornamental pond plant in several countries and its further spread in this way is bound to continue.”

## Short Description

From Popay (2014):

“*C. papyrus* is a large, emergent, aquatic perennial, producing short rhizomes covered in thick, black scales. The roots are tough, extending 1 m or more in suitable substrate. Rootlets are numerous. Culms are erect, up to 5(-9) m tall, 5-6 cm or more (15 cm or more; Ludwig Triest, personal observation, 2015) across at the base (widest point), smooth, trigonous (angles very rounded, particularly on lower parts) and green (photosynthetic), spreading when old. The pith is solid, white-light brown; vascular bundles prominent. Leaves are reduced, sheathing and restricted to the basal 50 cm or so of the culms. They are tough, reddish-blackish brown when young, expanding with age, the coloration restricted to lateral edges sub-marginally; margins scarious, becoming papery. Colours fade and sheaths split ventrally with age.”

## Biology

From Popay (2014):

“*C. papyrus* grows in full sun, in wet swamps, freshwater areas of river estuaries and on freshwater lake margins where it is native, and will also persist in similar habitats in subtropical and tropical climates in countries to which it has been introduced.”

“*C. papyrus* is known to be adapted to normal climatic cycles of drying-flooding and exhibits both sexual reproduction and unlimited clonal propagation. Young floating papyrus mats can detach from the shoreline to be dispersed by wind and wave action; they then may join existing mature stands elsewhere or establish new populations along formerly unoccupied shorelines (Terer et al., 2014).”

## Human Uses

From Popay (2014):

“In its native environment it has been used for millennia as food for humans and livestock, as a source of herbal medicines and perhaps most importantly as the source material for the making of paper (papyrus), cordage, ropes, boats, matting, mattresses, cushions, roofing and flooring. More recently it has been seen as a potential source of material for biofuel, as an effective natural biofilter for aquatic pollutants, and has been recognized for its contribution to ecosystem functions and services.”

From Juffe (2010):

“The plant was first described by Theophrastus (c. 372–287 B.C.) from material under cultivation in the Nile delta. The very extensive cultivation of papyrus that was carried on in Egypt died in the 9th and 10th Centuries A.D. by competition from new sorts of paper.”

## Diseases

According to Poelen et al. (2014), *Cyperus papyrus* is a host of the following pathogens: *Cainia* sp., *Galaerella plicatella*, *Cistella* sp., *Stictis radiata*, *Orbilia curvatispora*, and *Lasionectria sylvana*.

## Threat to Humans

No information was found on threats to humans from *Cyperus papyrus*.

## 3 Impacts of Introductions

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Although *Cyperus papyrus* has been reported as introduced beyond its native range, no information on documented impacts of introduction was found. The following information describes *potential* impacts of introductions.

From Popay (2014):

“*C. papyrus* has potentially serious impacts on environments in countries to which it has been introduced, with its propensity for forming monotypic stands on the margins of lakes and rivers.”

“In south-western Western Australia [...] This rapidly growing species can spread to cover areas of open water, preventing other aquatic species from growing, and reducing light levels to submerged native plants (Queensland Government, 2015).”

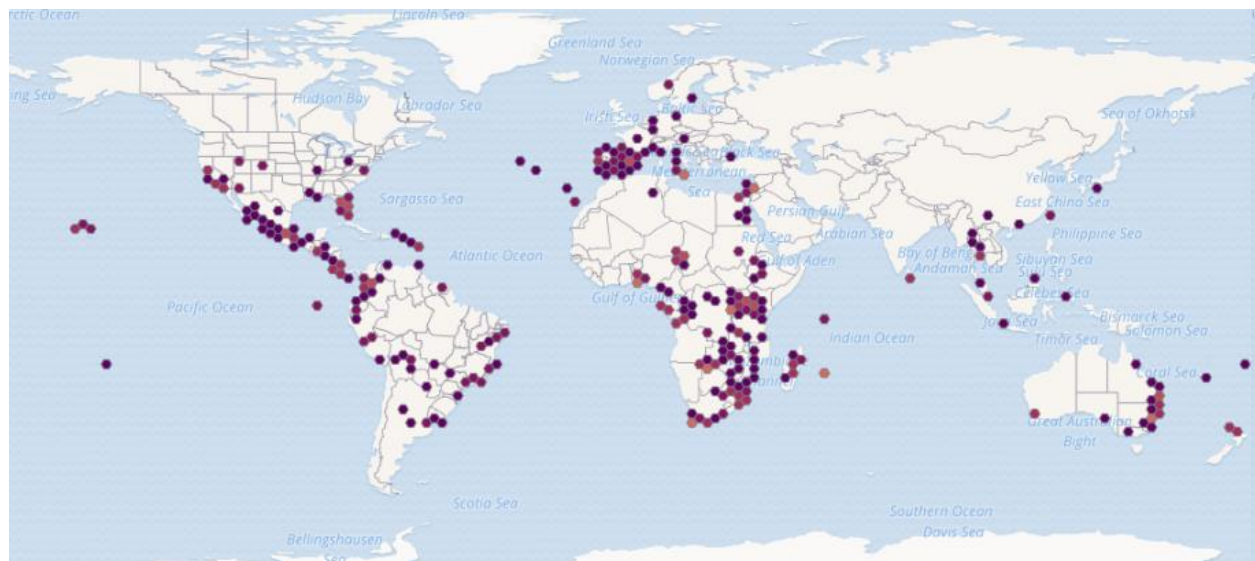
*Cyperus papyrus* is currently unregulated within the United States.

## 4 History of Invasiveness

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Although *Cyperus papyrus* is established outside of its native range, is widely available in trade, and has the potential to create monocultures within an ecosystem, there is no scientific evidence regarding impacts of introduction. Therefore, the History of Invasiveness for *Cyperus papyrus* is classified as Data Deficient.

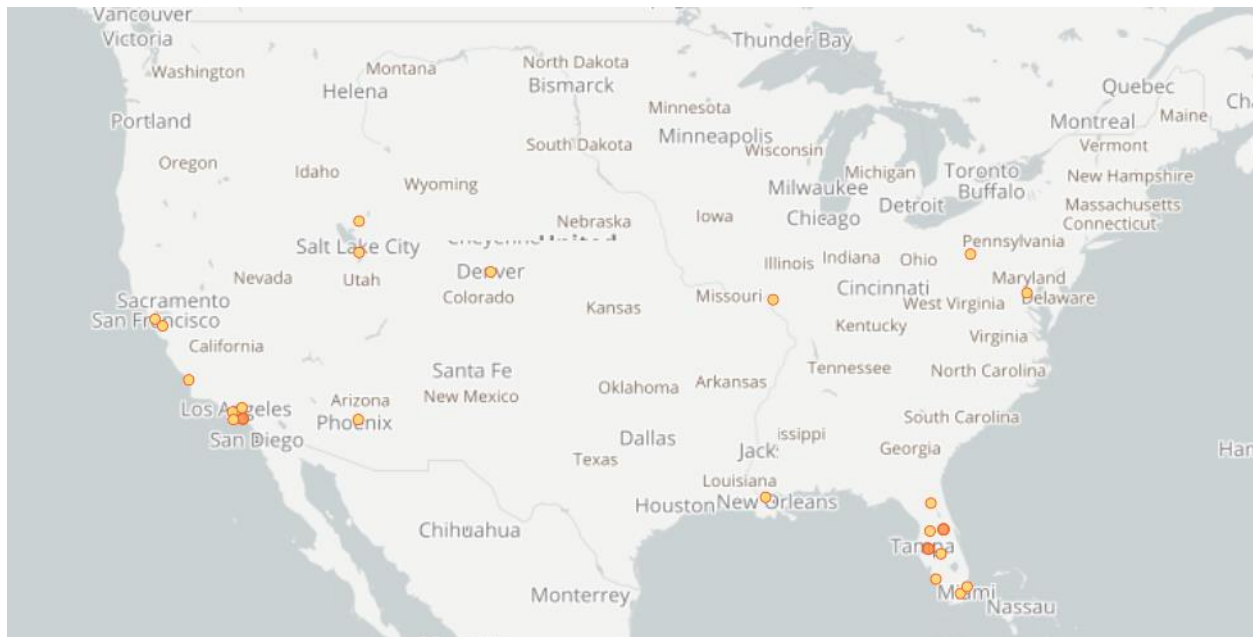
## 5 Global Distribution



**Figure 1.** Reported global distribution of *Cyperus papyrus*. Map from GBIF Secretariat (2023). Observations are reported from all continents excluding Antarctica. Observations in French Polynesia, Fiji, China, Japan, Norway, Sweden, Germany, Austria, France, continental Italy, Turkey, Honduras, Panama, as well as Utah, Arizona, Colorado, Missouri, Pennsylvania, and D.C. do not represent established populations and were therefore excluded from the climate match analysis.

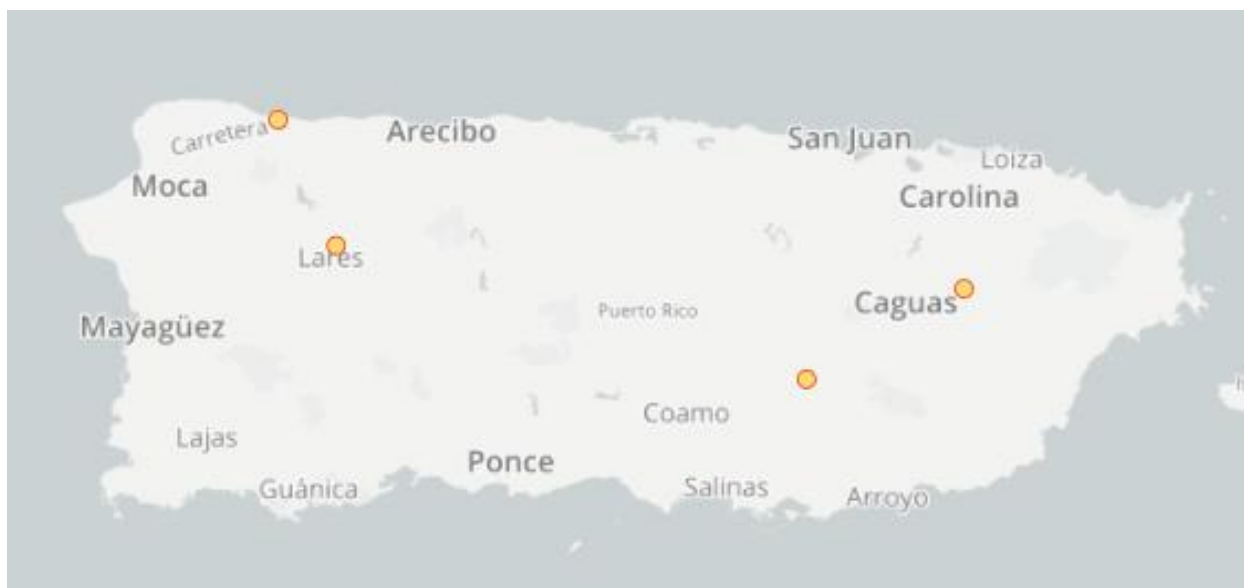


## 6 Distribution Within the United States



**Figure 2.** Reported distribution of *Cyperus papyrus* in the United States. Map from GBIF-US (2023). Observations are reported from, Hawaii, Florida, California, and Louisiana. Observations in Utah, Arizona, Colorado, Missouri, Pennsylvania, and Washington, D.C. do not represent established populations and were not used to select source locations for the climate match.

**Figure 3.** Reported distribution of *Cyperus papyrus* in Hawaii. Map from GBIF-US (2023).



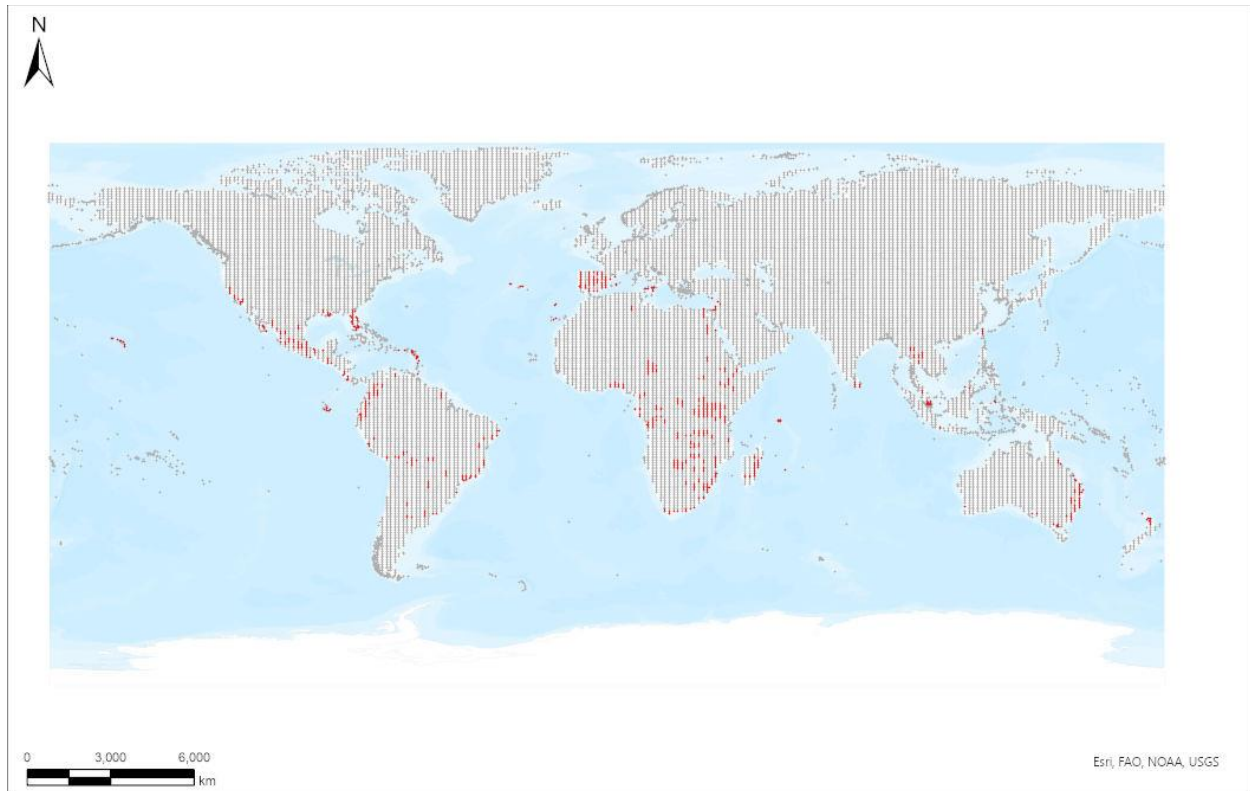
**Figure 4.** Reported distribution of *Cyperus papyrus* in Puerto Rico. Map from GBIF-US (2023).

## 7 Climate Matching

### Summary of Climate Matching Analysis

Areas with the highest climate match were found in the southern and western United States primarily where *Cyperus papyrus* has been established (California, Louisiana, Florida). The climate match decreased in the northern States near the Canadian border and northeastern States but remained medium to high throughout most of the United States. Small areas of low match were found in the western mountains and along the northern Pacific Coast. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.783, indicating that Yes, there is establishment concern for this species. The Climate 6 score is calculated as:  $(\text{count of target points with scores} \geq 6) / (\text{count of all target points})$ . Establishment concern is warranted for Climate 6 scores greater than or equal to 0.002 based on an analysis of the establishment success of 356 nonnative aquatic species introduced to the United States (USFWS 2024).

Projected climate matches in the contiguous United States under future climate scenarios are available for *Cyperus papyrus* (see Appendix). These projected climate matches are provided as additional context for the reader; future climate scenarios are not factored into the Overall Risk Assessment Category.



**Species:** *Cyperus papyrus*

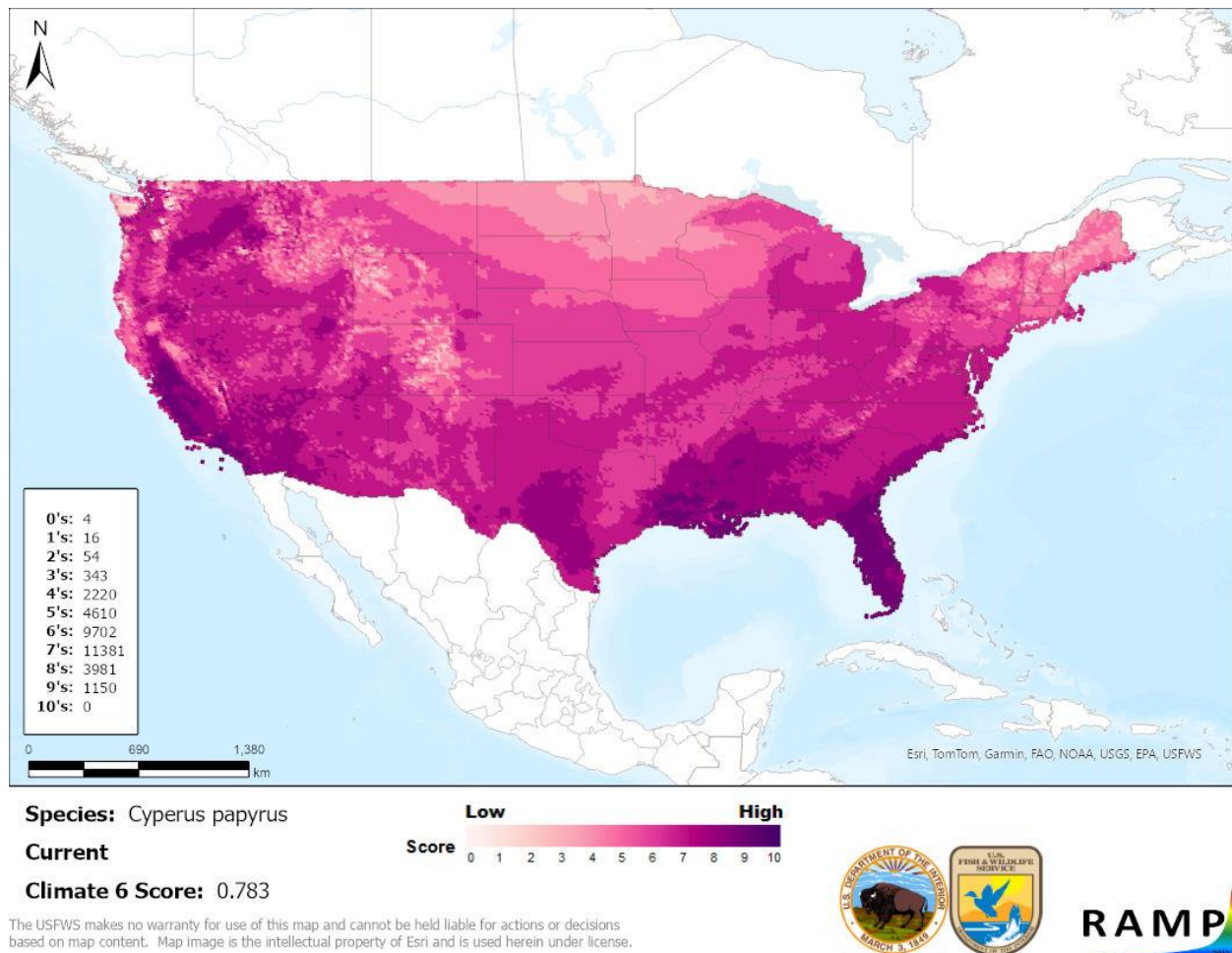
**Selected Climate Stations** ●



**RAMP**

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**Figure 5.** RAMP (Sanders et al. 2023) source map showing weather stations in the world selected as source locations (red; southern United States, Mexico, South America, Africa, Spain, Portugal, Southeast Asia, Indonesian archipelago, Australia, New Zealand) and non-source locations (gray) for *Cyperus papyrus* climate matching. Source locations from GBIF Secretariat (2022). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.



**Figure 6.** Map of RAMP (Sanders et al. 2023) climate matches for *Cyperus papyrus* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

## 8 Certainty of Assessment

The Certainty of Assessment for *Cyperus papyrus* is classified as Low. Reliable information regarding the species biology, ecology, and distribution was available. The species seems to be cryptogenic in many locations which reduces confidence in the understanding of the native range. Records of introduction and establishment were found but only information on potential impacts and not documented impacts was available.

## 9 Risk Assessment

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### Summary of Risk to the Contiguous United States

*Cyperus papyrus*, Papyrus, is a flowering plant that is native to most of Africa and northern Israel. *C. papyrus* grows in freshwater lakes, wetlands, and river estuaries. It can reach heights of 3-16 ft and is commonly used as an ornamental plant. *C. papyrus* has been used as an herbal medicine, food source for humans and livestock, and a source to make paper, cordage, ropes, boats, matting, mattresses, cushions, roofing, and flooring. Currently, this species is not regulated within the United States and has been introduced in California, Florida, Louisiana, Hawaii, and Puerto Rico. This species is readily available throughout the United States and can be obtained and shipped through online vendors. There was no information found that documented *C. papyrus* introduction impacts, but sources suggest this species has the potential to outcompete natives, impede water flow, reduce light levels to submerged plants. The History of Invasiveness for *Cyperus papyrus* is classified as Data Deficient due to there being no information regarding impact of introductions. The climate matching analysis for the contiguous United States indicates establishment concern for this species. Areas of high match were primarily found in southern and western areas of the contiguous United States. Certainty of Assessment for this ERSS is classified as Low due to disagreement regarding the native and introduced ranges and the lack of impact information. The Overall Risk Assessment Category for *Cyperus papyrus* in the contiguous United States is Uncertain.

### Assessment Elements

- **History of Invasiveness (see section 4): Data Deficient**
- **Establishment Concern (see section 7): Yes**
- **Certainty of Assessment (see section 8): Low**
- **Remarks, Important additional information: None**
- **Overall Risk Assessment Category: Uncertain**

## 10 Literature Cited

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**Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in section 11.**

Beentje HJ, Lansdown RV. 2018. *Cyperus papyrus*. The IUCN Red List of Threatened Species 2018: e.T164158A120152171. Available: <https://www.iucnredlist.org/species/164158/120152171> (February 2024).

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GBIF Secretariat. 2023. GBIF backbone taxonomy: *Cyperus papyrus* L. Copenhagen: Global Biodiversity Information Facility. Available: <https://www.gbif.org/species/2716311> (February 2024).

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Poelen JH, Simons JD, Mungall CJ. 2014. Global Biotic Interactions: an open infrastructure to share and analyze species-interaction datasets. *Ecological Informatics* 24:148–159.

Popay I. 2014. *Cyperus papyrus* (papyrus). In CABI Compendium. Wallingford, United Kingdom: CAB International. Available: <https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.17503> (March 2023).

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[WFO] World Flora Online. 2023. World Flora Online – a project of the World Flora Online Consortium. Available: <http://www.worldfloraonline.org> (March 2023).

## 11 Literature Cited in Quoted Material

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**Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.**

- Archer C. 2004. *Cyperus papyrus* L. South African National Biodiversity Institute (SANBI). Available: <http://www.plantzafrica.com/planted/cyperuspap.html>.
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- Terer T, Muasya AM, Higgins S, Gaudet JJ, Triest L. 2014. Importance of seedling recruitment for regeneration and maintaining genetic diversity of *Cyperus papyrus* during drawdown in Lake Naivasha, Kenya. Aquatic Botany 116:93–102.
- Terer T, Muasya AM, Triest L. 2015. Strong isolation by distance revealed among *Cyperus papyrus* populations in the Rift Valley lakes, Lake Victoria, and isolated wetlands of Kenya. Aquatic Botany 121:57–66.
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# Appendix

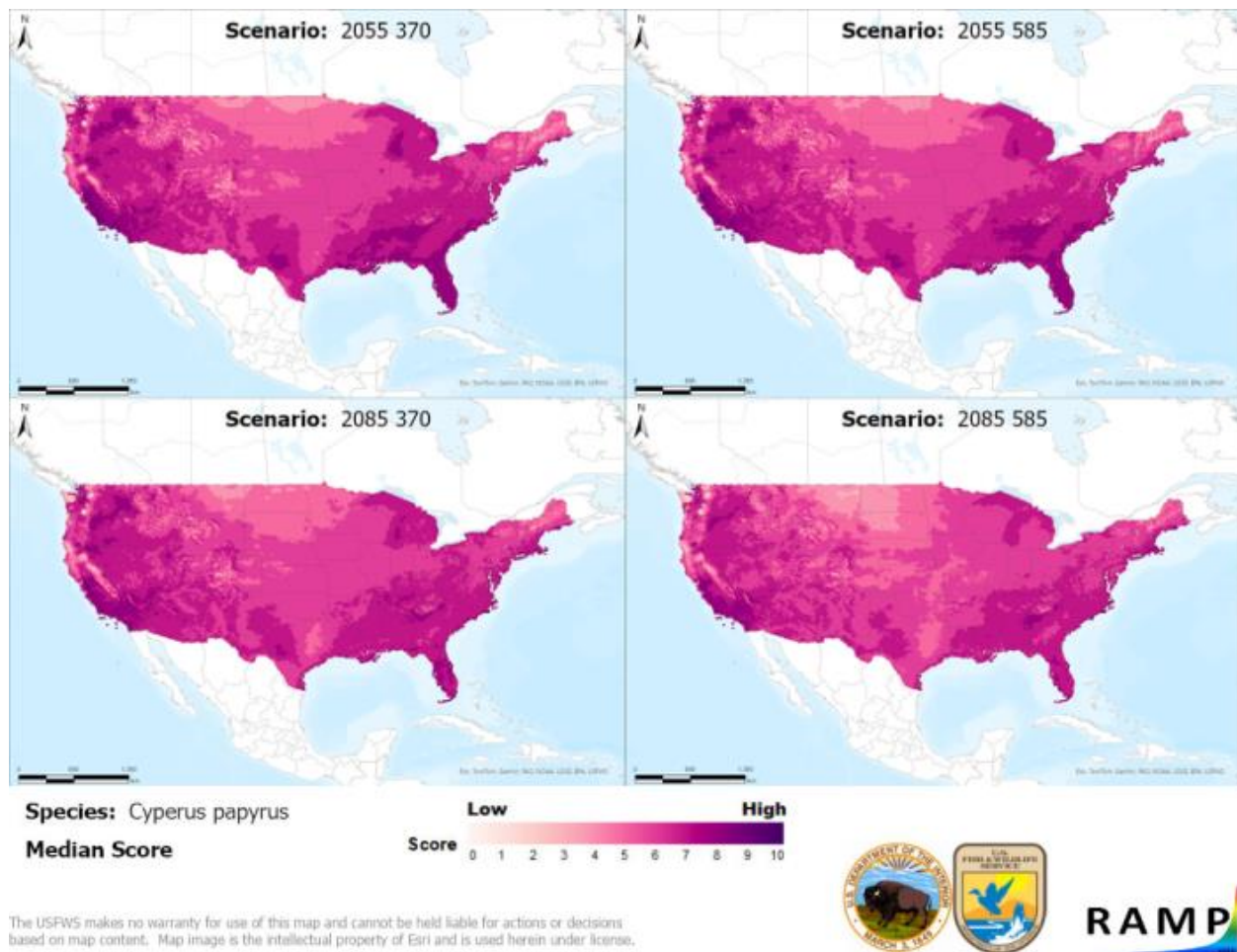
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## Summary of Future Climate Matching Analysis

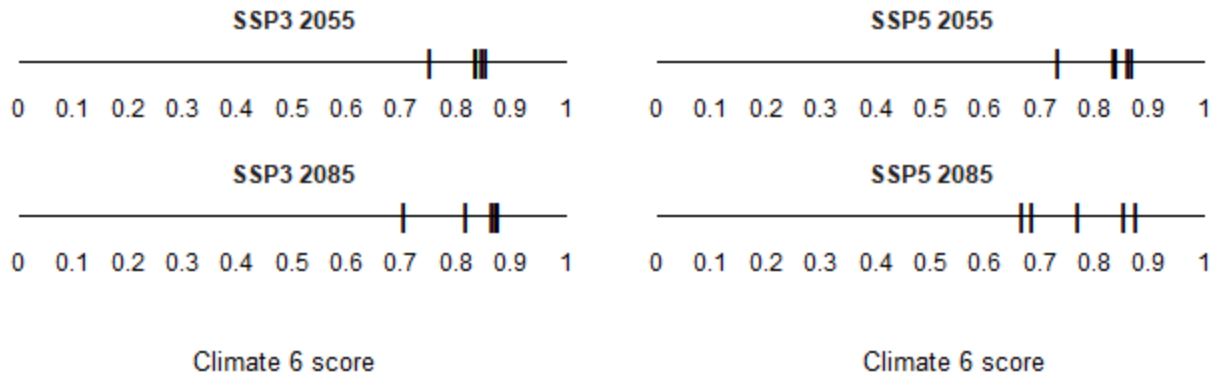
Future climate projections represent two Shared Socioeconomic Pathways (SSP) developed by the Intergovernmental Panel on Climate Change (IPCC 2021): SSP5, in which emissions triple by the end of the century; and SSP3, in which emissions double by the end of the century. Future climate matches were based on source locations reported by GBIF-Secretariat (2022).

Under the future climate scenarios (figure A1), on average, high climate match for *Cyperus papyrus* was projected to occur in California, the Southern Atlantic Coast, and Southern Florida. These areas of high match decreased over time. Areas of low match were found in the Northern Plains and increased over time. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.666 (model: MPI-ESM1-2-HR, SSP5, 2085) to a high of 0.873 (model: MRI-ESM2-0, SSP3, 2085). All future scenario Climate 6 scores were above the Establishment Concern threshold, indicating that Yes, there is Establishment Concern for this species. The Climate 6 score for the current climate match (0.783, figure 6) falls within the range of scores for future projections. The time step and climate scenario with the most change relative to current conditions was SSP5, 2085, the most extreme climate change scenario (figure A3). Under one or more time step and climate scenarios, areas within the Northeast saw a large increase in the climate match relative to current conditions. Additionally, areas within the Colorado Plateau, Great Lakes, Northern Plains, and Western Mountains saw a moderate increase in the climate match relative to current conditions. Under one or more time step and climate scenarios, areas within California, the Great Basin, Gulf Coast, Southeast, Southern Atlantic Coast, Southern Florida, Southern Plains, and Southwest saw a moderate decrease in the climate match relative to current conditions. No large decreases were observed regardless of time step and climate scenarios.

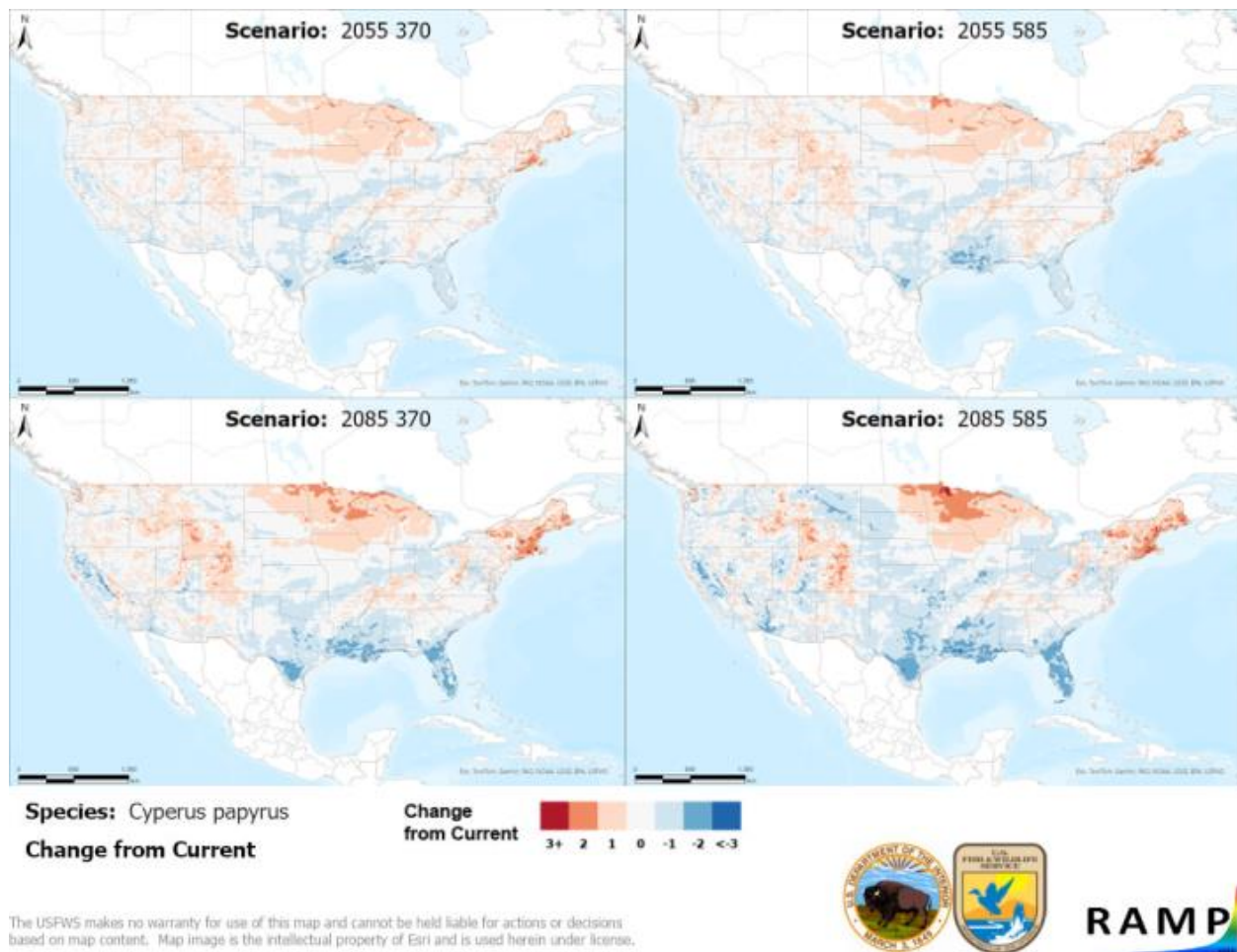




**Figure A1.** Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Cyperus papyrus* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2022). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.



**Figure A2.** Comparison of projected future Climate 6 scores for *Cyperus papyrus* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0.



**Figure A3.** RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Cyperus papyrus* based on source locations reported by GBIF Secretariat (2022). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. Shades of blue indicate a lower target point score under future scenarios than under current conditions. Shades of red indicate a higher target point score under future scenarios than under current conditions. Darker shades indicate greater change.

## Literature Cited

GBIF Secretariat. 2023. GBIF backbone taxonomy: *Cyperus papyrus* L. Copenhagen: Global Biodiversity Information Facility. Available: <https://www.gbif.org/species/2716311> (February 2024).

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