Limpograss (*Hemarthria altissima*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, March 2023
Revised, July 2023
Web Version, 3/27/2024

Organism Type: Flowering Plant
Overall Risk Assessment Category: High

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1 Native Range and Status in the United States

Native Range

From Diop et al. (2020):

"This is a sub-cosmopolitan species that occurs in tropical Africa southwards to the Cape and northwards to southern Europe and southwest Asia, in Madagascar, Myanmar, Thailand and

Borneo. […] In the Arabian Peninsula this species is known from a single collection from Saudi Arabia (Cope 2007).”

From POWO (2023):

“Algeria, Angola, Baleares [Spain], Borneo, Botswana, Cameroon, Canary Is., Cape Provinces [South Africa], Caprivi Strip [Namibia], Chad, China North-Central, China South-Central, China Southeast, East Aegean Is. [Greece], Egypt, Ethiopia, Free State [South Africa], Greece, India, Italy, Ivory Coast, Kriti [Greece], KwaZulu-Natal [South Africa], Laos, Lebanon-Syria, Lesotho, Madagascar, Malawi, Mali, Manchuria [China], Mauritius, Morocco, Mozambique, Myanmar, Namibia, Niger, Nigeria, Northern Provinces [South Africa], Palestine, Rwanda, Réunion, Saudi Arabia, Senegal, Sicilia [Italy], Spain, Sudan, Swaziland, Tanzania, Thailand, Transcaucasus [Armenia, Azerbaijan, Georgia], Tunisia, Turkey, Vietnam, West Himalaya [India, Pakistan], Zambia, Zaïre [Democratic Republic of the Congo], Zimbabwe”

Status in the United States

NatureServe (2023) reports *Hemarthria altissima* as Exotic in Florida, Texas, and Pennsylvania.

USDA, NRCS (2023) reports *Hemarthria altissima* from the following States (Counties given in parentheses): Florida (Brevard, Lee, Martin, Osceola), Pennsylvania (Berks, Philadelphia), Texas (Aransas, Brewster, Calhoun, Cameron, Goliad, Karnes, Refugio, San Patricio, Starr, Uvalde).

From Starr et al. (2004):

“[…] *H. altissima* (limpo grass) is locally common on Maui in pastures and roadsides from Pi‘iholo to Ha‘iku. […] These collections represent a new state record for the Hawaiian Islands.”

From Sellers et al. (2007):

“Presently, only one limpograss cultivar (‘Floralta’) is widely accepted by Florida cattlemen and has been planted on at least 81,000 ha (Paul Mislevy, personal communication).”

Regulations

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

Means of Introductions within the United States

From Toth (2016):

“Restoration of the [Kissimmee River, Florida] floodplain has been accompanied by an invasion of an exotic grass, *Hemarthria altissima* (Poir.) Stapf and C. E. Hubb. (limpograss), which was previously introduced for cattle forage in tributary watersheds. *H. altissima* […] was introduced to Florida because it is suitable for growth and production on wet and seasonally inundated soils (Quesenberry et al. 1978).”

Remarks

No additional remarks.

2 Biology and Ecology

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 Poaceae
                    Genus *Hemarthria*
                      Species *Hemarthria altissima*

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

Size, Weight, and Age Range

From Heuzé et al. (2015):

"Limpo grass is a perennial creeping grass […] The culms, which are generally decumbent at first and then ascending, may reach 30 to 150 cm."

Environment

From Diop et al. (2020):

"It typically grows on the banks of permanent streams, lakes and swamps in damp and wet sites or shallow water. It can be tolerant of dry conditions (Burkill 1985)."

From Heuzé et al. (2015):

"Its optimal growth conditions are high rainfalls, average annual temperatures between 16°C and 27°C and a wide range or soil textures provided they have adequate moisture. Optimal soil pH range is between 5.5 and 6.5 (Ecocrop, 2011; Cook et al., 2005). It may withstand short droughts, moderate frosts and acidic soils (pH down to 4.5). It does not well [sic] on drained soils and its growth may be seriously hampered at temperatures above 38°C. Limpo grass is very sensitive to fires (Ecocrop, 2011; FAO, 2011; Cook et al., 2005)."

Climate

From Cook (2020):

"Native and naturalized in warm temperate, subtropical and tropical climatic zones between about 40° N and 34° S, and from near sea level to 2,000 m asl [above sea level]. This equates to a range in average annual temperature from 16 to 27 °C. For the types assessed, the optimum temperature for growth is 31–35 °C, with growth declining rapidly above 38°C. Tops can be killed by moderate frost (temperatures down to -10 °C), but plants regrow with the onset of warm, moist conditions. Genotypic variation in winter-hardiness has been identified. While some genotypes are killed by heavy frosts (-13 °C) others can survive temperatures as low as -18°C."

Distribution Outside the United States

Native

From Diop et al. (2020):

"This is a sub-cosmopolitan species that occurs in tropical Africa southwards to the Cape and northwards to southern Europe and southwest Asia, in Madagascar, Myanmar, Thailand and Borneo. […] In the Arabian Peninsula this species is known from a single collection from Saudi Arabia (Cope 2007).

From POWO (2023):

"Algeria, Angola, Baleares [Spain], Borneo, Botswana, Cameroon, Canary Is., Cape Provinces [South Africa], Caprivi Strip [Namibia], Chad, China North-Central, China South-Central, China Southeast, East Aegean Is. [Greece], Egypt, Ethiopia, Free State [South Africa], Greece, India, Italy, Ivory Coast, Kriti [Greece], KwaZulu-Natal [South Africa], Laos, Lebanon-Syria, Lesotho, Madagascar, Malawi, Mali, Manchuria [China], Mauritius, Morocco, Mozambique, Myanmar, Namibia, Niger, Nigeria, Northern Provinces [South Africa], Palestine, Rwanda, Réunion, Saudi Arabia, Senegal, Sicilia [Italy], Spain, Sudan, Swaziland, Tanzania, Thailand, Transcaucasus [Armenia, Azerbaijan, Georgia], Tunisia, Turkey, Vietnam, West Himalaya [India, Pakistan], Zambia, Zaïre [Democratic Republic of the Congo], Zimbabwe"

Introduced

From POWO (2023):

"Argentina Northeast, Argentina Northwest, Bolivia, Brazil South, Brazil West-Central, Colombia, El Salvador, […] French Guiana, Guyana, […] Honduras, Jamaica, Mexico Central, Mexico Gulf, Mexico Northeast, Mexico Southeast, Mexico Southwest, Nicaragua, Paraguay, […] Peru, […] Trinidad-Tobago, Uruguay, Venezuela"

Means of Introduction Outside the United States

From Heuzé et al. (2015):

"Limpo grass (*Hemarthria altissima* (Poir.) Stapf & CE Hubbard) is a grass from tropical Africa that has been introduced in many humid tropical and subtropical zones, mainly for pasture."

Short Description
From Cook (2020):

"Perennial with short rhizomes; culms loosely tufted or prostrate to decumbent, 100–250 cm long, 2–4 mm diameter, rooting at lower nodes, ascending to 30–80 (–160) cm tall, nodes glabrous. Leaves green, often developing red colouration mostly on tips and sheaths, largely glabrous except for fringe on sheath of some genotypes; leaf sheaths loose, compressed, keeled, usually shorter than internodes, glabrous except near mouth; ligule a short, ciliate membrane; leaf blades linear or linear lanceolate, attenuate, 5–15 (–25) cm long and (2–) 3–4 (–6) mm wide, usually folded. Inflorescence comprising single spike, or a panicle of 2–4 spikes arising inconspicuously from axils of upper leaves; spikes 5–12 cm long, ovate-keeled in section (1.5 × 3 mm), tapering toward the apex, semicylindrical, articulation line oblique, tardily disarticulating; spikelets 5–8 mm long, in pairs, one sessile and hermaphrodite, the other pedicellate, smaller and male). Caryopsis brown about 2 mm long."

Biology
From Toth (2016):

"The proliferation of *H. altissima* on the restored Kissimmee River floodplain reflects its ability to establish vegetatively by fragmentation (Smith et al. 2004) and rooting of detached nodes (Sellers et al. 2007), rapid stoloniferous growth (Lenssen et al. 2004), and physiological adaptations for broad ranging depths (Luo et al. 2009, 2011). The correlation between major colonization periods and flood events suggests the *H. altissima* invasion was facilitated by hydrochoric transport of propagules (i.e., fragments)."

Human Uses
From Heuzé et al. (2015):

"*Hemarthria altissima* is mainly used as pasture but it can also be made into hay and silage. It is not suited to cut-and-carry. It grows well during early and late seasons. In Florida, it is often stockpiled for winter feeding (Nation, 2006; Anton et al., 2003). In Lesotho, the rhizomes are sometimes eaten as a vegetable (FAO, 2011; Cook et al., 2005). Commercial cultivars with different spreading abilities and potential yields are available (Cook et al., 2005)."

From Cook (2020):

"Seed is not commercially available due to generally poor seed-set. It is therefore propagated by cuttings planted into wet soil, […]."

Diseases
From Cook (2020):

"No major foliar diseases have been identified."

Threat to Humans
No information was found on threats to humans from *Hemarthria altissima*.

3 Impacts of Introductions

From Sellers et al. (2007):

"Limpograss has been found in natural areas, and is thought to be competing with native plant communities. As a result, limpograss has been placed on the Florida Exotic Pest Plant Council's Category II invasive plant list, which is a list of plants that are increasing in number, but not causing ecological harm (FLEPPC 2005). However, the University of Florida-IFAS invasive weed assessment indicates that limpograss can currently be recommended by Florida Extension faculty for forage production (Fox et al. 2005). Therefore, it is important that escaped limpograss swards be controlled so that Florida cattlemen can continue to utilize this important forage resource and to prevent the destruction of native ecosystems."

"Today, it is estimated that the total area of the floodplain infested with limpograss totals over 1000 ha in an area where a broadleaf marsh existed prior to channelization (Ferriter et al. 2006). In order to reestablish the native broadleaf marsh, limpograss must be removed. Additionally, limpograss appears to be spreading to other areas of the floodplain, where cattle ranchers did presumably not plant limpograss."

"The control of limpograss in native ecosystems should not be delayed as limpograss quickly forms monospecific swards out competing and preventing native plant establishment. Therefore, treatment of limpograss swards with glyphosate should be performed with little concern for non-target damage as limpograss has the potential to out compete desirable species."

From Toth (2016):

"Evidence for the hypothesized impacts on restoration of wet prairie indicator taxa, species richness and turnover rates was provided by comparisons of sample sites with variable levels of *H. altissima* cover over multiple years of evaluation, and as the community reestablished after herbicide treatments. Although detectable effects on species richness and temporal turnover rates of plant species were identified only when cover of *H. altissima* was >75 %, cover of the wet prairie indicator species (*P. punctatum*, *P. hemitomon* and *L. fluitans*) appeared to be suppressed when *H. altissima* cover exceeded 25 %. These indicator species largely accounted for differences in community structure (i.e., wetland forb and grass cover) between heavily infested (47 % cover of *H. altissima*) and lightly or uninfested sites prior to herbicide treatments, and between untreated and low and high regrowth (59 % cover of *H. altissima*) plots 2–3 years after treatments. These results indicate that the cover dominance threshold at which *H. altissima* begins to affect wet prairie community characteristics is similar (i.e., 40–50 %) to that reported for exotic species in other invaded communities (Hejda et al. 2009). The logistic rate of increase of *H. altissima* cover in invaded plots indicate a 3–5 year lag time between colonization and profound impacts on community structure and assembly processes. An inherent post-colonization impact lag can be attributable to early exponential population growth, but also was influenced by an enhanced hydrochoric transport vector for colonization and expansion (Crooks 2005), which was conferred by restored hydrologic regimes."

"The most significant threat of the *H. altissima* invasion to the restored wet prairie is the potential for disruption of the reestablished linkage between community assembly processes and hydrologic disturbance regimes. Results indicate *H. altissima* not only persists, but expands its distribution during high amplitude flood events when cover of vegetation is largely eliminated (Toth and van der Valk 2012) due to intolerance of native wet prairie species to deep flooding (Banach et al. 2009). […] Though not implicitly measured, it is likely that propagule pressure (Von Holle and Simberloff 2005; Simberloff 2009) will be increasingly dominated by *H. altissima* as its distribution and cover increases (Larios et al. 2013), and will thereby preclude reassembly processes and associated diversity of the native wet prairie community. Thus, *H. altissima* has the potential to inhibit invasibility as a pathway for plant community assembly (Davis and Pelsor 2001; Davis et al. 2005).

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

4 History of Invasiveness

The History of Invasiveness for *Hemarthria altissima* is classified as High. It is widely established outside of its native range in North America, South America, and Asia, likely due to its cultivation as cattle forage. This species is reported to be utilized as a pasture crop in the United States. *H. altissima* has escaped cultivation and become established in the Kissimmee River floodplain in Florida, where it forms monospecific stands which outcompete native wetland plants. Despite this documented invasiveness, it is not a regulated species in Florida. *H. altissima* has also been reported from Texas, Hawaii, and Pennsylvania, although no information is available on its impact in those States.

5 Global Distribution

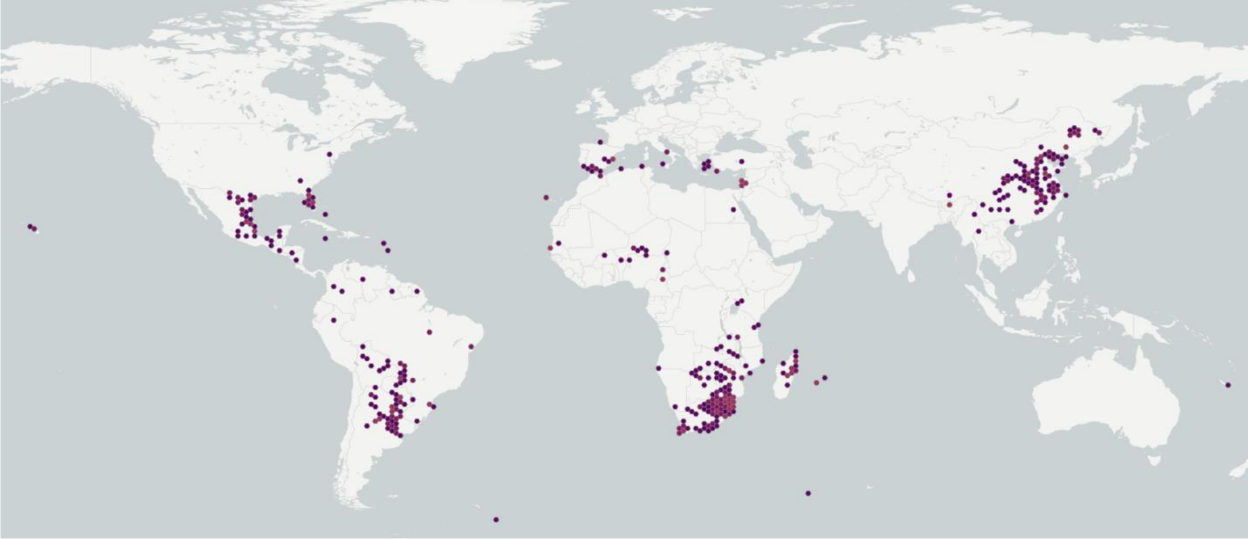

Figure 1. Reported global distribution of *Hemarthria altissima*. Map from GBIF Secretariat (2022). Observations are reported from the Americas, Europe, Asia, and Africa. A point in Georgia, United States was excluded from climate matching analysis because it did not represent a wild occurrence of *H. altissima*. A point from Pennsylvania was excluded because it was a single collection from 1949 and it is unclear if it represents a currently established population of *H. altissima*. Points that appear to be in marine environments occur on small islands.

No georeferenced occurrence data were available for parts of the range of *H. altissima* in Angola, on the island of Borneo, in the Democratic Republic of the Congo, Ethiopia, Laos, Saudi Arabia, Thailand, Uruguay, or Vietnam.

6 Distribution Within the United States

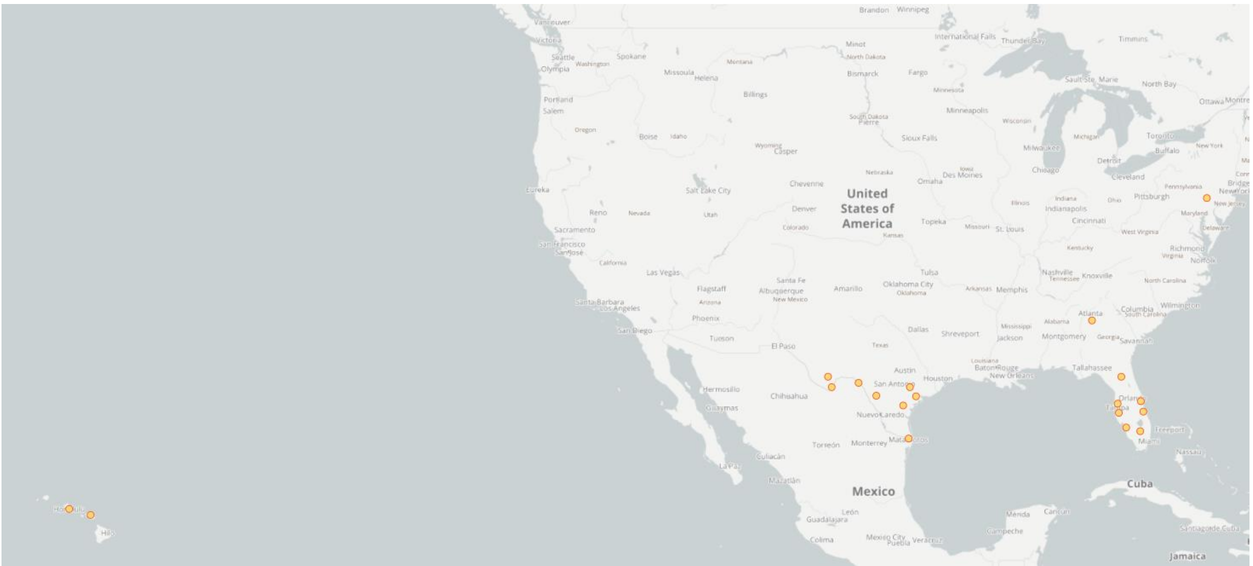

Figure 2. Reported distribution of *Hemarthria altissima* in the United States. Map from GBIF-US (2023). Observations are reported from Hawaii, Texas, Florida, Georgia, and Pennsylvania. Points in Georgia and Pennsylvania do not represent current, wild, established populations of *H. altissima* and were therefore excluded from climate matching.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Hemarthria altissima* was highest in peninsular Florida and southern Texas, areas where the species is already known to be established. Other areas of high match included much of the southern and western United States, and the southern Great Plains. Most of New England, the northern Great Lakes Basin, and the coastal Pacific Northwest had a low match. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.819, indicating that Yes, there is establishment concern for this species. The Climate 6 score is calculated as: (count of target points with scores ≥ 6)/(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 *Hemarthria altissima* (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.

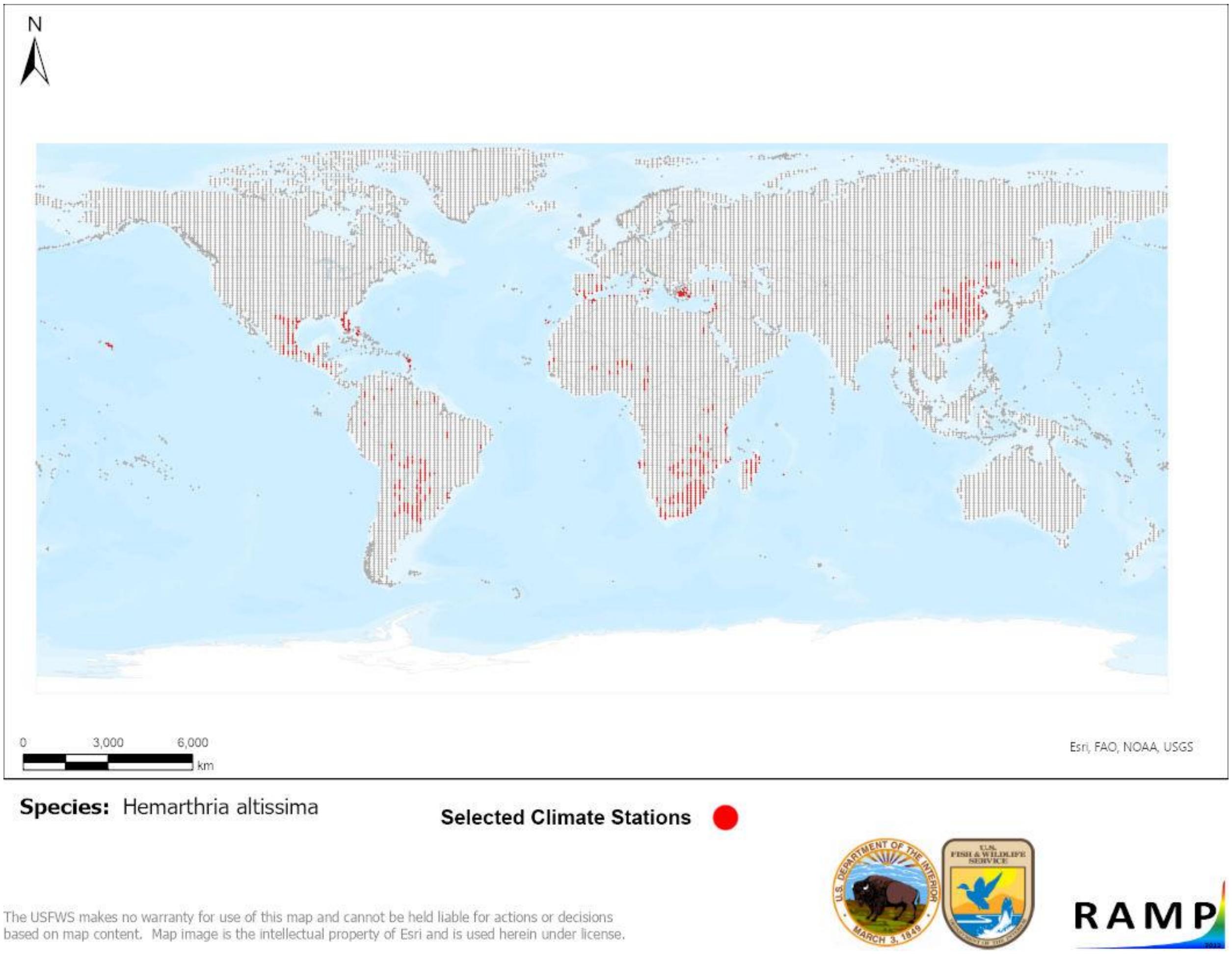

Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations worldwide selected as source locations (red; South America, southern North America, southern Europe, sub-Saharan Africa, southwest Asia, and eastern Asia) and non-source locations (gray) for *Hemarthria altissima* climate matching. 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.

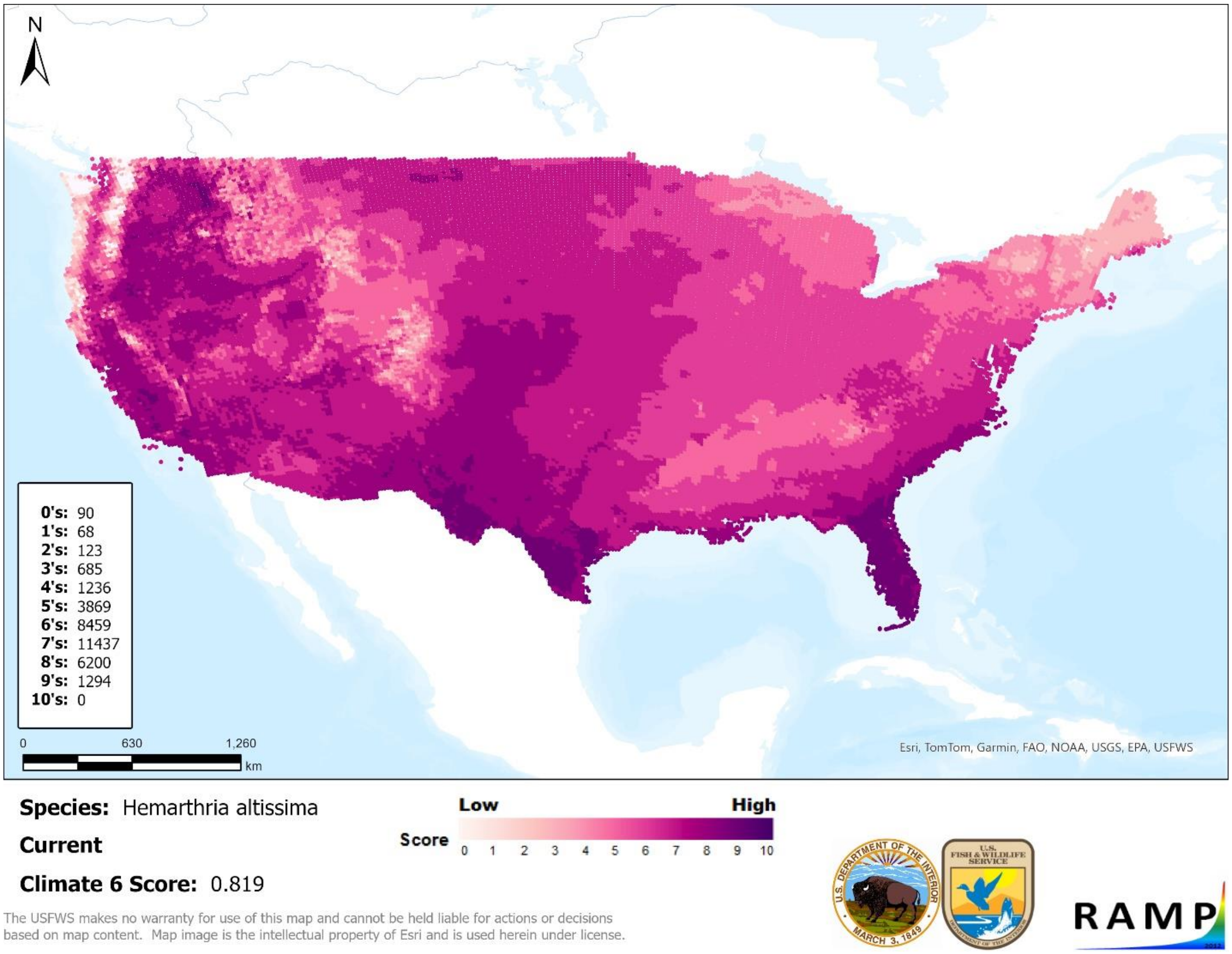

Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Hemarthria altissima* in the contiguous United States based on source locations reported by GBIF Secretariat (2022). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Hemarthria altissima* is classified as Medium. *H. altissima* is reported as introduced and established outside of its native range. In Florida, it is documented as having negative impacts; however, some of the impacts discussed are potential or presumed impacts of the species. It is widely planted in the State as a forage crop, but impacts have only been reported from one locality. *H. altissima* has also been reported from Texas, Hawaii, and Pennsylvania, although no information is available on its impact in those States. Further information on specific negative impacts of *H. altissima* in Florida, as well as its distribution, status, and impacts elsewhere in the United States, would increase the certainty of this assessment.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Hemarthria altissima, Limpograss, is a plant species native to Africa, southern Europe, and western Asia. It has been introduced in North and South America and eastern Asia as a pasture grass. *H. altissima* reproduces more readily from vegetative propagation than it does from seed, and it is well-adapted to wet soils. The History of Invasiveness for *H. altissima* is classified as High due to its establishment in the wild in Florida, where it has escaped cultivation as a forage crop and has altered the composition of the Kissimmee River floodplain flora by outcompeting native wet prairie species. The climate matching analysis for the contiguous United States indicates establishment concern for this species. High climate matches were found primarily in the southern and western United States. The Certainty of Assessment for this ERSS is classified as Medium because although negative impacts of this species' introduction have been documented in Florida, greater clarity on the risk *H. altissima* poses to other States and ecosystems would strengthen the certainty of this assessment. The Overall Risk Assessment Category for *Hemarthria altissima* in the contiguous United States is High.

Assessment Elements

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

10 Literature Cited

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

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11 Literature Cited in Quoted Material

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.

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Appendix

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 *Hemarthria altissima* was projected to occur in central to southern California, along the Southern Atlantic Coast including peninsular Florida, and in the Southern Plains and Southwest regions of the contiguous United States. Low matches were projected to occur along the Pacific Coast from the

Olympic Peninsula to northern California, along the eastern slope of the Cascades and the eastern slope of the northern Rockies, as well as in much of New England. There were minimal differences in the geographic distribution of high and low matches across scenarios. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.747 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.906 (model: MRI-ESM2-0, SSP5, 2085). All future scenario Climate 6 scores were above the establishment concern threshold, indicating that Yes, there is establishment concern for this species under future climate scenarios. The Climate 6 score for the current climate match (0.819, figure 4) 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). Areas within the Colorado Plateau, Great Lakes, Northeast, Northern Pacific Coast, and Western Mountains saw a moderate increase in the climate match relative to current conditions, particularly under scenario SSP5, 2085. No large increases were observed regardless of time step and climate scenarios. Under one or more time step and climate scenarios, areas within California, the Intermountain West, Southwest, Southern Plains, and Southeast regions saw a moderate decrease in the climate match relative to current conditions. These changes were particularly widespread under scenario SSP5, 2085. No large decreases were observed regardless of time step and climate scenarios.

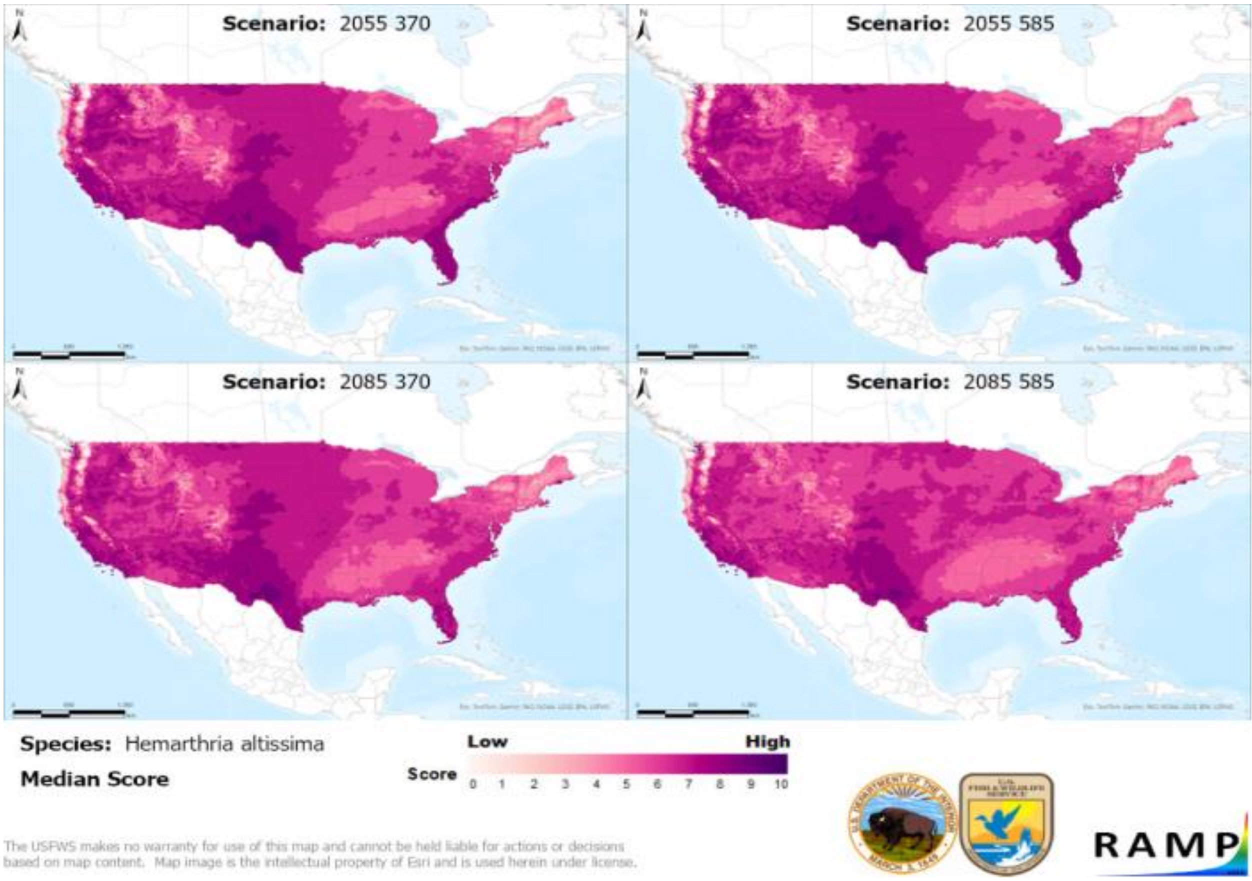

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Hemarthria altissima* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2022). Shared 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.

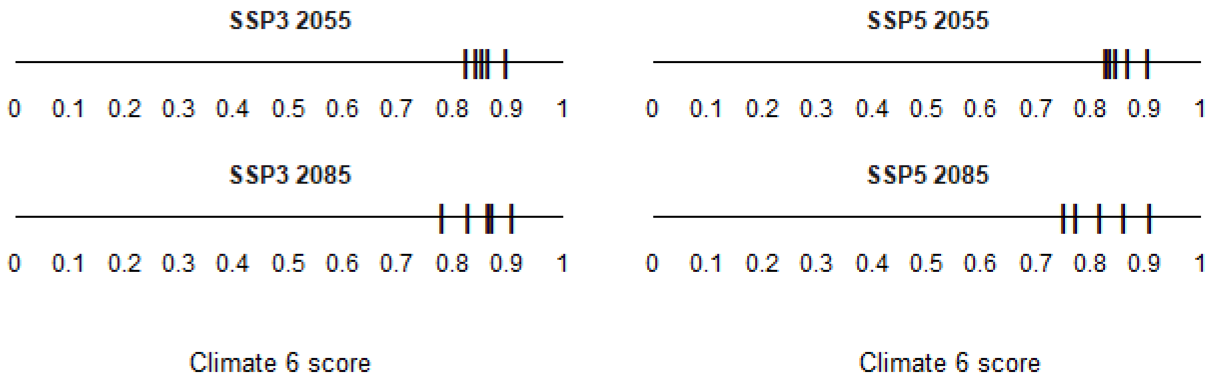

Figure A2. Comparison of projected future Climate 6 scores for *Hemarthria altissima* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; 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.

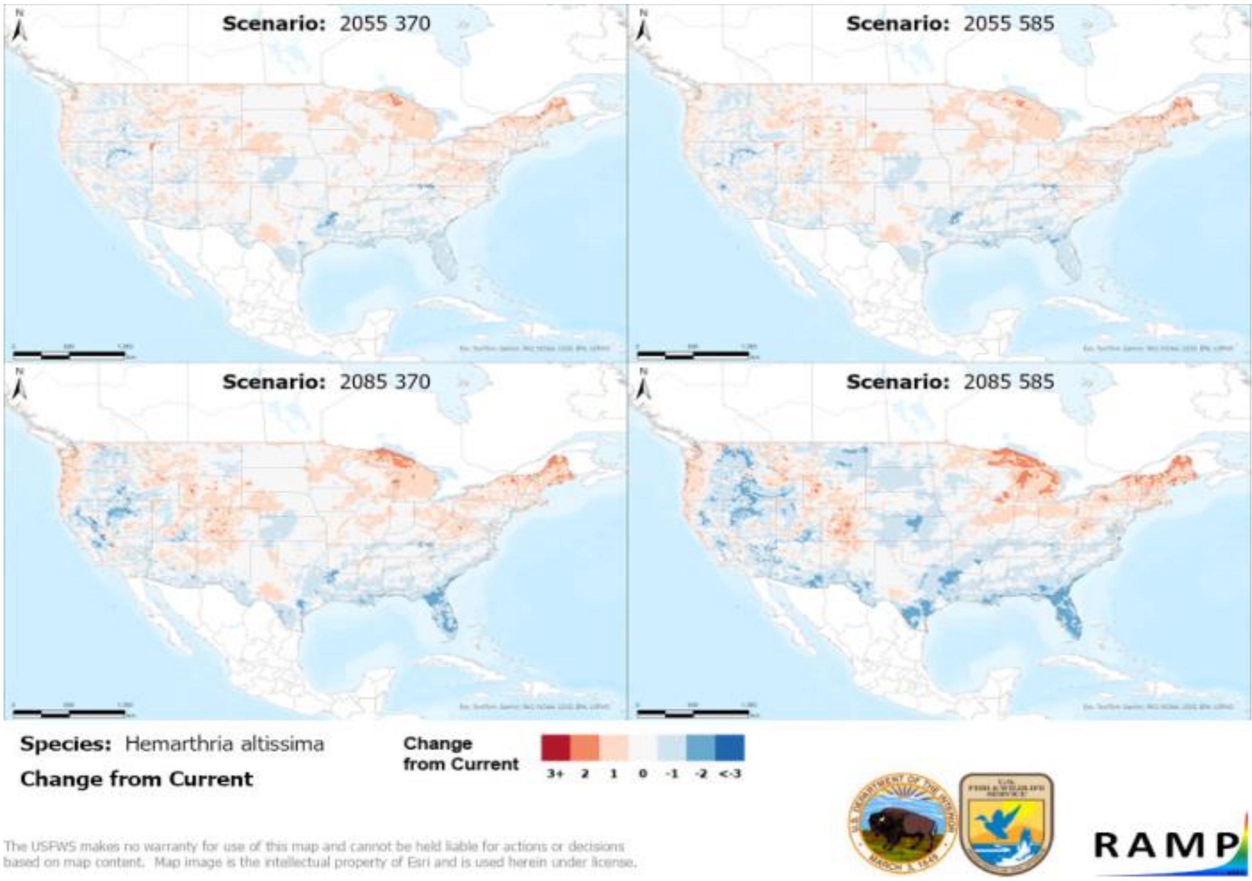

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Hemarthria altissima* based on source locations reported by 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.

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