U.S. Fish & Wildlife Service

Wild Taro (*Colocasia esculenta*)
Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, January 2023
Revised, January 2023
Web Version, 3/14/2025

Organism Type: Flowering Plant
Overall Risk Assessment Category: High

Photo: Allain L, U.S. Geological Survey. Public domain. Available: https://warcapps.usgs.gov/PlantID/Species/Details/851 (December 2022).

1 Native Range and Status in the United States

Native Range

From Hunt et al. (2013):

"Taro is believed to originate in Southeast Asia, where all other wild species of *Colocasia* are distributed (Matthews 1991; see also Li and Boyce 2010). The natural range of wild taro (also classified as *C. esculenta*) may extend from India to southern China, Australia and Melanesia

(Ivancic 1995; Matthews 1990, 1991, 1995, 1997; Matthews 2006; Matthews and Naing 2005; Spier 1951)."

From POWO (2022):

"Native to: Assam [eastern India], Bangladesh, China South-Central, China Southeast, East Himalaya, India, Laos, Malaya, Myanmar, Nepal, Sumatera [Indonesia], Taiwan, Thailand"

Status in the United States

From Serviss et al. (2000):

"[…] *Colocasia*, in addition to occurring throughout Florida and most of eastern Texas, also occurs in scattered locations throughout the Gulf coastal region. *Colocasia esculenta* var. *aquatilis*, *Colocasia esculenta* var. *nymphaeifolia*, and *Colocasia esculenta* var. *antiquorum* are established as far north as east central Texas, northern Louisiana, and throughout the lower one-half of Alabama, Georgia, and Mississippi. These three varieties of *C. esculenta* are invasive weeds of semi-aquatic and aquatic conditions throughout the Gulf coastal region."

From Moran and Yang (2013):

"Two taxonomic varieties occur in Texas as naturalized populations (*sensu* Richardson et al,. 2000), including *C. esculenta* var. *esculenta* and *C. esculenta* var *antiquorum* Hubbard and Rehder (USDA-NRCS, 2012), […] Both types also occur in Louisiana, Georgia, and Florida, and var. *esculenta* has been reported from Mississippi, North and South Carolina, and Pennsylvania (USDA-NRCS, 2012). Two other varieties, *C. esculenta* var. *aquitilis* Hassk. and *C. esculenta* var. *nymphiifolia* (Vent.) A.F. Hill, are found only in Florida and Louisiana, respectively."

"Small scale-commercial (under 1500 acres) and non-commercial production of both *C. esculentum* and *X. sagittifolium* occurs in Florida (Stephens, 2009) and subsistence cultivation may occur in Texas."

From University of Florida (2022):

"Distribution in Florida: throughout the state"

From Keener et al. (2022):

"In Alabama it occurs in the southern two-thirds of the state."

From Robinson and Allen (2014):

"In late 2013 resource managers at Delta Meadows, an unclassified State Parks property (Delta Meadows), located near Walnut Grove, CA, reported a large-leaved plant growing along the slough banks in several locations. Plants were collected in early 2014 and confirmed by CDFA botanists to be taro root (*Colocasia esculenta*)."

“Another mapping visit was conducted in September 2014 and observations indicated that the plant had spread from previously mapped locations.”

“After the original determination of taro root in early 2014 State Parks managers sent out a weed alert to other land managers in the Delta area and received a few more locations. In addition to Sacramento County, taro root has now been reported in Solano, San Joaquin and Orange counties.”

From Serviss et al. (2023):

“In the state [Arkansas], naturalized populations for this species previously were known from Clark and Garland counties (Gentry et al. 2013; Serviss et al. 2017). Field work in 2023 by the authors documented it from multiple sites in Clark and Garland counties […] and three additional Arkansas counties — Hot Spring, Ouachita, and Union […]. Naturalized plants of *C. esculenta* also have been recorded from Pulaski County (Theo Witsell, pers. comm., 2023), along with iNaturalist observations from Arkansas, Johnson, Miller, and Pope counties (iNaturalist 2023). Based on our observations, *C. esculenta* likely is more widely established in the state than its current known distribution indicates […].”

PIER (2011) cites Wagner et al. (1999), which reports *Colocasia esculenta* as introduced, invasive, cultivated, and of aboriginal introduction on the Hawaiian Islands of Hawai‘i, Lāna‘i, Maui, Moloka‘i, Ni‘ihau, and O‘ahu.

According to Rojas-Sandoval and Acevedo-Rodríguez (2013), *Colocasia esculenta* has been introduced and become invasive in Puerto Rico and been introduced in American Samoa, Guam, and the Northern Mariana Islands.

This species is available in trade in the United States. For example:

From Plant Delights Nursery (2022):

“Colocasia esculenta 'Lemonade'”

“$24.00”

Regulations

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

Means of Introductions within the United States

From Florida Fish and Wildlife Conservation Commission (2022):

“This native of India and southeastern Asia was brought from Africa to the Americas as a food crop for slaves. By 1910, it was introduced into Florida and other southeastern states by the U.S. Department of Agriculture as a possible substitute crop for potatoes.”

From Robinson and Allen (2014):

"The origin of the infestation at Delta Meadows [California] is not known, but it may have been planted near the houseboats that are parked along The Meadows Slough in summer. Patches of taro root occur near the houseboats as well as across the slough and downstream."

From Cho et al (2007):

"Around 900 to 1000 AD, a rapid colonization of all of Polynesia occurred that included the discovery and settlement of Hawaiʻi [Athens 1997, Athens et al. 2002, Burney and Burney 2003, Carson 2005, Kirch 1981, Whitney et al. 1939, Patrick V. Kirsch, personal communication (2006), Terry L. Hunt, personal communication (2006)]. Archaeological evidence suggests that kalo [wild taro, *Colocasia esculenta*], […] were among the foods introduced to the islands by Polynesians, most likely in multiple arrivals."

Remarks

From University of Florida (2022):

"Wild taro is commonly confused with elephant ear (*Xanthosoma sagittifolium*)."

From Rojas-Sandoval and Acevedo-Rodríguez (2013):

"The taxonomy of *Colocasia* cultivars with edible corms is confusing. The number of species recognized varies among authors, some recognizing *C. esculenta* as a highly variable species, others recognizing several species or varieties within this complex […]."

"When cultivated as a crop, there are two forms of *C. esculenta* or taro. The dasheen type has a large central corm with a few small cormels which are generally not eaten. The eddoe type produces a smaller central corm surrounded by large, well-developed cormels which are the main harvestable yield. Eddoes are often more drought-hardy than dasheens."

"Although the eddoe type is frequently classified as a separate species, *C. antiquorum* Schott, it is more generally accepted that it is a variety, *C. esculenta* var. *antiquorum* (Schott) Hubb. & Rehder, of a very variable species that includes both dasheens and eddoes."

"There are many taro cultivars, and these are distinguished by morphological characteristics (e.g., corm size and shape) as well as time taken to mature. Colour of corm flesh, lateral buds, petioles, and leaf blades are also used to differentiate cultivars."

The following synonyms of *Colocasia esculenta* from World Flora Online (2022) were used to search for information for this report: *Colocasia antiquorum*.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2022):

Kingdom Plantae
  Subkingdom Viridiplantae
    Infrakingdom Streptophyta
      Superdivision Embryophyta
        Division Tracheophyta
          Subdivision Spermatophytina
            Class Magnoliopsida
              Superorder Lilianae
                Order Alismatales
                  Family Araceae
                    Genus *Colocasia*
                      Species *Colocasia esculenta*

According to World Flora Online (2022), *Colocasia esculenta* (L.) Schott is the current valid name for this species.

Size, Weight, and Age Range

From Rojas-Sandoval and Acevedo-Rodríguez (2013):

"*Colocasia esculenta* […] can grow to 4 ft. (1.5 m) in height."

"Storage stem (corm) massive (up to 4 kg), cylindrical or spherical, up to 30 x 15 cm, […]"

"Leaves are arranged in a loose rosette; blades pointing downward, 23-55 × 12-38 cm, […]"

Environment

From Dana et al. (2017):

"It occurs mainly in wetlands with low salinity levels (< 5 mM NaCl), although it can also be found in dry lowland environments (Fujimoto, 2009)."

From Rojas-Sandoval and Acevedo-Rodríguez (2013):

"*C. esculenta* grows best in well-drained loamy soils, but it has the potential to grow in a wide variety of soils including clay, sandy, and loamy soils with pH normally ranging from 5.5 to 6.5 (Onwueme, 1999; Safo-Kantaka, 2004). In Malaysia it is reported to tolerate soil pH ranging from 4.2 to 7.5."

Climate

From Matthews and Ghanem (2020):

"[…] taro is widely distributed in tropical to temperate regions of both hemispheres, it is much more than just a 'tropical root crop' […]."

"Taro overlaps with these two major crops [potatoes and cassava], spanning latitudes from 35°N to 35°S. In Japan, taro cultivation can reach 40°N."

From Dana et al. (2017):

"Within its native range, *C. esculenta* grows in tropical areas with high rainfall (1800-2500 mm/year) and [air] temperatures in the range of 25-35°C."

Distribution Outside the United States

Native

From Hunt et al. (2013):

"Taro is believed to originate in Southeast Asia, where all other wild species of *Colocasia* are distributed (Matthews 1991; see also Li and Boyce 2010). The natural range of wild taro (also classified as *C. esculenta*) may extend from India to southern China, Australia and Melanesia (Ivancic 1995; Matthews 1990, 1991, 1995, 1997; Matthews 2006; Matthews and Naing 2005; Spier 1951)."

From POWO (2022):

"Native to: Assam [eastern India], Bangladesh, China South-Central, China Southeast, East Himalaya, India, Laos, Malaya, Myanmar, Nepal, Sumatera [Indonesia], Taiwan, Thailand"

Introduced

According to Rojas-Sandoval and Acevedo-Rodríguez (2013), *Colocasia esculenta* has been introduced in Africa (Algeria, Angola, Burkina Faso, Cabo Verde, Cameroon, Central Africa Republic, Chad, Democratic Republic of the Congo, Republic of the Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Morocco, Niger, Nigeria, Rwanda, Saint Helena, São Tomé and Príncipe, Senegal, Seychelles, Sierra Leone, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe), Asia (Japan, Philippines, Sri Lanka), Europe (Italy, Malta, Portugal (including Azores and Madeira), Spain (including Balearic and Canary islands)), North America (Antigua and Barbuda, British Virgin Islands, Cayman Islands, Dominica, Dominican Republic, Grenada, Guadeloupe, Guatemala, Haiti, Honduras, Martinique, Mexico, Montserrat, Nicaragua, Panama, Saint Kitts and Nevis, Saint Lucia), Oceania (Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Palau, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu, Wallis and Futuna), and South America (Easter Island (Chile), Colombia, French Guiana, Guyana, Peru, Suriname, and Venezuela).

According to Rojas-Sandoval and Acevedo-Rodríguez (2013), *Colocasia esculenta* has been introduced and become invasive in Africa (Réunion, South Africa), Asia (Singapore, Taiwan), North America (Costa Rica, Cuba, Jamaica), Oceania (French Polynesia, New Zealand), and South America (Chile, and Ecuador (including Galapagos Islands)). It has been introduced and become naturalized on Christmas Island and Norfolk Island, both territories of Australia. It is listed as present in Ethiopia, Iran, Maldives, Mauritius, South Korea, and Turkey.

Means of Introduction Outside the United States

From Rojas-Sandoval and Acevedo-Rodríguez (2013):

"It has been intentionally introduced in many tropical and subtropical regions to be used as a food crop and animal fodder (Onwueme, 1999; Safo-Kantaka, 2004), and has subsequently escaped from cultivated areas into natural areas where it becomes invasive (Langeland et al., 2008)."

"Archaeological evidence suggests human use of the plants 28,000 years ago in the Solomon Islands (Loy et al., 1992). It was spread by human settlers eastward to New Guinea and the Pacific over 2000 years ago, where it became one of the most important food plants economically and culturally."

"Distribution to China and via Arabia to Egypt and East Africa also occurred at least 2000 years ago. From there *C. esculenta* was introduced by Arab people to West Africa. It was introduced into Europe from Egypt (Greenwell, 1947)."

"During the seventeenth century, *C. esculenta* was introduced from Africa to the Americas as a food crop for slaves by Spaniard, Portuguese, and British slave traders (Greenwell, 1947). For example, as early as 1647, taro was cultivated in Barbados as a slave dietary staple (Carney and Rosomoff, 2009). Later, by 1864, it was reported as 'naturalized' in Jamaica and St. Kitts and widely cultivated in most islands in the West Indies (Grisebach, 1864)."

Short Description

From Florida Fish and Wildlife Conservation Commission (2022):

"Leaves: Leaf blades to 60 cm (24 in.) long and 50 cm (20 in.) wide, arrowhead shaped, with upper surface dark green velvety and water repellent; leaves peltate (stalked from back of blade); petioles large, succulent, often purplish near top."

"Flowers: Inflorescence on a fleshy stalk shorter that leaf petioles, with part of the fleshy stalk enveloped by a long yellow bract (spathe). Flowers tiny, densely crowded on upper part of the fleshy stalk, with female flowers below and male flowers above."

"Fruits: Fruit a small berry, in clusters on the fleshy stalk."

Biology

From Matthews et al. (2012):

“Taro is a soft, leafy herb with low tolerance for drought, and is unable to compete with woody vegetation. When soil and temperature conditions are good, and light is limited, the vertical leaf stems (petioles) can become greatly elongated (2 to 3m). This allows the leaf blades to catch light. Plant height is thus much more variable than other morphological characters such as blade shape, or the shape and colour of corms (the underground storage organs), and sidecorms. Stolons (elongated side-shoots from which new plants grow at nodes) are also highly variable in length, but the factors affecting their growth are not obvious, and have not been studied. The plant requires continuous water supply, but tolerates a wide range of light, nutrient, and temperature conditions.”

“In wild habitats—whether ruderal (obviously disturbed) or apparently natural (not obviously disturbed)—and in rainfed cultivations, the geographical distribution, growth rate, size, and flowering of taro plants are very closely linked to local climate and water supply, soil fertility, harvesting patterns, and vegetation cover. The full sequence of flowering, fruiting and seed production by wild or cultivated taros (*C. esculenta*) has only been reported in tropical to subtropical regions of Asia and the Pacific.”

Human Uses

From USDA, NRCS (2022):

“Taro was the most important food throughout the Hawaiian Islands. The mature root is boiled as a starchy vegetable. It was the staple of the Hawaiian diet and the plant used to make poi.”

“Taro corms have been used in the production of taro chips, dehydrated stable commodities, starch, flour, and in non-food application of taro starch in the manufacture of biodegradable plastics.”

“There are more than 200 cultivars of taro, selected for their edible corms or cormels, or their tropical looking ornamental foliage. These cultivars fall into two main groups: wetland taros, the source of the Polynesian food *poi*, which is made from the main corm; and upland taros, which produce numerous eddos that are used much like potatoes for cooking and in processing.”

From Sembera et al. (2019):

“Ornamental cultivars of wild taro are also a valuable crop in the United States and around the world with species grown in Florida having, in part, an estimated overall horticultural economic value of $45 million (Wirth et al., 2004).”

Diseases

From USDA, NRCS (2022):

"Taro diseases caused by biotic agents include four main groups of fungi: Ascomycetes, basidiomycetes, phycomycetes, and fungi imperfecti. These biotic agents cause leaf blight, leaf spot, soft rot, spongy black rot, and pocket rot of the corm."

Threat to Humans

From USDA, NRCS (2022):

"Caution: If taro is not prepared and cooked well, the acridity will cause itchiness in the mouth and throat. All parts of taro can cause stomach aches, if ingested without cooking."

From Dana et al. (2017):

"[…] physical contact may cause dermatitis because this species contains calcium oxalate (Franceschi & Nakata, 2005; Oscarsson & Savage, 2007)."

3 Impacts of Introductions

From Dana et al. (2017):

"*C. esculenta* has shown invasive behaviour in several warm and temperate areas of the world. Extensive stands of elephant ear alter the vegetation composition, structure and dynamics of riparian plant communities. Many cultivars are well adapted to saline conditions, low water availability and/or seasonally flooded soils and are also widely cultivated throughout tropical and subtropical regions (Onwueme, 1999). By virtue of its corms, or vegetative fragments, it may become invasive along irrigation channels and surrounding lands, riversides and lakes, where it can modify the vegetation composition and structure as well as the dynamics of riparian plant communities (Cufodontis, 1953-1972; Kunkel, 1975; Wester, 1992; Visser et al., 1999; FLEPPC, 2000; Tye, 2001; Brown & Brooks, 2003; García-Camacho & Quintanar, 2003; Henderson, 2007; Atkins & Williamson, 2008; Silva et al., 2008; Ferrer-Gallego et al., 2015). *C. esculenta* is also an allelopathic species (Pardales et al., 1992). These undesired ecological consequences have led to the implementation of management actions to control invasive populations (Brown & Brooks, 2003; Atkins & Williamson, 2008)."

From Florida Fish and Wildlife Conservation Commission (2022):

"Wild taro populations have changed the ecology of a large portion of shorelines along the St. Johns River and its tributaries by crowding out native plants that are important sources of food for wildlife."

"Biologists have reported that wild taro infestations are spreading in Florida's water bodies increasing from 32 percent in 1983 to 62 percent in public lakes and rivers in 2002."

“Wild taro populations are difficult to control in Florida and quickly resprout after herbicideapplication [*sic*] or hand-pulling if the entire rhizome is not killed or removed.”

From Moran and Yang (2013):

“In Texas, wild taro has formed monotypic stands in the headwaters of the San Marcos River (Owens et al., 2001; […]) that displace native plants (Langeland et al., 2008) […] Nesom (2009) placed wild taro among the 51 most highly invasive and damaging woody, herbaceous, and aquatic plants among 800 non -natives known to occur in Texas, based on its potential to colonize both disturbed and natural habitats and displace native species. The spring-fed San Marcos River provides habitat for several Federally-endangered fish, amphibians, and Texas wild rice (Poaceae: *Zizania texana* Hitchc.).”

From Sembera et al. (2019):

“In the southeastern United States, as well as in Puerto Rico, Jamaica, and India, wild taro is identified as an invasive exotic ornamental species in freshwater swamps, streambanks, and river bank areas (Atkins and Williamson, 2008; Bindu and Ramasamy, 2008; Early Detection and Distribution Mapping System, 2018; Everitt et al., 2007; Florida Exotic Pest Plant Council, 2017; Kurien and Ramasamy, 2006; Matthews, 2003). Extensive stands of wild taro live in a variety of riparian habitats and are superior competitors against native species (Atkins and Williamson, 2008; Gonzalez and Christoffersen, 2006). Plants prevent light from reaching submerged species below the leaf cover, increase the rates of evapotranspiration, and offer little value to local wildlife (Atkins and Williamson, 2008; Everitt et al., 2007). The presence of crystalized calcium oxalate in the leaves, stems, and root structures allow for no natural predation in the United States, increasing its ability to outcompete native species (Atkins and Williamson, 2008). Wild taro is often dispersed by purposeful or accidental spread of vegetation fragments (Atkins and Williamson, 2008; Gonzalez and Christoffersen, 2006). Chemical treatments currently used to manage wild taro can damage local ecosystems and are potentially less effective when compared with alternative means of management (Atkins and Williamson, 2008; Nelson and Getsinger, 2000).”

4 History of Invasiveness

The History of Invasiveness for *Colocasia esculenta* is classified as High. Multiple introductions of this species outside of its native range have been documented due to its historical and present-day status as a staple food crop in many regions. It is native to Southeast Asia but has escaped cultivation and is established on all continents except Antarctica. Multiple sources document that wild populations of *C. esculenta* affect riparian plant communities by crowding out native species with its large leaves and by forming dense monospecific stands.

5 Global Distribution

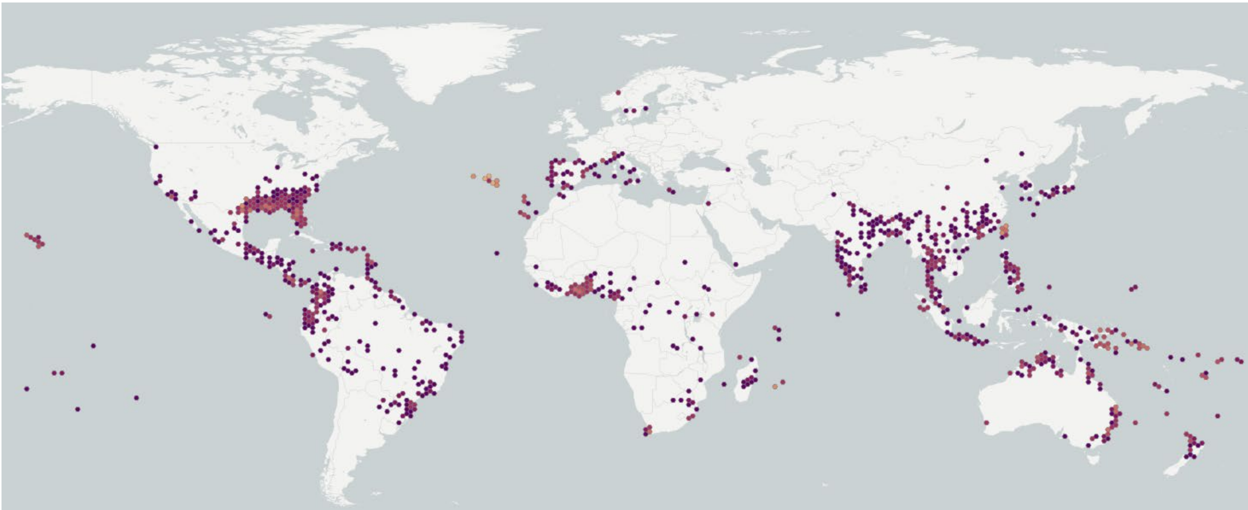

Figure 1. Reported global distribution of *Colocasia esculenta*. Map from GBIF Secretariat (2023). Observations are reported from all continents except Antarctica. Points in parts of the United States (Washington, Illinois, Missouri, Pennsylvania, Arizona), Norway, Sweden, Israel, and Georgia were excluded from climate matching because they are preserved specimens or otherwise do not represent naturally-occurring established populations of *C. esculenta*.

6 Distribution Within the United States

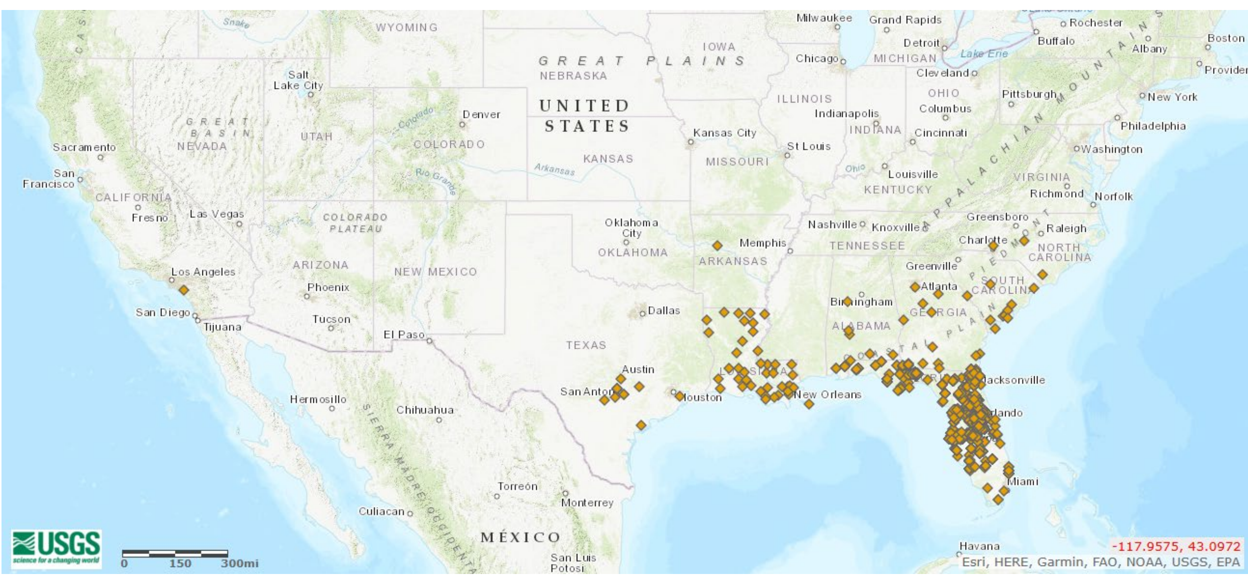

Figure 2. Reported distribution of *Colocasia esculenta* in the United States. Map modified from U.S. Geological Survey (2022). Observations are reported from Alabama, Arkansas, California, Florida, Georgia, Hawaii, Louisiana, Mississippi, North Carolina, South Carolina, Texas, and Puerto Rico. Orange points represent established populations.

Figure 3. Reported distribution of *Colocasia esculenta* in Hawaii. Map from U.S. Geological Survey (2024).

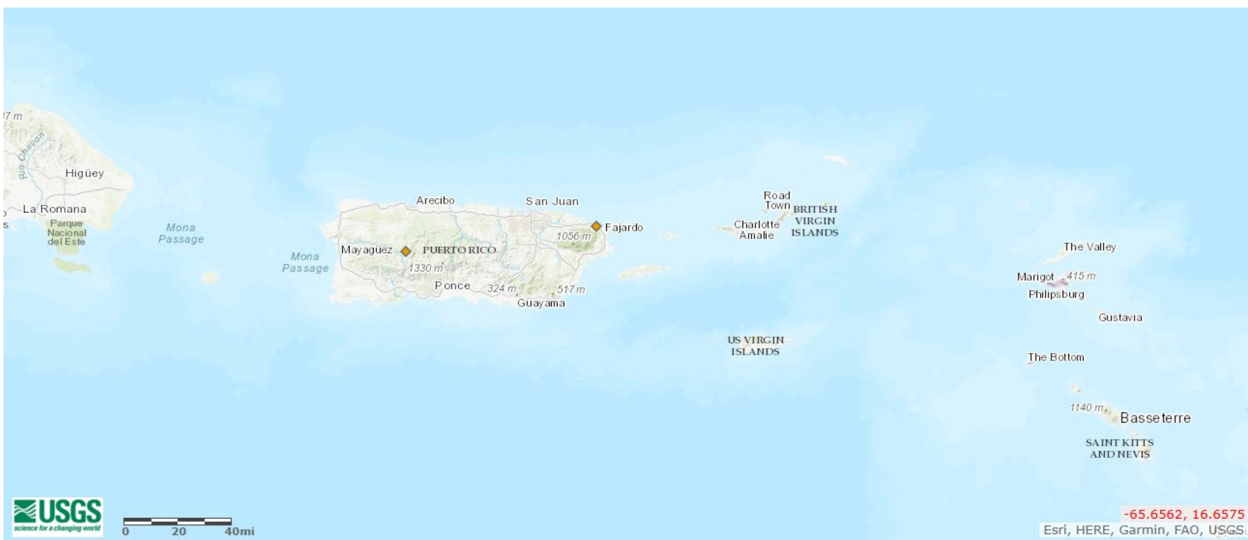

Figure 4. Reported distribution of *Colocasia esculenta* in Puerto Rico. Map from U.S. Geological Survey (2024).

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Colocasia esculenta* was very high in the Southeast United States. There were also areas of high climate match in the western United States mainly in central California. Isolated areas of low climate match were found in the Colorado Plateau and Western Mountains. In general, the climate match for the rest of the contiguous United States was medium. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.965, 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 *Colocasia esculenta* (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.

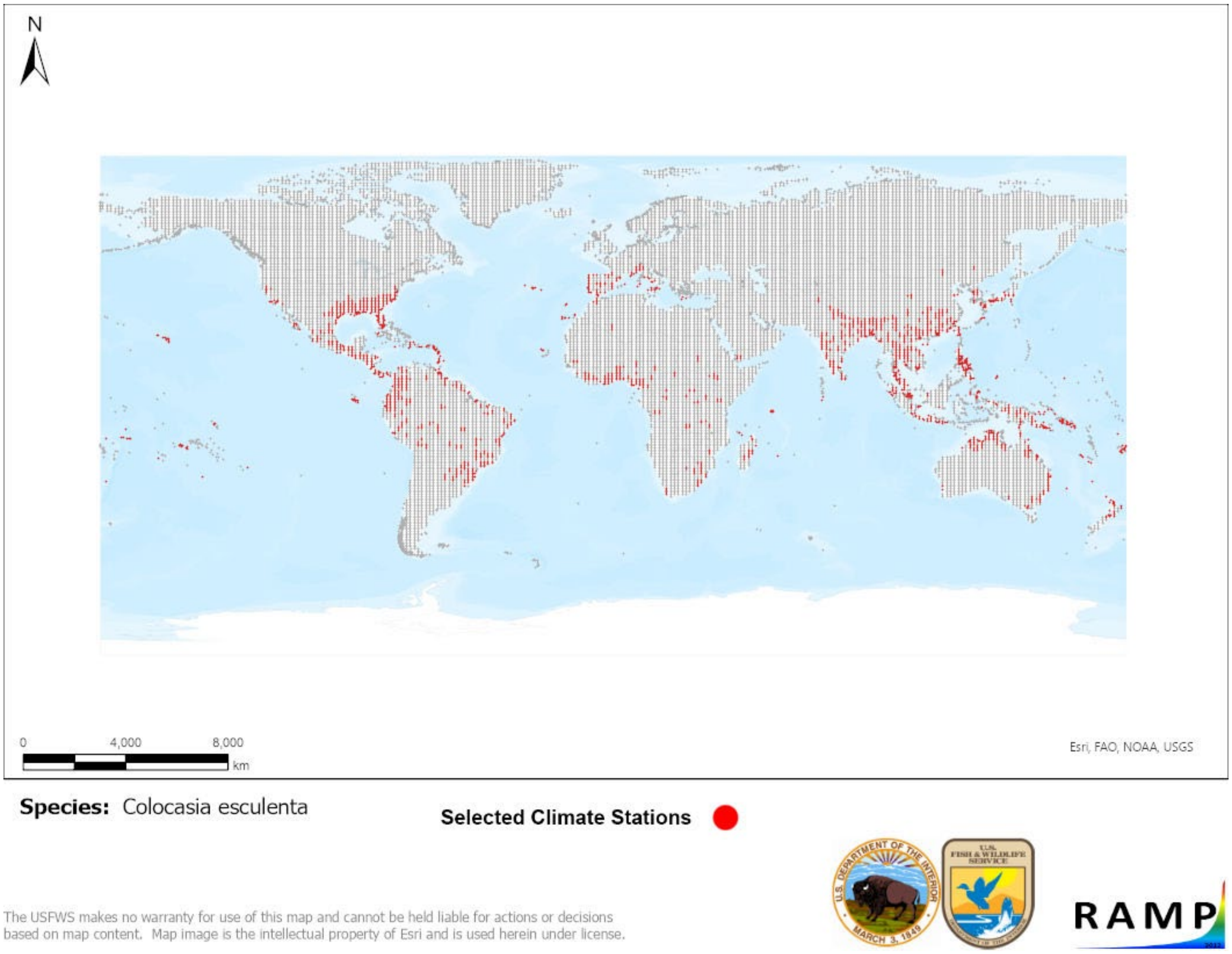

Figure 5. RAMP (Sanders et al. 2023) source map showing weather stations in worldwide selected as source locations (red; central and southern North America, South America, Africa, southern and western Europe, Australia, Southeast Asia, Indian Subcontinent, and the Pacific Islands) and non-source locations (gray) for *Colocasia esculenta* climate matching. Source locations from GBIF Secretariat (2023). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

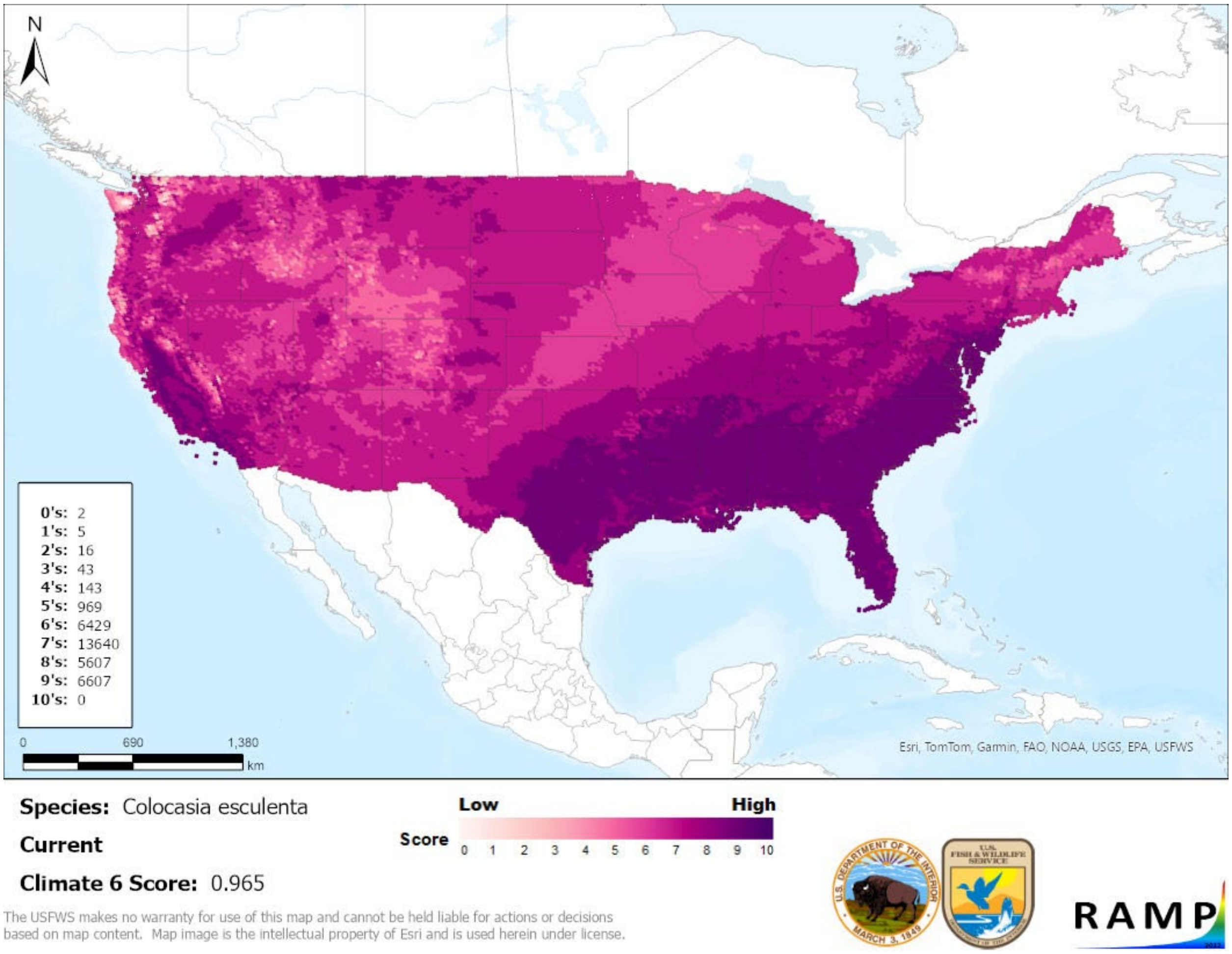

Figure 6. Map of RAMP (Sanders et al. 2023) climate matches for *Colocasia esculenta* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Colocasia esculenta* is classified as High. Adequate information was available regarding the species biology, ecology, and distribution. The species has a long history of introductions and establishment of nonnative populations. Information regarding negative impacts of introduction was available from multiple scientific sources.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Colocasia esculenta, Wild Taro, is a plant that is native to Southeast Asia, but has been introduced and naturalized in many areas of the world due to its importance as a staple crop. This species inhabits moist soils, flooded areas, and riparian habitats in tropical and subtropical climates worldwide. It is an economically and culturally significant crop in many cultures, but it readily escapes cultivation, leading to its cosmopolitan distribution. *C. esculenta* is widely established in the Southeastern United States, where it forms dense monospecific stands which outcompete native plant communities. It propagates vegetatively and has no native predators in the United States due to the toxic levels of calcium oxalate in the plant. The History of Invasiveness for *Colocasia esculenta* is classified as High due to its well-documented establishment outside of its native range and multiple documented impacts of its introduction. The climate matching analysis for the contiguous United States indicated establishment concern for this species. Areas of high match were found in the southeast and southwest. Much of the contiguous United States had a medium match. The Certainty of Assessment is classified as High. The Overall Risk Assessment Category for *Colocasia esculenta* 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): High**
- **Remarks, Important additional information: Calcium oxalate in the plant can cause irritation or digestive issues in humans if eaten raw.**
- **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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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 (2023).

Under the future climate scenarios (figure A1), on average, high climate match for *Colocasia esculenta* was projected to occur in the Appalachian Range, California, Great Lakes, Gulf Coast, Mid-Atlantic, Northeast, Southeast, Southern Atlantic Coast, Southern Florida, Southern Plains, and Southwest regions of the contiguous United States. Areas of medium match in the Great Plains, Great Basin, and Western Mountains were projected to increase in extent between time step 2055 and 2085 under both SSPs. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.906 (model: MPI-ESM1-2-HR, SSP5, 2085) to a high of 0.987 (model: IPSL-CM6A-LR, SSP5, 2055). All future scenario Climate 6 scores were above the Establishment Concern threshold, indicating that Yes, there is establishment concern for this species under future scenarios. The Climate 6 score for the current climate match (0.965, 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. Under one or more time step and climate scenarios, 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. No large increases were observed regardless of time step and climate scenarios. Under one or more time step and climate scenarios, areas within California saw a large decrease in the climate match relative to current conditions. Additionally, areas within the Appalachian Range, Gulf Coast, Mid-Atlantic, Northern Pacific Coast, Northern Plains, Southeast, Southern Atlantic Coast, Southern Florida, Southern Plains, Southwest, and Western Mountains saw a moderate decrease in the climate match relative to current conditions. Additional, very small areas of large or moderate change may be visible on the maps (figure A3).

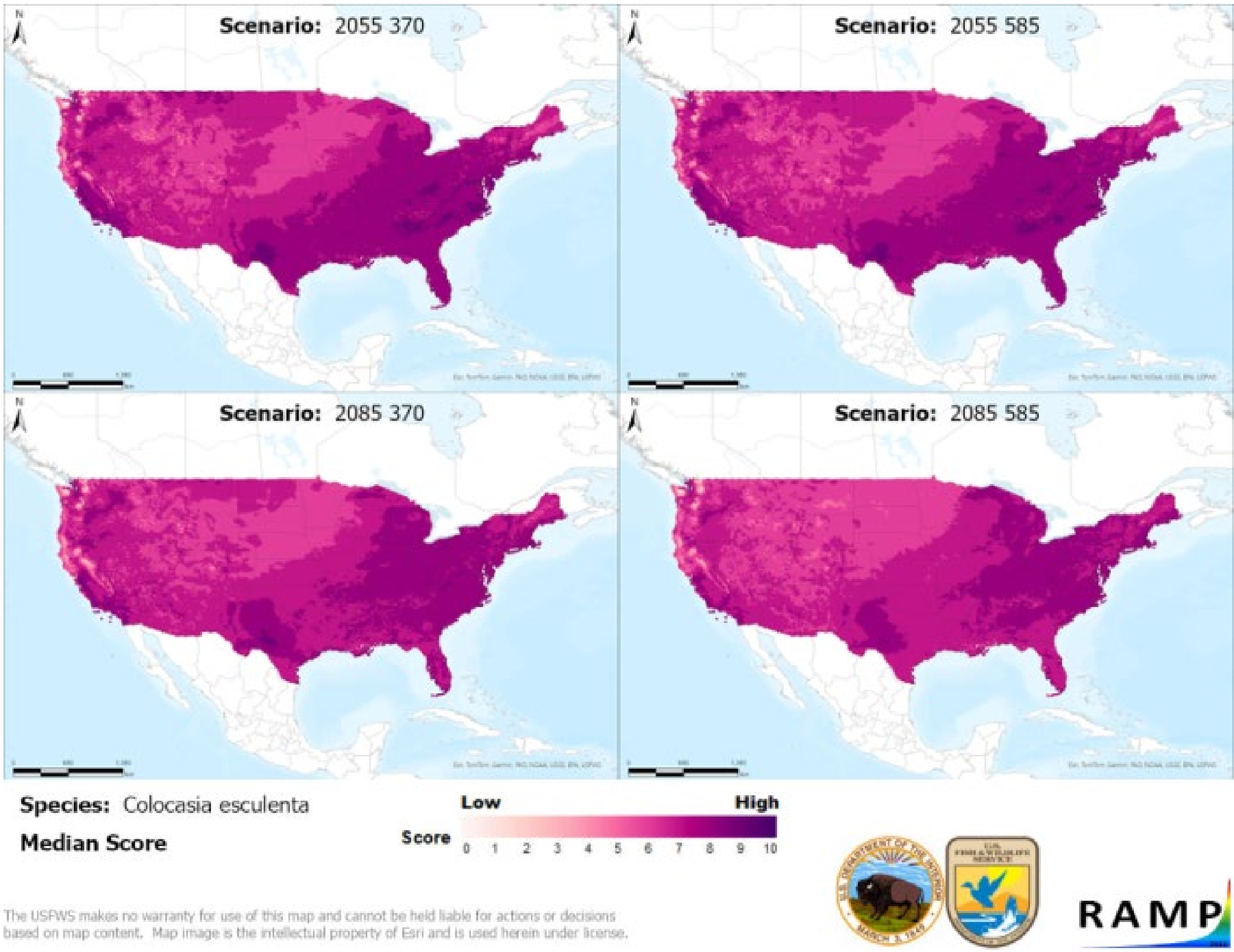

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Colocasia esculenta* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023). Shared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

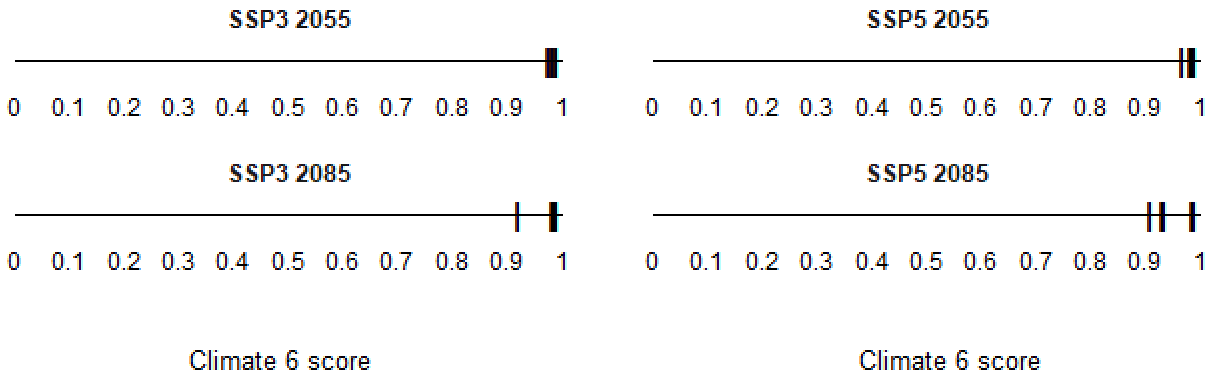

Figure A2. Comparison of projected future Climate 6 scores for *Colocasia esculenta* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018;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

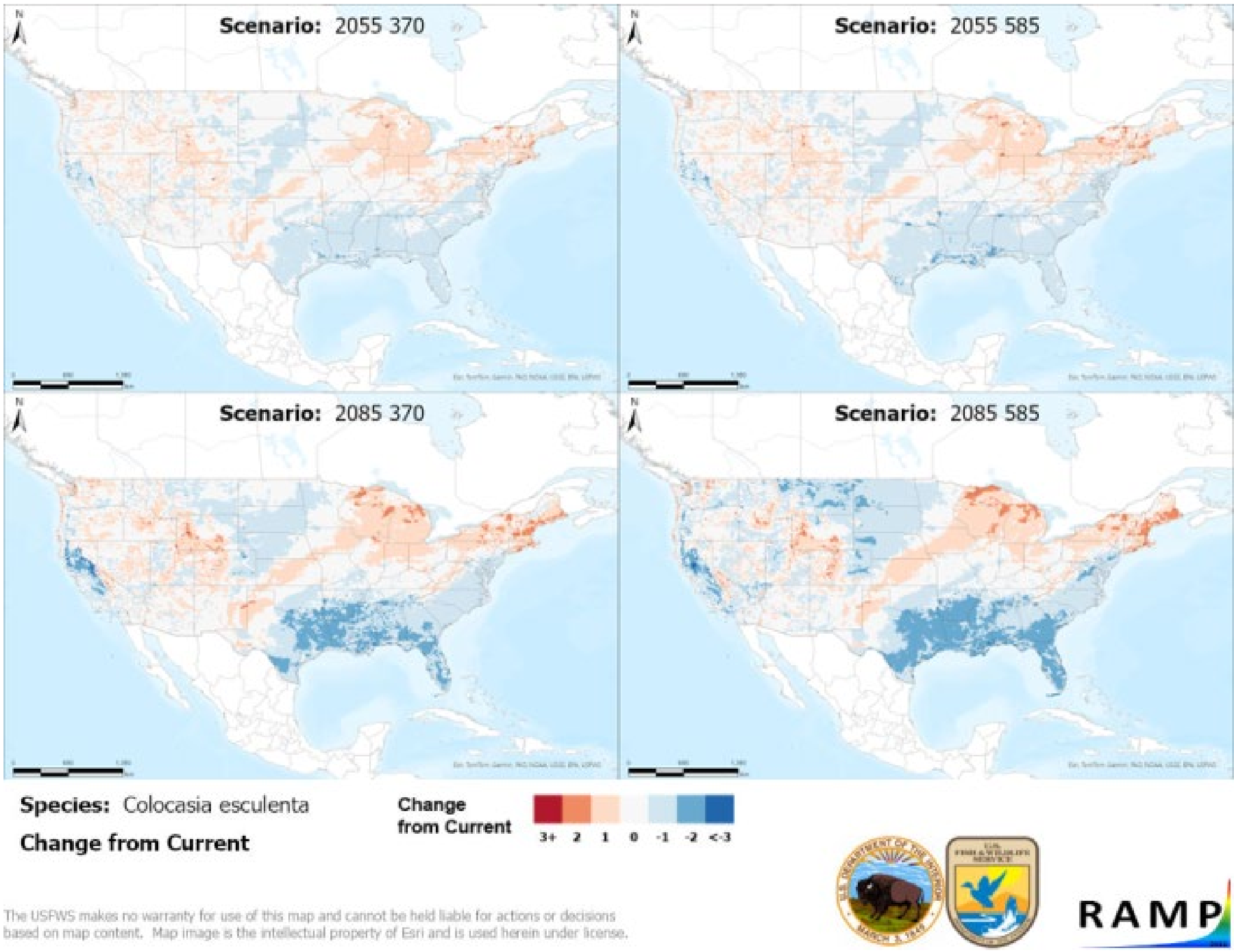

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 6) and the median target point score for future climate scenarios (figure A1) for *Colocasia esculenta* based on source locations reported by GBIF Secretariat (2023). 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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