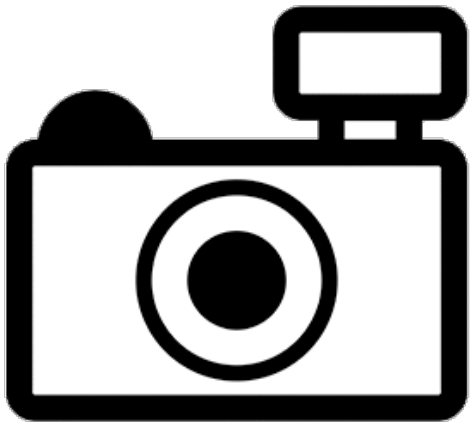
Indian Oxygen-weed (*Nechamandra alternifolia*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, September 2020
Revised, January 2021
Web Version, 4/1/2021

Organism Type: Plant
Overall Risk Assessment Category: Uncertain



1 Native Range and Status in the United States

Native Range

From POWO (2019):

"Native to:
Assam [India], Bangladesh, China Southeast, India, Myanmar, Nepal, Socotra [archipelago in Yemen], Sri Lanka, Thailand, Vietnam"

From Shaffer-Fehre (1991):

"The monotypic genus *Nechamandra* occurs in S.E. Asia."

From Ito (2013):

"Together with the recent new locality report from Myanmar (Ito et al., 2009), the species [*Nechamandra alternifolia*] distribution seems to be continuous from India to Southeast Asian

countries, i.e., China, Myanmar, Thailand, and Vietnam. In Thailand, this rare species [*N. alternifolia*] is known from only one locality [Pathum Thani], based on a single herbarium sheet. Only female individuals have been collected in Thailand so far."

Status in the United States

This species has not been reported within the United States. There is no indication that this species is in trade within the United States.

Nechamandra alternifolia is considered a Class 1, prohibited aquatic plant in the state of Florida. It has not been reported on any other federal or state noxious weed lists (USDA NRCS 2020).

Means of Introductions in the United States

This species has not been reported in the United States.

Remarks

Govindarajalu (1984) indicated that there has been considerable confusion concerning this species correct nomenclature and characterization, resulting in many synonyms. Synonyms listed within Govindarajalu (1984), and confirmed in WFO (2021), include *Vallisneria alternifolia*, *Lagarosiphon alternifolia*, *L. roxburghii*, and *Nechamandra roxburghii*. Due to the various redescriptions and reclassifications of the species the exact native range is unclear. Many sources describe the entire known extent of the species without notation as to native or introduced areas (e.g. Ito et al. 2009; Ito 2013). The few sources that do indicate a native or introduced range include areas that span a wide area from archipelagos in Yemen to Southeast Asia (Cook 1985; Shaffer-Fehre 1991; POWO 2019). There seems to be the most agreement with the large native range so that is the interpretation followed by this screening.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to WFO (2021), *Nechamabdra alternifolia* is the accepted name for this species.

From ITIS (2020):

Kingdom Plantae
Subkingdom Viridiplantae
Infrakingdom Streptophyta
Superdivision Embryophyta
Division Tracheophyta
Subdivision Spermatophytina
Class Magnoliopsida
Superorder Lilianae
Order Alismatales
Family Hydrocharitaceae
Genus *Nechamandra*
Species *Nechamandra alternifolia* (Roxb.) Thwaites

Size, Weight, and Age Range

From Govindarajalu (1984):

"*Stems* terete, 40-100 cm long."

From Das et al. (2013):

"[Seeds:] Shape oblong-ellipsoid. Dimension 0.84 mm –1.07 mm x 0.33 mm – 0.44 mm. Base & Apex obtuse. Surface glossy with areolae in rows; superficial surface composed of polygonal cells being traversed by microfibrillar threads in each cell as seen under SEM [scanning electron micrographs]. Colour brown to yellowish brown. Weight 0.026 mg/seed. Seed number 50 per fruit."

Environment

From Ghosh (1964):

"The plants form a dense population and occur commonly in ditches, shallow water depressions around rice fields, chocked canals and stagnant pools in association with species of *Hydrilla*, *Ceratophyllum*, *Najas*, and *Nymphoides*. Generally they inhabit the fresh water and their growth is profuse in brackish stagnant water. The pH of the medium [water] ranges generally from 6.9-8.2."

From Govindarajalu (1984):

"*Nechamandra alternifolia* is common and thrives well in almost all fresh water tanks, ponds and semipermanent water sheds […]"

Climate

No information on climate for *Nechamandra alternifolia* was found.

Distribution Outside the United States

Native

From POWO (2019):

"Native to:
Assam [India], Bangladesh, China Southeast, India, Myanmar, Nepal, Socotra [archipelago in Yemen], Sri Lanka, Thailand, Vietnam"

From Shaffer-Fehre (1991):

"The monotypic genus *Nechamandra* occurs in S.E. Asia."

Introduced
Cook (1985) reports *Nechamandra alternifolia* as introduced to tropical Africa and Southeast Asia. For this screening, Southeast Asia is considered part of the species' native range.

From POWO (2019):

"Introduced to:
Sudan"

Means of Introduction Outside the United States
No means of introduction have been reported.

Short Description
From Ito (2013):

"*Herbs* submerged. *Plants* monoecious. *Stems* elongated, slender, much branched. *Leaves* alternate but usually opposite at base, irregularly arranged, densely crowded toward ends of stems, linear, 2–7 cm × 1–1.5 mm, apex acute, lacking a prominent midvein, parallel veins present, slightly sheathing at base, margin minutely serrulate with teeth. *Flowers* unisexual. *Male inflorescence* pedunculate, 60–100 flowered; spathe 2-united, ovate, membranous, bifid at apex, ca 5 × 4 mm. *Staminate flowers* minute, slender pedicel ca 0.6 mm; sepals 3, transparent, ovate, 0.5–1 × 0.4–0.7 mm; petals 3, subequal to sepals; stamens 3, opposite to sepals; filaments slender, very short, ca 0.3 mm. *Female* spathe tubular, ca 5 mm, sessile, 1-flowered. *Carpellate flowers* solitary, sessile, with filiform hypanthia; sepals 3, transparent, ovate, 0.5–1 × 0.4–0.7 mm; petals 3, subequal to sepals; stamens 3, opposite to sepals; ovary oblong, 5–10 mm, flattened, margin serrulate on each side; styles 3, retuse at apex, densely papillate. *Fruits* ovoid-oblong or linear. *Seeds* numerous, oblong, minute. […] (Cook & Luond, 1982; Ito et al., 2009)."

From Mukherjee and Kumar (2018):

"Submerged slender, fresh water, much branched, reddish, aquatic herbs. Leaves alternate, amplexicaule, sessile linear-lanceolate. Flowers dioecious; male minute, numerous, densely crowded in an axil, sessile, ovoid; 2 fid spathe; female flowers solitary - axillary. Fruits numerous utricles; embedded in spathe, linear."

From Govindarajalu (1984):

"It is interesting to observe that in any given habitat not only green but partly or wholly pinkish specimens are encountered but the factor(s) responsible for this variation in colour are not clear."

Biology
From Govindarajalu (1984):

"*Nechamandra alternifolia* is common and thrives well in almost all fresh water tanks, ponds and semipermanent water sheds and is characterized by stoloniferous habit and monopodial

growth. Because of this particular growth habit coupled with the vegetative propagation caused by means of fragmentation of stems and stolons followed by their dissemination this species gains supremacy in course of time over other hydrophytes and becomes ultimately dominant in a given area within a short period. […] Both chasmogamous and cleistogamous male flowers occur together in a spathe in varying combination and proportion. The chasmogamous flowers are more abundant than the cleistogamous ones. It is also observed that for every 90-105 chasmogamous flowers there are 1-15 cleistogamous flowers. In all the chasmogamous flowers a pair of petaloid staminodes is always present showing antero-posterior disposition. In cleistogamous flowers only one petaloid staminode is present in each whose position may be either anterior or posterior as the case may be."

From Les et al. (2008):

"In *Maidenia*, *Nechamandra* and *Vallisneria* […], the pollen remains dry within elevated anthers and the stigmas remain dry within the perianth of the pistil-late flower. Pollination ensues as the floating staminate flowers aggregate around the solitary pistillate flowers, which orient their opening just at the water surface while remaining attached to the submersed female plants by long, flexuous peduncles. Eventually, the anthers make contact with the stigmas and deposit their pollen, occasionally as entire staminate flowers tumble into the pistillate flower (Wylie 1917; Svedelius 1932; Kausik 1939; Sculthorpe 1967; Cook 1982, 1996a). After fertilization, the peduncle coils into a spiral, effectively pulling the developing fruit under water to complete its maturation (Kausik 1939; Wilder 1974)."

Human Uses
No human uses were reported for this species.

Diseases
No information available.

Threat to Humans
No threat to humans has been reported in relation with this species.

3 Impacts of Introductions
Nechamandra alternifolia has been introduced to Sudan. No information on impacts of introduction was found.

4 History of Invasiveness
Nechamandra alternifolia has been introduced to Sudan. Multiple sources included Sudan in the species' range indicating the likelihood of an established population there. No information on impacts from this introduction were found. Due to the history of taxonomic confusion the native range of the species was not clear. Some sources regarded *N. alternifolia* as an introduced species in one half or another (Southeast Asia or Indian subcontinent) of what is considered the species' native range in this screening. See Remarks for more information. Since there is likely

to be an established, nonnative population in Sudan but there was no information found regarding impacts of introduction, the history of invasiveness is classified as Data Deficient.

5 Global Distribution

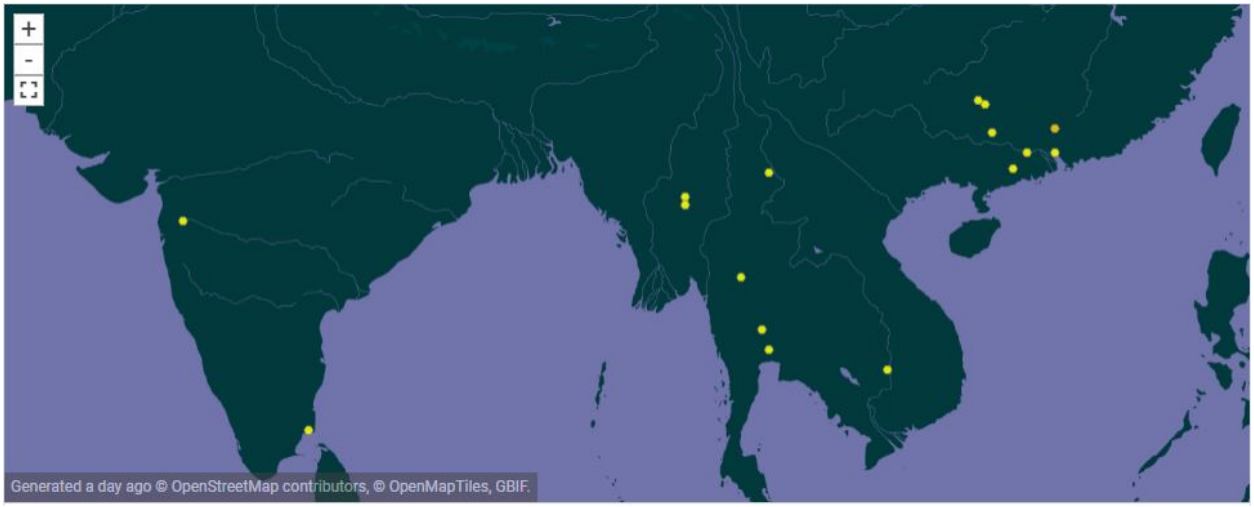


Figure 1. Known global distribution of *Nechamandra alternifolia*. Observations are reported from India and Southeast Asia including Myanmar, Thailand, Cambodia, and southern China. Map from GBIF Secretariat (2020).

Additional locations in Bangladesh, India, Myanmar, Nepal, Sudan, Vietnam, and Yemen given in Ito et al. (2009), Niroula and Singh (2010), Das et al. (2013), Ito (2013), Panda et al. (2016), Saha et al. (2017), and Kumar et al. (2020).

6 Distribution Within the United States

This species has not been reported within the United States.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match of *Nechamandra alternifolia* with the contiguous United States was generally low throughout much of the United States. Areas of medium match were found along some of the southern border with Mexico, in southern Texas, and along the southeastern coast, and a high match was found peninsular Florida. The overall Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.014, Medium (scores between 0.005 and 0.103, exclusive, are classified as medium). Florida had a high individual Climate 6 score while Georgia and Texas had medium individual scores. All other States had low individual climate scores.

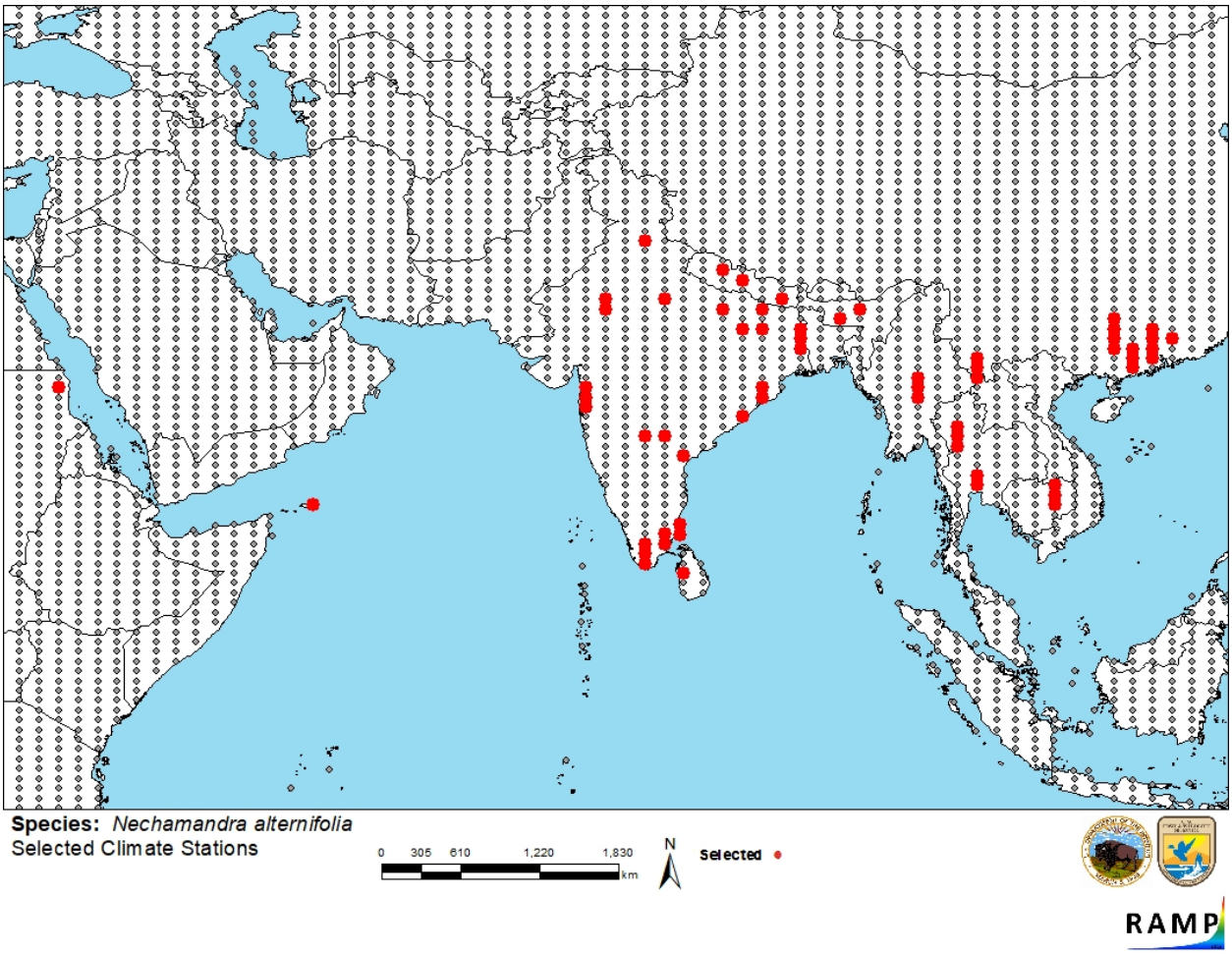


Figure 2. RAMP (Sanders et al. 2018) source map showing weather stations in southern Asia and eastern Africa selected as source locations (red; Sudan, Yemen, India, Nepal, Myanmar, Thailand, Cambodia, China) and non-source locations (gray) for *Nechamandra alternifolia* climate matching. Source locations from Ito et al. (2009), Niroula and Singh (2010), Das et al. (2013), Ito (2013), Panda et al. (2016), Saha et al. (2017), GBIF Secretariat (2020), and Kumar et al. (2020). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

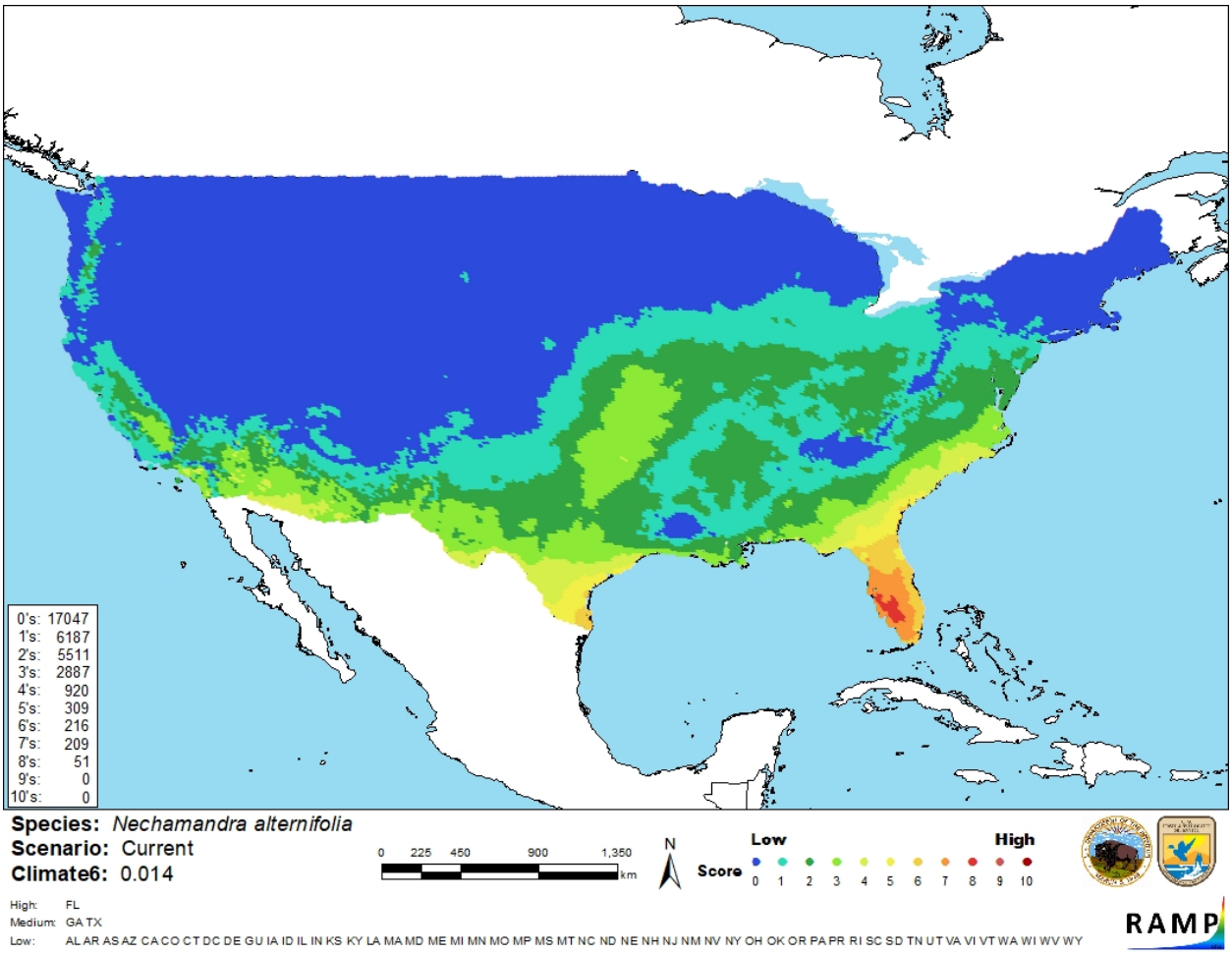


Figure 3. Map of RAMP (Sanders et al. 2018) climate matches for *Nechamandra alternifolia* in the contiguous United States based on source locations reported by Ito et al. (2009), Niroula and Singh (2010), Das et al. (2013), Ito (2013), Panda et al. (2016), Saha et al. (2017), GBIF Secretariat (2020), and Kumar et al. (2020). Counts of climate match scores are tabulated on the left. 0 = Lowest match, 10 = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: (Count of target points with climate scores 6-10)/ (Count of all target points)	Overall Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

8 Certainty of Assessment

Some information was available regarding the distribution and biology of *Nechamandra alternifolia*, but information regarding native distribution was somewhat unclear. Some taxonomic uncertainty has led to their being many synonyms in use for this species. No records

of any impacts of introductions or interactions were recorded. With limited and sometimes confusing information regarding introductions, distribution, and taxonomy, the certainty of assessment is Low.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Nechamandra alternifolia, Indian oxygen-weed, is a submersed aquatic plant native to freshwater systems of India and Southeast Asia. There is some disagreement as to if the species is native to the entirety of the southern Asian range or just to the eastern or western parts. It is recorded as present in Sudan. There was no information found regarding any impacts from the species' presence in Sudan, making the history of invasiveness Data Deficient. This species has not been reported in the United States, but is listed as a Class 1, prohibited aquatic plant in the state of Florida. The overall climate match for the contiguous United States was Medium, with an area of high match in Florida, and areas of medium match occurring along the border with Mexico, the Gulf Coast of Texas, and the southeastern coast. The certainty of assessment is Low due to a lack of information on impacts, limited information on introductions and contradictory information on native distribution, and taxonomic confusion. The overall risk assessment category for this species is Uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 4): Data Deficient**
- **Overall Climate Match Category (Sec. 7): Medium**
- **Certainty of Assessment (Sec. 8): Low**
- **Remarks/Important additional information: None**
- **Overall Risk Assessment Category: Uncertain**

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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