Minnesota Noxious Weed Risk Assessment

Developed by the Minnesota Noxious Weed Advisory Committee

Assessment Information

Common Name: Castor Bean, Castor Oil Plant, Palm of Christ/*Palma Christi*

Scientific Name: *Ricinus communis* L. (the only species in the monotypic genus *Ricinus*; synonyms – *Croton spinosus*, *Cataputia major*, *Cataputia minor*, and many synonyms with a variety of species epithets within the genus *Ricinus* including *Ricinus africanus*, *Ricinus atropurpureus*, *Ricinus compactus*, *Ricinus giganteus*, *Ricinus glaucus*, *Ricinus hybridus*, *Ricinus inermis*, *Ricinus japonicus*, Ricinus laevis, *Ricinus macrocarpus*, *Ricinus microcarpus*, *Ricinus perennis*, *Ricinus rugosus*, *Ricinus speciosus*, *Ricinus viridis*, *Ricinus vulgaris*, and others, many of which also show up as variety (var.), subspecies (subsp.), and forma (f.) names in synonyms for *Ricinus communis*.

Family Name: Euphorbiaceae (Spurge Family)

Current reviewer name and organizational affiliation: James Calkins, Minnesota Nursery and Landscape Association (MNLA)
Date of current review: August 9, 2021

Species Description

Photographs

Photo Caption: Castor bean (*Ricinus communis*) plant. Photo Credit: John D. Byrd, Mississippi State University, Bugwood.org.

Photo Caption: Castor bean (*Ricinus communis*) flowers. Photo Credit: Pancrat; Wikimedia Commons – File: Ricinus communis fleurs.jpg - Wikimedia Commons.

Photo Caption: Castor bean (*Ricinus communis*) fruits (capsules). Photo Credit: John D. Byrd, Mississippi State University, Bugwood.org.

Photo Caption: Castor bean (*Ricinus communis*) seeds. Photo Credit: Steve Hurst, hosted by the USDA-NRCS PLANTS Database.

Why the Plant is Being Assessed

- Castor bean (*Ricinus communis* L.) has not been documented as an escape in Minnesota but is commonly sold as seed or transplants and grown as an annual in containers and in garden beds in designed landscapes in Minnesota and similar and warmer climates; the species has been reported as an escape in the southern United States and warmer regions of the world outside its native range; regulated as an invasive species in Florida (EDDMapS). Some references also say castor bean is regulated in California but it is not on the CA noxious weed list (CDFA Weed Pest Ratings (ca.gov)) although the species is regulated by the city of Hayward, CA, which prohibits the possession of castor bean plants and seeds and the planting of castor beans by municipal code.
- Given that castor bean is not cold hardy in Minnesota (the species is only cold hardy to USDA Hardiness Zone 9), the primary concern associated with castor bean in Minnesota appears to be that all parts of the plant, and especially the seeds, are toxic (poisonous); the primary toxin is ricin (seeds), but several other toxic compounds are also present.
- Interestingly, relative to the difference between an invasive species and a noxious weed, since castor bean is not cold hardy in Minnesota and, therefore, cannot escape cultivation, it could not be considered an invasive species in Minnesota but might be categorized as a noxious weed as a consequence of the toxicity of its seeds based on the federal and state definitions of a noxious weed. The federal definition of a noxious weed is "any plant or plant product that can directly or indirectly injure or cause damage to crops, livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment" (Title IV – Plant Protection Act;) and the Minnesota definition of a noxious weed is "an annual, biennial, or perennial plant that the commissioner designates to be injurious to public health, the environment, public roads, crops, livestock, or other property (Minnesota Noxious Weed Law Statute 18.77).
- Contact with castor bean sap and pollen is a potent allergen (Friedman et al. 2019).
- The possession, transfer, or use of ricin is prohibited in the United States under the Public Health Security and Bioterrorism Preparedness Act (2002) because it is a potential weapon of biological

terrorism (Category B Bioterrorism Agent) and chemical warfare (Schedule Number 1 Chemical Warfare Agent. (CDC 2018), but there are no federal regulations restricting the possession of castor bean plants.

Identification, Biology, and Life Cycle

- Castor bean (*Ricinus communis* L.) is a member of the Euphorbiaceae (Spurge Family) and is native to northeastern Africa, the Middle East, and western Asia (Brickell and Zuk 1997). The species is typically monecious and self-fertile with separate, apetalous male and female flowers produced in terminal clusters (racemes) on the same plant with the male flowers produced at the base and female flowers borne at the tips of the clusters and all plants are capable of reproducing sexually by seed; the fruit is a spherical, spiny, reddish-brown capsule (a 3-segmented schizocarp) that explosively dehisces to disseminate the seeds around the parent plant.
- Castor bean is a fast growing, herbaceous, evergreen perennial with hollow stems that become semi-woody over time in frost-free climates; plants can reach 9.1-12.2 meters (30-40 feet) in height with a spread of 3.7-4.6 meters (12-15 feet) where native and in warm climates but typically only reach a height and width of about 1.2-1.8 meters (4-6 feet) and 0.9 meter (3 feet), respectively (but can sometimes grow as tall as 3.0 meters/10 feet), in cold temperate climates like Minnesota's climate where they are grown as annuals (Brickell and Zuk 1997).
- Plants have a tropical appearance with large, alternate, glossy, deeply-cut, toothed, palmately-lobed leaves that are generally round in outline and 15-45 cm (6-18 inches) long and wide with 5 to 12 lobes and the distal lobes longer than the proximal lobes (Brickell and Zuk 1997); no look-alike species are found in Minnesota while schefflera (*Schefflera* spp.; various common names), although it has palmately compound leaves, and Japanese aralia (*Fatsia japonica*; also called glossy-leaf paper plant, fatsia, paperplant, and false castor oil plant), tropical species that are sometimes sold as house plants, are probably the closest in appearance but, like castor bean, cannot survive a Minnesota winter outdoors.
- Foliage, stem, flower, and fruit color is variable from green to various shades of reddish maroon to scarlet based on the genetics of individual plants and as a result of cultivar selection; there are at least 250 cultivars that have been selected for landscape use and the commercial production of castor oil.
- Plants reproduce exclusively by seed and although the common name castor bean suggests the seeds are beans, they are not beans given that castor bean is not a member of the Fabaceae (Pea/Bean Family); the seeds are smooth and shiny, oblong-rounded, about 1.6 cm () long and 1.0 cm () wide, and mottled and are often described as looking like engorged ticks – in fact, the genus name *Ricinus* is the Latin name for "tick" (Friedman et al. 2019).

Current Distribution

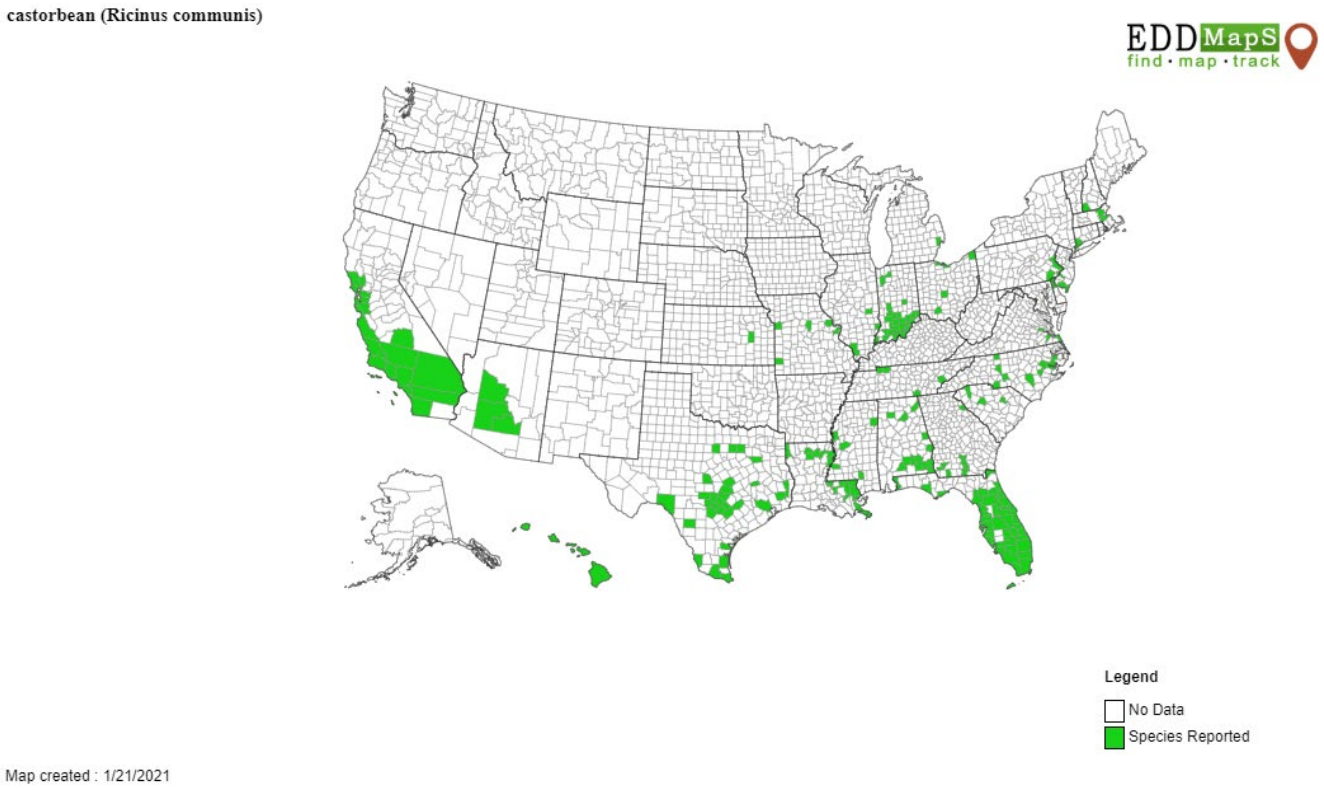

Image caption: Reports of castor bean at the county level (EDDMapS 2021a). Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at EDDMapS. Accessed January 18, 2021.

Current Regulation

Ricinus communis is not currently regulated as a noxious weed or invasive species in Minnesota. Ricin, a toxic compound is regulated by the federal government, but the plant is not regulated at the federal level.

Risk Assessment

Box 1:

Is the plant species or genotype non-native?

Answer: Yes
Outcome: Go to Box 3
Ricinus communis is not native to Minnesota; it is native to northeastern Africa and western Asia (Brickell and Zuk 1997).

Box 2:

Does the species pose significant human or livestock concerns or have the potential to significantly harm agricultural production?

Question 2A: Does the plant have toxic qualities that pose a significant risk to livestock, wildlife, or people?

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

All parts of the castor bean plant are toxic to humans and other animals; poisonous if ingested and exposure to the sap can cause an allergic reaction; castor bean pollen is also a significant allergen (Friedman et al. 2019). This said, among all types of plant poisonings, human cases of ricin poisoning are rare and the fatality rate is low based on modern supportive care (around 1.8%), except for suicide cases where a ricin-containing extract is injected.

Question 2B: Does the plant cause significant financial losses associated with decreased yields, reduced quality, or increased production costs?

Outcome: Decision tree does not direct to this question.

Box 3:

Is the species, or a related species, documented as being a problem elsewhere?

Answer: Yes

Outcome: Go to Box 6

Castor bean has become naturalized worldwide in areas with a warm climate and has escaped and become problematic in these areas but is only regulated as an invasive species by the city of Hayward, CA, which prohibits the possession of castor bean plants and seeds and the planting of castor beans by municipal code (City of Haywood, California 2021). Although castor bean is sometimes referenced as being regulated as an invasive species in California and Florida, the species is listed as a species with a rating of "Limited" (*These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.*) by the California Invasive Plant Council (Cal-IPC) but is not listed as an invasive species by the California Department of Food and Agriculture (CDFA) (Cal-IPC 2021a; Cal-IPC 2021b) and is listed as a Category II invasive species by the Florida Invasive Species Council (FISC) (Florida Invasive Species Council 2019) but is not on the Florida noxious weed list (Florida Department of State 2020).

Box 4:

Are the species' life history and growth requirements understood?

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Outcome: Decision tree does not direct to this question.

Box 5:

Gather and evaluate further information

Outcome: Decision tree does not direct to this question.

Box 6:

Does the species have the capacity to establish and survive in Minnesota?

Question 6A: Is the plant, or a close relative, currently established in Minnesota?

Answer: No.
Outcome: Go to Question 6B
Although castor bean can survive, flower, and set fruit during the summer in cold temperate climates like Minnesota's and is commonly grown as an annual in designed landscapes, no evidence has been found that indicates the species is established outside of cultivation in Minnesota or is able to survive a Minnesota winter.

Question 6B: Has the plant become established in areas having a climate and growing conditions similar to those found in Minnesota?

Answer: No.
Outcome: Go to Question 6C
Castor bean plants are only cold hardy to USDA Cold Hardiness Zones 9-10 (average minimum temperatures of 20 to 40° F); plants are not top-hardy in Zone 9 (average minimum temperature of 20° F), but resprouting may occur in the spring with protection; seeds may survive the winter in Zone 8 (10° F; SFGATE).

Question 6C: Has the plant become established in areas having a climate and growing conditions similar to those projected to be present in Minnesota under future climate projections?

Answer: No.
Outcome: THE SPECIES IS NOT BELIEVED TO BE A RISK.
Castor bean cannot survive on its own in Minnesota because the species is only cold hardy to USDA Hardiness Zones 9 to 10 (average minimum temperatures of 20 to 40° F) and it is unlikely that the Minnesota climate would warm this much in the near future (20-40 years; 2040-2060) based on climate shift modeling (EDDMapS 2021b; see map included in the Appendix).

Box 7:

Does the species have the potential to reproduce and spread in Minnesota?

Question 7A: Are there cultivars of the plant that are known to differ in reproductive properties from the species?

Outcome: Decision tree does not direct to this question

Question 7B: Does the plant reproduce by asexual/vegetative means?

Outcome: Decision tree does not direct to this question

Question 7C: Are the asexual propagules - vegetative parts having the capacity to develop into new plants - effectively dispersed to new areas?

Outcome: Decision tree does not direct to this question

Question 7D: Does the plant produce large amounts of viable, cold hardy seeds? For woody species, document the average age the species produces viable seed.

Outcome: Decision tree does not direct to this question

Question 7E: For species that produce low numbers of viable seeds, do they have a high level of seed/seedling vigor or remain viable for an extended period (seed bank)?

Outcome: Decision tree does not direct to this question

Question 7F: Is the plant self-fertile?

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Castor bean plants are monecious with separate, unisexual male and female flowers and are wind pollinated and self-fertile (Rojas-Sandoval and Acevedo-Rodríguez 2014).

Question 7G: Are sexual propagules – viable seeds – effectively dispersed to new areas? List and consider all vectors.

Outcome: Decision tree does not direct to this question

Question 7H: Can the species hybridize with native species (or other introduced species) and produce viable seed and fertile offspring in the absence of human intervention?

Outcome: Decision tree does not direct to this question

Question 7I: Do natural controls, species native to Minnesota, which have been documented to effectively prevent the spread of the species in question?

Outcome: Decision tree does not direct to this question

Question 7J: Was the answer to Question 7A (Are there cultivars that differ in reproductive properties from the original species) "Yes"?

Outcome: Decision tree does not direct to this question

Box 8:

Does the species pose significant human or livestock concerns or have the potential to significantly harm agricultural production, native ecosystems, or managed landscapes?

Question 8A: Does the plant have toxic qualities, or other detrimental qualities, that pose a significant risk to livestock, wildlife, or people?

Outcome: Decision tree does not direct to this question

Question 8B: Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?

Outcome: Decision tree does not direct to this question

Question 8C: Can the plant aggressively displace native species through competition (including allelopathic effects)?

Outcome: Decision tree does not direct to this question

Question 8D: Can the plant hybridize with native species resulting in a modified gene pool and potentially negative impacts on native populations?

Outcome: Decision tree does not direct to this question

Question 8E: Does the plant have the potential to change native ecosystems (adds a vegetative layer, affects ground or surface water levels, etc.)?

Outcome: Decision tree does not direct to this question

Question 8F: Does the plant have the potential to introduce or harbor another pest or serve as an alternate host?
Outcome: Decision tree does not direct to this question

Box 9:

Does the species have clearly defined benefits that outweigh associated negative impacts?

Question 9A: Is the plant currently being used or produced and/or sold in Minnesota or native to Minnesota?
Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
Caster bean is sold as seed and young plants in Minnesota and seeds are sold online. There are several botanical varieties and at least 250 named cultivars (Ovenden et al. 2009) that have been selected for oil production and based on size (dwarf to large), form (upright to spreading), and foliage and immature seed capsule color and caster bean is planted as an annual in the ground and in containers in designed landscapes.

Question 9B: Is the plant an introduced species and can its spread be effectively and easily prevented or controlled, or its negative impacts minimized, through carefully designed and executed management practices?
Outcome: Decision tree does not direct to this question

Question 9C: Is the plant native to Minnesota?
Outcome: Decision tree does not direct to this question

Question 9D: Is a non-invasive, alternative plant material or cultivar commercially available that could serve the same purpose as the plant of concern?
Outcome: Decision tree does not direct to this question

Question 9E: Does the plant benefit Minnesota to a greater extent than the negative impacts identified at Box #8?
Outcome: Decision tree does not direct to this question

Box 10:

Should the species be regulated as Prohibited/Eradicate, Prohibited/Control, or Restricted Noxious Weed?

Question 10A: Is the plant currently established in Minnesota?
Outcome: Decision tree does not direct to this question

Question 10B: Would prohibiting this species in trade prevent the likelihood of introduction and/or establishment?
Outcome: Decision tree does not direct to this question

Question 10C: Does this risk assessment support this species being a top priority for statewide eradication if found in the state?
Outcome: Decision tree does not direct to this question

Question 10D: Does the plant pose a serious human health threat?
Outcome: Decision tree does not direct to this question

Question 10E: Is the health threat posed by the plant serious enough, and is the plant distribution sufficiently small enough to be manageable, and are management tools available and effective enough to justify listing as Prohibited / Eradicate species?
Outcome: Decision tree does not direct to this question

Question 10F: Is the plant known to cause significant ecological or economic harm and can the plant be reliably <u>eradicated</u> (entire plant) on a statewide basis using existing practices and available resources considering the distribution, reproductive biology and potential for spread?

- *For distribution, note if the distribution is well documented, the number and acreage of known infestations and how widespread they are in the state. Note if there are infestations in border areas.*
- *For reproductive biology, note if there are reproductive biology factor that make the plant easier to control and eradication more likely (for example, long pre-reproductive period, self-incompatible pollination, short-lived seed bank).*
- *For potential for spread and re-invasion of controlled areas, note its potential to spread beyond places where it is being controlled such as deliberate planting by people, wildlife vectors, re-infestation from border states, or other factors that facilitate spread.*
- *For known management tools, note what management tools are available, potential non-target impacts, and the reasonableness of state management or mandating that landowners throughout the state use the management tools to eradicate or control existing plants.*
- *For available resources, consider the capacity of state and local personnel and availability of funding to respond to new and existing infestations.*

Outcome: Decision tree does not direct to this question

Question 10G: Is the plant known to cause significant ecological or economic harm and can the plant be reliably <u>controlled</u> to limit spread on a statewide basis using existing practices and available resources? Would the economic impacts or other hardships incurred in implementing control measures be reasonable considering any ongoing or potential future increase of ecological or economic harm?

- *Also consider all bullet points listed under 10F when evaluating 10G*

Outcome: Decision tree does not direct to this question

Question 10H: Would prohibiting this species in trade have any significant or measurable impact to limit or reduce the existing populations or future spread of the species in Minnesota?
Outcome: Decision tree does not direct to this question

Question 10I: Are there any other measures that could be put in place as Special Regulations which could mitigate the impact of the species within Minnesota?
Answer:
Outcome: Decision tree does not direct to this question

Box 11:

The species is being proposed to be designated as a Specially Regulated Plant. What are the specific regulations proposed?

Answer: Decision tree does not direct to this question

Final Recommendations of Risk Assessment (2021)

NWAC Listing Subcommittee

Outcome: Because castor bean (*Ricinus communis*) is only cold hardy to USDA Hardiness Zones 9 to 10 (average minimum temperatures of 20 to 40° F) the species is not believed to be a risk; do not list castor bean as a noxious weed (no regulation).
Comments:

NWAC Full Committee

Outcome: Do not list
Comments: The vote was 16-0 in favor and 1 abstained regarding the recommendation.

MDA Commissioner

Outcome: Do not list
Comments: No comments

Risk Assessment Current Summary (8-9-2021)

- Castor bean (*Ricinis communis*) is not currently regulated in Minnesota but was petitioned for review in response to its toxic characteristics.
- Like many native and introduced plants, castor bean can be toxic if ingested but the risk is minimal and regulation is not justified based on toxicity alone given the level of risk.
- Because castor bean (*Ricinus communis*) is only cold hardy to USDA Hardiness Zones 9 to 10 (average minimum temperatures of 20 to 40° F) and cannot survive outside of cultivation, the species is not believed to be a risk as an invasive species; do not list castor bean as a noxious weed (no regulation).

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Appendix

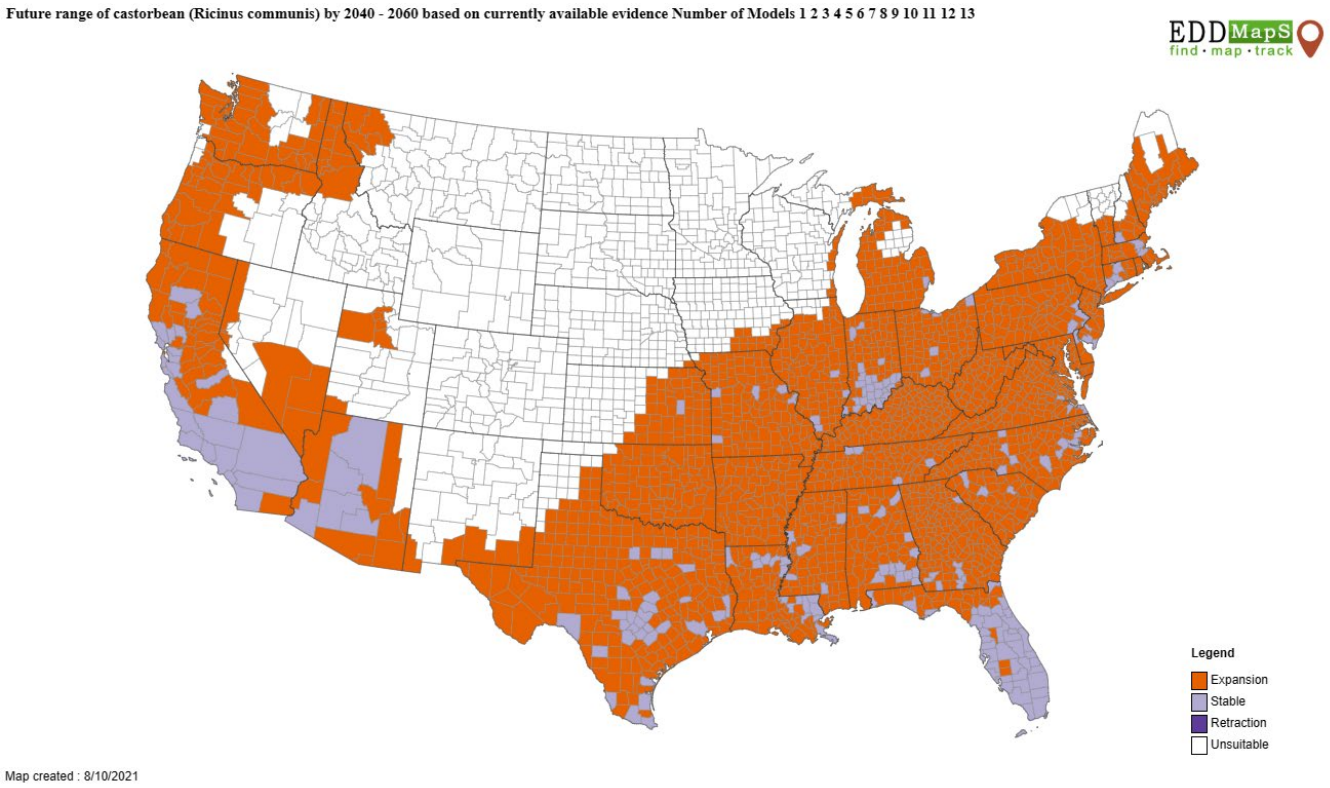

Image caption: Potential county level range for castor bean (*Ricinus communis*) by 2040-2060 based on the modeled range-shift impacts of current climate change trends (EDDMapS 2021b).