

# NYBG

FIELD GUIDE TO THE ASH TREES OF  
NORTHEASTERN UNITED STATES

NEW YORK BOTANICAL GARDEN



## Field Guide to the Ash Trees of Northeastern United States

Daniel Atha and Brian Boom

Center for Conservation Strategy  
The New York Botanical Garden  
2900 Southern Boulevard  
Bronx, NY 10458

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## PREFACE

The Ash genus (*Fraxinus*) is one of the largest genera of trees in North America. Ash species may comprise up to 60 percent of total tree diameter in forests of the northeastern United States. White Ash (*Fraxinus americana*) in particular is a keystone species, providing food and habitat for numerous organisms from birds and mammals to insects and microorganisms. The wood is economically important, useful for its strength and resiliency, particularly in sporting equipment such as baseball bats. Ashes are widely planted as street trees throughout North America.

Remarkably, for such a large, important group of trees, there is no consensus on the exact number of species that occur in North America (or worldwide). Estimates range from 15 to 25 species for North America and from 40 to 50 worldwide. Research impediments include the fact that the plants take years to reach reproductive maturity, they are dioecious (male and female flowers on different trees), and there are few discrete morphological characters by which to define the species.

Unfortunately, Ash trees are threatened worldwide; in Europe primarily by a fungal disease and in North America by the Emerald Ash Borer (EAB), a metallic-green colored beetle first discovered in North America near Detroit in 2002 that is moving rapidly eastward through New York and New England. The beetle larvae burrow under the tree's bark, creating extensive tunnels that disrupt the flow of water and nutrients throughout the tree. Mortality is nearly 100 percent and all North American Ash species are likely susceptible to EAB infestation and death. The authors and their collaborators seek to develop a robust taxonomic framework of North American Ash trees, focusing first on the complicated New York and New England species, and this field guide is offered as a non-technical means to identify Ash species in the forests of this region.

Fortunately, EAB-resistant Ash breeding programs are underway and showing signs of progress, such as the program at the Northern Research Station of the U.S. Forest Service. Citizen scientists can help this effort by being on the lookout for Ash trees that may have natural resistance to the EAB, the so-called "lingering Ash." This field guide is designed to provide an easy means to learn the species of Ash trees occurring in the northeastern U.S. With heightened awareness of Ash tree diversity in our northeastern forests will come greater chances of discovering EAB-resistant trees, and a brighter future for Ashes in the region and throughout North America.

While the emphasis in this field guide is identification through pictures of the bark, leaves, twigs, and fruits, a dichotomous key is provided on page 5 for those readers inclined to use it in conjunction with the photographs. Botanical terminology has been minimized as much as possible; readers having questions can refer to the glossary at the end of this book, which is based on an excellent online resource (Mori, S. A. & N. P. Smith. 2012 onward. The New York Botanical Garden's glossary for vascular plants [<http://sweetgum.nybg.org/science/glossary/>]. Virtual Herbarium of The New York Botanical Garden, Bronx, New York). At the end of each species description in this field guide, the conservation status of that species is indicated, per The IUCN Red List of Threatened Species™ (<http://www.iucnredlist.org/>).



## ***Fraxinus***

Ash (Oleaceae, Olive Family)

Trees or rarely shrubs, the bark usually thick and furrowed, sometimes smooth or scaly. Leaves opposite, odd-pinnately compound or rarely simple. Inflorescences in axillary panicles usually borne on twigs of the previous season. Flowers usually reduced and wind pollinated; calyx short-tubular, deciduous or persistent; petals usually 0, rarely 2–4. Fruit a single-seeded samara. The genus consists of about 45 species, widely distributed in the Northern Hemisphere in forest edges, light-gaps, and swamps. Only specimens with leaves and fruit can be used to identify Ash species with a high degree of confidence.

### **Key to the Identification of *Fraxinus* Species in Northeastern United States and Adjacent Canada**

1. Twigs sharply 4-angled; flowers perfect.....*Fraxinus quadrangulata* (p. 20)
1. Twigs terete, not sharply angled; flowers polygamous or dioecious.
  2. Petiolules (at least some of them) 0.5–2 cm long, the blades not decurrent to the base.
    3. Leaflet abaxials whitened (with minute waxy papillae).
      4. Twigs usually glabrous; leaflets chartaceous.....*Fraxinus americana* (p. 6)
      4. Twigs usually pubescent; leaflets coriaceous.....*Fraxinus biltmoreana* (p. 8)
    3. Leaflet abaxials pale green.
      5. Samara wing extending to base of fruit; calyx < 2 mm long.....*Fraxinus caroliniana* (p. 10)
      5. Samara wing not extending to base of fruit; calyx > 2 mm long.....*Fraxinus profunda* (p. 18)
  2. Petiolules (most or all) 0–0.5 cm long, the blades decurrent nearly to or completely to the base.
    6. Samara wing not extending to base of fruit.....*Fraxinus pennsylvanica* (p. 16)
    6. Samara wing extending to base of fruit.
      7. Leaflets 5–7; calyx persistent.....*Fraxinus caroliniana* (p. 10)
      7. Leaflets (7–) 9–13; calyx deciduous.
        8. Axillary buds brown; leaflets sessile with a dense tuft of hair at junction with rachis.....*Fraxinus nigra* (p. 14)
        8. Axillary buds black; leaflets sessile or short-petiolulate without a dense tuft of hair at junction of rachis.....*Fraxinus excelsior* (p. 12)

## *Fraxinus americana* L.

White Ash

Tree to nearly 40 m tall with a massive trunk to 2 m diameter; bark rough, the ridges and furrows forming prominent diamond pattern; twigs and rachis essentially glabrous, the leaf scar crescent-shaped with tapering, curled tips; leaves 20–40 cm long, the leaflets 7–9, ovate or lanceolate, 10–15 × 6–10 cm, chartaceous, whitened below, crenate or toothed; samaras 2.5–5 cm long and 3–6 mm wide, the wing extending less than 1/3 length of the plump, cylindrical seed body; calyx persistent. This is the largest Ash of the northeastern U.S. White Ash is characterized by the usually glabrous twigs and thin leaflets, whitened beneath. White Ash usually grows in rich, moist upland soils of uplands and lowlands. IUCN Status: Critically Endangered.



Bark

20 cm



Leaf

20 cm



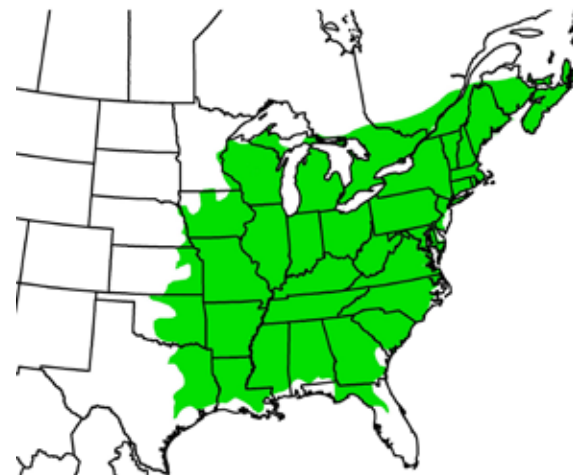
Twig

10 cm



Fruit

4.5 cm



## *Fraxinus biltmoreana* Beadl.

Biltmore Ash

Tree 8 to 35 m tall; bark rough, the ridges and furrows forming diamond pattern; twigs and rachis usually pubescent, the leaf scar usually crescent-shaped; leaves 20–30 cm long, the leaflets 7–9, ovate-lanceolate, 7–12 × 3–7 cm, coriaceous, whitened below, entire or shallow crenate; samaras 3.3–5.5 cm long and 6–8 mm wide, the wing extending less than 1/3 length of the plump, cylindrical seed body; calyx persistent. Biltmore Ash has densely pubescent twigs and thick leathery leaves, whitened beneath. It usually grows in upland, sandy soils. IUCN Status: Not Assessed.



Bark

20 cm



Leaf

20 cm



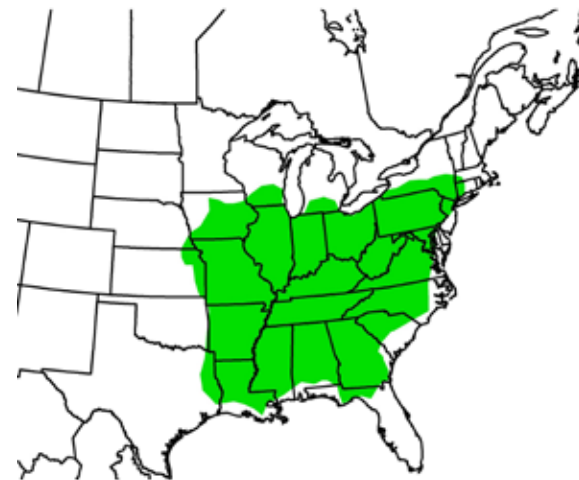
Twig

10 cm



Fruit

5 cm



## *Fraxinus caroliniana* Mill.

Water Ash

Tree to about 10 m tall, often multi-stemmed; bark scaly, light gray, not deeply furrowed; twigs glabrous, the leaf scar shield-shaped; leaves 12–40 cm long, the leaflets 5–7, lanceolate, ovate-lanceolate or elliptic, 4–12 × 2–3 cm, chartaceous, pale green below, margins serrate to crenulate distally; samaras 3.5–5.5 cm long and 11–20 mm wide, the wing extending to the base of the fruit, the calyx persistent. Water Ash is the smallest of the northeastern Ash species and grows in swamps and wet woods. IUCN Status: Endangered.



Bark

20 cm



Leaf

20 cm



Twig

10 cm



Fruit

5 cm



## *Fraxinus excelsior* L.

European Ash

Tree to about 18 m tall; bark smooth at first, becoming longitudinally furrowed; twigs glabrous, the leaf scar shield-shaped (flat above); leaves 18–30 cm long, the leaflets 9–13, elliptic, 6–9 × 1.5–2.5 cm, chartaceous, pale green below, margins toothed; samaras 2.5–5 cm long and 5–7 mm wide, the wing extending along the entire flat seed body, the calyx deciduous. The buds of European Ash are exceptionally large and jet black, making it easy to identify, even without leaves or fruit. It is native to Europe and is increasingly escaped in disturbed sites. IUCN Status: Not Assessed.



Bark

20 cm



Leaf

20 cm



Twig

10 cm



Fruit

5 cm





## *Fraxinus nigra* Marshall

Black Ash

Tree to about 20 m tall with a slender trunk to 60 cm diameter, rarely larger; bark corky, becoming longitudinally furrowed and scaly with age; twigs glabrous, the leaf scar shield-shaped (flat above); leaves 25–40 cm long, the leaflets usually 9 (7–13), oblong, 9–14 × 2.8–4.5 cm, chartaceous, pale green below, margins finely toothed; samaras 2.5–4.5 cm long and 6–8 mm wide, the wing extending along the entire flat seed body, the calyx deciduous. Black Ash has rough, corky bark and large leaves that resemble those of Walnuts. It grows in cold, forested swamps. IUCN Status: Critically Endangered.



Bark

20 cm



Leaf

20 cm



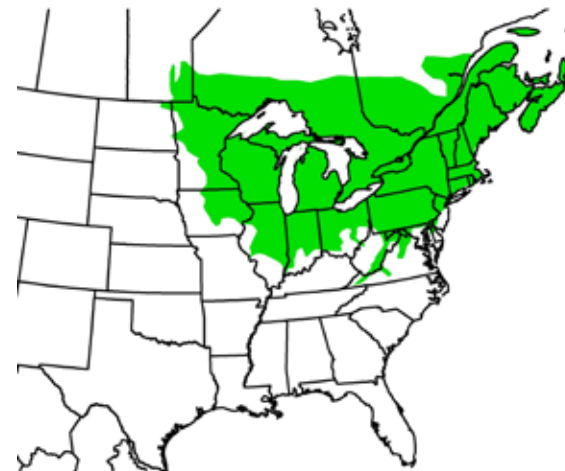
Twig

10 cm



Fruit

5 cm



## *Fraxinus pennsylvanica* Marshall

Green Ash, Red Ash

Tree to about 20 m tall and rarely exceeding 50 cm diameter; bark rough, with narrow ridges forming prominent diamond pattern; twigs glabrous or pubescent, the hairs red or white, the leaf scars shield-shaped ( $\pm$  flat above); leaves 10–25 cm long, the leaflets 5–7, ovate, ovate-lanceolate or elliptic, 3.5–12  $\times$  1.5–4 cm, chartaceous to subcoriaceous, pale green below, margins usually crenate or toothed, rarely entire; samaras 2–6 cm long and 3–6 mm wide, the wing extending  $> 1/3$  the length of the slender seed body, the calyx persistent. Green Ash has the widest geographic range of North American Ash species and is extremely variable in pubescence, leaf, and fruit characters. It usually grows in moist or dry upland soils. IUCN Status: Critically Endangered.



Bark

20 cm



Leaf

20 cm



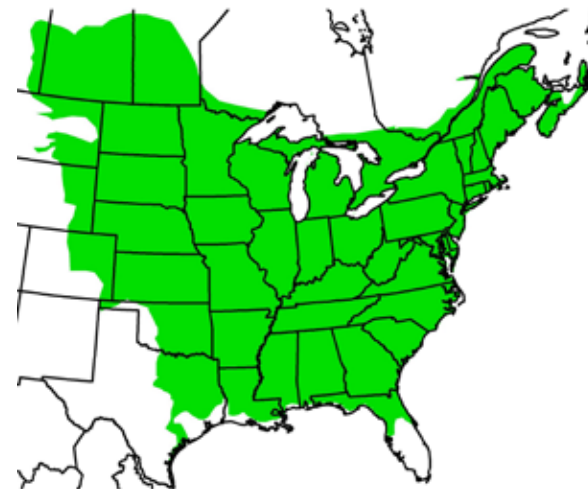
Twig

10 cm



Fruit

5 cm



## *Fraxinus profunda* (Bush) Bush

Pumpkin Ash

Tree to 35 m tall and 2 m diameter, the trunk often swollen at the base; bark rough, forming rectangular blocks, the irregular furrows deep and only vaguely diamond patterned; twigs densely pubescent or rarely glabrous, the leaf scars crescent-shaped (curved above); leaves 25–50 cm long, the leaflets 7–9, ovate-lanceolate, 10–20 × 4–8 cm, coriaceous, pale green below, margins essentially entire; samaras 5.5–8 cm long and 7–12 mm wide, the wing extending > 1/3 length of the tapered fruit body, the calyx persistent, 2–5 mm long. Pumpkin Ash has the largest fruit of any Ash species. It is found in swamp forests and wet depressions. IUCN Status: Critically Endangered.



Bark

20 cm



Leaf

20 cm



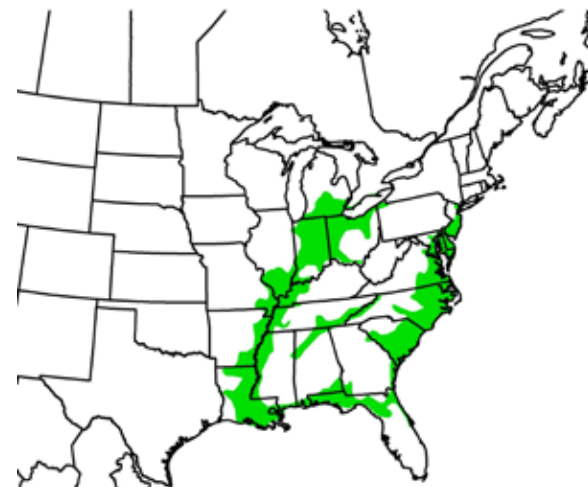
Twig

10 cm



Fruit

6 cm



## *Fraxinus quadrangulata* Michx.

Blue Ash

Tree 20–30 m tall; bark becoming rough and scaly, forming longitudinal plates; twigs glabrous, 4-angled, the leaf scar crescent-shaped; leaves 18–30 cm long, the leaflets 7–11, ovate to lanceolate, 6–13 × 2.5–4.5 cm, chartaceous, pale green below, margins serrate; samaras 3–4 cm long and 8–12 mm wide, the wing extending along the entire length of the flat seed body, the calyx deciduous. Blue Ash is distinctive in the Northeast for the 4-angled twigs. It grows on dry uplands, usually on limestone. IUCN Status: Critically Endangered.



Bark

20 cm



Leaf

20 cm



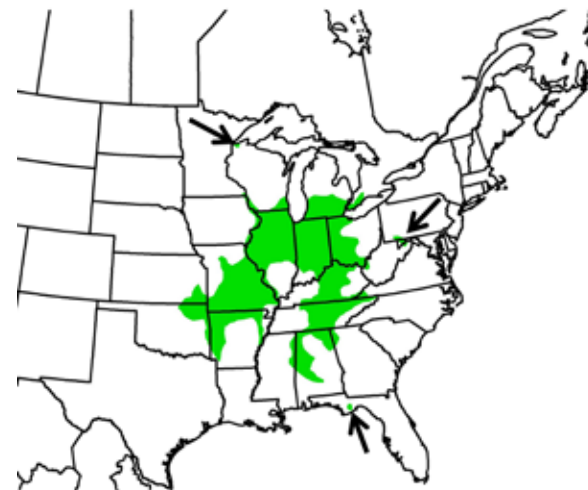
Twig

10 cm



Fruit

5 cm





## IMAGE SOURCES

Images are vouchered by indicated specimens, deposited in the William and Lynda Steere Herbarium of The New York Botanical Garden. Specimens may be viewed at <http://sweetgum.nybg.org/science/vh/>. Fruit vouchers in images are listed from left to right. Photographs (© The New York Botanical Garden) by J.N. Campbell or D. Atha.

Cover: *Fraxinus pennsylvanica*, The New York Botanical Garden, Bronx, New York, 17 August 2017. D. Atha 15990.

Page 2: *Fraxinus pennsylvanica*, Prospect Park, Brooklyn, New York, 11 June 2017. iNaturalist observation, <https://www.inaturalist.org/observations/6608949>.

Page 4: *Fraxinus pennsylvanica* and Erik Danielsen, Goethals Pond Complex, Staten Island, New York, 18 July 2017. D. Atha 15967.

Pages 6–7: *Fraxinus americana*  
Bark, twig, leaf: J.N. Campbell 2016.09-14.  
Fruit: C.A. Weatherby 7036; S.B. Jones 23521; J. Fowler s.n.; J.K. Small s.n.

Pages 8–9: *Fraxinus biltmoreana*  
Bark, twig, leaf: J.N. Campbell 2016.09-06.  
Fruit: J.N. Campbell 2016.09.94; M. Nee 62594; Biltmore 4049a; J.W. Taylor s.n.

Pages 10–11: *Fraxinus caroliniana*  
Bark, twig, leaf: J.N. Campbell 2017.08-08.  
Fruit: S.B. Jones 13682; J.N. Campbell 2016.09.61; J. Ewan s.n.; D.S. Correll 13340.

Pages 12–13: *Fraxinus excelsior*  
Bark, twig, leaf: D. Atha 15976.  
Fruit: F. MacKeever 436; D. Demaree 9270; E.P. Bicknell 7036; M. Nee 57187.

Pages 14–15: *Fraxinus nigra*  
Bark, twig, leaf: J.N. Campbell 2017.07-01.  
Fruit: H.C. Hovey 6891; I.C. Martindale s.n.; A. Commons s.n.; K.K. MacKenzie 853.

Pages 16–17: *Fraxinus pennsylvanica*  
Bark, twig, leaf: J.N. Campbell 2016.09-13.  
Fruit: M. Nee 55886; M.L. Fernald 13995; R.R. Haynes 7960; D. Atha 6787.

Pages 18–19: *Fraxinus profunda*  
Bark, twig, leaf: J.N. Campbell 2016.09-05.  
Fruit: S.R. Hill 32041; D. Atha 15843; H. Kurz s.n.; D. Atha 15841.

Pages 20–21: *Fraxinus quadrangulata*  
Bark, twig, leaf: J.N. Campbell 2016.09-15.  
Fruit: F. Brendel s.n.; L.M. Umbach s.n.; H.N. Patterson s.n.; J.N. Campbell 2016.09.15.

Page 22: *Fraxinus profunda*, The New York Botanical Garden, Bronx, New York, 10 September 2016. *D. Atha* 6810.

Page 24: *Fraxinus profunda*, Central Park, New York, New York, 21 April 2017. *D. Atha* 15792.

Back Cover: *Fraxinus biltmoreana*, University of Kentucky, Lexington, Kentucky, 25 September 2016. *J.N. Campbell* 2016.09-06.



## SELECTED GLOSSARY

Based on Mori, S. A. & N. P. Smith. 2012 onward. The New York Botanical Garden's glossary for vascular plants (<http://sweetgum.nybg.org/science/glossary/>). Virtual Herbarium of The New York Botanical Garden, Bronx, New York.

**Abaxial (leaves):** Referring to the side of an organ situated away from the axis, i.e., the morphologically lower surface of a leaf.

**Axillary:** Arising from an axil, e.g., an axillary bud arising in the axil between the stem and the petiole.

**Calyx:** The outer circle or first whorl of floral parts; a collective term for the sepals.

**Chartaceous:** Having the texture of a thick paper.

**Coriaceous:** Having the texture of leather.

**Crenate:** Referring to a leaf blade margin with teeth rounded at the apex. Compare with serrate.

**Crenulate:** Referring to margins with the teeth rounded at the apex. Compare with serrate.

**Crescent-shaped (leaf scar):** A plane shape similar to the moon in its first quarter.

**Deciduous:** A process in which certain structures of a plant, e.g., leaves, fall in response to environmental changes.

**Decurrent:** Referring to a leaf blade base that extends down the petiole.

**Dioecious:** Describing a sexual condition of a species that bears only functionally staminate flowers on some plants and only functionally pistillate flowers on other plants.

**Distal:** Remote from the place of attachment.

**Elliptic:** Referring to the outline of essentially two-dimensional structures, such as leaves, bracts, petals, and sepals, which are widest at or near the middle. Elliptic shapes are divided based on their length-width ratios. An elliptic shape has a length-to-width ratio from 2:1 to less than 3:1.

**Flower:** The reproductive part of a plant, usually consisting of sepals, petals, stamens, and carpels.

**Fruit:** In the flowering plants, the ripened ovary or the seed-bearing organ of a plant.

**Glabrous:** Smooth, devoid of trichomes (hairs).

**Inflorescence:** The structure in which the flower or flowers are displayed on a plant.

**Lanceolate:** Referring to a leaf, sepal, petal, or other flat structure that is wider at the base than at the midpoint, tapers toward the apex, and has a length-to-width ratio of 3:1 or more.

**Leaf:** A green, expanded structure usually consisting of a petiole and a blade but sometimes without a petiole in which photosynthesis takes place. When a petiole is absent the leaf is called sessile.

**Leaf scar:** The scar left on a stem when a leaf falls.

**Leaflet:** A division of a compound leaf.

**Oblong:** Referring to a two-dimensional shape in which the greatest width extends throughout a middle zone at least one-third the length of the blade (in this zone the margins are more-or-less parallel) and the length-to-width ratio is 2:1 to less than 3:1. Other types of oblong shapes are determined by the length-to-width ratio.

**Odd-pinnately compound:** Pinnate with an uneven number of leaflets, i.e., with a terminal leaflet. Same as odd pinnate.

**Ovate:** Referring to a leaf, sepal, petal, or other flat structure that is wider at the base than at the midpoint, tapers toward the apex, and has a length-to-width ratio of 1.5:1 to less than 2:1.

**Panicle:** A compound inflorescence in which the primary branches give rise to secondary branches, which in turn give rise to stalked flowers.

**Papillae:** Minute, rounded protuberances that may cover a surface, e.g., the abaxial leaf blade surface.

**Perfect:** Referring to a flower that possesses both male (staminate) and female (pistillate) organs.

**Persistent:** Referring to a structure that remains attached. Opposite of deciduous.

**Petal:** An outermost segment of the corolla.

**Petiolule:** The stalk of a leaflet. Several different orders of petiolules may exist in leaves twice or more compound; those in a palmately compound leaf radiate from a common central point.

**Pinnately compound:** Bearing leaflets along a common axis or rachis.

**Polygamous:** Referring to the sexual condition of a species that bears bisexual and unisexual flowers on the same plant, e.g., an andromonoecious plant (with male [staminate] and female [pistillate] species is one example of a polygamous species).

**Pubescent:** Referring to plants with some or all of their parts covered with trichomes (hairs).

**Rachis:** The primary axis of a compound leaf or compound inflorescence.

**Samara:** An indehiscent, winged fruit; e.g., those of *Acer* spp. and *Fraxinus* spp.

**Serrate:** Leaf blades with margins with sharp teeth oriented toward the apex.

**Subcoriaceous:** Having a somewhat leathery texture.

**Terete:** Circular in transverse section.

**Toothed:** Having teeth.

## ABOUT

Center for Conservation Strategy at  
The New York Botanical Garden

The mission of the Center for Conservation Strategy (CCS) is to maximize the reach and impact of The New York Botanical Garden's scientific programs and catalyze conservation action that will help save the plants of the world. The driving force behind the CCS's mission is NYBG's commitment to stimulate conservation *action* that will help mitigate Earth's biodiversity crisis.

[nybg.org/ccs](http://nybg.org/ccs)



