



The ARNOLD
ARBORETUM
of HARVARD UNIVERSITY



Tree Spotters Phenophase Guide



1199*J
1251-79*B
1251-79*A
1251-79*E
1199*D

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds									
	Increasing Leaf Size									
	Leaves									
	Colored Leaves Falling Leaves									
	Flower Buds Open Flowers Pollen Release		Fruits Ripe Fruits							



The ARNOLD
ARBORETUM
of HARVARD UNIVERSITY



Table of Contents

- Breaking leaf buds.....3
- Leaves.....4
- Increasing leaf Size.....5
- Colored leaves.....6
- Falling leaves.....7
- Flowers or flower buds.....8
- Open flowers.....9
- Pollen release.....10
- Fruits.....11
- Ripe Fruits.....12
- Recent fruit drop.....13

Appendices

- Appendix A: Dormant Buds.....14
- Appendix B: Addenda.....15

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds										
	Increasing Leaf Size				Leaves			Colored Leaves Falling Leaves			
	Flower Buds Open Flowers Pollen Release		Fruits Ripe Fruits								



Breaking leaf buds

Description

- One or more breaking leaf buds are visible on the tree.
- A leaf bud is considered breaking once a leaf tip is visible at the end of the bud, but before the first leaf from the bud has unfolded to expose the petiole (leafstalk).



Look for

Green leaf tip visible at the end of the bud.



Clarification

- Leaf buds break *after* the flower buds appear.
- Cone-like female flowers stand erect on twigs, with leaves emerging at their base.
- Leaves also emerge along the stems and at the tips.



Note

- Continue to report breaking leaf buds throughout the season.

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds			Leaves						
	Increasing Leaf Size			Colored Leaves Falling Leaves						
	Flower Buds Open Flowers Pollen Release		Fruits Ripe Fruits							



Leaves

Description

- One or more live, unfolded leaves are visible on the tree.
- A leaf is considered unfolded once its entire length has emerged from a breaking bud, stem node, or growing stem tip, so that the petiole is visible at its point of attachment to the stem.
- Young leaves are yellow-green, opening after the flowers.



Look for

Petiole visible at the point at which it is attached to the stem.

Clarification

- Continue to report leaves from the time you see your first unfolded leaf until there are no leaves left on the tree.
- Do *not* include fully dried or dead leaves.

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds			Leaves						
	Increasing Leaf Size			Colored Leaves Falling Leaves						
	Flower Buds Open Flowers Pollen Release		Fruits Ripe Fruits							



Increasing leaf size

Description

A majority of leaves on the tree have not yet reached their full size and are still growing larger.

Look for

Many leaves that are still growing.

Clarification

- Increasing leaf size begins with the first unfolded leaf and ends when over 50 % of leaves from that first flush have expanded to their full mature size.
- As they expand, leaves will often gradually change color from a lighter to a darker green and also might change from a soft, thin texture to a tougher mature texture.
- Do *not* include new leaves that may emerge at the ends of elongating stems throughout the growing season.



Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds			Leaves						
	Increasing Leaf Size				Colored Leaves Falling Leaves					
	Flower Buds Open Flowers Pollen Release									
					Fruits Ripe Fruits					



Colored leaves

Description

One or more leaves that:

- Show typical late-season yellow color.
- Are yellow or brown due to drought or other stresses.

Typical late season color
November 13, 2016



Look for

Leaves that are turning yellow or have turned yellow.

Clarification

Do make a note in the comments field when leaves are yellow or brown due to stress.

ssp. deltoides

Stressed leaves
July 20, 2016



Do *not* include:

- Small spots of color due to minor leaf damage.
- Dieback on branches that have broken.
- Fully dried or dead leaves that remain on the tree.

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds			Leaves							
	Increasing Leaf Size			Colored Leaves Falling Leaves							
	Flower Buds Open Flowers Pollen Release										
					Fruits Ripe Fruits						



The ARNOLD
ARBORETUM
of HARVARD UNIVERSITY



Falling leaves

Description

One or more leaves are falling or have recently fallen from the tree since your last observation.

Look for
Colored leaves on the ground.



Clarification

- Summer wind storms often cause a few handfuls of healthy green leaves to fall. Do *not* report these as “Falling leaves”.
- Leaves may stop falling during a spell of mild weather. Report “No” to “Falling leaves” if none appeared to fall from the tree since your last observation, even if you previously reported “Yes”.

Note

- Your last “Yes” observation of the season will likely be “Yes” to “Falling leaves”: No leaves are left on the tree, but you observe leaves on the ground that were not there on your previous visit.

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds									
	Increasing Leaf Size									
	Leaves									
	Colored Leaves Falling Leaves									
	Fruits Ripe Fruits									



Flowers or flower buds

Description

- One or more fresh open or unopened female/male catkins are visible on the tree.
- Include only those catkins that are swelling or expanding.

Look for

- Female flower buds that are pointed and upright.
- Male flower buds that are brownish yellow and appear at the ends of twigs in groups of 2-5.

Clarification

- The female catkin is cone-like, with leafy scales and remains erect. Once the female flowers wilt, the green catkin grows thicker as the fruits develop.
- The male catkin, which formed the previous summer, is compact, stiff, and reddish brown when dormant. In the spring, it swells, turns golden, unfolds, and lengthens as flower buds mature.
- Do not count dormant buds. (See Appendix A for more information.)



April 17, 2017



April 20, 2017



April 27, 2017

Female catkins



April 18, 2017

Male catkins



April 17, 2017

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds			Leaves							
	Increasing Leaf Size				Colored Leaves						Falling Leaves
	Flower Buds		Open Flowers		Fruits		Ripe Fruits				
	Pollen Release										



The **ARNOLD**
ARBORETUM
of HARVARD UNIVERSITY



Open flowers

Description

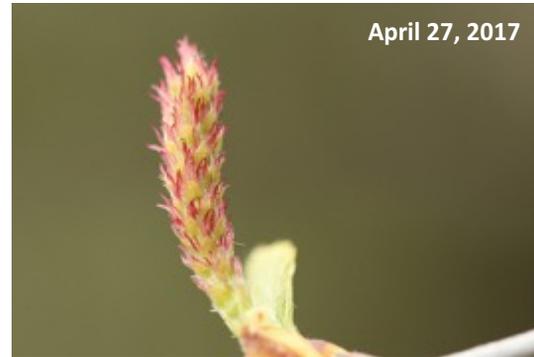
- One or more open, fresh flowers are visible on the tree.
- Female flowers are considered open when the pistils (the female reproductive parts) are visible.
- Male flowers are considered open when the stamens (the male reproductive parts) are visible between or within unfolded/open flower parts.

Look for

Visible reproductive parts: pistils within the female cones and stamens within the unfolded male catkins.

Clarification

- Female flowers will be very difficult to see. (A hand lens and/or binoculars will help.)
- The male flowers open once the initially compact catkin has unfolded and is hanging loosely.
- Do not include wilted or dried flowers.



Open female flowers



Open male flowers

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds									
	Increasing Leaf Size									
	Leaves									
	Colored Leaves Falling Leaves									
	Fruits Ripe Fruits									
	Flower Buds Open Flowers Pollen Release									



The ARNOLD
ARBORETUM
of HARVARD UNIVERSITY



Pollen release

Description

- One or more male flowers on the plant release visible pollen grains when gently shaken or blown into your palm or onto a dark surface
- A cloud of pollen can be seen in the air when the wind blows.



Look for

Pollen grains on male flowers.

Note

- Bring along a piece of black paper and gently shake a male catkin above it to dislodge the pollen.

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds			Leaves							
	Increasing Leaf Size			Colored Leaves Falling Leaves							
	Flower Buds Open Flowers Pollen Release										
				Fruits Ripe Fruits							



The ARNOLD
ARBORETUM
of HARVARD UNIVERSITY



Fruits

Description

- One or more maturing or mature cone-like catkins are visible on the tree.
- The fruits are small winged nutlets hidden within the catkins. A single catkin will contain many nutlets.

Look for

The female catkin turning color once the flowers have faded.



Clarification

- As the catkin matures, it changes from green to dark brown and opens to expose the winged nutlets, which are borne on 3-lobed hairy scales.
- Do not include empty catkins that have already dropped all their nutlets.



Developing fruit

Note

- The fruits of the River birch ripen and drop from the trees in the spring and are rapidly dispersed.

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds			Leaves							
	Increasing Leaf Size			Colored Leaves Falling Leaves							
	Flower Buds Open Flowers Pollen Release										
				Fruits Ripe Fruits							



Ripe fruits

Description

- One or more cones containing ripe fruit are visible on the tree. Mature catkins change from green to dark brown and open to expose the ripe fruit.
- The fruit is a very tiny hairy winged nutlet, borne on 3-lobed hairy scales hidden within the cone-like catkin. As the nutlet ripens, it turns light brown and readily drops when the catkin is touched.



Look for

Small tan or light brown winged nutlets on 3-lobed scales within mature cones.

Clarification

- Do not include empty catkins that have already dispersed all their nutlets.

Note

- The fruits of the River birch mature in late spring, in contrast to the Yellow birch, whose fruits mature in the fall and often stay on the tree over the winter.



Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds			Leaves							
	Increasing Leaf Size				Colored Leaves						Falling Leaves
	Flower Buds		Open Flowers		Pollen Release						
				Fruits		Ripe Fruits					



Recent fruit drop

Description

- One or more ripe fruits are visible on the the ground. The fruit, a tiny tan or light brown winged nutlet, may have separated from the catkin or it may still be hidden inside it.

Look for

Small winged nutlets, alone or within ripe (typically dark brown) cone-like catkins that are lying on the ground.



Clarification

- Do not include obviously immature fruits that have dropped before ripening, such as in a heavy rain or wind.
- Do not include empty catkins (i.e., those that have opened and dispersed all of their nutlets).

Note

- Because the fruits are brown, very small, and easily blown away, we suggest you come as often as possible once the fruit ripens in order to observe this phenophase.

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds			Leaves						
	Increasing Leaf Size			Colored Leaves Falling Leaves						
	Flower Buds Open Flowers Pollen Release		Fruits Ripe Fruits							



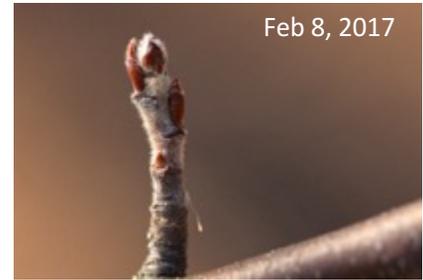
Appendix A: Dormant Buds

Description

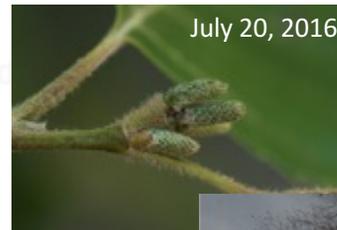
- The inconspicuous female flower buds form laterally in spur-shoots along the branches. They are erect and usually flanked by leaf buds that become more apparent as spring progresses.
- During the summer, after the seeds have dispersed, male flower buds appear at twig tips in clusters of 3 – 5. They turn from green to brown as they elongate and are clearly visible on the tree during the winter.

Note

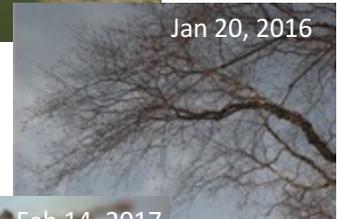
- At this time we are not officially observing dormant buds, but if you are interested in the development of the *Betula nigra* flowers over the course of the year, feel free to include those observations in the Comments section of the “Flowers or flower buds” phenophase.



Dormant female flower bud flanked by two leaf buds



July 20, 2016



Jan 20, 2016



Feb 14, 2017

Dormant male flower buds

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds									
	Increasing Leaf Size									
	Leaves									
	Colored Leaves Falling Leaves									
	Fruits Ripe Fruits									
	Flower Buds Open Flowers Pollen Release		Fruits Ripe Fruits							



Appendix B: Addenda

Credits

- Phenophase Guide Team: Betsey Henkels, Karen Owens Linehan, Suzanne Mrozak, and Julie Whelan
- Photos: Unless otherwise noted, all photos were taken by Karen Owens Linehan or Suzanne Mrozak

References

- The Genus *Betula*: A Taxonomic Revision of Birches by Kenneth Ashburner and Hugh A. McAllister
- [NPN *Betula nigra* species profile](#) ssp. deltoides
- [NPN Phenophase Primer for Plants \(Current draft\)](#)
- USDA Plants Database: <http://plants.usda.gov/>

Questions, Comments, Suggestions?

- Email TreeSpotters@fas.harvard.edu

Species	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
 River Birch <i>Betula nigra</i>	Breaking Leaf Buds			Leaves							
	Increasing Leaf Size				Colored Leaves						Falling Leaves
	Flower Buds Open Flowers Pollen Release										
				Fruits Ripe Fruits							