

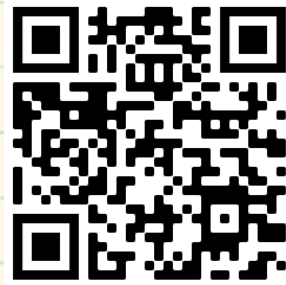
WE NEED YOUR HELP!



We are glad to provide these materials for free. In order for us to continue receiving funding for new materials, we need to collect information on how they are used.

Thank you for taking the time to answer the following one-minute survey.

There are three ways to complete the survey:



- 1** Scan this code with your smartphone camera
- 2** Type the following link into your web browser:
<https://plantheroes.org/educator-survey>
- 3** Email your answers to:
plantheroes@publicgardens.org



- 1) Job title
- 2) Name of organization you belong to
- 3) What kind of educator are you?
 - Teacher
 - Summer camp counselor
 - Home schooler
 - Public garden educator
 - Informal educator
 - Other (please describe)
- 4) What grade level do you teach?
 - Elementary (K-5)
 - Middle School (6-8)
 - High School (9-12)
 - Other (please describe)
- 5) Specify what subject area you teach:
 - Science
 - Math
 - Language Arts
 - Social Studies
 - Other (please describe)
- 6) How many students do you teach in a school year?



Help the Plant Heroes protect our forests
by slowing the spread of pests and diseases!

ARMILLARIA SHOESTRING ROOT ROT

PLANTHEROES.ORG
ADVANCED
ACTIVITY
BOOK



BE A PLANT HERO!
Help the Plant Heroes
slow the spread of
the Armillaria
Shoestring Root Rot!



Plant
Protection
Program

AMERICAN PUBLIC GARDENS ASSOCIATION

Untangling the Mystery of Shoestring Root Rot



SUMMER BREAK has been great and the Plant Heroes (Aponi, Frankie, Laura and Nate) have been busy, but before starting the new school year they meet up for their annual camping trip reunion! After they pitch the tents, they start exploring the rest of the surrounding clearing and nearby forest...

Aponi discovers big clusters of honey-brown mushrooms growing and sprouting out of several old stumps.



Nate finds a few fallen trees nearby, some snapped near the base and others with roots pulled out of the ground.



Laura sees some trees around the edge of the clearing that are clearly dead but still standing.



Laura chips some bark off of one and, underneath, finds some freshly decayed wood that is unusually white. Curious, she uses her hatchet to chop out a few pieces and puts them in a plastic bag in her backpack.

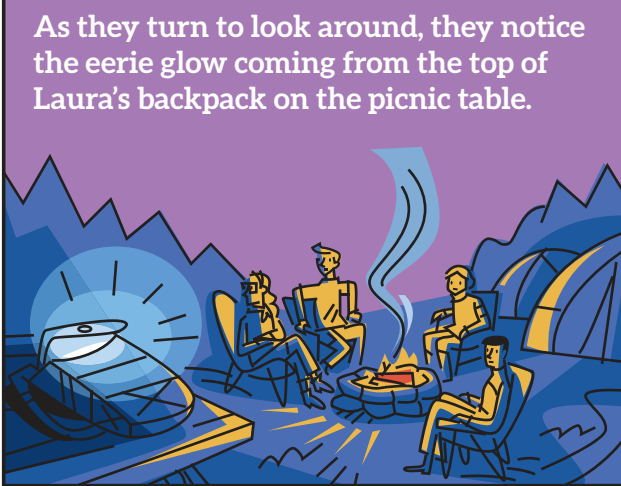


Frankie is practicing his climbing skills on some trees just outside the clearing and notices that a few have some yellowing needles and dead tips.

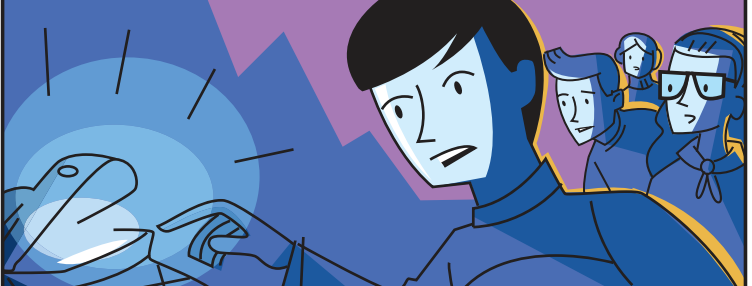
**Over the campfire that evening...
the Heroes trade stories about what each of them saw and where.**



Pretty quickly they see the pattern ... trees in the middle of the clearing have been dead the longest and that whatever killed them is **GROWING INTO THE FOREST!**

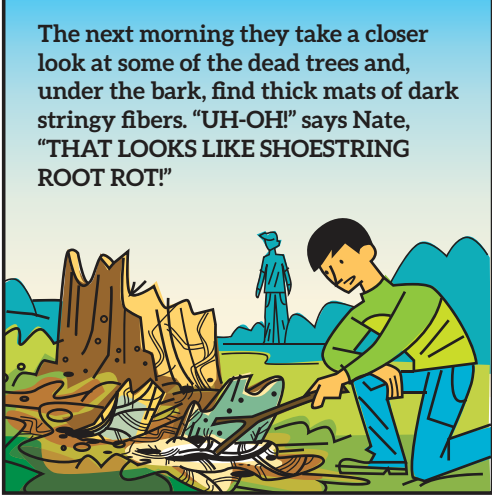


As they turn to look around, they notice the eerie glow coming from the top of Laura's backpack on the picnic table.



THAT'S FOXFIRE!

Nate explains to the others that he's heard lots of different kinds of fungi glow but that some of them are **REALLY BAD** for the forest and they need to try to find out what kind it is.



The next morning they take a closer look at some of the dead trees and, under the bark, find thick mats of dark stringy fibers. "UH-OH!" says Nate, "THAT LOOKS LIKE SHOESTRING ROOT ROT!"



The Heroes rush to the park headquarters and tell the local forester what they've seen. She runs some tests to be sure and then brings in excavators to remove all of the dead and dying trees. It's a mess, but at least they've stopped the fungus from spreading further into the woods!

After all the stumps are gone, the Heroes help restore the forest by replanting the area with trees that are resistant to the fungus.





Name _____

Date _____

Complete the maze and then find the words. The words can only be found along your maze path.

Find and circle these words:

Canker
Spores
Armillaria

Fungus
Mycellium
Rhizomorphs

Infested
Dispersal
Pathogen

BFCWMHWC PBTDRLLHMGPAOBVYXS FVBHBMGRUXDABWNJXV TYHDXJXY YUFUNGUSH
 U O P R
 D U F W
 M C H M
 WLUOJMLOQPSJBCWFNEQSO OAVEN S QWQWWMOTA J FANNY F
 V J X Y S V A
 V J F A R G Q
 J E D F H A O ►END
 N SFMVNQOOK G U F V J E QBNXX I P S P O R E S A C B O I P Y B
 N E G S Z A B Q V B
 W T G U O R B D B F
 N J H K M M R S X F
 S K X AMNCKCPATHOGENVEAWGO O I H TUMQE A B
 U H D R L B M J
 START ► L L B P L L L E
 J I X H A Q M Y
 V MCANKERCF J KM KEMNVSE QCTHS R N SILXGFKPFRMDH
 I I H Y F I L T
 I N N C L A G Q
 D F V E T G O V
 FCCXUHI AW EYNOHTWJT L CELTSBHGV PBQW VAFSDIUGWULVF T
 F S S L O U H Q S
 U T F I P J I R J
 S E L U I I J U U
 B GKODMIRFD X J M H O A Q SNPOA P C W
 D Y O X W V N
 B K A U F N U
 B H X S M A N
 UKDTEPDISPERSALB XBDODVPMWYUFSDDKDKCPFLFUFVXTPPSBKJRAYVEXFPYBM



GAMES!

Learn more and test your knowledge with interactive games on plantheroes.org



Name _____

Date _____

Curvy Words

Oh, no! The letters from 10 words have been curved and hidden in the puzzle. A curved word may start anywhere in the puzzle. It can then move in any direction. Once a word has used a square in the puzzle, that word may not re-use the same square. But another word is allowed to re-use squares from other words.

Inoculum
Genus
Conifer

Host
Armillaria
Mushroom
Reforestation

Hardwood
Resistance
Dieback

U	R	E	S	T	A	T	I	O	N	D	E
C	L	O	T	G	K	C	N	K	K	K	R
O	U	F	R	I	M	A	E	M	O	T	B
N	M	E	C	U	A	E	C	N	A	T	S
I	I	N	B	I	G	D	O	O	W	M	I
A	D	E	R	A	L	O	N	A	D	R	S
M	R	A	O	D	C	U	B	H	R	E	N
I	L	W	F	L	M	K	S	U	L	A	O
L	C	H	M	O	O	R	H	G	I	H	R
O	N	I	E	B	U	S	W	L	A	D	H
I	F	F	R	N	U	E	O	T	O	N	A
S	T	E	G	W	E	G	S	H	F	F	S



GAMES!

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Name _____

Date _____

Complete the maze and then find the words. The words can only be found along your maze path.

Find and circle these words:

- | | | |
|----------|-----------------|------------|
| Species | Resistance | Armillaria |
| Mushroom | Bioluminescence | Host |
| Conifer | Hardwood | Inoculum |
| Dieback | Genus | |

END ◀

```

HQDPQFJARYACQMEJLJWIJRXTXXRQOJHJYDHNFLXRJLJLTTXHUQRCJDSKLTFOVTOXECEVEFRXKWRJNDFFLFF
I      V      C      R      H      T      R      V      W
N      H      H      I      J      P      Q      X      O      P
I  EOMJXHA  C  RAVX  XPWA  W  PUKAMUX  E  YXXBFWLJQQ  Q  NOIU  N  U  G  F  ONTT  P
      Y      L  A      O  L      F  I      O  N      P  W
      D      N  Q      Y  W      V  J      Q      L      S  T
F  QHCMYXBKOSOHWLGQULPGI  UPJKHKSBSJ  EBXPSIYNXOGAOEVDYYI  MPLENTGVBKQKCLEJBNT  W
X  O      W      N      O      V      W      O      C  E      M
Q  W      R      V      R      S      U      O      I  L      G
H  F  NCDQ  SHYT  B  B  B  J  DJIW  U  FJBAMBXSJYRGCWUK  NXIAKVUXXO  D  X  DFBAXHW
X  M  F      P      M  O  G  J  E      U      M      Q      Y  A
A  U  R      I      F      E  I  C      H      Q      B      F      F  V
C  S  V  N  T  KFEDRXBIYAORX  X  OFWXXKIL  ROIB  LGRB  HFBH  W  K  RLXT  XLRENCW  E
U  H  S  D  X      I      S      R      D      M      P      O  K  J  C  V
S  R  L  P  E      S      R      N      D      D      J      L      N      V      S
P  O  C  G  MXCHKBP  S  WXHFVOXEVPFP  W  R  BSFRXGXDXD  RAYMBTIJFT  I  Q  WVCRWLS
E  O  I  T  S  E  I  H  O  I  G  J  O  O  B
C  M  J  L  K  F  I  C  L  F  J  M  Q  J  N
I  E  L  PXQNCVG  J  U  H  JWLYHBJ  ERDV  L  CTQGATV  X  N  LWKKQQMWGIRUE  ONIU  X
E  H  F      R  D  O  O  H  V  L  A      C      L      J      S  Q
S  M  D      T  W  L  X  C  S  T  F      R  G      Y  X
U  QCTT  OBIE  NXLIBHTLGH  K  HQXCMKAIIW  LYIKKEYRDRYEJTMIST  O  K  R  SFCPGMY  B
K      L  D  P      U      E      I      Q      H
R      A  N  I      C      F      D      D      I      Q      A      D
NRGL  W  A  YXQWSXIMKONVR  XCJY  VDJM  AUII  ESUFUTS  M  M  FEHDDSABYTWACPLQSV  X
P      R      Q      R      F      X  J  N  J  X  X  K  S      I      D      X
B      Q      U      R      D      C      O  K  V  G  N  Q  G  N  B  G  YNA  Y  QCUY  V
D      U      E      N      E  U  C  V  V  K  P  D  R  F  V
B      U      N      J  L  X  V  W  W  J  D  L  V
WKXA  M  F  OBPRTKQPNTIARMILLARIAOSJ  M  U  TVVL  G  MMVOMKD  FCCVLDN  SBMB  H  C
T      X  S  U  H      L  F  M  E  E  D  V  I
F      B  I  A  R      Y  V  Y  P  L  D  Q  B  E  B  G  K
K  UEQESTE  J  D  VEYSFSC  G  GLQSAKO  O  TNBT  BCRESISTANCEA  IEDAQPTKUEJVVHJX  B
U      S  B  B  O  R  L  N  S  A  W  U
U      A  K      Y  V  Y  P  L  D  Q  W  U
MCONIFERNLDNS  SCDC  J  L  RSBW  H  B  IIAHARDWOODGPSUS  C  ABDJ  KODJIERBJRUSQTXL
Q      F      U      U      K      E      L      T      I      V      W      C
K      N      C      URNOVKFCJQFYWYPYVOKKKVLA  XDSK  F  E  T  QFFE  EWURYII  ECKW  B  D
J  O  L  X  R      H      C      C      T  C      D  A  O  R  A  Y  S  I  Q  B
S  M      V  C      H      C      M  K  S  C  A  T  L  O  L  H  C  D
D  P      S  P      N      E      M  K  S  C  A  T  L  O  L  H  C  D
N  USVNONV  RFJJ  J  G  I  P  TFSB  K  G  I  QUMEDAR  B  L  WRYN  X  IYPI  O  M  R
D  P      L  F  I  U  S  T  F  C      O  M  K  J  D  S  I  E  K
W      N      M  G  V  H  T  P  E      D  P  U      B  U      T      Y  E  L  V
O  KIPB  E  H  E  SEHK  M  A  Q  TCTFGAEYKR  N  HLXXRMWYXKVLU  CRHB  TOIH  S  VDWPA
F  E      R      N  P      O  Y  Q  F      R      H      R      G      E      A
F  O      Q      U  B      F      Q  F      S      M      W      D      P      Q      E
O  Y  LLEVEIANCS  Y  DHOLGXHOST  X  Q  Y  YGLOPKTTY  R  CRRXOFD  I  E  WTXWTAI  G
U  T      L      I      D      S      T      D
K  A      E      Y      A      F      O
JUDIVIEORVAJQLHNMKOPLAIJVVYUFQEDMFPUMVDFIUMDDYXUNSTDWEEUGRRDIPLUTEHKVHCHXBPVNVGKKN
  
```

▶ START



GAMES!

Learn more and test your knowledge with interactive games on plantheroes.org



Name _____

Date _____

Find and circle the following words:

**Bioluminescence
Inoculum
Genus**

**Reforestation
Hardwood
Dieback**

**Conifer
Armillaria
Species**

**Mushroom
Resistance
Host**

M E S R A R I T A T S E R O F E R O R C
S M I B I O L U M I N E S C E N C E R I
C A R M I L L A R I E H A R D W O O C C
N D U L B E W L E A H E C O N I F E N L
A N S S U O M N N T N N A D T O U C N C
T D B I O L U M I N E S C E N C R E R I
S U R T G K C A B E I D T R E F I N O C
I W M N I A R L A S C M U S H R O O M G
S U C O C S U T M R M N H S G T S M P I
E E A I S E T M I D M U A A E H C D P I
R A U T N M E A E R U I S T R I A D E A
R C N A E I F R U O L R L H S D C O D O
C S U T N E S R R R U R N L R I W E I L
C A D S I A E N E O C E N U A O S O P A
H O I E E I I S I R O C U I L R O E O S
R R E R I D A R H R N E L C T U I T R D
O S B O E O N O S E I H N M L H C A N B
M N A F I R E O U A R O N O E O H O K O
L I C E P S G E N U S S E C O M I U N E
E S E R R T N B T O T T G N M T N S O I

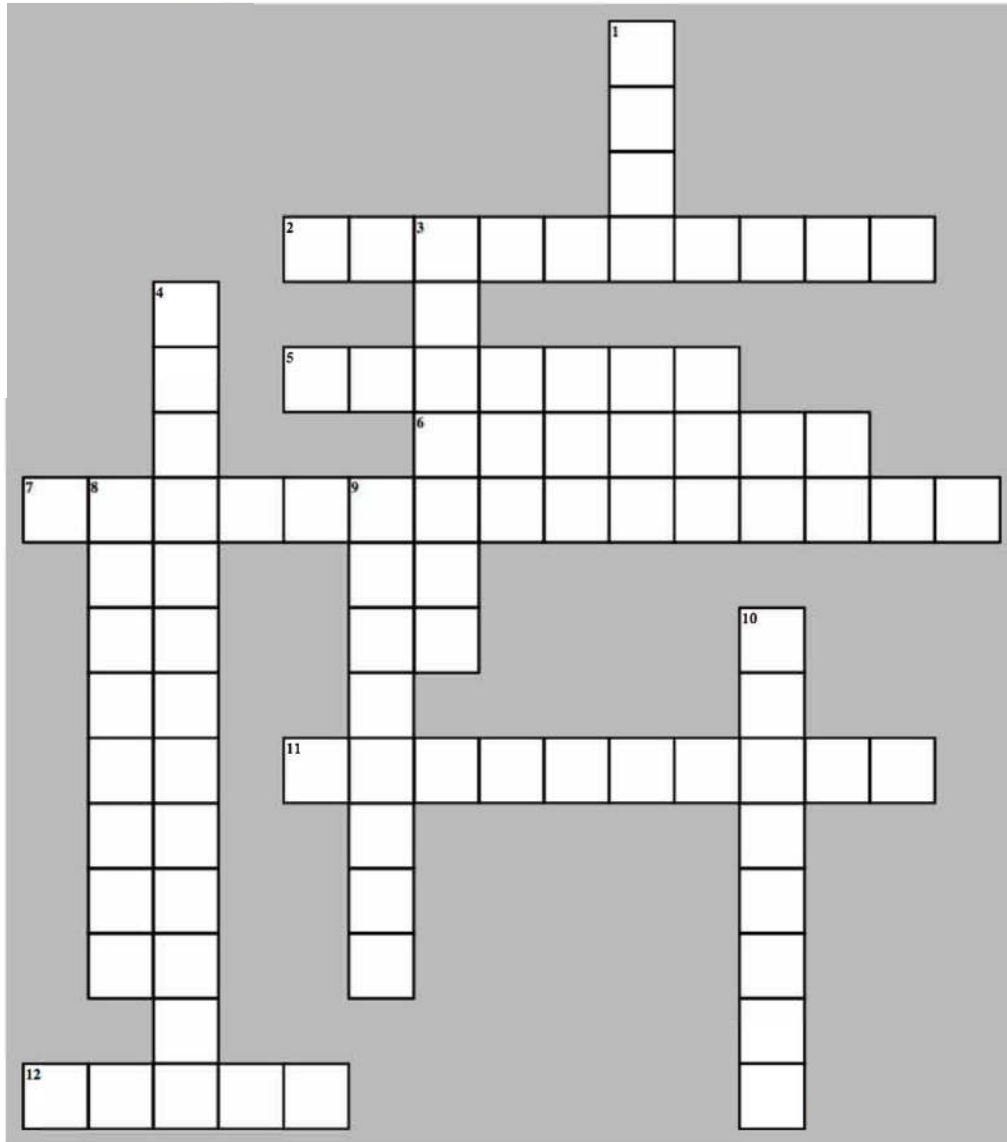


GAMES!

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Complete the Shoestring Root Rot crossword puzzle - look on the next page for clues!



Use the following clues to complete the cross-word puzzle!

Across

2 the ability of an organism to resist harmful influences (such as disease, toxic agents, or infection)

5 a condition in which a tree or shrub begins to die from the tip of its leaves or roots backward, owing to disease or an unfavorable environment

6 a tree that bears cones and evergreen needle-like or scale-like leaves

7 the biochemical emission of light by living organisms such as fireflies and deep-sea fishes

11 a genus of parasitic fungi that live on trees and woody shrubs, can be a destructive forest pathogen. known by the common name "shoestring root-rot"

12 a principal taxonomic category that ranks above species and below family, and is denoted by a capitalized Latin name

Down

1 a living plant or animal on or in which a parasite lives

3 a taxonomic group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding

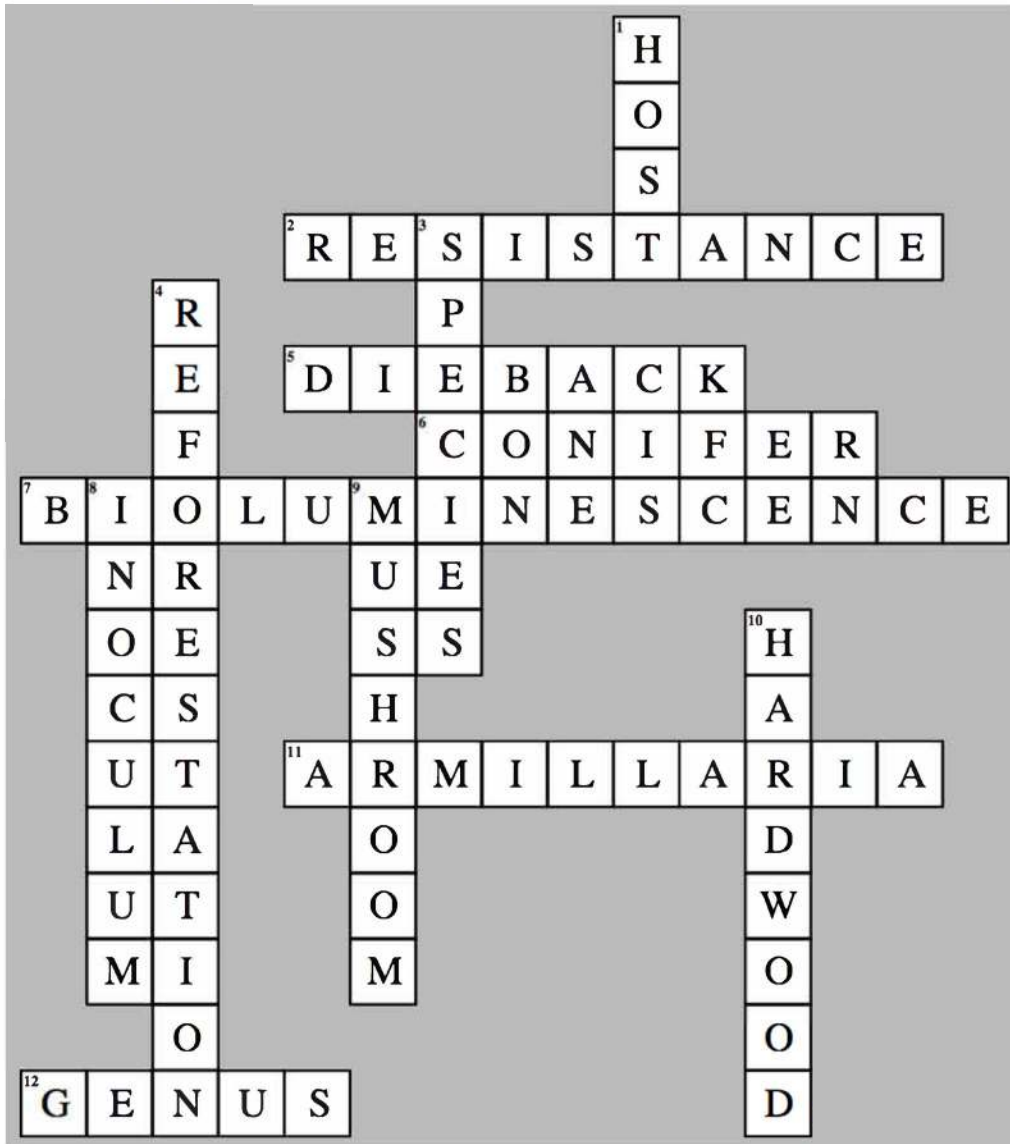
4 the act of planting tree seeds or young trees in an area where there used to be a forest

8 a substance used to introduce a pathogen into a living organism

9 a fungal body that is shaped like an umbrella

10 the wood from a broadleaved tree (such as oak, ash, or beech) as distinguished from that of conifers

Need help? Here are the answers to the crossword puzzle!



Plant Heroes Pledge

This Certifies That

is an Official Member of the Plant Heroes Team and pledges to:

**Learn about the
pests and diseases
that affect the
plants in my region**

**Be on the lookout
for symptoms of
pests and diseases
on trees in my
neighborhood**

**Report any suspicious
findings to an adult
who can notify the
local extension agent**

**Refrain from
moving firewood**

Awarded by the
American Public
Gardens Association





Join our team of Plant Heroes and learn about trees, forests, and the natural world around you!

PLANTHEROES.ORG

You can be a Plant Hero!

Are you curious about plants and animals? Do you like asking questions about nature? Do you enjoy being outdoors and having fun, climbing trees, balancing on logs, or finding a new butterfly or beetle? If so, you are already on your way to becoming a Plant Hero! We invite you to join forces with Nate, Laura, Aponi, and Frankie to protect the plants and ecosystems we all love.

How can you become a Plant Hero?

Join our team and go on a journey with Nate, Aponi, Laura, and Frankie. As a Plant Hero, you will learn to notice when plants are in trouble. You will also find out ways you can act quickly to help find solutions in your own neighborhood. Follow their adventures and learn how they help plants and ecosystems stay healthy.

On the Plant Heroes website, you will find materials to help you learn about plants, forest health, and ecosystem balance. The more you know, the more you can help protect plants and ecosystems in your own yard, neighborhood, and community!

Plant Heroes strives to spark curiosity about nature and science in all children. Our program provides hands-on, nature-based learning materials for educators to engage children in topics of plant health, ecosystem balance, and forest health. We also spotlight the amazing work our public gardens do in protecting the plants and ecosystems we all depend on through our website and printed materials. Visit plantheroes.org today to learn more!

Plant Heroes is brought to you by the American Public Gardens Association, founded in 1940. Over the last eight decades, the Association has supported the work of public gardens in North America and beyond. Our mission is to champion and advance public gardens as leaders, advocates, and innovators in the conservation and appreciation of plants. Our vision is "A world where public gardens are indispensable" as they provide botanic, conservation, community, education, and economic resources to their community.

The Association is committed to increasing the knowledge of public garden professionals throughout North America through information sharing, professional development, networking, public awareness, and research, so that they have the tools to effectively serve visitors and members.



**American
Public Gardens
Association**

PublicGardens.org



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