

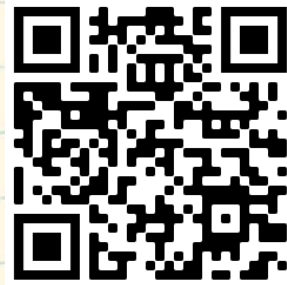
# WE NEED YOUR HELP!



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](mailto: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!

# INSECT | WALNUT TWIG BEEBLE

PLANTHEROES.ORG  
ADVANCED  
ACTIVITY  
BOOK

**Aponi Star**



**BE A PLANT HERO!**  
Help Aponi slow  
the spread of the  
Walnut Twig Beetle!

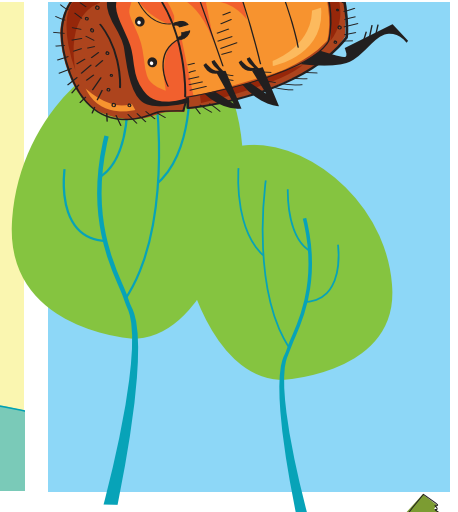


Plant  
Protection  
Program

AMERICAN PUBLIC GARDENS ASSOCIATION



# TO CATCH A THOUSAND CANKERS



**Aponi is spending the summer helping her dad, Ben, remodel their kitchen.**



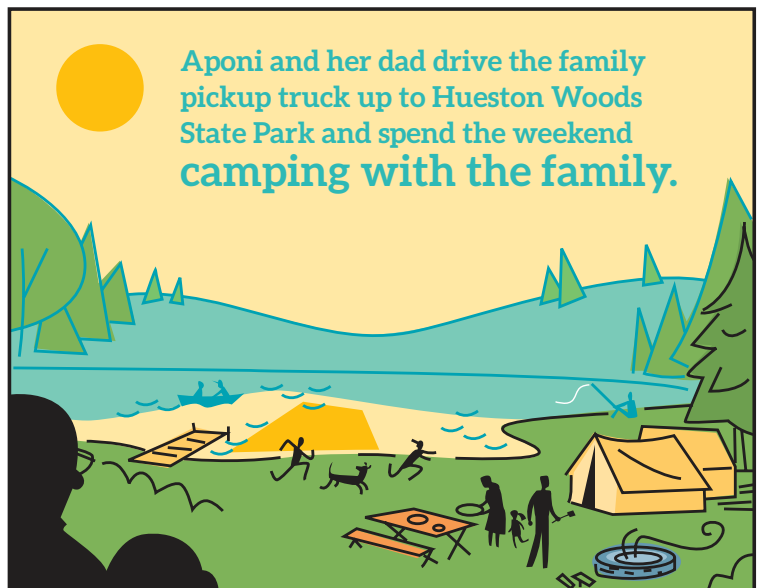
**Ben loves making furniture!**



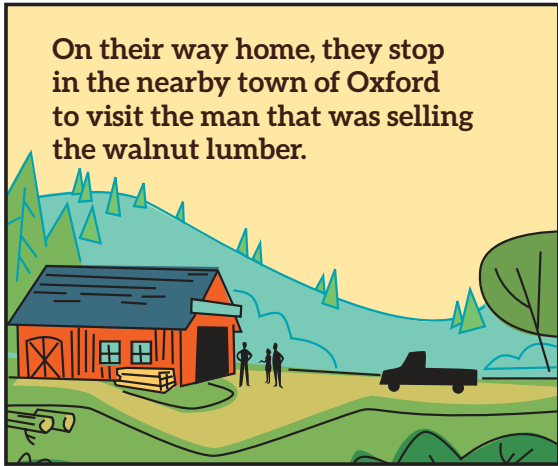
He has spent weeks searching the internet for rough-sawn walnut and has finally found a supplier in Ohio for the last item on their project list—a new kitchen table and chairs!



Ben realizes that the seller is located near Aponi's cousins in Hamilton, Ohio, and suggests that they make it into an end-of-summer ROAD TRIP!



Aponi and her dad drive the family pickup truck up to Hueston Woods State Park and spend the weekend camping with the family.



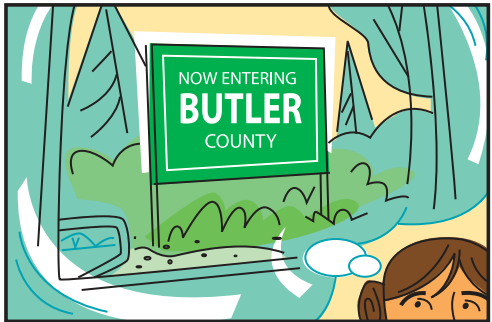
On their way home, they stop in the nearby town of Oxford to visit the man that was selling the walnut lumber.



LOOKS GOOD ENOUGH TO EAT!



Ben inspects the wood and everything looks good... the bark is still on the edges but the lumber looks straight and the price is right!



**WAIT DAD!** "Illinois has an exterior quarantine to prevent raw walnut from being brought in from places known to have walnut twig beetle and thousand cankers disease. I don't think we should risk it! Can we look at some other type of wood instead?"



"Good catch, Aponi. I forgot about the fact that you folks were coming from out of state! Why don't I show you some of the redoak timber I just milled?"

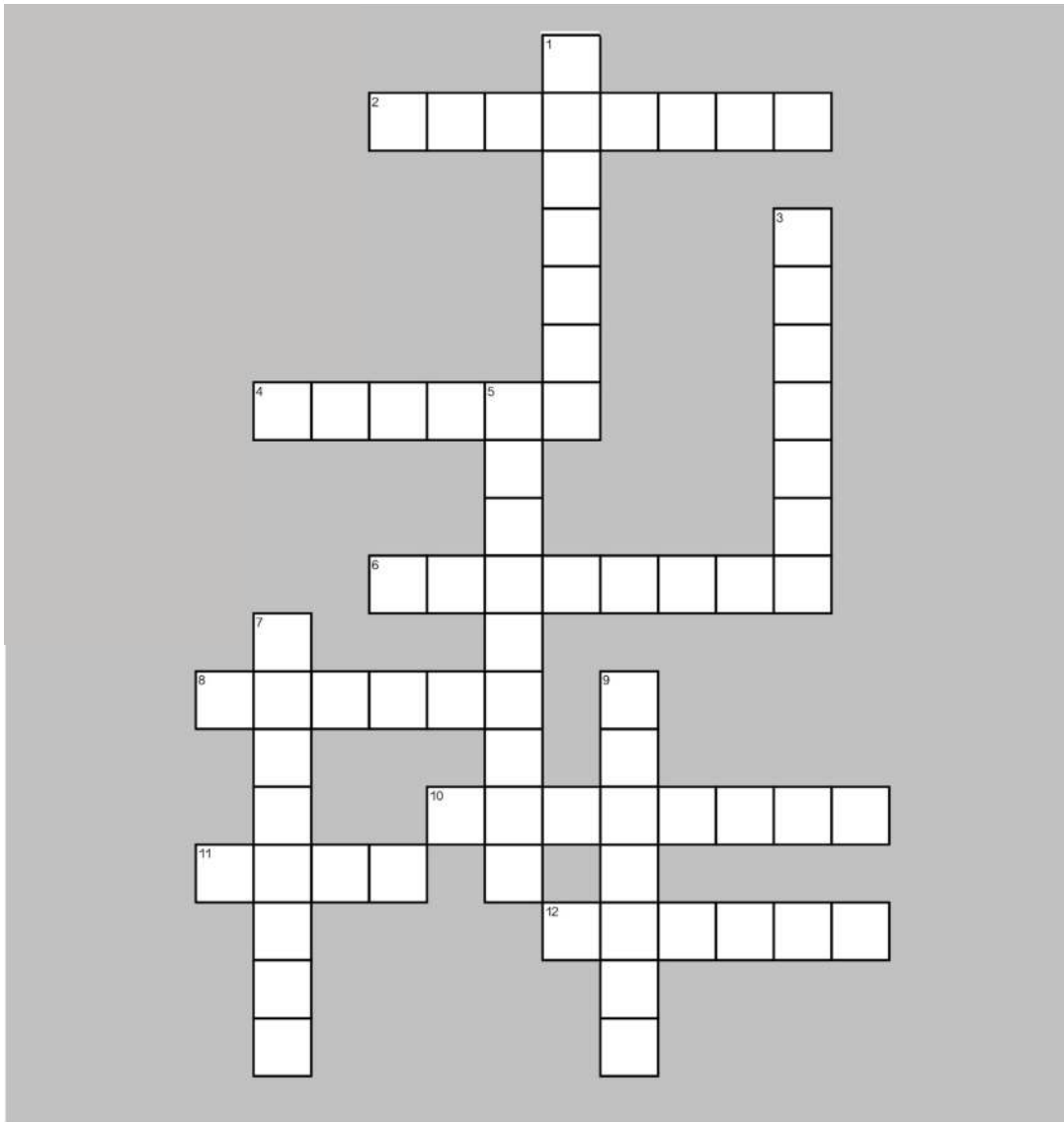


Aponi and Ben load up and head home. They spend the last few weeks of her vacation together in Ben's woodshop and before school starts have finished the kitchen table and chairs. The grain looks beautiful and they can rest easy knowing that they didn't accidentally introduce a new forest pest!

Name \_\_\_\_\_

Date \_\_\_\_\_

**Complete the walnut twig beetle crossword puzzle.  
Look on the next page for word clues!**



**HOST  
EPICORMIC  
INVASIVE**

**MYCOLOGY  
DIEBACK  
PHLOEM**

**GALLERY  
PATHOGEN  
CANKER**

**LARVAE  
FIREWOOD  
CAMBIUM**

## DOWN

- 2 Organisms that are \_\_\_\_\_ have the ability to grow and spread aggressively, far beyond their typical range and numbers.
- 4 In vascular plants, this is the tissue that transports nutrients made in the leaves to all parts of the plant.
- 6 The branch of biology that studies fungi and fungus-caused diseases.
- 8 A defined area of diseased tissue on a plant stem or branch. Many times it is discolored or sunken.
- 10 This is used as fuel to start and keep a fire going. Tree killing pests love to use this to hitch rides to new places, so don't take it with you when you camp!
- 11 An animal or plant that nourishes and supports a parasite; often it does not benefit and is harmed by the association.
- 12 The immature, worm-like stage of some insects that occurs between the "egg" and "pupa" stages. In the walnut twig beetle, this stage is always found inside the tree.

## ACROSS

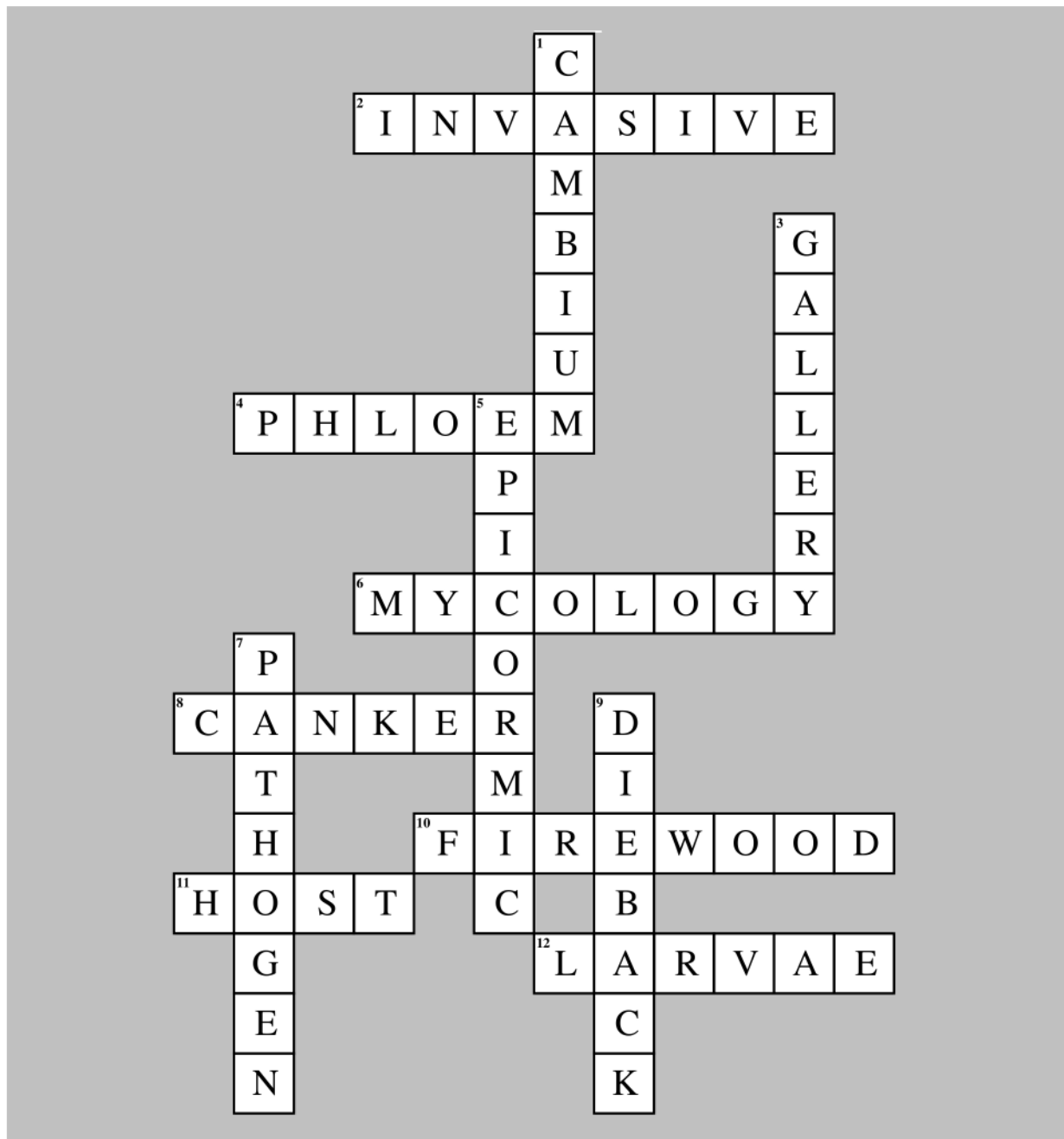
- 1 A cylinder of growing tissue that is located between the bark and wood in a tree's stem. This important tissue is killed by thousand cankers disease!
- 3 Tunnels that adults or larvae of wood boring insects like walnut twig beetle create when burrowing in the tree's wood.
- 5 A shoot or branch is said to be \_\_\_\_\_ if it is growing from a previously dormant bud on the trunk or limb of a tree. Typically these kinds of shoots appear when the tree is stressed or diseased.
- 7 Any disease-producing agent, especially a virus, bacterium, fungus, or other microorganism.
- 9 The death of a plant's shoots, beginning at the shoot tips and progressing inward towards the main stem.

**Walnut twig beetle adults make tunnels like this one in walnut trees. A fungus carried by the bugs grows in the galleries, eventually killing the tissue around the tunnel. If enough of the beetles attack, the tree dies from thousands of these small cankers.**



Ned Tisserat, Colorado State University, Bugwood.org

**Answer Key**





Name \_\_\_\_\_

Date \_\_\_\_\_

**Find each of the following words.**

**SPECIES  
CAMBIUM  
JUGLANS**

**PHLOEM  
HOST  
MYCOLOGY**

**DIEBACK  
ENTOMOLOGY  
DISEASE**

**INVASIVE  
XYLEM  
CANKER**

M L O M H S M O S E N T O M O L E A S M  
S E L C M E L Y X O E E I C E P S C S I  
E S H A K R E K N A C S A S I O H M Y U  
N L P E A S N C M M X M P H L O E M Y A  
T L I N V A S I V P S B L L D M S L T N  
O M H D J U G L A N S A Y C G E E T E V  
M E J O E N E V I N C E E A O C I N E A  
O U A E S L J C E D M L O O L G C G Y L  
L I C M O T M C E G Y Y K T O N E E A K  
O G G N U G S S N X N C K S C V P K S L  
G N T B O Y A O E A C I C O Y T S T E C  
Y A I Y C E G M I D A O A M M Y T P O L  
M A S R S A C O O S N O B P B E J D I L  
S A O I A X B A L S E E E O M C I O M B  
E M D L R E J E M O O E I E A E S I D C  
L L A K D Y S T I B C A D A R L B G I B  
G O C C J U G L L D I Y Y V E M I S T E  
C O I N V A S I V E O U M R A C C H C I  
M L O O A O Y L L E T B M C B L L Y E H  
V J P O S N M N E C M L B L Y Y L S M E



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Name \_\_\_\_\_

Date \_\_\_\_\_

Oh, no! The letters from 12 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. One word has already been found for you! Find each of the following words.

SPECIES  
FIREWOOD  
LARVAE

ADULT  
PUPA  
FUNGUS

DISEASE  
DAMAGE

INSECT  
TUNNEL

GALLERY  
WALNUT

D	L	A	L	L	C	T	U	N	L
I	R	E	W	O	O	D	T	A	S
S	I	V	N	I	C	R	S	S	W
T	E	F	A	N	U	E	V	U	S
E	S	A	D	E	I	T	A	G	F
Y	S	P	U	C	P	P	R	N	U
M	A	L	E	G	U	F	A	M	C
U	T	D	S	E	C	T	E	C	T
Y	N	Y	N	D	A	M	G	I	M
P	R	I	R	E	L	L	A	G	M



### 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.

START  
▼

NOGXNSHQISFDAMAGEGGTTAQIUAKDVQAHXOCMCPWUINJF WTUXUUSXFLNIVWGYBDEQCWAFBPYSJTWXFPPOWQ

F Q D Y Y N J S  
K D P P J M B  
P TSFP J WXLXABV UBPAYRG T D QIFLARVAEBKPD O NPRRLDU M DIRWASX GTGA A  
C F W L I Q C T G P M D H C A  
W V D I D K W T E R L N E K Q  
GASV N X C EVTICLGWANSDUJBOQBYSYR V G O Y K HVGJQYVJED YPJKWPPWUUIKM  
D T V W V Q F Q D R A W T A  
I G V J V M L B M V J X D B  
S XHFYQJYVMX T W M DDNKIIP FXLU KGWD NAPQSQV PCIJ O X S J IYMTEJM D  
E A O E I V M A R H W Y  
A E N B M C L E U F A K  
S NHVD JJTHQCTNKWLPK JJEK HGHP WYDDEEFJMSGQHADW XDUMMAEJUS YQRAQCNEURTPR T  
E P U K S W I E G L V  
F P D U G A X M G F I M  
AXML MPDA VVKUDNN ONYEVJE OJLJGRG IXNH C M M Y P LEICUOYGANALW X GDOF  
X X Q V S R I A B K V F R U C T  
B S F W M K V Q O S J I G R G B  
E AGJPOJMGYR U OAIFOUH O Y D U Y IAKDWCR JCXQ RTAG G NEJV T QRV T G  
D L U I C X B C V S E X D M G F R  
X U C F J C S J M A W Q K N I O L  
SXUX Q TIVA W U SGQCMUFLAJJPU HDVP I U LCVD YCHO YGMA S A E J DDEI  
A V G N B L W H L U O P D D U L U  
D R R G P L P X A L D R B N N X A  
I L CIRNMSSVCB U W QMVCQDF S W QDKXXHSLIJ TUMF DVPW M M J X Q B F  
F Q Y O S L D V F F O W K J R L X  
J M T N M Q S Q H Y K S Q W D U L  
O NSYH NGDF E UVRYDNJ OFWXYAUPCW O Q T DAWLNEGJRY HYJR T UYVFHIDUPO H  
A O O H H B J V T F D  
O Y Y F L O H E K P Q G K P  
F YMTCAIB UXLJAHWYHKWIMPNU H YYVNFHFIGYNMCKY GPPS SGNL G K SBQTQXIIB E  
X H U H B K P K I D H K D  
T S L L C Q G R G A M R E G I D  
TVEW EVPV H GJSPJKQGBNBFSQXC R T IIUIEUR R M LNANVXRNDH S CJAR C TGGF  
Y C V U T K X I X X B X P P T X  
N L U P G K G K F I R Y Q V P G  
U XVTBFJULQHFPC A GALLERY Y Y A WENPJALAJTNP U Q SSUD E EGFF EYHJ R M  
J D H P B R N X I X B J V F  
F J Y Y P P V J X S K S E F  
C JBG TUCL KUHO W V S WJTXNTRRKCWMHPSE S H FSPECIESOTINVTSA S A NAOQ L  
M T U I B A R V Y A K G I  
D Y N W D S X O N M U G A B  
GWAW DHDXMSC IKXABVF JPCO X VDOECAMBHPXEX K PTUNNEL G MKLI EXLUAKC J  
D L Y X F A A V S Q C J H Y  
O S F N L J G G K P S X I A I  
D FYGP DLBMQYH R S BQRYNAPJVOKBC P JSIS TSIXBWW Y GYLO Y HSNX Q Y T  
H F O O R J W B A S G D T X A G Q  
L Q P D I O E K L L N P O E G N A  
NGQM IVNFCOPUTSKLK U QPUN NCOLXRIOAN K P R V N KDFY FDMM O D J D O  
B M U B G A U V X Y  
M U Y P X T K Y V

▼  
END

Find and circle these words:

**LARVAE  
TUNNEL  
GALLERY**

**DISEASE  
DAMAGE  
PUPA**

**SPECIES  
ADULT  
FIREWOOD**

**WALNUT  
FUNGUS  
INSECT**



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Name \_\_\_\_\_

Date \_\_\_\_\_

Find each of the following words.

**ADULT  
PUPA  
INSECT**

**DAMAGE  
DISEASE  
FUNGUS**

**TUNNEL  
SPECIES  
LARVAE**

**GALLERY  
FIREWOOD  
WALNUT**

G A L L E R L A F U C E I S A G A W L A  
R D D E W A L N U T L S S E U L P L S E  
A P C A F U D A Y R D A I A Y T Y C C O  
L S T F E S L T P O U E L D U I C E P S  
A D I S E A D A O U O S S P E C I E S U  
W D L C T P I W R E U I T O E L P R E T  
E T D D T T E E A V E D C A L E L E R P  
A P U P U R C V S R A P E R R S I S L S  
U A S E I G U E F N S E E L S F S I L T  
A S E F T D L T S Y G A N E E N O A E D  
W P G L U I L N S N N S P N E P U L L U  
I O A L N N S A E E I E M N S E U T D A  
T E L D E S D U R Y T I P U A D U U R L  
E I L S P L V T G V D D E T V G N L D I  
R T E E I R P G S N A G T E N A R I Y E  
T G R Y I A L G A A U I I U W I E E A S  
R S Y A V A P S C M A F F V N M A N L R  
I G W E R I F E E T A E I T L U D A U T  
R F A P D A M A G E P D T S G U A D T T  
Y S S F S S E D N I U A E G I T I P I A



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# 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](http://plantheroes.org) today to learn more!

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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.



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Association**

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