

FORESTRY

Purpose

The Forestry Contest is designed to stimulate students' interest in forestry and the principles and benefits of forest resource management.

Objectives

- I. Ability to understand and have a basic knowledge of forestry and agroforestry principles.
- II. Ability to identify trees common to Missouri.
- III. Ability to recognize tools and equipment and their uses in forest management.
- IV. Ability to inventory standing timber.
- V. Ability to understand timber stand improvement principles.
- VI. Ability to interpret topographic maps and understand legal descriptions.
- VII. Ability to identify common tree or forest disorders commonly found in Missouri.

Crosswalk with Show Me Standards

Objectives – Students participating in the Career Development Event should be able to:		Show-Me Standards	
		Knowledge Standards (Content Areas)	Performance Standards (Goals)
1.	Ability to understand and have a basic knowledge of forestry and agroforestry principles.	CA.3	1.3, 1.4, 1.5, 1.8
2.	Ability to identify trees common to Missouri.	MA.1, MA.2, MA.3	3.2, 3.4, 3.8
3.	Ability to recognize tools and equipment and their uses in forest management.	SC.3, SC.4, SC.8	4.4, 4.8
4.	Ability to inventory standing timber.	SS.4	
5.	Ability to understand timber stand improvement principles.		
6.	Ability to interpret topographic maps and understand legal descriptions.		
7.	Ability to identify common tree or forest disorders.		

Corresponding Secondary Agriculture Curriculum			
Course and/or Curriculum:	Agricultural Science II	Unit(s):	Forestry
	Forest Management		All Units
	Plant Science Curriculum		Forestry

Event Format

The Forestry CDE shall consist of the following seven (7) components:

A. General Knowledge - 30 minutes

1. This phase of the contest will test the contestant's knowledge and understanding of basic forestry and agroforestry principles.
2. Contestants will see fifty (50) objective type, multiple choice or true/false questions reflecting the contest objectives and coming from the reference list.

B. Tree Identification - 30 minutes

1. Twenty (20) unduplicated specimens from the Tree ID Contestant Reference Sheet will be displayed for contestants to identify by common names. **Duplicate samples may not be used in any identification portion of the event.**
2. Each specimen will be designated by a number
3. Contestants will have approximately one and one-half minutes for each specimen station.
4. Specimens may be actual specimens or mounted specimens.

C. Equipment Identification - 10 minutes

1. Twenty (20) pieces of equipment from Equipment ID contestant Reference Sheet will be displayed for contestants to identify by proper technical name. **Duplicate samples may not be used in any identification portion of the event.**
2. Each piece of equipment will be designated by a number.

D. Timber Cruising (measuring standing timber on a 1/10 acre plot) - 50 minutes

1. Using a Biltmore tree scale stick, in the correct manner, each contestant will measure pre-numbered trees on a 1/10 acre plot for DBH, 4.5 ft. from the high side of the tree, tree height to the nearest 1/2 log (8') and board foot volume. The correct manner in which to use the Biltmore stick includes the following: using a single stick that is free from any string or other modification. If modifications required, the request should be made following the general guidelines for student accommodations. At NO time should the Biltmore stick be rolled on the tree. Students are prohibited from wrapping their arms around the tree or 'hugging' the tree to determine DBH.
2. The diameter of all marked trees on the plot must be measured in order to calculate stocking level and determine merchantability. Any tree less than 12 inches in diameter at breast height on the uphill side is not merchantable and will have 0 height and 0 board foot volume. The first FIVE trees will be of merchantable size and scored in the following manner: TWO PTS for correct species, FOUR PTS for correct diameter, and FOUR PTS for correct height. Any other numbered contest trees a contestant deems merchantable will be needed to determine total merchantable volume and value.
3. WHILE TREE FORM AND MINIMUM MERCHANTABLE TREE DIAMETERS VARY ACROSS THE STATE, TO LEVEL THE PLAYING FIELD FOR THIS PART OF THE CONTEST, TREE VOLUMES SHOULD BE DETERMINED USING THE FOLLOWING GUIDELINES:
 - a. Given a general Form Class of 78, one can expect to lose one inch diameter (outside bark) for every four-foot log.
 - b. Minimum merchantable tree diameter will be ten inches (outside bark).
Merchantable height stops
 - i. At the point where the outside stem diameter becomes 10 inches

- ii. Where a major fork in the main stem occurs
- iii. Where a limb has a diameter equal to one-half of the diameter of the main stem at that point.
- c. No volume is to be determined for logs above the fork (or defect) as well as any side limbs.
- d. After measuring all trees, the contestant will find total volume per acre, total value per acre, the average DBH per acre, the total number of trees per acre, and the desired minimum number of trees per acre. The student will then decide if the stand was understocked, adequately stocked, or overstocked. The student will then recommend that the stand be harvested, commercially thinned, non-commercially thinned (timber stand improvement), or left to grow.

Rounding Rules

1. If the calculated average stand diameter is less than XX.50", ROUND DOWN TO THE NEAREST WHOLE NUMBER (for example, 11.49" would round DOWN to 11")
2. If the calculated average stand diameter is xx.50" OR GREATER, ROUND UP TO THE NEAREST WHOLE NUMBER (for example, 11.50" would round UP to 12")

Standing Timber Management Option

BASED UPON THE AVERAGE STAND DIAMETER AND THE NUMBER OF TREES PER ACRE, THERE ARE NOW FOUR POSSIBLE STAND PRESCRIPTIONS

- If the average DBH is EQUAL TO OR GREATER THAN 16 inches AND the stand is OVERSTOCKED, then prescribe a HARVEST.
- If the average DBH is BETWEEN 12 and 15 inches AND the stand is OVERSTOCKED, then prescribe a COMMERCIAL THINNING
- If the average DBH is EQUAL TO OR LESS THAN 11 inches AND the stand is OVERSTOCKED, then prescribe a NON-COMMERCIAL THINNING
- Regardless of DBH, if the stand is UNDERSTOCKED or ADEQUATELY STOCKED, then prescribe LEAVE TO GROW
- A chart showing the desirable stocking level will be provided and a chart with the International 1/4" Tree Scale will also be provided.

E. Timber Stand Improvement (TSI) - 20 Minutes

1. The site will be a fixed area, normally 1/10 acre or (merely designated).
2. All trees will be identified by number.
3. On the scorecard, the student will be given the following information:
 - a. existing number of trees per acre
 - b. number of trees to thin (or leave) per plot
 - c. objective or management plan for the stand
4. Using the information furnished on the scorecard, the student will determine whether each tree will be:
 - a. left for growing stock or
 - b. deadened/remove for a cull or undesirable species/harvest
5. The management plan will be explicit in scope giving all information needed by the student to decide whether to cut, leave, or deaden.

- a. If the plan is for timber production, it will state the species which are desirable and those that are undesirable and size and quality limits of merchantable trees.
 - b. If the plan is for wildlife habitat management, the plan is to include the species desirable and undesirable, number of den trees needed per acre, and the number of foresting trees to be left per acre.
6. Additional information, as appropriate, may be included.
 7. NOTE: Cutting of firewood is not to be considered a harvest operation.
 8. Only those trees 4" DBH and larger will be tagged or numbered.

F. Map Reading - Legal Descriptions - 20 minutes

1. Contestants will be furnished a U.S. geological survey map with specific points marked for the student to identify.
2. The student will need to know legal descriptions, size or location of no less than one 10-acre land parcel.
3. **The student must understand contour lines and be able to determine the difference in elevation between two points on the map.**
4. **The student must be familiar with the map scale and be able to use it to determine the distance between two points on the map.**
5. When the student is asked to identify points on a geological survey map, the points will be clearly marked with a letter and an arrow pointing to the section or symbol or area on the map to be identified or sized.

Examples are:

- a. Find Letter A--What is the legal description of the area boxed in? southwest one quarter of the northwest one quarter of the northwest one quarter of section
- b. Find Letter B--What is the item located at this point? Church
- c. Find Letter C--What is the acreage of this point boxed in? 10acres
- d. Find Letter D--What is the line shown here called? contour line

G. Tree/Forest Disorders – 20 minutes

1. Symptoms of ten (10) disorders from the Tree/Forest Disorders Contestant Reference List will be displayed for participants to identify by common names. The disorder will be presented in one or more of the following forms:
 - a. Actual sample of sign or symptom
 - b. Picture of sign or symptom
 - c. Written description of sign or symptom
 - d. Written case history of the disorder in question
2. Each disorder will be designated by a number. Participants will identify the disorder presented using the number associated with the disorder from the Tree Disorder Identification List.
3. Scoring: A total of 100 points are possible for this section; 10 points for each disorder.

Event Scoring

Event	Points
General Knowledge (50 questions @ 2 pts each)	100
Identification (20 plants at 5 pts each)	100
Equipment ID (20 @ 2 pts each)	40
Timber Cruising	100
Timber Stand Improvement	100
Map Reading (12 questions @ 5 pts each)	60
Tree / Forest Disorders (10 @ 5 pts each)	50
TOTAL	550

1. Scoring Timber Cruising

- a. There are a total of 100 points possible in this section.
- b. Fifty (50) points will come from proper measurement of the first five saw timber trees. This would be ten points for each tree:
 - Two points for correctly identifying the tree species
 - Four points for correctly measuring DBH
 - Four points for correctly measuring proper tree height to the nearest 1/2 log.
- c. The remaining 50 points will come from answering questions about measurements:
 - 10 points for total volume per acre
(allowing for a variance of plus or minus 10 % for full 10 points, allowing for a variance of plus or minus 15% for 5 points)
 - 10 points for value per acre
(allowing for a variance of plus or minus 10 % for full 10 points, allowing for a variance of plus or minus 15% for 5 points)
 - 10 points for minimum number of trees per acre
 - 10 points for assessing stand (understocked, adequately stocked, or overstocked)
 - 10 points for determining if the stand should be thinned, harvested, or left to grow

2. Tie scores among teams in all events should be broken using the high individual team member's score. In case the scores are tied, the scores of the second high individual on each team should be used.

Event Rules and Regulations

1. Under no circumstances will any contestant be allowed to touch or handle plant material during the contest, with the exception of the tree measuring activity. Any infraction of this will be sufficient cause to eliminate the team from the contest.
2. Observers will not be permitted in the contest area while the contest is in progress.
3. No contest team, team member, or team coach shall visit the contest facilities to observe plant materials and facilities prior to the contest.
4. Any contestant caught cheating during the contest will, along with his/her team members, be expelled from the contest.
5. All contestants are expected to be prompt at their stations throughout the contest. No provisions will be made for tardiness and will most certainly cause late contestants to lose contest points.

6. Contestants will be assigned to group leaders who will escort them to various contest staging lines. Each contestant is to stay with his or her group leader throughout the contest or until told to change leaders by the contest superintendent.
7. All contestants will be given a contestant number by which they will be designated throughout the contest.
8. Contestants must come to the contest prepared to work in adverse weather conditions. The contest will be conducted regardless of weather conditions, except those outlined in the FFA Severe Weather Guidelines in the General Guidelines section. Contestants should have heavy coats and other warm clothes and footwear. **NO open-toed shoes will be allowed.**
9. Tools and Equipment: All tools and equipment will be furnished for the contest. Contestants must use the tools and equipment furnished at the contest site for all instructional areas, with the exception that contestants may provide their own Biltmore stick.
10. Any non-graphing calculator may be used.
- 11. Written Materials: All written materials will be furnished for the contest. At the state contest, each contestant will receive:**
 - a. Scansheet to mark all answers
 - b. Contestant Reference Sheet 1 – Cruising Sheet 1/10 Acre Plot
 - c. Contestant Reference Sheet 2 – Cruising Sheet Calculations
 - d. Contestant Reference Sheet A – Tree Identification
 - e. Contestant Reference Sheet B – Forestry Equipment List
 - f. Contestant Reference Sheet C – Tree Disorders
12. Contestants should provide clipboards and pencils. Electronic calculators and magnifying glasses will be allowed.

Test References

- Missouri Forest Management Guidelines Unit I: Background Resource Elements
<https://mdc.mo.gov/sites/default/files/downloads/forestmanagement2.pdf>
- Missouri Forest Management Guidelines Unit II: Foundations of Forest Management
<https://mdc.mo.gov/sites/default/files/downloads/forestmanagement3.pdf>
- 2015 MU Center for Agroforestry Training Manual Chapter 5: Riparian & Upland Forest Buffers
http://www.centerforagroforestry.org/pubs/training/chap5_2015.pdf
- 2015 MU Center for Agroforestry Training Manual Chapter 6: Windbreaks
http://www.centerforagroforestry.org/pubs/training/chap6_2015.pdf
- 2015 MU Center for Agroforestry Training Manual Chapter 7: Forest Farming
http://www.centerforagroforestry.org/pubs/training/chap7_2015.pdf

Training References

Forest Management for Missouri Landowners, MDC 2003, Bruce Palmer

Designing a Windbreak Agroforestry Practice, MU Center for Agroforestry

Designing a Riparian Forest Buffer Agroforestry Practice, MU Center for Agroforestry

50 Common Trees of Missouri, MDC 2005, David Knotts

Trees of Missouri, 1983, Carl Settegren & R.E. McDermott, University of Missouri, Agricultural Experiment Station, B767.

Missouri's Oaks and Hickories, Missouri Department of Conservation Field Guide, Reprinted from the August and December 1993, and January 1994 *Missouri Conservationist* by the Conservation Commission of the State of Missouri.

Trees of Indiana (CD), Purdue University, by Sally Weeks and George Parker Phone 888-398-4636 to order or visit <http://www.ces.purdue.edu/extmedia/menu.htm>

University of Missouri Forestry Website, www.snr.missouri.edu/forestry/extension/ffa.php

Equipment ID References

Official Reference: MDC Forestry Tools (CD), Missouri Department of Conservation, Outreach and Education Division, P.O. Box 180, Jefferson City, MO 65102

Other References: Forestry Supplies, Inc., 205 West Ranken Street, Jackson, MS 39204-0397

The Ben Meadows Company, 3589 Broad Street, Atlanta, GA 30366

“Missouri FFA Forestry CDE Training Guide”, Dr. Hank Stelzer, 2010. Available at:
<http://snr.missouri.edu/forestry/extension/ffa.php>

Contestant Reference Sheet 1 for use with Forestry CDE Scansheet

Cruising Tally Sheet 1/10 Acre Plot

Name: _____ Contestant Number: _____
 School: _____ School Number: _____

Tree No.	Tree Species	DBH Diameter Breast Height	Tree Height 16 ft. Logs	Board Foot Volume
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
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21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

All trees marked on the plot are to be tallied. Total data is necessary in order to complete the computations. Any tree less than 12 inches will have 0 height and 0 board feet volume; however, they should be considered when calculating the stocking level.

The first five trees will be scored in the following manner:
Two points for each species, **four points** for each DBH, **four points** for each height, for a total of **ten points** per tree.

Total Number of Trees: _____ Not Scored

Total DBH: _____ Not Scored

Total Volume: _____ Not Scored

TREE SCALE - (International 1/4 Inch)

DBH (in)	Number of 16-Foot Logs							
	1/2	1	1 1/2	2	2 1/2	3	3 1/2	4
12	30	60	80	100	120			
14	40	80	110	140	160	180		
16	60	100	150	180	210	250	280	310
18	70	140	190	240	280	320	360	400
20	90	170	240	300	350	400	450	500
22	110	210	290	360	430	490	560	610
24	130	250	350	430	510	590	660	740
26	160	300	410	510	600	700	790	880
28	190	350	480	600	700	810	920	1020
30	220	410	550	690	810	930	1060	1180
32	260	470	640	790	940	1080	1220	1360
34	290	530	730	900	1060	1220	1380	1540
36	330	600	820	1010	1200	1380	1560	1740
38	370	670	910	1130	1340	1540	1740	1940
40	420	740	1010	1250	1480	1700	1920	2160
42	460	820	1100	1360	1610	1870	2120	2360

Cruising Tally Sheet

Numbered questions are worth 10 points each.

Name: _____ Contestant Number: _____

School: _____ School Number: _____

Total Volume of Plot:

1. Total volume/acre _____ (± 10% will be correct)

2. Total value/acre _____

(based upon _____ cents/board foot) to be given for area (± 10% will be correct)

Average DBH _____

Total number of trees/acre _____

3. Desired minimum number of trees/acre _____

4. Is this stand: (check one)	Overstocked	
	Understocked	
	Adequately Stocked	

5. Should this stand be: (check one)	Harvest	
	Commercial Thin	
	Non-commercial Thin	
	Left to Grow	

Use the table below to determine appropriate stocking rate:

Desirable stocking Level/Number of Trees Per Acre		
Average DBH	Minimum Number	Maximum Number
5	324	430
6	243	328
7	194	259
8	151	206
9	125	170
10	105	143
11	89	121
12	77	106
13	66	93
14	59	81
15	52	73
16	43	61
17	38	54
18	34	48
19	30	43
20	27	39
21	25	35
22	23	32

UNDERSTOCK

ADEQUATELY STOCKED

OVERSTOCKED

Tree Identification List

OAK

01. Black Oak / Quercus velutina
02. Blackjack Oak / Quercus marilandica
03. Bur Oak / Quercus macrocarpa
04. Chinkapin Oak / Quercus uehlenbergii
05. Northern Red Oak / Quercus rubra
06. Pin Oak / Quercus palustris
07. Post Oak / Quercus stellata
08. Scarlet Oak / Quercus coccinea
09. Shingle Oak / Quercus imbricaria
10. White Oak / Quercus alba

HICKORY

11. Bitternut Hickory / Carya cordiformis
12. Mockernut Hickory / Carya tomentosa
13. Shagbark Hickory / Carya ovata
14. Pecan / Carya illinoensis

MAPLE

15. Red Maple / Acer rubrum
16. Silver Maple / Acer saccharinum
17. Sugar Maple / Acer saccharum
18. Boxelder / Acer negundo

ELM

19. American Elm / Ulmus americana
20. Slippery Elm / Ulmus rubra

PINE

21. Shortleaf Pine / Pinus echinata

OTHER

22. American basswood / Tilia americana
23. American Sycamore / Platanus occidentalis
24. Ash, Green / Fraxinus pennsylvanica
25. Ash, White / Fraxinus americana
26. Baldcypress / Taxodium distichum
27. Black Cherry / Prunus serotina
28. Black Locust / Robinia pseudoacacia
29. Black Walnut / Juglans nigra
30. Blackgum / Nyssa sylvatica
31. Downy Serviceberry / Amelanchier arborea
32. Eastern Cottonwood / Populus deltoides
33. Eastern Hophornbean / Ostrya virginiana
34. Eastern Redbud / Cercis canadensis
35. Eastern Redcedar / Juniperus virginiana
36. Flowering Dogwood / Cornus florida
37. Hackberry / Celtis occidentalis
38. Hawthorn / Crataegus spp.
39. Honeylocust / Gleditsia triacanthos
40. Kentucky Coffeetree / Gymnocladus dioica
41. Ohio buckeye / Aesculus glabra
42. Osage-orange / Maclura pomifera
43. Pawpaw / Asimina triloba
44. Persimmon / Diospyros virginiana
45. Red Mulberry / Morus rubra
46. River Birch / Betula nigra
47. Sassafras / Sassafras albidum
48. Sweetgum / Liquidambar styraciflua
49. Yellow Poplar / Liriodendron tulipifera
50. Willow / Salix spp.

Forestry Equipment Identification Specimen List

Directions: Bubble in the correct number of the specimen.
Two points each for a total of 40 points.

01. Backpack Water Pump		16. Hard Hat
02. Bark Guage		17. Increment Borer
03. Biltmore Stick		18. Loppers
04. Broom Rake		19. Peavy-Canthook
05. Chainsaw		20. Pruning Saw
06. Chaps		21. Pulaski-Forester Axe
07. Clinometer		22. Safety Glasses
08. Compass		23. Scale Stick
09. Cruising Vest		24. Sling Psychrometer
10. Diameter Tape		25. Stereoscope
11. Digital Data Recorder		26. Tally Meter
12. Drip Torch		27. Tree Caliper
13. Hand Pruners		28. Tree Marking Gun
14. Hearing Protection		29. Tree Planting Bar
15. GPS Unit		30. Wedge Prism

Timber Stand Improvement (TSI) Instructions

Directions: Evaluate each tree. Using the information furnished below, determine whether each tree will be:
K. Left for growing stock or
R. Deadend/removed for a cull or undesirable species/harvested
 For each tree, mark **K** if the tree should be left to grow. Mark **R** if the tree should be removed, harvested, or deadend. Possible score of 100, depending on the percentage of correct answers.

Scenario:

Tree/Forest Disorder List

1. Air pollution
2. Armillaria root rot
3. Asian longhorned beetle
4. Butt or heart rot
5. Canker (other than Hypoxylon or Thousand Cankers)
6. Cedar-apple gall rust
7. Cicada
8. Climatic injury: snow/ice, wind, drought, hail
9. Emerald ash borer
10. Gypsy moth
11. Herbicide damage
12. Hypoxylon canker
13. Landscape equipment damage
14. Lightning damage
15. Oak wilt
16. Pine shoot beetle
17. Pine nematode
18. Pine sawfly
19. Scale
20. Sunscald
21. Tent caterpillar
22. Thousand cankers disease
23. Wildlife/Livestock damage
24. Wetwood or slime flux
25. Wood borer