

# Missouri FFA Forestry CDE Training Guide

Welcome! This training guide has been developed to assist Missouri's agricultural education instructors prepare Forestry Teams for Regional and State Career Development Events.

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

The objectives of the Forestry CDE are for students gain the ability to:

- Understand and have a basic knowledge of forestry and agroforestry principles.
- Identify trees common to Missouri.
- Recognize tools and equipment used in forest management.
- Inventory standing timber.
- Understand timber stand improvement (TSI) principles.
- Interpret topographic maps and understand legal land descriptions.

This guide follows the five parts of the Forestry CDE, namely:

- Part I – General Knowledge
- Part II – Tree Identification
- Part III – Equipment Identification
- Part IV – Timber Cruising
- Part V – Timber Stand Improvement
- Part VI – Map Reading and Legal Land Descriptions

Complete details of the Forestry CDE format and scoring can be found at:

[http://dese.mo.gov/divcareered/documents/FFA\\_CDE\\_Forestry\\_Revised\\_10.pdf](http://dese.mo.gov/divcareered/documents/FFA_CDE_Forestry_Revised_10.pdf)

## Contact Information

Feel free to contact me anytime with any questions you or your team members might have.

Hank Stelzer  
State forestry Extension Specialist  
203 ABNR  
University of Missouri  
Columbia, MO 65211  
(573) 882-4444  
email: [stelzerh@missouri.edu](mailto:stelzerh@missouri.edu)  
website: [www.snr.missouri.edu/forestry/extension](http://www.snr.missouri.edu/forestry/extension)

## References

The following references were used to develop the Forestry CDE. This is not an exhaustive reference list, but it should get any new instructor headed in the right direction.

*Forest Management for Missouri Landowners*. 2003. Missouri Department of Conservation.

[http://mdc.mo.gov/sites/default/files/resources/2010/05/5574\\_3489.pdf](http://mdc.mo.gov/sites/default/files/resources/2010/05/5574_3489.pdf)

*Training Manual for Applied Agroforestry Practices*. 2006. MU Center for Agroforestry.

*Section 5: Riparian Forest Buffers*.

<http://www.centerforagroforestry.org/pubs/training/sec5.pdf>

*Section 6: Windbreaks*.

<http://www.centerforagroforestry.org/pubs/training/sec6.pdf>

*Section 7: forest Farming*.

<http://www.centerforagroforestry.org/pubs/training/sec7.pdf>

*Trees of Missouri Field Guide*. 2005. Missouri Department of Conservation.

*50 Common Trees of Missouri*. 2005. Missouri Department of Conservation.

*Trees of Missouri*. 1983. University of Missouri Extension Publication SB767.

*Trees of Indiana* (CD). Purdue University Extension Publication CD-FNR-1.

**SPECIAL NOTE:** The guide, *Conservation Education Series – Forest Management for Missouri Landowners*. 2005. Missouri Department of Conservation. **IS NO LONGER AVAILABLE**

## Part I – General Knowledge

The General Knowledge exam consists of 50 questions (25 true/false and 25 multiple-choice) covering the following five, equally weighted, categories:

- Forest Ecology
- Forest Health
- Forest Management
- Agroforestry
- Marketing Timber & Forest Products

I rely heavily on information presented in *Forest Management for Missouri Landowners* and the *Training Manual for Applied Agroforestry Practices*.

### Sample Questions

The following are examples from previously used state general knowledge exams:

#### Forest Ecology

1. Succession is the gradual replacement of one community of plants by another community. (**T**)
2. Soils with a high proportion of sand tend to be drier than those soils with a lot of clay. (**T**)
3. Which tree species would you **not** expect to see in a bottomland forest?
  - a. sycamore
  - b. post oak**
  - c. sweetgum
  - d. boxelder
4. East-facing slopes are wetter than west-facing slopes because:
  - a. The sun shines more on west slopes during the hottest part of the day**
  - b. The trees take up less water
  - c. There is increased evaporation from the soil
  - d. A and C

#### Forest Health

1. Unrestricted grazing is not detrimental to tree growth. (**F**)
2. Pesticides are commonly used in forest settings to control harmful insects and diseases. (**F**)
3. Soil erosion in a grazed forest can be \_\_\_ times greater than erosion in ungrazed forests
  - a. two
  - b. ten
  - c. twenty
  - d. one hundred**

4. Which forest pest was not introduced from a foreign country?
  - a. gypsy moth
  - b. oak wilt**
  - c. chestnut blight
  - d. emerald ash borer

### Forest Management

1. Regenerating your forest is basically about managing the amount of light that reaches the forest floor. (*T*)
2. In pole stands, most trees average less than 5 inches DBH. (*F*)
3. How many seedlings will be planted on one acre at a spacing of 12'x12'?
  - a. 1,742
  - b. 889
  - c. 436
  - d. 302**
4. Which silvicultural system listed below would produce an uneven-aged forest?
  - a. shelterwood
  - b. single-tree**
  - c. seed tree
  - d. clearcut

### Agroforestry

1. The width of a riparian forest buffer can vary to accommodate runoff hot spots. (*T*)
2. Windbreaks can improve air quality. (*T*)
3. Which range of riparian forest buffer widths will work for surface erosion control?
  - a. 10' – 20'
  - b. 15' – 25'
  - c. 20' – 30'
  - d. 30' – 50'**
4. Properly applied windbreaks can benefit which of the following agricultural practices?
  - a. crop production
  - b. confined animal feeding operations
  - c. livestock and dairy cattle husbandry
  - d. all of the above**

## Marketing Timber & Forest Products

1. The most valuable log in a tree is the butt log. (*T*)
2. One cord contains 128 cubic feet of solid wood. (*F*)
3. White oak is best known for what wood product?
  - a. **cooperage**
  - b. trim and molding
  - c. flooring
  - d. pallets
4. A lump-sum timber sale places all of the risk on the
  - a. seller
  - b. **buyer**
  - c. forester
  - d. sawmill (assuming the sawmill is not the buyer)

## Part II – Tree Identification

Tree identification can be particularly challenging during the spring, state CDE because twigs have lost their winter characteristics (especially color characteristics), buds are swelling, and leaves are not yet out! About the only trait a student might have is bark; which can be extremely variable.

One helpful habit you might encourage your students to do is look up, look down, and all around. Look up to determine the arrangement pattern (opposite vs alternate) of the tree in question by observing the branching pattern. Look down for evidence of acorns, nut husks, decaying leaves, and twigs cut off by squirrels. Look all around the tree in question to make sure you pick up a representative sample of the evidence. Make sure that the acorn caps, leaves and twigs came from the tree in question and not from a neighboring tree.

An easy way to ease your team member into tree identification is to remember the mnemonic:

### MADBUck

It represents those species or species groups (Genera) that have *opposite* leaf/branch arrangement: **M** – maples, **A** – ashes, **D** – dogwoods, and **Buck** – buckeye.

Below are sample images of twigs, leaves, and bark of some of the more common trees you are likely to encounter. Use the reference manuals listed above to hone your skills and see examples of all of the possible specimens our students may encounter at the Regional and State CDE.

Images are from either my personal collection or from Forestry Images [www.forestryimages.org](http://www.forestryimages.org). A few of the species do not have good quality images of either twigs, leaves, and/or bark. As I secure these images, they will be added to this training manual.

Trees with OPPOSITE ARRANGEMENT (MADBuck)



**sugar maple (*Acer saccharum*)**



**silver maple (*Acer saccharinum*)**



**red maple (*Acer rubrum*)**



**boxelder (*Acer negundo*)**



**green ash (*Fraxinus pennsylvanica*)**



**white ash (*Fraxinus americana*)**





**flowering dogwood (*Cornus florida*)**



**Ohio buckeye (*Aesculus glabra*)**

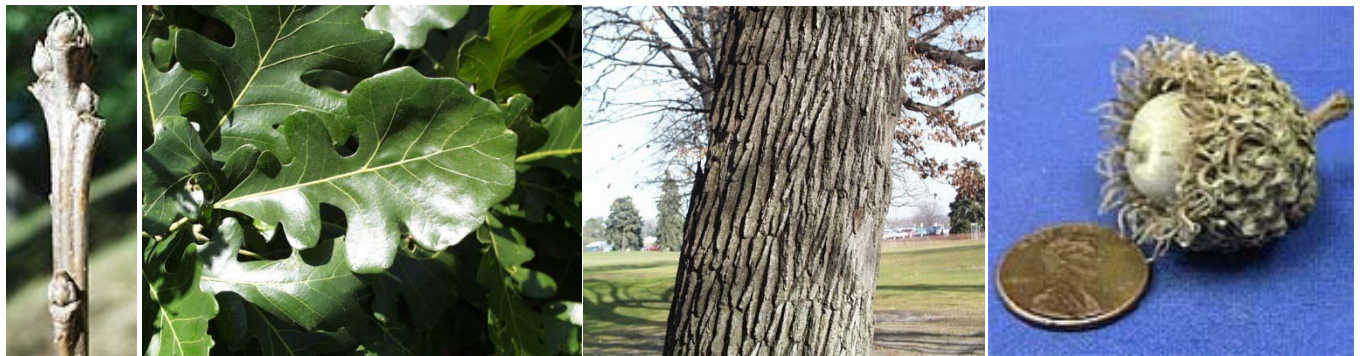
Trees with ALTERNATE ARRANGEMENT



**white oak (*Quercus alba*)**



**post oak (*Quercus stellata*)**



**bur oak (*Quercus macrocarpa*)**



chinkapin oak (*Quercus muehlenbergii*)



pin oak (*Quercus palustris*)



black oak (*Quercus velutina*)



**northern red oak (*Quercus rubra*)**



**scarlet oak (*Quercus coccinea*)**



**shingle oak (*Quercus imbricaria*)**



**black walnut (*Juglans nigra*)**



**pecan (*Carya illinoensis*)**



**shagbark hickory (*Carya ovata*)**



mockernut hickory (*Carya tomentosa*)



bitternut hickory (*Carya cordiformis*)



American elm (*Ulmus Americana*)



**slippery elm (*Ulmus rubra*)**



**hackberry (*Celtis occidentalis*)**



**American basswood (*Tilia americana*)**



**baldcypress (*Taxodium distichum*)**



**American sycamore (*Platanus occidentalis*)**



**black cherry (*Prunus serotina*)**





**black locust (*Robinia pseudoacacia*)**



**honeylocust (*Gleditsia triacanthos*)**



**blackgum (*Nyssa sylvatica*)**



**downy serviceberry (*Amelanchier arborea*)**



**eastern cottonwood (*Populus deltoides*)**



**eastern redbud (*Cercis canadensis*)**



**eastern redcedar (*Juniperus virginiana*)**



**hawthorn (*Crataegus* spp.)**



**Kentucky coffeetree (*Gymnocladus dioica*)**



**Osage-orange (*Maclura pomifera*)**



**pawpaw (*Asimina triloba*)**



**persimmon (*Diospyros virginiana*)**



**sassafras (*Sassafras albidum*)**



**red mulberry (*Morus rubra*)**



**river birch (*Betula nigra*)**

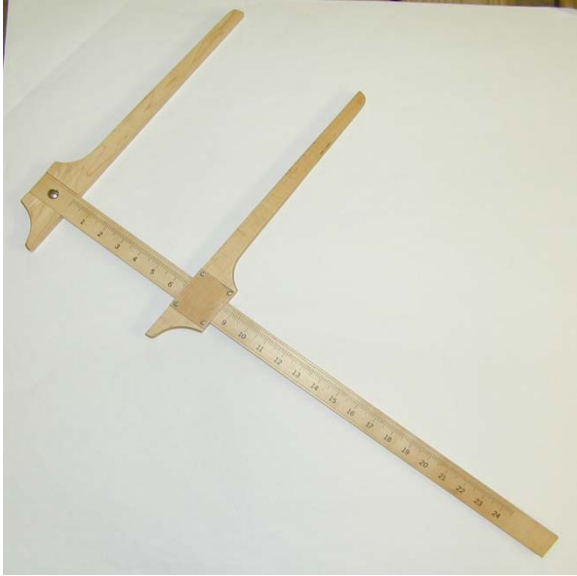


**shortleaf pine (*Pinus echinata*)**



**willow (*Salix* spp.)**

### Part III – Equipment Identification



**Tree Calipers**



**Increment Borer**



**Hard Hat**



**Chaps**



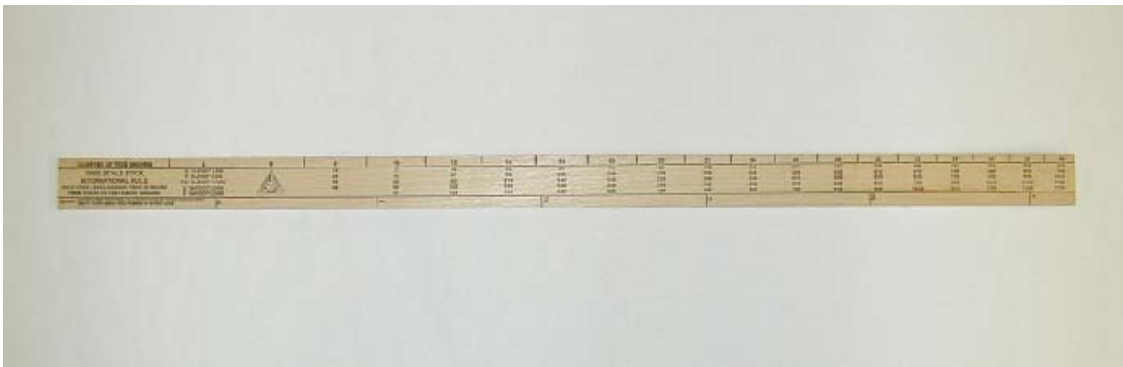
**Stereoscope**



**Ear Protectors**



**Wedge Prism**



**Biltmore Stick**





**Clinometer**



**Safety Glasses**



**Bark Gauge**



**Scale Stick**



**Tally Meter**



**Diameter Tape**



**Tree Marking Gun**



**Peavy – Canthook**



**Drip Torch**



**Broom Rake**



**Tree Planting Bar**



**Tally Meter Pulaski-Forester Axe**



**Staff Compass**



**Tree Injector**



**Abney Level**



**Steel Tape**

## **Part IV – Timber Cruising Training Examples**

WHILE TREE FORM AND MINIMUM MERCHANTABLE TREE DIAMETERS VARY ACROSS THE STATE, TO LEVEL THE PLAYING FIELD, TREE VOLUMES SHOULD BE DETERMINED USING THE FOLLOWING GUIDELINES:

- Expect to outside bark diameter to DECREASE one inch for every eight-foot log
- Minimum merchantable diameter will be 10 inches (outside bark)
- Merchantable volume will STOP at the first major fork or obvious defect in the trunk
- NO volume is to be determined for logs above the fork or defect, as well as any side limbs



**Timber Cruising Example 1.** Obvious large side branch on the left at 24 feet (1-1/2 logs)



**Timber Cruising Example 2.** Obvious multiple fork at 24 feet (1-1/2 logs)



**Timber Cruising Example 3.** Obvious large side branch just below 28 feet (1-3/4 logs), so this tree could present a challenge. Most students would probably try to squeeze out that second log. **HOWEVER**, in this case, note the remains of a dead branch on the right at 24 feet. This is a good indication that there are internal defects at this point. So, the proper call would be 1-1/2 logs.





**Timber Cruising Example 4.** Upper log limit is where the main stem has a crook to the right at 28 feet (1-3/4 logs). BUT, this tree also has obvious defect at its base. So, a butt-cut would be made to remove the defect. That would leave you with 1-1/2 logs.

## Part V – Timber Stand Improvement (TSI)



**TSI Example 1.** Good example of a ‘U-shaped’ double stem. These twins are sprouts from the original stump which is since long gone. In this case where one can place his/her boot easily between the two stems, one stem can be safely removed without too much fear of adversely affecting the remaining stem. But, which tree to remove? At first glance, one might choose the larger stem on the left. But, note the epicormic branches and the slight lean. Therefore, the better choice is the stem on the right. While smaller, it has better overall form.



**TSI Example 2.** Good example of a ‘V-shaped’ double stem. Again, these twins are sprouts from the same stump. But, in this case, one cannot place his/her boot easily between them. In this situation, there is higher risk that cutting only one stem will allow defect to enter into the base of the remaining stem. Either keep both trees or remove both trees. If they are growing well, with no visible defects, and there are no better neighboring trees then the proper call would be to keep them. However, if there is a better crop tree growing next to these twins then both should be removed.



**TSI Example 3.** Good example a crop tree (with pink ribbon). While this white oak does have a large side branch effectively stopping its merchantable height at that point, it is clearly the best tree in view. The leaning black oak immediately to the left, besides the fact that it is leaning, is a shorter-lived species and should be removed. The other white oaks in view possess inferior form and are growing too close to the selected crop tree. **THE ONLY WAY** one might keep **ONE** of these adjacent trees would be if both trees kept would be released on the remaining three sides.



**TSI Example 4.** Three crop trees have been selected in this view. Note the spacing. The crop tree on the right was kept mainly because there were no better options. The center and right crop trees are a bit closer than a forester would like, but again allowable given that both trees have room to grow on the remaining three sides once the TSI is performed. A general rule of thumb for spacing crop trees is ‘double the diameter’; meaning ‘two feet between the crop tree and its neighbor for every inch of the crop tree’s diameter.’ This rule allows for more trees per acre in younger stands. Ideally, the mature forest stand would have about 35 trees, 35 feet apart on every acre. Of course, Mother Nature oftentimes has other plans.



**TSI Example 5.** Three crop trees have been selected in this view. While not necessarily the biggest trees, they have better form and are more evenly spaced.



**TSI Example 6.** Leaning trees like these red oaks need to be removed because apart from having no commercial value, they are really competing with crop tree canopies much more so had they been growing straight.



**TSI Example 7.** The number of wildlife den trees to leave will depend upon the landowner's objectives. Timber oriented objectives will leave fewer den trees than wildlife or recreation oriented objectives. But, you should consider leaving one or two such trees per acre regardless of the objectives.



**TSI Example 8.** However, wolf trees like the one shown here take up too much space. This tree was probably a pasture tree that has been encroached upon after the pasture was abandoned. In other parts of the state, particularly in the western and northern regions where woodland savannahs once predominated, these wolf trees play a more valuable role in restoring this ecotype.



**TSI Example 9.** While bark is an extremely variable trait among species, interpreting the variation within a species can yield clues relating to a tree's growth. The bark of a slow-growing white oak like the one shown here will be 'blocky' resulting from right-angled cracks in the bark ridges. Also, the furrows ('valleys' between the ridge) will be deeper.



**TSI Example 10.** Fast-growing white oak, on the other hand, will have very flaky bark extending most of the way down the trunk. Only low-down on the trunk will one encounter bark with more defined ridges and furrows; and even then they will not be as defined as the ridges and furrows found on slower-growing individuals.





**TSI Example 11.** Before selecting any crop tree, inspect the trunk carefully for epicormic branches. These small branches are indicative of slow growth and the tree's attempt to stimulate growth by producing more leaf area. Unfortunately, releasing such a tree only stimulates these weak branches and one will end up with a main stem loaded with branches.



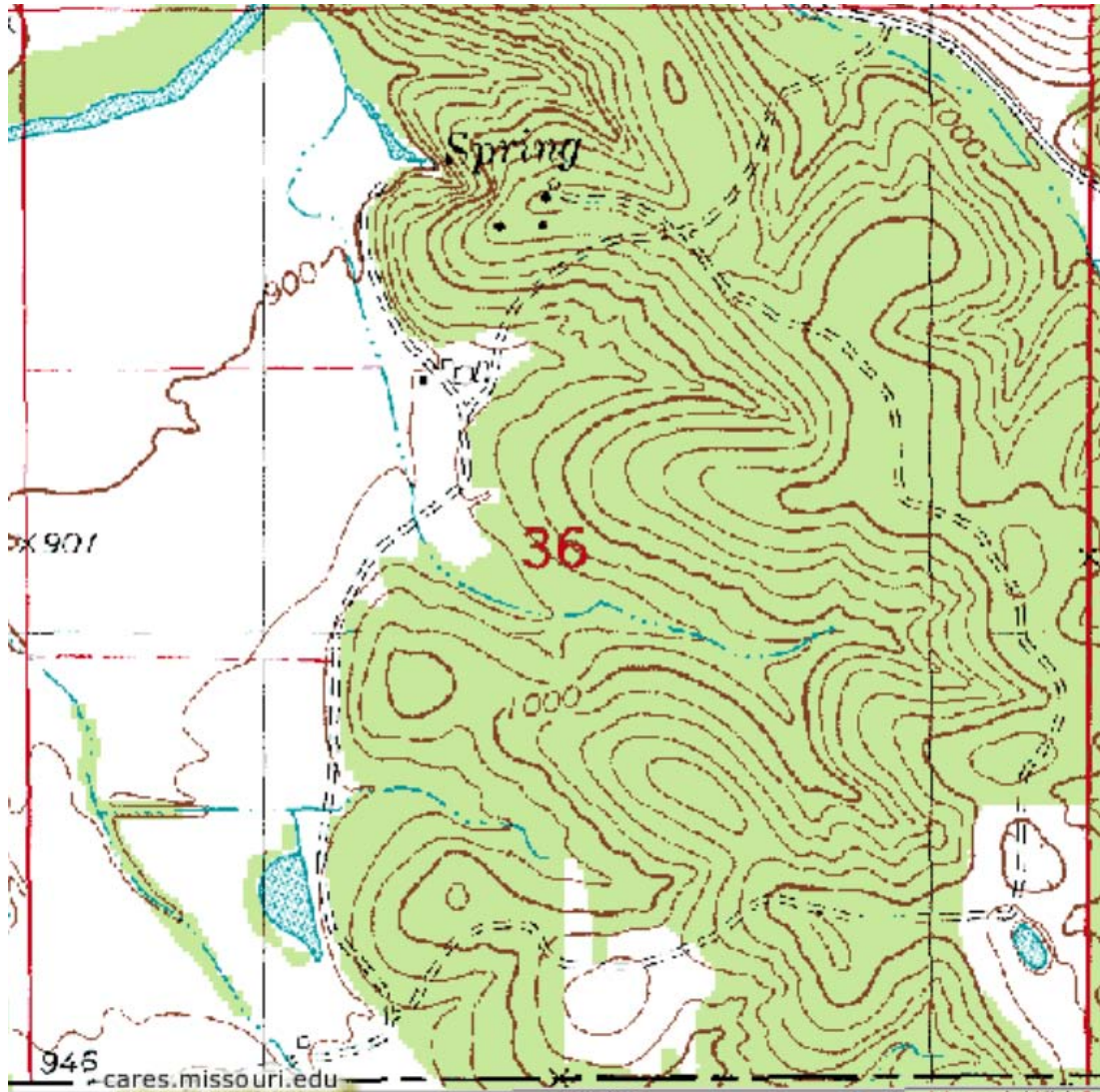
**TSI Example 12.** Not only must you look around when selecting crop trees, but you must also LOOK UP. Releasing a crop tree with a weak, slow-growing crown like the one shown here buys you nothing. This tree will not be able to respond to the TSI compared to another crop tree that has a balance, vigorous crown.

## Part VI – Map Reading – Legal Descriptions

The United States Geological Service (USGS) has a very useful online education series for teaching how to understand topographic maps. The web address is:

[http://education.usgs.gov/common/lesons/teaching\\_with\\_topographic\\_maps.html](http://education.usgs.gov/common/lessons/teaching_with_topographic_maps.html)

Below are a few sample questions that your team members will be asked at the Regional and State CDE.



1. What is the difference in elevation between the highest elevation in the SE 1/4 NE 1/4 of Section 36 and the occupied dwelling in the SE 1/4 NW 1/4 of Section 36?
  - a. 80 feet
  - b. 180 feet**
  - c. 280 feet
  - d. 380 feet

2. What percentage of the SW  $\frac{1}{4}$  SE  $\frac{1}{4}$  of Section 36 is forested?
  - a. 25%
  - b. 50%
  - c. 75%**
  - d. 100%
  
3. The contour interval is \_\_\_ feet.
  - a. 5
  - b. 10
  - c. 15
  - d. 20**
  
4. The road in Section 36 running north-south is a(n) \_\_\_\_ road.
  - a. light-duty
  - b. unimproved dirt**
  - c. medium-duty
  - d. heavy-duty
  
5. What is the highest contour line in the NW  $\frac{1}{4}$  of Section 36?
  - a. 1,100
  - b. 1,110
  - c. 1,120**
  - d. 1,140
  
6. What is the elevation of the occupied dwelling on the west side of the unimproved road in the SE  $\frac{1}{4}$  NW  $\frac{1}{4}$  Section 36?
  - a. 900 feet
  - b. 920 feet**
  - c. 940 feet
  - d. 960 feet
  
7. The intermittent stream in the NW  $\frac{1}{4}$  SE  $\frac{1}{4}$  Section 36 is flowing in which general direction?
  - a. north
  - b. south
  - c. east
  - d. west**
  
8. If traveling west on the road in the SE  $\frac{1}{4}$  of Section 36, you would be
  - a. going downhill
  - b. climbing
  - c. staying level**
  - d. roller coaster type ride
  
9. Which 40-acre parcel has the steepest terrain?
  - a. NE  $\frac{1}{4}$  NW  $\frac{1}{4}$  Section 36**
  - b. NW  $\frac{1}{4}$  NW  $\frac{1}{4}$  Section 36
  - c. SW  $\frac{1}{4}$  SE  $\frac{1}{4}$  Section 36
  - d. SE  $\frac{1}{4}$  SW  $\frac{1}{4}$  Section 36

**End of Training Manual**