

Course	Agricultural Science II
Unit	Forestry
Lesson	Timber Stand Improvement (TSI) Principles
Estimated Time	Two 50-minute blocks

Student Outcome

Analyze how timber stand improvement (TSI) can improve forest production.

Learning Objectives

1. Describe timber stand improvement (TSI).
2. Identify practices involved in TSI.
3. Identify how sprouts are selected in preparing a site for natural reproduction.
4. Identify how trees are removed when practicing thinning and release.

Grade Level Expectations

SC/EC/1/A/09-11/a

SC/EC/1/A/09-11/b

SC/EC/1/B/09-11/b

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. Handout
 - ☐ HO 1 – Tree Spacing by Diameter
2. *Forestry* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1986.
3. *Forestry Curriculum Enhancement*. University of Missouri-Columbia: Instructional Materials Laboratory, 2008.

Supplemental Information

1. Internet Sites
 - ☐ Are You Interested in Making \$1000 per Hour, in Your Woods? Krecik Forestry Consulting Services. Accessed May 28, 2008, from <http://krecik.com/forestry/TSI.htm>.
 - ☐ Moving Toward Sustainable Forestry: Strategies for Forest Landowners. Virginia Cooperative Extension. Accessed May 28, 2008, from <http://www.ext.vt.edu/pubs/forestry/420-144/ch3.html>.
2. Print
 - ☐ Kurtz, W.B., and Carol B. Trokey. *Determining the Profitability of Timber Stand Improvement Investments* (Guide G5151). Columbia: University of Missouri Extension, reviewed 1993. Accessed June 4, 2008, from <http://extension.missouri.edu/xplor/agguides/forestry/g05151.htm>.
 - ☐ Palmer, B., and J. McKee (ed.). *Forest Management for Missouri Landowners*. Jefferson City: Missouri Department of Conservation, revised 2003. Accessed June 4, 2008, from http://www.mdc.mo.gov/documents/forest/private/forest_manag.pdf.

-
- ❑ Slusher, J.P., H.E. Garrett, C. Solomon, and I.L. Sander. *Increase Woodland Products Through Timber Stand Improvement* (Guide G5150). Columbia: University of Missouri Extension, reviewed 1993. Accessed June 4, 2008, from <http://extension.missouri.edu/xplor/agguides/forestry/g05150.htm>.
-

Interest Approach

The average Missouri woodland contains about 20 percent cull trees and produces at less than one-third of its potential. Through the practices of timber stand improvement, woodlands can more effectively reach their potential.

Communicate the Learning Objectives

1. Describe timber stand improvement (TSI).
2. Identify practices involved in TSI
3. Identify how sprouts are selected in preparing a site for natural reproduction.
4. Identify how trees are removed when practicing thinning and release.

Instructor Directions	Content Outline
Objective 1 <i>Ask students to discuss what timber stand improvement is.</i>	Describe timber stand improvement (TSI). TSI denotes management practices that improve the vigor, productivity, and quality of stands of trees. TSI programs may improve the following resources. 1. Value of timber products 2. Water 3. Recreation 4. Forage 5. Wildlife 6. Natural beauty In most cases, more than one woodland use will benefit from a TSI practice.
Objective 2 <i>Discuss with students the five practices involved in TSI. Let the students give their ideas. List these practices on the board. Or visit a woodlot and have students suggest what TSI principles might be applied.</i>	Identify practices involved in TSI. Site preparation for natural reproduction in understocked stands 1. Preparing site allows a. Natural reseeding b. Resprouting of desirable species 2. May involve interplanting seedling stock a. Fully using the available growing space b. Improvement of the type of trees found in the stand Thinning 1. Thinning – cutting trees from a young stand, thus improving growth of remaining trees

Instructor Directions	Content Outline
	2. Trees compete for a. Light (most important) b. Soil moisture c. Nutrients 3. Spacing a. Varies depending on the species, purpose of management, and quality of the site b. Spacing for trees of various diameters at breast height (d.b.h.) Release 1. Cut or remove undesirable trees to encourage fast growth and better quality of desirable trees. 2. Different types of trees may be removed. a. Cull trees - Rotten - Diseased - Fire scarred - "Wolf trees" b. Trees of inferior species which interfere with selected desirable trees 3. Goals may conflict and therefore must be well established. a. If plans include hunting - removing all cull trees may be removing wildlife habitat. b. Removing "wolf" or trees of non-commercial species may remove habitat and interfere with esthetic value. Pruning 1. Removing limbs from trees to produce knot-free lumber. 2. Pruning can improve lumber grades by 60 percent. 3. Pruning can be expensive; prune only selected hardwoods with high return value. 4. Pruning principles include the following. a. Don't remove too much leaf surface of young trees. (At least two-thirds of food-producing leaf surface should be left.) b. Trees should be pruned before they reach 8 inches in diameter. c. Limbs being removed should be less than 2 inches in diameter.

Instructor Directions	Content Outline
	- Reduces wound size - Assists proper closing - Lessens the impact of entry of diseases and insects d. Make pruning cuts close to, but not into, the limb collar of the tree. - Make a smooth cut. - Use sharpened hand saw. Vine removal 1. Vines may do considerable damage to trees (especially young trees). 2. Retain some vines if they provide wildlife food or fall color. 3. Remove vines carefully. a. Cut as low to the ground as possible. b. Immediately treat the vine stump with herbicides.
Objective 3 <i>Discuss with students how sprouts are selected and how undesirable sprouts are removed. An alternate method is to visit a woodlot area and find examples of sprouts for removal.</i>	Identify how sprouts are selected in preparing a site for natural reproduction. Importance of sprout selection 1. Many Missouri hardwoods species sprout heavily from stumps of cut trees. 2. Sprouts grow rapidly into multi-stemmed clumps. 3. Sprouts can be used economically. Kinds of sprouts 1. Seedling sprouts a. Originate from several seedlings b. As good as seedling tree if cut to one stem 2. Tree stump sprouts a. Originate from older trees b. Less desirable than seedling sprouts c. Can develop into good quality trees depending on - Size of stump - Point of origin of sprout Managing sprouts 1. Best managed before 20 years of age – permits better selection from the standpoint of

Instructor Directions	Content Outline
	a. Attachment b. Size of parent stump c. Lessens danger from decay 2. General principles for sprouts 20 years old or less than 3 inches in diameter a. Favor the lower sprout; cut high sprouts. b. Preserve sprout from small stump rather than large stump. c. Remove attached sprout with a flush smooth cut. d. Cut well separated surplus sprouts at any convenient height. 3. General principles of treating sprouts over 20 years old or more than 3 inches in diameter a. Companion sprouts joined at base with a V-shaped crotch should not be cut (difficult to cut without leaving a large wound). b. Companion sprouts with a low U-shaped crotch between them or entirely separated can be removed.
Objective 4 <i>Ask students to discuss methods of removing trees from competition. List methods on the board and let students give their ideas. Refer to HO 1.</i>  HO 1 – Tree Spacing by Diameter	Identify how trees are removed when practicing thinning and release. Thinning – cutting trees from a stand to increase the rate of growth and improve the form of remaining trees Release – removing or deadening undesirable older overtopping growth and quality of young, desirable trees Methods for removing trees when using the TSI practice of thinning or release 1. Timber sale (improvement harvest) a. A great amount of TSI can be accomplished where merchantable trees which are too closely spaced are thinned and sold. b. Some culled trees may be used for firewood. 2. Mechanical methods of removing undesirable trees a. Cutting b. Girdling c. Brush hogging (rarely used) 3. Chemical control a. Often more economical than felling b. More certain of killing trees than girdling c. Controlled resprouting

Instructor Directions	Content Outline
	d. Possible injury to other crops by silvicides and herbicides - Chemicals must be applied with <u>caution</u>. - Always <u>read the label</u> and use the chemical according to <u>label recommendations</u>. e. Methods of applying chemicals - Frilling or mechanical injection • Cuts are made into bark completely around tree. • Suitable chemical is applied to fresh cuts • Mechanical injectors apply chemical at the time they make the cuts. • Hard to kill species (such as ash, maple, or persimmon) must have a continuous cut well into sapwood. - Basal Spraying • This method is used effectively on trees less than 4 inches in diameter. • Spray chemical mixture on lower 12 inches of the trunk, wetting bark thoroughly.
Application	Other activities: 1. Visit a woodland where TSI principles have been used. 2. Assign students as individuals or in teams, to make up a TSI plan for a given woodlot. 3. Have a local TSI contest involving a 2-acre site.
Closure/Summary	You can increase the financial return from a stand of Missouri forest land by improving tree quality and woodland composition. Timber stand improvement (TSI) includes a broad range of practices: site preparation, thinning, release, pruning, and vine removal. Free technical service is available to help you with your TSI plan through local district foresters of the Missouri Department of Conservation.
Evaluation: Quiz	Answers: 1. a. Value of timber products b. Water c. Recreation d. Forage e. Wildlife f. Natural beauty

Instructor Directions	Content Outline
	2. a. Site preparation for natural reproduction in understocked stands b. Thinning – cutting trees from young stand to improve growth of remaining trees c. Release – cutting or removing undesirable older overtopping growth to encourage fast growth of desirable trees d. Pruning – removing limbs from trees to produce knot-free lumber e. Vine removal – cutting vines as close to the ground as possible 3. 20 years, 3 inches 4. a. Timber sale b. Cutting c. Brush hogging d. Girdling e. Chemical control