

Definition

The manipulation of species composition, stand structure and stocking by cutting or killing selected trees and understory vegetation.

Purpose

Purposes include increasing the quantity and quality of forest products by manipulating stand density and structure; harvesting of forest products; initiating forest stand regeneration; reducing wildfire hazard; improving forest health reducing the potential of damage from pests and moisture stress; restoring natural plant communities; achieving or maintaining a desired native understory plant community for special forest products, grazing, and browsing; improving aesthetic and recreation, values;

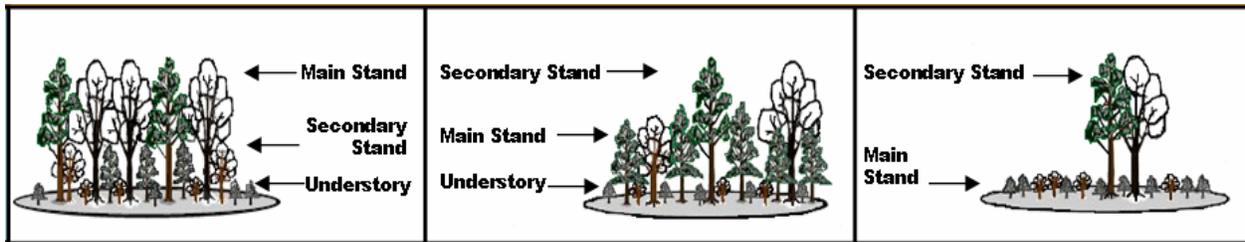
improving wildlife habitat; altering water yield; and increasing carbon storage in selected trees.

Where used

The practice is used on all forest land.

Resource management system

Forest stand improvement is normally established concurrently with other practices as part of a resource management system for a conservation management unit. For example, forest trails and landings, tree/shrub establishment, forest slash treatment, and prescribed grazing can act together to improve forest health and provide wood products and understory forage.



Forest stands may be even-aged or uneven-aged or one to multiple-storied depending on past management, regeneration strategies and ecological succession. Forest stand improvement can be used to manipulate the existing stand structure in one or more canopy levels to achieve management objectives.

Wildlife

Tree species and stocking rates can be managed that meet desired wildlife species food and cover requirements. In addition, snags can be created, recruited and maintained and down woody material maintained to meet requirements of desired wildlife species. Forest stand improvement activities can be timed to minimize disturbance to wildlife and seasonal wildlife activities.

Operation and maintenance

Periodic inspections during and after treatment activities are necessary to ensure that purposes are achieved and resource damage is minimized, e.g., assessment of insects, disease and other pests, storm damage, and damage by trespass. The results of inspections shall determine the need for additional treatment under this practice.

Specifications

Site-specific requirements are listed on the following pages. Specifications are prepared in accordance with the NRCS Field Office Technical Guide. See practice standard Forest Stand Improvement, code 666.



A shade-tolerant conifer has colonized beneath the aspen, a relatively short-lived tree, and will eventually dominate the stand. If aspen is the desired tree species, forest stand improvement can be used to remove the conifer and later, when the aspen matures, used again to regenerate a new stand of aspen by clonal means.



FOREST STAND IMPROVEMENT - 666

Conservation Practice Specifications/Job Sheet

WY-ECS-31

JANUARY 2007

Client/Operating Unit:		Farm No.:	
Farm/Ranch Location:		Field No.:	
Planned Installation Date:			

Installation shall be in accordance with the following specifications, drawings, and other requirements and comply with applicable federal, state and local laws and regulations during the installation, operation, and maintenance of this practice. No changes are to be made in the specifications without prior approval by an agency representative.

Purpose (check all that apply)

<input type="checkbox"/> Increase the quantity and quality of forest products by manipulating stand density and structure.	<input type="checkbox"/> Achieve or maintain a desired native understory plant community for special forest products, grazing, and browsing
<input type="checkbox"/> •Harvest forest products.	<input type="checkbox"/> Restore natural plant communities
<input type="checkbox"/> •Initiate forest stand regeneration.	<input type="checkbox"/> Improve aesthetic and recreation values .
<input type="checkbox"/> Reduce wildfire hazard.	<input type="checkbox"/> Improve wildlife habitat
<input type="checkbox"/> Improve forest health reducing the potential of damage from pests and moisture stress	<input type="checkbox"/> Alter water yield.
	<input type="checkbox"/> Increase carbon storage in selected trees

Objectives

Describe Objective and Management Strategy:

Desired activity to achieve the purpose(s) and objective (check appropriate box)

- Thinning
Use table 1 to determine the planned spacing and trees per acre on the next page.
- Regeneration Harvest
Check one system box. Use table 2 to determine planned conditions on the next page.
Uneven-aged management system:
single-tree selection, group selection, coppice selection
Even-aged management system:
clear-cut, seed-tree, shelterwood, coppice
- Understory/Brush Control
Remove undesired understory species using mechanical or chemical means or by prescribed burning. Coordinate with provisions of Pest Management (595) when chemicals are used and Prescribed Burning (338) when fire is used.

Stand Characterization (enter information as applicable per objective)										
	Existing ¹					Planned				
Forest Stand Structure	<input type="checkbox"/> 1-story <input type="checkbox"/> 2-story <input type="checkbox"/> 3-story					<input type="checkbox"/> 1-story <input type="checkbox"/> 2-story <input type="checkbox"/> 3-story				
	Comp %	Site Index	Age Range	Trees /Ac	Avg dbh ²	Comp %	Age Range	Avg. Spacing (feet)	Trees /Ac	Avg. dbh
Main Story Tree Species										
Secondary Story Species										
Third/Other Story Species										
Understory Species (list in order of abundance)										
Additional Description of Planned Conditions (e.g., regeneration system details):										

¹Refer to WY-ECS-30 Forest Inventory & Summary Worksheet

²dbh = diameter-at-breast-height (4.5 feet above the ground)

Additional Specifications

For thinnings or partial cuttings, residual or “leave” trees shall be well-formed, healthy and pest-free. Trees to be cut shall achieve planned stocking or spacing requirements and include the cutting of poorer quality trees such as those with forked or spike tops, crooked stems, impaired or diminished foliage, or evidence of pest or environmental damage.

The method, felling direction and timing of tree cutting shall protect site resources including residual trees, wetlands, cultural resources, improvements and utilities. Trees shall be cut so that stumps do not exceed 1-foot in height or that specified for the particular site: _____ feet.

Specify range of dates of the forest stand improvement activity: _____

Felling direction must be compatible with trail layout as specified by Forest Trails and Landings, 655. All ground-based equipment shall be operated and timed to minimize soil erosion, compaction, rutting, and damage to remaining vegetation and maintain hydrologic conditions. All forest stand improvement activities will be conducted within applicable limitations of the site’s soils based soil survey interpretive tables: _____

Manage slash to minimize wildfire risk and avoid buildup of insect or disease populations by using Forest Slash Treatment (384). Based on the characteristics and life cycles of existing and anticipated pest species (<http://www.fs.fed.us/r6/nr/fid/wid.shtml>), treat and/or dispose of slash in a way to minimize harm and infestation to the residual trees and adjacent stands/areas.

If there is a wildfire (crown fire) risk, the thinning or partial cutting must result in residual trees spaced so that crowns are no closer than 4 feet. Remove ladder fuels using Tree/Shrub Pruning (660). Coordinate forest stand improvement activities with Forest Slash Treatment (384) and Fuel Break (383).

Create, recruit and maintain sufficient snags and down woody material to meet requirements of resident wildlife species in balance with conditions needed to achieve other intended purposes. Minimize improvement actions that disturb seasonal wildlife activities.

For planned tree regeneration, coordinate activities with the “natural regeneration” component of Tree/Shrub Establishment (612) and Tree/Shrub Site Preparation (490) including use of Prescribed Burning (338) as appropriate.

For sites that will be grazed, coordinate activities with Prescribed Grazing (528) and, when the site is being regenerated, Use Exclusion (472).

Operation and Maintenance

Inspect the area periodically during and after treatment activities to ensure that purposes and the objective are achieved and resource damage is minimized, e.g., assessment of insects, disease and other pests, storm damage, and damage by trespass. The results of inspections shall determine the need for additional treatment under this practice. Additional requirements:

Table 1a. General "D+X" Thinning Spacing Guide

<p>For a tree story ≥ 10" average dbh, D = <u>existing</u> average dbh. For a tree story ≤ 9" average dbh; D = the <u>planned future dbh</u>.</p>			
Species Groups (and site index ranges)	Additional Requirements:	Average Spacing between Trees (in feet)	
		Thin to:	Thin again when:
Very shade tolerant <i>Subalpine fir</i>	1. For small diameter stands (existing average dbh ≤ 9 ") use the specified <u>planned future dbh</u> (usually 10, 11, or 12" dbh) in combination with the "thin again when" D+X spacing to determine planned average spacing (feet). 2. For species having published site index curves, use the bounds of spacing (<u>constants</u> are underlined) shown in the two columns to the right for mid-range sites (middle one-third of the site index range). For highest or best sites (upper one-third) subtract one foot from the <u>constants</u> . For the lowest sites (lower one-third), add one foot to the <u>constants</u> , respectively. 3. After the adjustment for site index, add +1 or +2 feet to the <u>constants</u> if the site has or can grow significant understory forage and browsing resources that are or will be used by animals. 4. Consider thinning over-stocked stands in two or three stages if there is a potential for snow or wind breakage or blowdown. This will provide tree-to-tree support while crowns and root systems grow and strengthen. 5. Use table 1b to convert average spacing between trees to stems per acre. Enter spacing and stems/acre on page 4 for the "planned" columns.	<u>D+4</u>	<u>D+1</u>
Shade tolerant <i>Engelmann spruce</i>		<u>D+5</u>	<u>D+2</u>
Somewhat shade tolerant <i>Blue spruce</i>		<u>D+6</u>	<u>D+3</u>
Shade intolerant <i>Douglas-fir (interior)</i> <i>Ponderosa pine</i> <i>Aspen</i> (20-44, 45-74, 75+)		<u>D+7</u>	<u>D+4</u>
Very shade intolerant <i>Lodgepole pine</i> <i>Pinyon</i> <i>Juniper (Utah, Rocky Mountain)</i>		<u>D+8</u>	<u>D+5</u>

Table 1b. Average Spacing (feet) and Trees/Acre

Spacing	Trees/ac.	Spacing	Trees/ac.	Spacing	Trees/ac.	Spacing	Trees/ac.
3	4840	14	222	25	70	36	34
4	2723	15	194	26	64	37	32
5	1742	16	170	27	60	38	30
6	1210	17	151	28	56	39	29
7	889	18	134	29	52	40	27
8	681	19	121	30	48	50	17
9	538	20	109	31	45	60	12
10	436	21	99	32	43	70	9
11	360	22	90	33	40	80	7
12	303	23	82	34	38	90	5
13	258	24	76	35	36	100	4

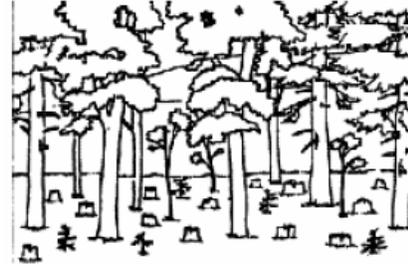
Table 2. Regeneration Harvests - Determining Planned Conditions

Using the information below for the identified system, enter the planned conditions on page 4.

Uneven-aged management systems:

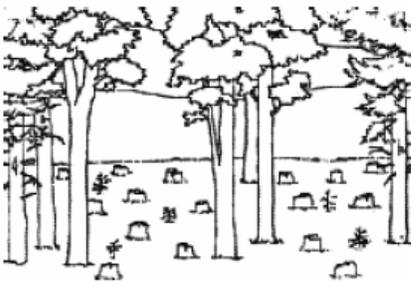
Single-tree selection

Poor condition trees are removed, overly dense areas are thinned, and some of the largest diameter trees are harvested. Tree species range from somewhat shade tolerant to very shade tolerant (see table 1). Seedlings of shade-tolerant trees develop in newly created openings. Harvests may be more frequent but typically yield lower volumes than even-aged systems. Damage to residual trees during harvest may be more likely than other systems. High-grading (taking only the largest, commercial trees in the initial cutting and subsequent cuttings) can diminish the long-term potential of the site to produce wood crops. A percentage of trees in each diameter class (e.g., 2-4" dbh, 5-9" dbh, 10-17" dbh, 18-24" dbh, 24"+ dbh) may be removed. Table 1 spacings with adjustments may be used to determine planned spacings for the target tree species in each diameter class. Trees must be individually marked before removal to assure reaching the management objective. Tree diameter growth in each diameter class compared to table 1 "thin again when" criteria determines the timing of the next cutting.



Group selection

Small groups of trees are removed periodically (usually 3 to 10-year intervals) leaving dispersed small openings ranging from ½-acre to 3 acres with edge trees providing a protected environment for new regeneration in the openings. Tree species typically range from somewhat shade tolerant to very shade tolerant. Damage to residual trees is generally less than single-tree selection. The total of all openings created during a single forest stand improvement cutting is regulated by the acreage of the stand, the planned age of the oldest trees just before they are cut, and the planned cutting interval. For example, a stand on 200 acres is planned to grow to 100 years old with periodic cuttings on a 5-year interval. The acres divided by the age (200/100) times the desired cutting interval (5 years) equals the total of all openings (10 acres) that can be cut during each forest stand improvement activity. The cutting on this interval can occur indefinitely provided the stand remains healthy and free from stand-replacing fire. Individual groups of trees must be marked before removal to assure reaching the management objective.



Coppice selection

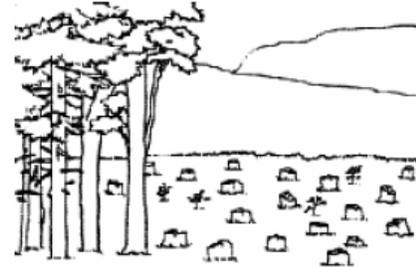
Individual trees or small groups of trees are removed periodically with primary reliance on sprouts from tree stumps or roots for regeneration in openings. Tree species typically range from somewhat shade tolerant to very shade tolerant. Refer to information in systems above for determining planned conditions.

(continued)

Even-aged management system:

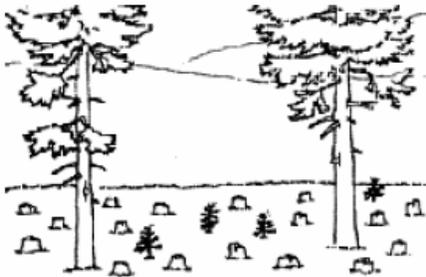
Clear-cut and Coppice

Clear cutting provides an open environment, with plenty of sunlight for shade-intolerant trees (see table 1) to be reproduced in the regenerated stand (or planted by hand after a cutting). Sufficient site preparation is typically needed to enhance survival and establishment of natural regeneration or create spots for tree planting by hand or machine. A coppice cut relies primarily on sprouts from tree stumps or roots for regeneration. The boundary of the area must be marked before cutting begins to assure reaching the management objective.



Seed-tree

Most of the stand is removed while leaving a small number of well-formed, well-distributed and wind-firm trees (usually 5 to 10 per acre) to produce seed. Seed trees may be removed after regeneration is established. The timing of the cutting must be planned to coincide with the likelihood of seed production of the remaining seed trees. The system is used with shade intolerant trees. Sufficient site preparation is typically needed to enhance survival and establishment of natural regeneration or create spots for tree planting by hand or machine. The



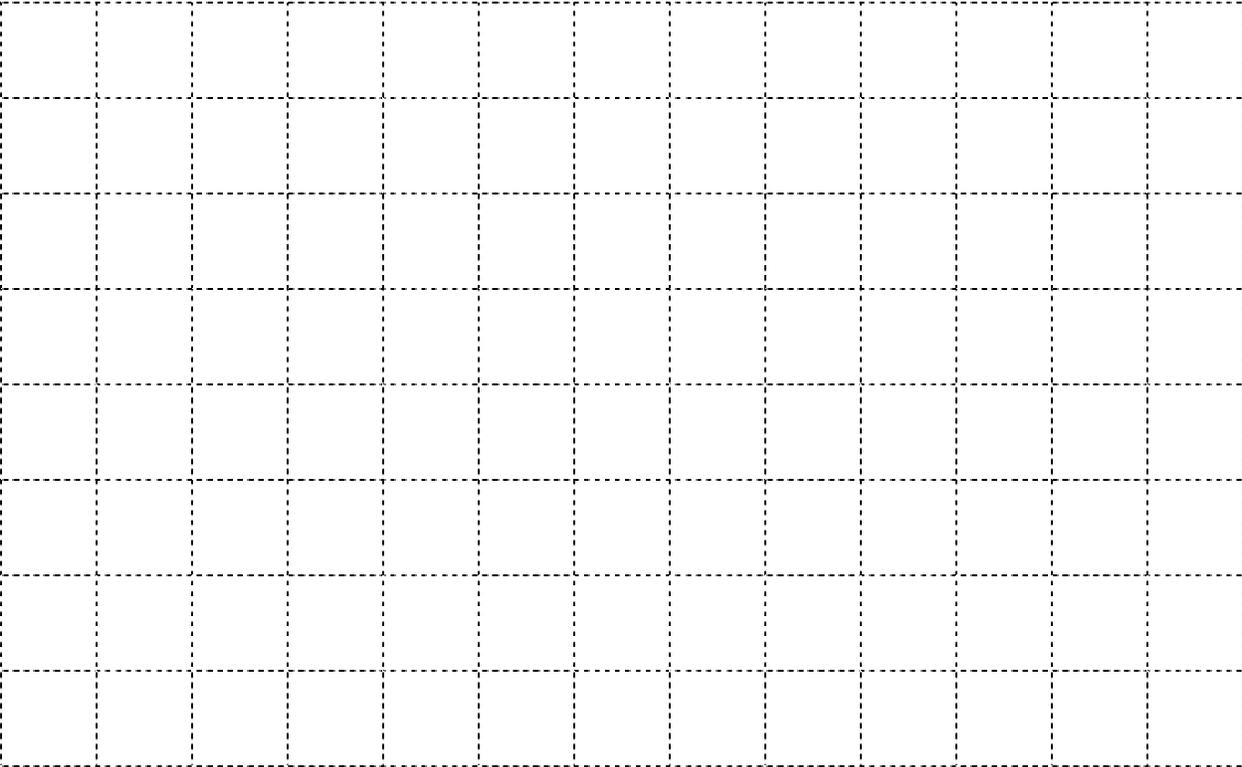
boundary of the area and seed trees must be marked before cutting begins to assure reaching the management objective.

Shelterwood

Enough overstory canopy (usually 15 to 30 percent) is left after the cutting to provide a seed source and protect new regeneration from direct sunlight. The system is typically used with shade tolerant to shade intolerant species that benefit from shade during their seedling stage. Depending on the initial condition of the stand, two or three cuttings (usually spaced over a 10 to 30 year period) are used to regenerate the stand. The objective of the initial cutting is to improve the vigor and seed production of the residual trees and to prepare the site for new seedlings. Subsequent cuttings remove the shelterwood trees and allow the regeneration to develop as an even-aged stand. The boundary of the area and trees to be left are marked to enhance the selection of well-formed, seed-producing trees, obtain a proper distribution of shade, and meet the management objective.

Layout Sketch and Drawing (optional)
(Provide sketch and/or drawings as necessary or refer to conservation plan or other map.)

Scale 1"=_____ ft. (NA indicates sketch not to scale: grid size=1/2" by 1/2")



Additional Clarifying Notes (technical, programmatic, etc.):

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Practice Specifications Approval and Completion Certification

DESIGN AND INSTALLATION/LAYOUT APPROVAL:

I have job approval authority and certify this practice has been designed with specifications to meet the conservation practice standard and that the client has been advised of installation and layout elements:

NRCS Representative name and title (type or print):		
NRCS Representative Signature:		Date:

LANDOWNER/OPERATOR ACKNOWLEDGES:

- a. I have received a copy of these specifications and understand the contents including the scope and location of the practice.
- b. I have obtained all necessary permits and/or rights in advance of practice application, and will comply with all ordinances and laws pertaining to the application of this practice.
- c. No changes will be made in the installation of the job without prior concurrence of the NRCS.
- d. Maintenance of the installed work is necessary for proper performance during the 10-year life of this practice.

I have reviewed all specifications and agree to install as specified:

Landowner/operator name and title (type or print):		
Landowner/operator Signature:		Date:

RECORD OF COMPLETION AND CHECK OUT CERTIFICATION:

Units (_____)	Date Completed by Client:	Date Certified:	Approver's Initials:

I have job approval authority and certify this practice has been applied and meets design specifications:

NRCS Representative name and title (type or print):		
NRCS Representative Signature:		Date:
Notes:		