NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

MULTI-STORY CROPPING

(Ac.)

CODE 379

DEFINITION

Existing or planted stands of trees or shrubs that are managed as an overstory with an understory of woody and/or non-woody plants that are grown for a variety of products.

PURPOSE

- Improve crop diversity by growing mixed but compatible crops having different heights on the same area.
- Improve soil quality by increasing utilization and cycling of nutrients and maintaining or increasing soil organic matter.
- Increase net carbon storage in plant biomass and soil.

CONDITIONS WHERE PRACTICE APPLIES

On all lands where trees, shrubs, woody or non-woody crops can be grown in combination. The practice does not apply on land that is grazed.

CRITERIA

General Criteria Applicable to All Purposes

Combinations of overstory and understory woody and/or non-woody plant species shall be compatible and complementary.

Plants shall be selected based on their adaptation to the climatic region and soil properties and capabilities. A precondition for any tree/shrub establishment is appropriately prepared sites. Refer to practice standard Tree/Shrub Site Preparation, 490.

The planting and care of selected tree and shrub species will comply with Tree/Shrub Establishment, 612.

Canopy covers will be balanced/managed to optimize health and growth of plants in each story or level as determined by client objectives for each story of vegetation.

Plants selected for purposes of protection, growth and production will, at a minimum, maintain soil organic matter content.

Moisture conservation or supplemental watering shall be provided for plant establishment and growth where natural precipitation is too low for one or more of the selected species.

Select pest-resistant plant varieties.

Select species that enhance habitat for beneficial insects including pollinators.

Avoid selecting tree or shrub species, which provide habitat to pests of the accompanying crop or forage.

The overstory canopy density will be determined by the following tree or shrub management objectives:

- Light requirements and growth period of the managed crops dispersed in the understory.
- Erosion control needs.
- Machinery widths and turning areas.

Information on forest stand management techniques can be found in WV Practice standard, Forest Stand Improvement, 666.

For areas with frequent or periodic high to severe winds, leave denser canopies towards the windward side(s).

To reduce surface water runoff and erosion on erosion-prone sites, ground-level vegetation will be of sufficient coverage and oriented on or near the contour. Use mulch as needed to

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

cover bare areas. Any bedding for any story of vegetation will be placed on the contour.

Heights and widths of trees or shrubs will be controlled so they will not interfere with structures and above or below ground utilities.

There are a variety of plants that may lend themselves to multi-story cropping scenarios in West Virginia. Establishment guidelines and procedures should be researched for each prior to the development of a multi-story cropping scenario. Field office personnel can contact the WV NRCS Forester for assistance.

Below is information regarding the establishment/management of two of the more common plants that lend themselves to multi-story cropping scenarios in WV, ginseng and ramps.

<u>GINSENG</u>

Ginseng is an understory plant that may lend itself to some multi-story cropping scenarios in West Virginia. Below is information regarding the establishment of ginseng:

Wild ginseng of the Appalachian region in particular is the most highly-valued ginseng in the world. In the wild, the ginseng plant begins to produce seed after about 3 years of age. In the fall before the vegetation dies back for winter, ginseng seeds fall to the ground and lay dormant for 16-18 months before germinating. Upon germination, the root must negotiate obstacles such as rocks, twigs, and leaves to become established. Growing under these natural conditions tends to make the root take on interesting shapes as it grows into the soil, working its way around pebbles, neighboring roots and other obstacles. The slow grown root with unique characteristics is highly valued in the Asian market.

The goal in growing wild-simulated ginseng is to produce a root which is virtually wild in appearance. This allows the grower to receive wild ginseng prices when it comes time to market the product. Growing in this method is almost always done exclusively from seed.

SITE SELECTION

A northern or eastern exposure is best to protect plants from the heat in summer and the freezing and thawing problems in late fall, winter, and early spring.

To ensure adequate drainage, ginseng is usually planted on the lower 1/3 of slight to moderate slopes.

Ginseng requires a mixed hardwood site. Some indicators of a good ginseng site include sugar maple, black walnut and tulip-poplar trees with ginseng, spicebush, ferns (particularly maidenhair fern), goldenseal, ramps, bloodroot, Soloman's seal, jack-in-the-pulpit, wild ginger, trilliums and black and blue cohosh as understory vegetation. Oak forests can cause slight problems because the leaves are thick and tough. The young plants have a difficult time growing through them in the spring. If oaks are present, keep this problem in mind. Shred the leaves in the fall or help the plants get through them in the spring. A possible problem with wild cherry and maple trees is their abundant production and germination of seeds. Much additional work will be needed to remove cherry and maple seedlings from your patch. Another problem with maples is that their roots are close to the surface, and they compete with the ginseng plants for moisture and nutrients. Also, the tree roots make digging ginseng planted under maples much more difficult.

The amount of light that reaches the forest floor is also an important factor. Unlike most plants, ginseng thrives in dense shade. Most references indicate that ginseng does best in at least 70% - 80% shade. Ginseng growing on sites that are too sunny appears pale and unhealthy. The understory plants discussed above also do best under shady conditions. The presence of these plants usually indicates that light conditions are appropriate for ginseng.

A quick method to approximate the amount of shade that is on a given site is to place 10 or more white paper plates at even distances on the ground at approximately noon on a sunny summer day. Count the number of plates that are at least half shaded. Next divide the number of shaded plates by the total number of plates placed on the ground. Multiply this number by 100. If this number is 70 or greater the site is probably shady enough to grow ginseng.

Generally, soils that support the overstory and understory plants discussed above are suitable for ginseng production. Loamy soils, which are intermediate in texture and have a balance of sand, silt, and clay, are usually best suited for ginseng production. Soils with too much sand tend to be too dry for ginseng to thrive, while those with too much clay often do not provide proper drainage. Poorly drained sites can be prone to fungal diseases.

American ginseng production does best on soils that are at least moderately acidic, ph 5.5 to 6.0. Calcium, magnesium, and phosphorous are most often listed as nutrients that may limit ginseng growth. Careful consideration should be given before applying fertilizers to ginseng sites. Adding too much or the wrong type of fertilizer or lime can be more detrimental than beneficial. This can result in an increased susceptibility to disease or conversely an over stimulation of growth that often results in a decrease in the value of the ginseng root. Usually it is best to concentrate your efforts on sites with the proper nutrient balance rather than adding fertilizers or other amendments to soils that are less suitable. One relatively safe way to improve a borderline site is to amend with leaf litter, from tree species discussed earlier in this publication, thus increasing organic matter content and adding the proper balance of nutrients. It is also a good idea to consult your county's soil survey or a soil scientist for additional soils information

Security of the site is also an important concern when selecting a site to produce ginseng. Pick a site that isn't frequently used by others and that you can monitor regularly. Ginseng's biggest pest is the poacher, and due to its high value, many poachers covet ginseng. Poaching can be a serious problem.

SITE PREPARATION

It is important to remember that ginseng (particularly ginseng under cultivation) is a plant prone to many diseases. The cause of many of these ginseng diseases is too much moisture and not enough air movement through the plants. Stagnant air in a moist setting can create serious disease problems, which can be very hard to control. Overcrowded plantings tend to have many more disease problems than well-spaced plantings. Usually the first step in preparing a wild-simulated ginseng growing site is to remove the necessary understory trees and shrubs in order to create an environment where air can flow more freely over the ginseng plants. <u>However, be sure not to clear the site to point were less 70% shade is available as described above</u>. When preparing the site, do not eliminate canopy trees that supply the necessary shade. This usually means going out with some hand pruners and pruning the lower branches off of small trees and shrubs that may be growing on your ginseng site. Typically, you do not want to remove these trees and shrubs altogether. Performing selective pruning allows increased air flow while maintaining proper shade levels. These small trees and shrubs will provide habitat and protection for your ginseng if managed properly. Pay attention to what direction the wind tends to blow on your site and clear accordingly to allow for maximum air flow over your ginseng plants. This will require yearly maintenance and some pruning to maintain good air circulation.

Any large rocks should be removed from the site. Site Preparation work can begin any time throughout the spring and summer of the year, but it must be completed prior to planting in the fall.

PLANTING WILD SIMULATED GINSENG

The process of growing wild-simulated ginseng begins by planting seed in the autumn around the time the trees begin to shed their leaves, but before the ground freezes (usually done between September and November). Ginseng seed must go through a period of cold dormancy (also known as stratification) before it can germinate the following spring. It is recommended that the novice ginseng grower acquire stratified seed from a reputable commercial seed source. Cost of good quality, stratified ginseng seed is around $50 to $100 per pound.

Ultimately you want no less than one and no more than two mature ginseng plants per square foot upon maturity. This density helps to ensure minimal disease problems and maximal growth. Normally planting 4 to 5 seeds per square foot, ensures proper density at maturity, since germination will not be 100%, and mortality in the first two years is often high. The first year plants will emerge the following spring and do not resemble a mature ginseng plant at this stage. Novice growers have even mistakenly weeded out all of their first year ginseng seedlings.

Begin the planting process by raking back the leaf litter along the bottom of the slope you are going to plant. You will want to rake the leaf litter off of an area about 5 feet wide and 40 feet long if possible. This is best done with a large heavy-duty leaf rake. This 5 x 40 foot area is equal to 200 square feet and will require approximately two ounces of seed. One pound of ginseng seed contains approximately 6,400 to 8,000 seeds (400 to 500 seeds to an ounce). Therefore each ounce of seed should cover approximately 100 square feet at the optimal seeding rate. Once this area is clear of leaves, go back and scratch the soil surface with your rake to loosen the soil up to about ½ -inch deep. This helps the seed to make better soil contact and increases your seed germination rate. The site is now ready to be seeded. Try to spread the seeds evenly over the plot by walking along the top of the plot and sprinkling the seeds by hand. Although it may take some getting used to, this should become a comfortable technique to use for seeding your ginseng. Remember you want to seed at a rate of 4 to 5 seeds per sq. ft. The next step is to move upslope and begin the process over again. This time you will use the leaf litter that you are raking downhill off of the next area to be seeded to cover the previously seeded plot. Make sure to cover the seeded plot entirely with leaf litter, but do not exceed more than 3 inches of leaf litter over the seeded plot. Once you've raked the leaf litter down onto the seeded plot, your next plot should be ready to seed. Repeat the process and continue until you have seeded your whole area.

SUMMARY

Growing wild-simulated ginseng can be a rewarding experience, however, there are laws regarding the planting, growing and harvesting it. West Virginia Code §19-1A-3a deals with ginseng. <u>You must take time research these laws. To learn more about the laws regarding planting, growing and harvesting ginseng in West Virginia, you must contact Office Assistant, Robin Black at the West Virginia Division of Forestry in Charleston. She can be reached at:</u>

WEST VIRGINIA DIVISION OF FORESTRY
1900 KANAWHA BLVD.,E.
CHARLESTON, 25305
Robin.S.Black@wv.gov
(304) 558-2788 ext. 51764

West Virginia Division of Forestry personnel will most likely need to visit a proposed planting site between April and June to determine if wild ginseng is in the area where you would like to plant ginseng. If there, a buffer may need to be established between the wild and planted ginseng. The West Virginia Division of Forestry will help you with determining these requirements. Additional information regarding the laws related to harvesting ginseng in West Virginia can be found at:

http://www.wvforestry.com/ginseng.cfm?menucall=ginseng

RAMPS

Ramps are another plant that may lend itself to some multi-story cropping scenarios in West Virginia. Below is information regarding the establishment of ramps:

SITE SELECTION

Ramps grow naturally under a forest canopy of beech, birch, sugar maple, and/or poplar. Other forest trees under which ramps will grow include buckeye, linden (basswood), hickory, and oak. A forested area with any of these trees present with a thick leafy mulch built up on the ground is a good starting point when looking for a place to produce a ramp crop. Areas that host trillium, toothwort, nettle, black cohosh, ginseng, bloodroot, trout lily, bellwort, and mayapple should be suitable for growing ramps.

Choose a well-drained site with rich, moist soil high in organic matter. Soil moisture appears to be an important environmental variable influencing seed germination, seedling emergence rate, survival, and growth rate of the plant. Thus, adequate moisture must be maintained throughout all seasons, not just the active growing season. Ramps usually perform best on the lower 1/3 of north facing slopes. Northeast and East slopes may also be adequate if no North facing slope is available. A good rule of thumb is to choose a place that the snow stays on the longest.

Ramps also need filtered sunlight or 70% shade. They will not tolerate direct sunlight. A quick method to approximate the amount of shade that is on a given site is to place 10 or more white paper plates at even distances on the ground at approximately noon on a sunny summer day. Count the number of plates that are at least half shaded. Next divide the number of shaded plates by the total number of plates placed on the ground. Multiply this number by 100. If this number is 70 or greater the site is probably shady enough to grow ramps.

Never plant ramps under evergreen trees or on windswept ground.

DIRECT SEEDING

Although ramp seeds can be sown anytime the soil is not frozen, late summer to early fall is usually considered the best time for seeding ramps. Fresh ramp seeds have a dormant, under-developed embryo. The seed requires a warm, moist period to break root dormancy and a subsequent cold period to break shoot dormancy. Some years there is enough warm weather after sowing in late summer or early fall to break root dormancy. The following winter cold breaks shoot dormancy and the plants emerge in spring. If there is not an adequate warm period after sowing, the seed will not germinate until the second spring. Thus, ramp seeds can take 6 to 18 months to germinate. Being able to provide adequate soil moisture and protection from wildlife are other key factors in determining where and when to sow seeds. Production from sowing seeds to root harvest can take 5 to 7 years.

To plant under a forested canopy, rake back the leaves on the forest floor, removing any unwanted weeds, tree sprouts, or roots. If the soil is not naturally high in organic matter, incorporate organic materials such as composted leaves and other decaying plant material from the forest. Loosen the soil and rake to prepare a fine seed bed. Sow seeds thinly (2-3 seeds in a 5-inch area) on top of the ground. Cover seeds with several inches of leaves and press them in with your foot to retain moisture in the soil and to protect the seeds and pre from wildlife. The planting area may be repeated every 2-3 feet.

As mentioned earlier, the seeds may take up to 18 months to germinate. Seeds planted in the fall of 2012 may not germinate until the spring of 2014.

A pack of 50 seeds can cost about $6.00. Assuming the scenario above --- 2 seeds on a 3' by 3' spacing -- the cost of seeds alone could be about $1000.

TRANSPLANTING/PLANTING BULBS

Many growers prefer planting bulbs or young plants instead of sowing seeds. Since germination of the seed can take up to 18 months, transplants and bulbs can be a good alternative for the beginning ramp grower. Planting large bulbs (> 1/2" diameter) can provide harvestable ramps within 2 to 3 years. Bulbs can be purchased in February and March or dug for transplanting between September and March, with February to mid March being the best time. The last week of February through the first two weeks in March (as soon as the ground has thawed and there is no danger of the ground freezing again) is the best time for transplanting young plants. Frost will not hurt the newly planted bulbs as long as the ground doesn't freeze and heave them out of the ground. If bulbs are to be dug for transplanting, once the ground has thawed gently dig the ramps, taking great care not to damage the roots or bulbs.

Put bulbs in a bucket and cover with mud so they will not dry out during planting. In a prepared planting bed (see direct seeding), transplant the bulbs approximately 3 inches deep, and 2-3 feet apart, allowing all the roots to be completely buried and keeping just the very tip of the bulb above the surface. Planting bulbs at the proper depth is important for survival. Pack the soil tightly around the bulb. Transplant leafed-out plants at the same depth they had been growing. If space is limited, clumps of 2 or 3 plants can be grouped together and planted as close as 6-8 inches apart. Mulch the planting bed with at least 2 to 3 inches of moist leaf litter.

Ramp bulbs can cost about $0.55 a piece. The cost of bulbs alone for planting an acre of bulbs on a 3' by 3' foot spacing would be over $2500.

MULCHING

Hardwood leaves provide the best mulch for ramps. Poor results have been obtained with pine bark and commercial mulches and they should be avoided until further research is done. The effects of mulching are numerous: decaying organic matter provides essential elements like nitrogen, much needed moisture is retained within the mulched area, and the mulch acts as an insulator to protect the plants in sub-zero temperatures. In addition, mulching helps to suppress weeds as well as protect newly sown seeds and seedlings from wildlife. When transplanting leafed out plants, spread the leaves out directly over the bulbs to conserve moisture

HARVESTING

In native populations, ramps usually form extensive colonies or clumps. Often the bulbs are so densely spaced that other vegetation can hardly penetrate the stands. Methods for harvest include digging the whole patch, harvesting a portion of a patch, or thinning out and harvesting just the largest plants. Do not harvest plants until they have filled the site, have large bulbs, and have flowered. If whole plots are harvested at one time, it is recommended to have enough plots to allow for a 5 to 7 year rotation. That is, to have continuous harvest year after year, harvest only one-fifth or one-seventh of your production area each year. When harvesting a portion of a plot, no more than 15% of the ramps should be removed. If the thinning method is used, great care should be taken not to damage plants that are not harvested. Based on research done on wild populations; harvests should be limited to 5 to 10% of the plants in each plot.

Tools for harvesting ramps vary with the person using them. A ramp "digger" tool can be purchased or made. This hand tool is the size of a hammer, with a long, narrow head similar to a mattock. Other suitable tools include a garden hoe, pick, and soil knife. For commercial operations, having a tool that can be used comfortably all day is essential.

Digging methods are the same as those described under TRANSPLANTING. Again, great care should be taken not to damage the bulbs. While harvesting, keep the dug ramps cool and moist. When harvesting is

complete, wash ramps thoroughly, and trim off the rootlets. Pack in waxed cardboard produce boxes and store in a cool place, preferably a walk-in cooler. Do not store in airtight containers.

PESTS

Currently, very little information is available on disease or insect pressures on ramps. At times, Septoria leaf spot has been observed in wild and cultivated ramps. Although the spot was unsightly on the foliage, it did not appear to adversely affect plant yields in 2001. The long-term effects of the disease are unknown. New ramp plantings do not compete successfully with weeds thus, weeds should be controlled until the plants are well established.

Additional Criteria to Improve Soil Quality by Increasing Utilization and Cycling of Nutrients and Maintaining or Increasing Soil Organic Matter

Plants selected for purposes of protection, growth and production will improve soil organic matter content.

Select deep-rooted species for the overstory.

Include nitrogen fixing species in the overstory and/or understory.

Retain thinning and pruning material on-site.

Additional Criteria to Increase Net Carbon Storage in Plant Biomass and Soil

For optimal carbon storage, select plant species that are adapted to the site to assure strong health and vigor and plant the full stocking rate for the site.

Manage the appropriate density for the site that will maximize above and below ground biomass production.

Minimize soil disturbance during establishment of the site.

Minimize soil disturbance during cultivation of the understory crop(s).

CONSIDERATIONS

Select crop, forage, tree and/or shrub varieties based on their tolerance to agriculture chemicals that will be used at the site.

Species diversity including use of native species should be considered to avoid loss of function due to species-specific pests or to enhance pollinator and wildlife needs.

High value trees or shrubs should be selected to maximize economic returns.

Consider selecting plants that are culturally important.

For areas with frequent or periodic high to severe winds, consider the use of Windbreak/Shelterbelt Establishment-380 on the windward side(s) of multi-story cropped areas.

Anticipate possible off-site effects and modify the practice design accordingly.

Coppice ability of selected species of trees and shrubs should be considered when they are to be pruned periodically.

PLANS AND SPECIFICATIONS

Plans and Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

Substrate material and site preparation necessary for proper establishment of the selected plant/seed shall be included in the design.

At a minimum the following will be identified in the conservation plan (as appropriate) with respect to the understory crop:

- ***Purpose of understory establishment***
- ***Field location / plan view***
- ***Acreage to be established***
- ***Site conditions prior to establishment***
- ***Soil amendments (if needed)***
- ***Site preparation methods (if applicable)***
- ***Plants to be used***
- ***Spacing (if applicable)***
- ***Establishment method(s)***

- ***Establishment dates***
- ***Protection methods (if applicable)***
  - ***Note dimensions and specifications of protection measures as applicable***
- ***Replacement strategies***

At a minimum, the following will be identified with respect to the overstory crop (as appropriate):

- ***Landowner objectives***
- ***Type of treatment***
- ***Treatment acreage / orientation***
- ***Treatment location***
- ***Existing conditions***
- ***Expected outcomes***
- ***Treatment specifications***
- ***Cultural practices necessary for management of the overstory (i.e. pruning, forest stand improvement, etc.) (if any)***
  - ***Spacing, density, size class, number and amounts of trees and understory species to be retained***
  - ***Stocking guidelines shall contain stocking in terms of basal area, spacing or trees per acre by species and size class distribution.***
  - ***The harvest-regeneration strategy will be identified for all planned forest improvement harvesting:***
    - ***Uneven-aged management systems (e.g., single-tree selection, group selection, coppice selection)***
    - ***Even-aged management (e.g., clear-cut, seed-tree, shelterwood, coppice)***
  - ***Treatment dates***
- ***Any required permits including CPA-52 or similar environmental evaluation documentation;***
- ***Win-PST Soil/Pesticide Interaction Hazard Ratings (if applicable)***
- ***Operation and maintenance requirements***

OPERATION AND MAINTENANCE

The trees, shrubs, crops, and/or forages will be inspected periodically and protected from adverse impacts including insects, diseases or competing vegetation. Newly planted trees or shrubs will also be protected from fire and damage from livestock or wildlife.

All other specified maintenance measures and techniques of tree/shrub establishment will continue until plant survival and establishment are assured. This includes replacement of dead and dying trees or shrubs, pruning of dead or damaged branches for safety reasons, periodic pruning of selected branches for control of product quality, and control of undesirable competing vegetation.

Any removals of tree or shrub products, use of agricultural chemicals, and maintenance operations shall be consistent with the intended purpose of the practice. Avoid damaging the site and soil and comply with applicable federal, state and local regulations pertaining to on-site and off-site effects.

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance).

The planting should be inspected at least annually and after storm/fire events.

Damaging pests will be monitored and controlled.

Pruning, thinning, and/or removal of dead or diseased plants should be performed and timed as to not interfere with the life cycle of the plants or the intended purpose of the planting.

Supplemental water will be provided as needed.

Additional operation and maintenance requirements may be developed on a site-specific basis to assure performance of the practice as intended.

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Robin S. Black, West Virginia Division of Forestry, 1900 KANAWHA BLVD.,E. CHARLESTON, 25305
Robin.S.Black@wv.gov
(304) 558-2788 ext. 51764

Cultivating Ramps: Wild Leeks of Appalachia, Jeanine M. Davis and Jacqulyn Greenfield

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**** NOTE: Information in bold italics has been added to the national standard by West Virginia***