

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

CRITICAL AREA PLANTING

**ACRE
Code 342**

DEFINITION

Establishing permanent vegetation on sites that have or are expected to have high erosion rates, and on sites that have physical, chemical, or biological conditions that prevent the establishment of vegetation with normal practices.

PURPOSE

- Stabilize areas with existing or expected high rates of soil erosion by water.
- Stabilize areas with existing or expected high rates of soil erosion by wind.
- Restore degraded sites that cannot be stabilized through normal methods.

CONDITIONS WHERE PRACTICE APPLIES

On areas with existing or expected high rates of erosion or degraded sites that usually cannot be stabilized by ordinary conservation treatment and/or management, and if left untreated, could be severely damaged by erosion or sedimentation or could cause significant off-site damage. Examples of applicable areas are dams, terraces, dikes, mine spoil, levees, cuts, fills, surface-mined areas, and denuded or gullied areas where vegetation is difficult to establish by usual planting methods.

CRITERIA

NOTE: Specific program guidance may be more restrictive on a number of these criteria, particularly approved plant species and seeding rates, weed control and operations, and maintenance.

General Criteria Applicable to All Purposes.

Critical area plantings will be established to permanent herbaceous vegetation. Species will be suitable for the planned purpose. The long-term objectives of the land user will be used in selection of vegetative cover. Where critical area plantings will act as filters, the species selected shall have stiff upright stems. Stem density shall be >30 stems/sq. ft. for legumes and > 50 stems/sq. ft. for grass or grass/legume mixture.

Native species are generally not recommended for critical area seedings due to their slow establishment. If native species are used, close evaluation of the site is needed to ensure minimal erosion occurs during the establishment period.

Monocultures are discouraged. Introduction of invasive species into areas where they do not already exist is prohibited.

Comply with all applicable federal, state, and local laws, rules, and regulations.

A. Seeding Periods.

Permanent, perennial vegetative cover will be established during the first recommended seeding or planting period for the selected species or mixture. Due to the inaccessibility of terraces, seeding

will be completed immediately after construction. Planting dates are outlined on Table 1 of this standard. These dates are based on long-term averages and may be extended by two weeks by the district conservationist. Extension of these deadlines shall be based on both favorable moisture and temperature for seed germination.

B. Fertilizer and Lime Requirements.

Soil fertility and pH level will be amended to satisfy the needs of the specific plant species planned. Fertilizer recommendations for establishment will be determined by an approved testing laboratory from soil samples collected in the area to be seeded. Refer to Nutrient Management, Practice Code 590, and Iowa State University publication, PM-1688, "General Guide for Crop Nutrient Recommendations in Iowa" and ISU PM-869 "Fertilizing Pasture" for fertilizer and lime recommendations for grasses or grass/legume seeding establishment. Since these sites have most of the topsoil removed and have low fertility, these fertilizer recommendations apply to both non-native and native seeding mixtures.

Sites that do not have soil sampling available, a general fertilizer and lime recommendation will be used. This general fertilizer recommendation is based on sites denuded of topsoil. To determine the general fertilizer recommendation see Iowa State University PM-1688, revised November 2002, to determine fertility levels of the subsoil for P and K. Determine the P and K subsoil levels by soil type in Tables A-L and Figure 1. Below is the general recommendation based on subsoil P and K levels.

Subsoil P levels	P Fert. Recom.	Subsoil K levels	K Fert. Recom.
Low	200 lb/ac	Low	100 lb/ac
High	100 lb/ac	High	50 lb/ac

The general recommendation for lime is 3000 lbs of ECCE. This will be applied to all soils except those that are known to be calcareous such as Ida and Canisteo.

C. Companion Crop.

All critical area plantings will contain a companion crop or will be mulched according to the Mulching (484) Standard. Mulching will be required on slopes steeper than 4:1 where mowing of a companion crop may be difficult or dangerous.

For spring seedings of introduced species, oats shall be seeded at a rate of 1 1/2 bushels/acre to reduce soil erosion and help control weed competition. The oats shall be clipped at the time of seed head emergence to promote growth of the new permanent cover. The use of the companion crop is not required when interseeding and is optional for all other seeding periods.

D. Seedbed Preparation and Seeding.

1. Conventional seeding for spring and late summer seeding periods where site conditions allow for safe operation of equipment.
 - a. The seedbed shall be worked to a depth of three inches before seeding. It shall be reasonably smooth, friable, and firm before seeding.
 - b. All tillage operations shall be performed across the general slope of the land.

- c. Grass and legume seed shall be drilled uniformly over the area at a 1/4-1/2 inch depth, or broadcast uniformly over the area and rolled into the seedbed.
 - d. Where erosion is a concern and conservation tillage is needed, prepare a seedbed with chisel, disk, or other similar tool that will leave enough residue to provide adequate protection.
2. No-till seeding for spring, late summer and dormant seeding periods where site conditions allow for safe operation of equipment.
 - a. Approved herbicides shall be applied to kill or suppress existing weed competition, as necessary.
 - b. A drill designed for no-till planting shall be used to plant the seed at a depth of 1/4 - 1/2 inch.
 3. Frost Seeding - Broadcast seed for only those species approved for frost seeding as shown in Table 2 and Table 3.
 4. Hydroseeding - On sites that are too steep for regular seeding equipment to operate, the use of a hydroseeder or mulch blower is an acceptable alternative. Follow manufacturer's supplier recommendations to apply the seed and fertilizer in a water slurry uniformly over the surface. A second trip will be needed to apply an asphalt emulsion to long fiber mulch as it is blown on.
 5. Sodding - All sod used shall be free of noxious weeds as listed in Iowa State Laws and shall be cut from stands giving not less than 90 percent ground cover.

Only moist, fresh sod shall be used. Lay sod as soon as possible after delivery to the site. Wet soil to a depth of two inches

or more prior to laying the sod. Lay the sod from the lower end of the slope. On steep slopes, use of ladders will speed up the laying and prevent damage to the sod. Sod strips shall be laid at right angles to the flow of water; stagger joints. Fill any open joints with loose soil. Tamp or roll laid sod to ensure a solid contact of root mass to soil surface.

On severely steep sites or when anticipating overland flow, sod shall be held in place by woven wire, wooden pegs, wire staples, or similar material. Pegs or staples will be a minimum of 10 inches long.

E. Seeding Stand Improvement.

(Includes any stand modification that maintains some vegetative component of the original stand.)

1. Incorporation of grasses and/or legumes with light tillage.
 - a. Weaken the existing stand in the fall or early winter by use of herbicides, grazing, mowing or a combination of these methods.
 - b. Use a disk, cultivator, or similar tool to disturb 40-50 percent of the existing stand.
 - c. Grass and legumes shall be drilled uniformly over the area at 1/4-1/2 inch depth, or broadcast uniformly over the area and rolled into the seedbed.
 - d. Remove early spring regrowth by mowing to reduce competition and allow the new seedlings to become established.
2. Incorporation of grasses and/or legumes with no-tillage (interseeding) for spring, late summer, and dormant seeding periods.

- a. When interseeding into existing sod, graze, burn, mow, or apply herbicides to kill strips or suppress existing vegetation and to control weed competition.
 - b. Control broadleaf weeds by applying herbicide at least two weeks prior to applying contact herbicides and prior to seeding. When using herbicides read and follow all label directions and heed all precautions.
 - c. Grass and legumes shall be drilled uniformly over the area at 1/4-1/2 inch depth.
 - d. Remove early spring regrowth by mowing to reduce competition and allow the new seedlings to become established.
3. Incorporation of grasses and/or legumes with frost seeding.
 - a. Broadcast seed only species approved for frost seeding as shown in Table 2 and Table 3. Small smooth (shiny) seeded species are best for incorporation into the soil during freezing and thawing.
 - b. Frost seeding is likely to be more successful if existing stand is weak and less than 50 percent of the ground is covered with live vegetation.

F. Inoculation.

1. Legume seed shall be inoculated.
2. Inoculant shall be specific to the legume seeded.
3. When more than one legume species is used, each species shall be inoculated separately. See Agronomy Tech Note 11, Legume Inoculation.

G. Seed Quality.

1. All seed shall be of high quality and comply with Iowa Seed and Weed Laws.
2. Cool season (introduced) grass and legume seeding rates are expressed in bulk pounds/acre. Seed quality shall not drop below 70% Pure Live Seed (PLS) where $PLS = (\% \text{ germination} + \text{dormant seed}) \times \% \text{ purity}$.
3. Native grass species seeding rates are expressed in PLS pounds/acre.
4. For native forbs, PLS requirements may be waived by receiving concurrence from the State Agronomist.

H. Approved Plant Species and Seeding Rates.

Plant species and cultivars shall be selected based upon:

1. Climatic conditions such as annual rainfall, seasonal rainfall, growing season length, humidity levels, temperature extremes, and the USDA Plant Hardiness Zones.
2. Soil condition and position attributes such as pH, percent slope, available water holding capacity, aspect, drainage class, inherent fertility, flooding and ponding, and levels of salinity and alkalinity.
3. Plant characteristics such as season of growth, vigor, ease of establishment, longevity of the species, growth habit, adaptation to soil conditions, and conservation value.
4. Resistance to diseases and insects common to the site or location.
5. Compatibility with other plant species and their selected cultivars in rate of

- establishment and growth habit when seeded together as a mixture.
6. Seeding Rates - Seeding rates are based on the optimum amount of seed necessary to provide vegetative cover in a reasonable amount of time. The pure stand rates in Table 2 of this standard are the minimum rates for planting a single species stand into well-prepared seedbed at the proper placement. The pure stand rates are decreased to a percentage of the desired stand when used to calculate a mixture of two or more species. Select combinations of plant species and cultivars best adapted to site conditions.
 - a. For more information on species and soil adaptation refer to Iowa Technical Guide Section II, Pasture and Hayland Interpretations.
 - b. For more information on introduced cultivar selection, refer to Agronomy Technical Note # 14.
 7. Where frost seeding is used or when terraces are seeded during the non-traditional seeding periods, the normal seeding rate shown in Table 2 and Table 3 shall be multiplied by 1.5.
 8. Introduced Species.
 - a. Approved introduced plant species, allowable mixture composition and the pure stand seeding rate are shown in Table 2.
 - b. A designed seeding mixture shall meet criteria specified in Table 2 as to species composition and seeding rate.
 - c. For critical area seeding used for erosion control, at least 50 percent of mixture shall be composed of grasses.
 - d. Mixtures may include up to 20 percent native grasses. Use the criteria for the predominant species in the mixture for stand establishment.
 9. Native Species.
 - a. Approved native plant species, allowable mixture composition and a pure stand seeding rate are shown in Table 3.
 - b. A designed seeding mixture shall meet criteria specified in Table 3 as to species composition and seeding rate. At least 50 percent of the mixture shall be composed of sod forming grasses.
 - c. When developing seeding mixtures, select grasses from Table 3 to acquire 60 seeds/sq. ft. for a grass establishment.
 - d. Mixtures may include up to 20 percent introduced legumes. Use the criteria for the predominant species in the mixture for stand establishment.

I. Weed Control During the Establishment Year.

Weed control during the establishment year shall be provided to ensure survival of the new permanent seeding.

1. To manage severe weed competition, native species may be mowed no closer than eight inches and introduced species no closer than four inches.
2. Approved herbicides may be used on both cool and native plantings to control weed species.

J. Establishment of Temporary Cover.

1. Temporary cover may be required to reduce potential weed and erosion problems where one of the following conditions exists.
 - a. Fields with herbicide carry over.
 - b. Where planting is delayed due to unavailability of seed.
 - c. The normal planting period has passed.
2. Temporary cover or mulching will be established on sites where construction delays or shutdowns occur if the delay or shutdown will last more than 30 days.
3. The temporary cover shall be seeded as specified in Table 4.

ADDITIONAL CRITERIA TO IMPROVE WILDLIFE HABITAT AND AESTHETIC RESOURCES.

Where wildlife is the primary or secondary land use objective, select species for wildlife planting that create an open structure that allows increased forb production and wildlife movement.

Grasses, forbs, and legumes can be planted both in mixes and separately to encourage maximum plant diversity. The best wildlife planting mixes will contain multiple species. Maximize plant and animal diversity by using prescribed burning or mechanical, biological, or chemical methods to promote plant diversity.

ADDITIONAL CRITERIA TO RESTORE DEGRADED SITES.

If gullies or deep rills are present, they will be treated, if feasible, to allow equipment operation and ensure proper site and seedbed preparation.

Soil amendments will be added as necessary to ameliorate or eliminate physical or chemical conditions that inhibit plant establishment and growth. Required amendments, such as compost or manure to add organic matter and improve soil structure and water holding capacity; agricultural limestone to increase the pH of acid soils; or elemental sulfur to lower the pH of calcareous soils shall be included in the site specification with amounts, timing, and method of application.

A. Abandoned Mine Soil.

Most coal mine spoil is extremely acid. Old spoil banks should be partially leveled before seeding operations begin. Apply minimum of six inches of friable soil material including topsoil to the surface if available. Apply high rates of ground limestone to the spoil. If possible, apply limestone six months before seeding.

B. Landfills.

Landfills shall have a minimum of 18 inches of friable soil over the refuse before permanent vegetative cover can be established. Often these sites have a methane vent so prescribed burning is not a viable management option for maintenance of the vegetative cover.

Select plant species that have a wide soil adaptation on all mine spoil and landfill sites. Consider species that are shallow rooted and will produce a good sod cover. Mulch the site according to Mulching, Practice Code 484. Mulch is important not only for erosion control, but to help maintain a better physical condition of the soil surface until seed emergence.

CONSIDERATIONS.

Native species or mixes that are adapted to the site and have multiple values should be considered.

Avoid species that may harbor pests. Species diversity should be considered to avoid loss of function due to species-specific pests.

All tillage operations should be done as near to a contour as possible on slopes steeper than two percent. Perform tillage, planting, and mulching operations across the slope.

Hydroseeding is recommended on slopes too steep for normal field equipment or where the use of normal field equipment is not feasible.

Fertilizer spreaders may be used to broadcast seed along with the lime and fertilizer requirements. Inert materials such as cracked corn may be used as bulk material to aid in seed dispersal.

Allelopathy effects have been documented with certain cereal grains used as temporary cover. These crops produce chemical substances that inhibit the growth or establishment of following crops. Light tillage is often used to reduce allelopathy prior to seeding permanent cover.

Cooperators using herbicides to control weed competition should be cautioned as follows:

Read and follow all label directions and heed all precautions. If herbicides are handled or applied improperly, or if unused portions are not disposed of safely, they may contaminate water and soil, injure humans, domestic animals, desirable plants, and fish or other wildlife. Herbicides should not be used over or directly adjacent to ponds, lakes, or streams. Cooperators should be aware of and adhere to the

provisions of local, county, state or federal laws and regulations concerning the use of agricultural chemicals.

Refer to Pest Management, Practice Code 595, for additional information on pesticide use and safety.

When using native plant species for prairie establishment or prairie reconstruction, the use of certified or source identified seed should be recommended whenever possible.

PLANS AND SPECIFICATIONS.

Specifications for establishment and maintenance of this practice shall be prepared based on specific objectives for each site or planning unit according to the criteria and considerations described in this standard.

Iowa CPA 4 or similar document shall be used to provide specifications for conservation cover to the land user.

When formal stand evaluation is needed use Agronomy Technical Notice No. 19 "Guideline for Herbaceous Stand Evaluation."

OPERATION AND MAINTENANCE.

Use of the area shall be managed as long as necessary to stabilize the site and achieve the intended purpose.

Control or exclude pests that will interfere with the timely establishment of vegetation.

During the establishment period, inspections, reseeding or replanting, fertilization, and pest control may be needed to ensure that this practice functions as intended throughout its expected life.

Mow, burn, clip, or use approved chemicals to reduce competition from existing stand to improve survival of desired species during the establishment period.

When plant vigor declines, maintenance levels of plant nutrients may be necessary. Refer to Nutrient Management, Practice Code 590, for recommendations.

Where critical area seeding is grazed or hayed, refer to Prescribed Grazing, Practice Code 528A, and Forage Harvest Management, Practice Code 511, for recommendations.

Where plant vigor declines in native plant species or where invader species threaten native mix stands, burning may be appropriate. See Prescribed Burning, Practice Code 338 for additional information on burning criteria.

REFERENCES.

These publications are available at County Extension Offices; Extension Distribution Center, Printing Building, Iowa State University, Ames, IA 50011; and several

are available on the ISU Publications Home page at <http://www.extension.iastate.edu/Pages/pubs/>.

- ISU PM-1688 "General Guide for Crop Nutrient Recommendations in Iowa."
- ISU PM-869 "Fertilizing Pasture."

The following publications are available at the Iowa NRCS Home page at: <http://www.ia.nrcs.usda.gov>.

- Native Grass Seeding Calculator.
- Agronomy Technical Note 19 "Guideline for Herbaceous Stand Evaluation."
- Agronomy Technical Note 27 "Guidance on Seeding Pothole, Floodplain, and Other Wetland".
- NRCS Standard Prescribed Burning, Practice Code 338.
- NRCS Standard Forage Harvest Management, Practice Code 511.
- NRCS Standard Prescribed Grazing, Practice Code 528A.
- NRCS Standard Nutrient Management, Practice Code 590.

Table 1. Seeding dates for cool and native species.

Type of Seeding	Introduced Species ² (Grasses and Legumes)	Native Species ³ (Includes Prairie Restoration Mixtures)
Spring	March 1 - May 15	April 1 - June 1
Late Summer	August 1 - September 15	Not Recommended
Dormant	November 15 - Freeze-up	November 15 - Freeze-up
Frost ¹	February 1 - March 15	February 1 - March 15
New Construction ⁴	Immediately after construction	Immediately after construction

1 - Refer to Tables 2 and 3 for applicable plant species.
2 - Includes all species generally considered introduced.
3 - Includes all warm and cool season natives when planted in mixture.
4 - This includes recently completed construction sites where seeding equipment such as a drill is not able to be used due to the steepness of slope.

Table 2. Seeding chart for introduced plant species.

Plant Species	% of Mixture (Range Allowed)		Seeding Rate Bulk pounds/acre
	Critical areas Grassland ^{3/}	Trees, Shrubs & Wildlife	
Smooth brome ¹	0-100	0-25	25
Kentucky bluegrass ¹	0-80	0-10	25
Orchardgrass ^{1,2}	0-50	0-100	10
Timothy ^{1,2}	0-50	0-100	10
Alfalfa ²	0-50	0-50	20
Red clover ²	0-50	0-50	16
Birdsfoot trefoil ²	0-50	0-25	16
Reed canarygrass	0-50	0	16
Perennial Rye	0-50	0-50	25
Ladino clover ²	0-50	0-50	8
Redtop	0-50	0-80	10
Alsike clover ²	0-50	0-50	8
Tall fescue ¹	0-50	0-10	16
Sweetclover ^{2,4}	0-20	0-20	10

1 - For critical area seeding used for erosion control at least 50 percent from the grassland or wildlife seeding mixture shall be composed of sod forming grasses. (Tall Fescue should not consist of more than 10 percent of the mix if primary or secondary purpose is for wildlife.)
2 - Species suitable for frost seeding, increase seeding rate by a factor of 1.5.
3 - Mixtures may include up to 20 percent native grasses. See Table 3 for seeding rates. Use the criteria for the predominate species in the mixture for establishment.
4 - Sweetclover is to be used in mixtures only.

Table 3. Seeding chart for native plant species.

Grasses¹	% of Mixture (Range Allowed)	Pure Stand Seeding Rate PLS pounds/acre	Seeds per Sq ft	# Seeds per lb
Big bluestem, <i>Andropogon gerardi</i>	0-100	16	60	165,000
Blue Grama, <i>Bouteloua gracilis</i>	0-20	4	75	825,000
Buffalograss, <i>Buchloe dactyloides</i>	0-20	65	60	40,000
Canada wildrye, <i>Elymus canadensis</i>	0-20	22	61	121,000
Eastern gamagrass, <i>Tripsacum dactyloides</i>	0-100	20	4	7,500
Indiangrass, <i>Sorghastrum nutans</i>	0-100	15	60	175,000
Little bluestem, <i>Schizachyrium scoparium</i>	0-20	11	60	240,000
Sideoats grama, <i>Bouteloua curtipendula</i>	0-20	14	61	191,000
Switchgrass, <i>Panicum virgatum⁵</i>	0-100	7	62	389,000
Virginia Wildrye, <i>Elymus virginicus</i>	0 -20	27	60	96,000
Western wheatgrass, <i>Agropyroni smithi</i>	0-20	24	61	110,000

^{1/}When developing seeding mixtures, except eastern gama grass, use 60 seeds/sq. ft. for grass stands. Grass and forbs/legume mixtures use 40 seeds/sq. ft. for the grass component and minimum of 20 seeds/sq. ft. for forbs/legume component.

^{2/}Annual and biannual forbs and legumes are to be limited to 20 percent of the forb/legume component. Naturalized wildflowers are not to be counted towards the forb/legume component.

^{3/} Mixtures may include up to 20 percent cool season introduced legumes. See Table 2 for seeding rates. Use the criteria for the predominate species in the mixture for establishment.

^{4/} These species are not native to Iowa statewide. Their use as part of seeding mixtures is to be restricted to local area with known native populations

^{5/}Species suitable for frost seeding, multiply seeding rate by factor of 1.5.

TABLE 4. Temporary Seeding Recommendations.

Fields with atrazine ^{1/} carryover, lack of suitable seed, or late planting date	
Sudangrass	20 lbs/ac
Sorghum-Sudangrass hybrid	20 lbs/ac
Corn	2 bushels/ac
Fields where planting is delayed due to lack of suitable seed or late planting date	
Oats	3 bushels/ac
Winter rye	2 bushels/ac
Spring or winter wheat	2 bushels/ac
^{1/} For other herbicide carry-over problems, check with the area office.	

Critical Area Seedbed Mixtures for Specific Site Conditions

Site Conditions	Seeding Mixture	Rate lbs./acre
Moderately to well drained, limed or nonacid, fertile soils	1. Alfalfa Red clover Smooth brome grass	3 2 15
	2. Alfalfa Timothy Smooth brome grass Or Orchardgrass	6 2 15 or 8
Imperfectly drained soils	3. Red clover Ladino clover Orchard	4 1 8
	4. Birdsfoot Trefoil Smooth brome grass Timothy	5 12 3
	5. Big bluestem Switchgrass	14 2
Poorly drained soils	6. Birdsfoot trefoil Timothy or Orchardgrass	4 8 or 12
	7. Alsike clover Ladino clover Tall fescue or Timothy	2 3 8 or 5
Very wet sites with high nutrient loading (ie animal waste filter strips)	8. Reed canarygrass	16
	9. Tall fescue	16
	10. Switchgrass	7
Medium acid to strongly acid (6.0-5.1) with well drained to poorly drained soil that has a high clay content	11. Birdsfoot Trefoil Tall Fescue Brome grass	7 5 8
Medium to strongly acid (pH 6.0-5.1) shallow (20in) with poorly drained soils with low fertility and low level management	12. Birdfoot Trefoil Tall Fescue Red Top Switchgrass	4 4 3 2
Deep or coarse sands, droughty, usually acid (pH 6.0)	13. Sand Lovegrass Switchgrass Prairie Sandreed grass	2 5 4
Reclaimed acid mine spoil (pH 4.0)	14. Birdsfoot Trefoil Red Clover Crownvetch Tall Fescue	4 4 4 4
Reclaimed acid mine spoil, deep coarse sands, droughty, low fertility (pH 4.0)	15. Switchgrass Big Bluestem Indiangrass Little Bluestem	2 4 4 3
Alkaline mine spoil (pH 7.4)	16. Crownvetch Alfalfa	8 10
	17. Brome grass Timothy	14 5