

TECHNICAL NOTES

US Department of Agriculture
Iowa State Office

Natural Resources Conservation Service
Des Moines, Iowa

AGRONOMY #19

DATE: October 16, 1997

SUBJECT: Revised Guidelines for Herbaceous Stand Evaluation (Plant Density)

This technical note with attachment should be used as a guide in evaluating herbaceous stands for all NRCS program activities. It includes a worksheet that may be completed where a formal stand evaluation procedure is needed to document the need to re-establish herbaceous vegetative stands.

This technical note replaces the current AGRONOMY TECHNICAL NOTE # 19 dated October 31, 1988.



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GUIDELINES FOR HERBACEOUS STAND EVALUATION (PLANT DENSITY)

Recent conservation programs have placed strong emphasis on diversifying herbaceous stands to benefit desired species of wildlife. The 1997 Conservation Reserve Programs have demonstrated the need to both quantify existing vegetation on CRP to determine if the stand meets the requirements for specific environmental points and to evaluate stands that have been improved to meet the new criteria. This technical note will describe how to measure and evaluate existing stands, existing stands that have been improved to meet the new criteria and newly establish seedings. These evaluation methods can also be used to evaluate stands for the purpose of critical area seeding and forage production.

Existing Stands and Stands with Improved Seeding:

Stands that are obviously adequate or inadequate by visual observation will not require a formal stand evaluation as described below unless the determination is disputed. In situations where the call is close or the call is disputed, one of the following procedures should be used to make and record the determination.

Frame Method

Determining stand density can be done in an accurate manner and a short period of time by using a frame count technique. Knowledge of the vegetation characteristics of the species to be sampled is essential. If seed heads are present they can be used to aid in identification. A one square foot frame is easily constructed with a variety of materials and shapes. A circular frame presents the least edge to area ratio thereby improving the sample accuracy. A circular one square foot frame has a circumference of 42.5 inches. Just about any 42.5" length of material will work. One can be constructed from 3/16 inch plastic covered cable or plastic hose. The ends can be joined with a short section (1 inch) of .25 outside diameter copper tubing for the cable or duct tape for the plastic tubing. Plastic anhydrous ammonia hose of 3/8" is available at most fertilizer dealers and works well.

The number of samples required depends on factors such as stand uniformity and the number of species to be counted. Generally a minimum of 10 counts (or frames) per 10 acres or less of field size would result in a representative sample. An effort must be made to avoid end rows or turn around areas that may have been doubled seeded. The observer must not be biased by dense or sparse stands, but needs to sample equally in a systematic manner. To begin a sampling transect, it works well to select a landmark on the horizon to walk towards in a straight line. The sampling pattern should be such that a "representative" plant density is obtained. A predetermined number of steps should be taken; on a line that is diagonal or perpendicular to the drill rows, and the frame placed at the toe of your shoe on the final step. Only those plants that are rooted within the frame will be counted and used in determining stand adequacy. To determine the number of plants within the frame count the crowns or to get the exact number of plant within the frame dig each plant. Tabular entries should be made after each frame count to ensure accuracy. Stands can be evaluated anytime during the growing season but late fall works well for most species. From the transect frames recorded, compute the percent composition for each species listed. See Stand Evaluation Worksheet.

Line Transect Method

The stand may be evaluated using the line transect method similar to the line transect method used in measuring crop residue in row crop systems. To estimate the percent of grass and legume species in a stand use a 50 or 100 foot long cable, tape measure or any other line that has 100 equally spaced beads, marks, knots or other marks at which to sight. Select an area representative of the field and stretch the line across the field. The line should be as close to the ground as possible. You may need to work the line down within the canopy before you start to count. Do not allow vegetation to deflect the alignment of the tape. The area to be measured should be selected randomly and be typical on the entire field. Walk along the line stopping at each mark. Position the eye directly over the mark and look down. Sight at one point on the bead, knot or mark (a point is considered about the size of a pin point) at the same exact location on each mark along the line. A flag works well to help sighting. Walk the entire length of the rope recording the number of plants by plant species on the stand evaluation form. Record ground level

and basal hits. Ground level is considered litter, bare ground, gravel or stone. Basal hit is live vegetation. To count as a basal hit the plant crown at or below a 1-inch height above the ground must be intercepted by the point. The total number of marks should then be divided into the number of desired species to determine percent of stand. This method works well in fields with short vegetation. Repeat the procedure. A minimum of 500 points per 10 acres should be taken.

Step Point Method

The step point method is similar to the line transect method. To estimate the percent of grass and legume species in a stand mark a point on one toe of your right shoe at which to sight. Select an area representative of the field and walk a straight transect across the field. You should sight in at an object in the horizon to ensure a straight line is followed. The transect lines to be measured should be selected randomly and be typical on the entire field. Walk along the line and stop at every third pace and look down at the mark on your shoe. Sight at one point on the mark (a point is considered about the size of a pin point). Record ground level and basal hits. Ground level is considered litter, bare ground, gravel or stone. Basal hit is live vegetation. To count as a basal hit the plant crown at or below a 1-inch height above the ground must be intercepted by the point. Walk 300 paces recording the number of plants by plant species on the stand evaluation form from every third pace. Stand count of weedy species or bare ground is optional. The total number of marks should then be divided into the number of desired species to determine percent of stand. This method works well in field with short vegetation. Repeat the procedure. A minimum of 5 line transects should be taken for every 10 acres.

Newly established seedings:

For newly established seedings use the **Frame Methods** as stated above. Stands can be evaluated anytime during the growing season but late fall works well for most species. From the transect frames recorded compute the percent composition for each species listed. See Stand Evaluation Worksheet.

Using a frame size of 1.0 square foot, the number of seedlings counted per frame will indicate a stand that is adequate, or inadequate according to numbers listed as needed per species and per planting type in Table 1. If the actual count is between those listed as adequate or inadequate; in Table 1, the stand will be considered questionable. Questionable stands will need to be reevaluated: after the second growing season for introduced species and after the third growing season for native species, before a final evaluation can be made.

If the stand is a mixture of grass and/or legume, all values in Table 1 will be reduced by the planned percentage of each species in the mixture. For example, if a stand was seeded to Big Bluestem at 40%, Indiangrass at 40% and Alfalfa at 20%, an adequate stand for idle land would be > 0.4 plants/sq. ft for big bluestem, > 0.4 plants/sq. ft for indiangrass and >0.3 plants/sq. ft for alfalfa. Grasses should compose a minimum of 50% of the stand and where legumes are used for wildlife benefits a minimum of 20% of the stand should be in legume species.

TABLE 1

SEEDLINGS NEEDED PER SQUARE FOOT
(At End Of First Growing Season)
For New and Interseeded Herbaceous Stand Evaluations

Species	Critical Area *		Forage Production		Idle Land *	
	Adequate	Inadequate	Adequate	Inadequate	Adequate	Inadequate
Big Bluestem	> 4.0	< 1.0	> 2.0	< 0.5	> 1.0	< 0.25
Indiangrass	> 4.0	< 1.0	> 2.0	< 0.5	> 1.0	< 0.25
Switchgrass	> 4.0	< 1.0	> 2.0	< 0.5	> 1.0	< 0.25
Sideoats Gama	> 4.0	< 1.0	> 2.0	< 0.5	> 1.0	< 0.25
Little Bluestem	> 6.0	< 1.5	> 3.0	< 0.75	> 1.5	< 0.38
Smooth Brome	> 4.0	< 2.0	> 2.0	< 1.0	> 1.0	< 0.5
Tall Fescue	> 4.0	< 2.0	> 2.0	< 1.0	> 1.0	< 0.5
Reed Canary	> 4.0	< 2.0	> 2.0	< 1.0	> 1.0	< 0.5
Crown Vetch	> 8.0	< 4.0	< 4.0	< 2.0	> 2.0	< 1.0
Ladino Clover	> 8.0	< 4.0	< 4.0	< 2.0	> 2.0	< 1.0
Orchardgrass	> 8.0	< 4.0	< 4.0	< 2.0	> 2.0	< 1.0
Bluegrass	> 10.0	< 5.0	< 5.0	< 2.5	> 2.5	< 1.25
Redtop	> 10.0	< 5.0	< 5.0	< 2.5	> 2.5	< 1.25
Timothy	> 10.0	< 5.0	< 5.0	< 2.5	> 2.5	< 1.25
Alfalfa	> 12.0	< 6.0	< 6.0	< 3.0	> 3.0	< 1.5
Alsike Clover	> 12.0	< 6.0	< 6.0	< 3.0	> 3.0	< 1.5
Birdfoot Trefoil	> 12.0	< 6.0	< 6.0	< 3.0	> 3.0	< 1.5
Red Clover	> 12.0	< 6.0	< 6.0	< 3.0	> 3.0	< 1.5

* For easy reference the plants/sq. ft for forage production can be multiplied by 2 to determine plants/sq. ft for critical area seeding and divided by 2 for plants/sq. ft on idle land.

All plantings where the stand falls between the adequate and the inadequate range, will be considered questionable and will be reevaluated after the second growing season. With native warm-season grass species you may not be able to determine adequacy until the third growing season.

STAND EVALUATION

Technician Im Counter
 Date 10/15/97
 Tract # 0047 Field # 4

Landowner Example
 Program CRP
 Practice Name CP-1 Code 327

Species	Counts																								Total	Ave.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Smooth Brome	1	7	4	5	5	4	4	4	7	8	6	3	1	8	0	3	1	1	4	5	6	4	4	5	100	4.2
Orchard Grass	0	0	0	1	0	1	2	1	2	3	0	2	2	0	1	0	0	2	2	1	0	2	1	1	24	1
Alfalfa	2	0	2	1	5	2	1	0	2	0	2	2	0	3	3	0	0	0	0	0	0	1	2	2	31	1.3
Total	3	7	6	7	10	7	7	5	11	8	7	3	11	4	3	1	3	6	6	7	7	7	8	155	6.5	
Forcail	4	3	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	12	.5
Quackgrass	0	5	3	1	0	4	1	2	0	0	0	0	3	0	5	4	5	2	1	0	0	0	0	0	36	1.5
Canadian Thistle	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	3	.05
Dandelion	1	0	0	1	1	0	1	0	0	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	9	.37
Total	5	8	5	2	1	4	2	2	0	0	1	3	1	5	4	6	5	2	1	0	1	1	0	60	2.5	

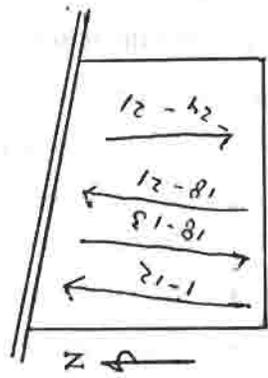
Guidelines

- sample in a systematic & uniform manner
 - avoid areas that may have been double seeded
 - sample perpendicular or diagonal to drill rows
 - minimum of 10 counts for each 10 acres
 - use a 1 square foot frame or line/transect method
 - plants/sq ft by growth habit in pure stand
- See Table 1 of Stand Evaluation for required Plants/sq ft.

Indicate number of counts 24
 Density of seeded species 65/sq ft
 Plant Vigor Good
 Weed Competition Density is 2.5/sq ft.
Canada Thistle heavy in center of field. Quackgrass heavy in SW corner.
 Comments Field has 20% legumes in stand

Recommendations to cooperator Need to establish 10% of field in Switchgrass to meet CRP 15 c-c-1000.

Indicate how field was sampled:



Seeding Direction: unknown
 Total Acres: 24

Attachment 1

Prescribed Plant Succession and Diversity

Plant diversity is encouraged and in many conditions required to meet the minimum criteria under conservation programs that encourage wildlife benefits. Through proper management diversity may be encouraged by providing environmental conditions that accelerate natural plant succession. Many current conservation cover acres such as the Conservation Reserve Program acres have several species (legumes, native grasses, perennial trees, shrubs and annual weeds, etc.) invading into the stand after 10 years of management under conservation cover. This is particularly true in acres where bromegrass stands are not vigorous and in poor condition. Before stands are destroyed or improved through interseeding the stands should be evaluated to determine if the existing stand meet the minimum criteria and/or if the plant diversity of the stand can be encouraged through natural succession.

Under current Conservation Reserve Program rules, diverse plant stands consist of 3, 4, 5 and up to 10 or more different plant species. Each plant species must comprise $\geq 5\%$ of the total area to be considered an acceptable cover type. Acceptable plant species allowed are: cool season grasses, cool season legumes, warm season grasses, forbs and shrubs. In general any biannual or perennial plants that are not listed as primary or secondary noxious weeds in Iowa are acceptable. **Annual plants are not acceptable plant species components in a diversified seeding mix.** See the Conservation Cover standard (327) for a list of acceptable cool season grasses, legumes, warm season grasses and a partial list of forbs.

For wildlife purposes, the intent is to create both diversity of plant species as well as vertical spatial diversity in the stands. For example, in a stand of existing low-growing grasses such as bromegrass, it is also desirable to have tall and mid height species. These may be grasses, forbs or woody species. This spatial diversity provides more niches for wildlife species than just a diversity of plant species that are all of similar heights. For stands of all tall species, such as switchgrass, the converse is true and we should encourage establishment of some short to medium height species. The list of noxious weeds can be found in Agronomy Technical Note 23 "Iowa Noxious Weeds" or Table 2 of this technical note. See Table 1 for additional plant species of acceptable forbs and shrubs.

Guidelines for evaluating existing stand of conservation cover for plant diversity.

1. Evaluate the stand based on procedures listed under Agronomy Technical Note # 19 "*Guidelines for Herbaceous Stand Evaluation (Plant Density)*". Document the results on the Stand Evaluation Worksheet.
2. Determine the number and percent of plant species.
3. If plant succession appears to be occurring encourage additional plant species by:
 - not fertilizing the grass with nitrogen;
 - mowing areas in the field with good bromegrass to reduce shading and allowing other species the opportunity to compete with bromegrass; and/or
 - use a chemical burndown to stress the brome when spring growth reaches 6".
 - Similar treatments can be used to open some areas in tall, warmseason grass fields.

4. Land and conservation cover features that encourage natural plant succession and diversity:

- the producer has not sprayed for weed control for the last 5 years;
- the field is predominately low in fertility or extremely droughty or poor producing soils;
- the initial CRP seeding was a diverse mix including some or all of the following: orchardgrass, timothy, alfalfa, red clover, sweet clover, birdsfoot trefoil, etc.;
- land use prior to CRP and row crop was hay, pasture, or idle land; or when
- native grasses, forbs, shrubs, or trees are encroaching upon the existing stand.

A field visit and good communications with the producer are needed if the prescribed succession method of improving these CRP fields is being used to meet the new criteria. Annual status reviews for 2-3 years are required to keep the lines of communication with producer open and to determine the progress of stand diversity. If after the second year there is not adequate diversity, then a good interseeding program should be implemented to establish needed legume or native grass diversity.

TABLE 1

Examples of Beneficial Forbs

Sunflowers; Saw-toothed, Stiff, Maximillian, Prairie
Sweet Clover, Bush clover
Wild Prairie Rose
Sedges
Swamp Milkweed,
Butterfly Milkweed,
Wolly Milkweed,
Whorled Milkweed
BroomSedge
Partridge Pea
Chickory
Birdsfoot Trefoil
Blue Vervain, etc.
Daisy Fleabane
Asters Sps.
Goldenrods Sps.
Goatsbeard
Purple and Gray-headed Coneflower

Phlox sps.
Bed Straw Sps.
Primrose Sps.
Iron weed
Gay Feather
Blazing Star
Compass Plant
Oneset
Sneezeweed
Rosinweed
Mullein
Indigo Bush
Cattails
Green, River, Hard-stemmed, Soft-stemmed Bulrush
Bergamot
Blackeyed Susan
Ox-eye Daisy

Examples of Beneficial Shrubs and Trees

Wild Grape
Elderberry
Snowberry
Service Berry
Chokecherry
Wild Plum
Hawthorn
White and Red Cedar
Dogwoods
Blackberry

Virginia Creeper
Hornberry
Wild Cherry
Aspen
Hickory
Sumac
Hackberry
Ashes
Raspberry

Alder
Mulberry
Oak
Walnut
Birches
Willows
Elms
Gooseberry
Hazelnut

TABLE 2

PRIMARY NOXIOUS WEEDS

Common Name

Buckhorn

Bull Thistle

Canada Thistle

Field Bindweed

Hoary Cress (Perennial Pepper Grass)

Horsenettle

Leafy Spurge

Musk Thistle

Quackgrass

Russian Knapweed

Tall Thistle

SECONDARY NOXIOUS WEEDS

Common Name

Buckhorn Plantain

Cocklebur

Poison Hemlock

Puncturevine

Red Sorrel (Sheep Sorrel)

Smooth Dock

Teasel

Velvetleaf (Butterprint)

Wild Carrot (Queen Ann's Lace)

Wild Mustard