Scouting For Weeds

An additional tool for monitoring a new planting is to scout for weeds in the field. A good scouting effort will reveal weed patches not detected by the quadrat samples. It is critical to find weed problems early because they could increase in abundance and displace prairie plants over time. When scouting in the field, weed patches consisting of 20 or more individual plants should be flagged. Mark their location and population size on the site map. This information is essential for the landowner to take the appropriate weed control measures.

Method 2: Assessing Stand Establishment Using Species Frequency

Prairie plant establishment can also be assessed in a newly reconstructed prairie by calculating species frequency (Siefert and Rosburg 2004). This method uses the same randomized quadrat sampling techniques as described in the previous section. Prairie species are identified within the quadrat and recorded on the data sheet as present or absent (see Table 2). Counting of individual plants is not needed. An advantage of this method is that it doesn't require determining individual plants, which can be difficult in a more mature prairie reconstruction (two or more years old) when many prairie species produce multiple tillers, stems, and spread by rhizomes. A reconstructed prairie should have a prairie plant frequency of 50% or higher (Rosburg 2006). Any persistent perennial weeds detected during quadrat sampling should trigger a scouting of the field to locate and map these plants for weed control (see Scouting section).

Table 2 – Plant Frequency Example

	Quadrat Samples (1 square foot area)																			
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	FRQ
Big bluestem	p		p	p			p	p										p			.30
Indian grass	p				p	p										p					.20
Switchgrass	p	p	p	p	p	p	p	p													.40
Side-oats grama					p	p														p	.15
Black-eyed Susan	p	p		p	p	p	p					p	p								.40
Wild bergamot					p			p													.10
Stiff goldenrod			p			p	p				p										.20
Showy tick trefoil				p					p					p							.15
Compass plant				p																	.05
PRESENT/ABSENT	p	p	p	p	p	p	p	p	p	a	p	p	p	p	a	p	a	p	a	p	.80
Canada thistle	p		p	p	p						p	p						p			.35
Smooth Brome	p	p	p	p	p			p	p		p	p	p		p		p	p	p		.70

a - absent p - present

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To calculate prairie plant establishment (by frequency) follow the three steps listed below.

Step 1 – Sum the number of quadrats where there was a prairie plant present -
Prairie plants occurred in quadrats # 1,2,3,4,5,6,7,8,9,11,12,13,14,16,18,20 = 16
quadrats had at least one prairie plant

Step 2 – Divide the total number of quadrats with prairie plants present by the total number of quadrats sampled
Plant frequency = 16 quadrats with prairie plants/20 quadrats sampled = 0.80

Step 3 – Multiply plant frequency by 100
Prairie plant frequency (%) = 0.80 x 100 = 80.0 %

In this example, prairie plant establishment exceeds the minimum of 50% and the planting is well on its way to being successful. However, the presence of Canada thistle, a persistent perennial plant, should trigger the need to control this weed (see Brochure 9).

Sampling Terminology

Investigator - The person conducting the vegetation sampling and evaluation of data.

Plant Density – The number of plants per unit area as measured by actual counts.

Plant Frequency – The percentage of samples in which a species or target group appears.

Quadrat - A frame of known area (usually 1 square foot) that the investigator places on the ground and samples only rooted plants inside of the frame.

Randomized Sampling - A technique to ensure that all locations of the planting and all individuals of the population have an equal chance of being sampled.

Sample Bias - Something that was done in sampling to produce results that do not represent the actual condition.

Seedling Average (plants per square foot) - The sum of all prairie seedlings counted in quadrats divided by the total quadrat area sampled.

Site - The area that has been seeded with prairie plants.

Stratified Random Sampling - A technique to ensure that all habitat types within the site are represented by samples.

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Photographic Monitoring

A picture is worth a thousand words. In 1994, at the 14th North American Prairie Conference in Manhattan, Kansas, Dr. Paul Christiansen presented his research project of establishing prairie species in a roadside by overseeding them into non-native smooth brome (Bromus inermis) after a burn. He had established a permanent photo point on his research site and took images of the site before seeding and at 2, 5, 10, and 13 years after seeding. Watching the plant community transform from a mono-culture stand of non-native grass to a diverse prairie plant community (that resembled a prairie remnant) was fascinating. Photographic monitoring can be extremely useful in reconstructed prairies to document the long-term vegetation changes.

Seasonal Changes in a 5 year-old prairie planting. Photos were taken the same year in (A) late spring, (B) mid-summer and in (C) early fall

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10 Evaluating Stand Establishment

Content by Dave Williams

PRAIRIE RESTORATION SERIES

This brochure is intended to assist the practitioner/landowner in the sampling and evaluation of prairie plant establishment in a new seeding. Deciding where to sample, how many samples to take, what to measure, and how to analyze the data for an assessment of prairie plant establishment are discussed.

Equipment Needed

Seeding Plan
The seeding plan should include the following: a species list, noting the quantities that were seeded; a description of the site preparation, seeding method, and sowing time; and an aerial photograph and soil map of the site.

Prairie Seedling Photographs and Seedling Key

Missouri Department of Conservation Pocket Seedling Guide mdc.mo.gov/grownative/plantID/

A field guide to identify prairie grasses and forbs for your region.

Knee pads
Hard ground is tough on the knees.

Clipboard
For a hard surface to record data.

Quadrat Frame

Weed Identification Guide
Weeds of Nebraska and the Great Plains, published by Nebraska Department of Agriculture, is an excellent reference book for weeds found in the tallgrass prairie region.

Hand Lens
Hairs, ligules, and auricles on seedling plants need magnification to be detected. A 5x, 10x, 15x triple lens can be bought for less than $5.00 from Forestry Suppliers, Inc. (www.forestry-suppliers.com).

Digital camera and spare batteries

Mechanical Pencils
Mechanical pencils maintain sharp lead, which makes data recording easier.

Blank data entry sheets

Lunch bags (paper) To hold plant specimens.

Vinyl flagging (roll and wire flags)
For marking areas on the site that need reseeding, weed/brush control ect.

Scissors
To clip plant specimens. Fiskars are very durable.

Fine tipped Sharpie
To mark on lunch bags for plant specimens

Calculator

Gloves
To prevent skin contact with plants that cause blistering like poison ivy (Toxicodendron radicans) and wild parsnip (Pastinaca sativa).

Insect Repellent
Works well for mosquitoes and chiggers but not so well for biting flies.

Sunglasses
The glare from the data sheets on a clear sunny day is intense.

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Why Assess Prairie Plant Establishment?

Assessing establishment of prairie plants in the first or second growing season can eliminate the unnecessarily reseeding of a successful planting or prolonging the maintenance of a failed planting. Establishment often varies throughout a planting. Variations in topography and soil types expose the seed to different growing conditions, sometimes resulting in poor emergence. One purpose of vegetative sampling is to find areas within the planting that have too few seedlings so they can be reseeded. Sampling can also detect areas where there are persistent perennial weeds, which will reduce prairie plant establishment. Controlling these weeds early in the reconstruction can save the landowner time and money.

What Is Sampling?

Sampling is a systematic process used to gather a small part (or sample) of something and analyze it to answer a basic question. A basic question asked by managers and landowners about a new prairie planting might be, Are there enough prairie plants in the planting? To answer this question you can proceed in one of two methods. The first method would be to identify and count every prairie plant in the planting. Then take that number and divide it by the total square feet in the planting which will result in the number of seedlings per square foot. This number can be compared with the recommended number of seedlings per square foot that are needed for adequate native plant establishment. The first method would be extremely time consuming but one could accurately calculate prairie plant establishment for the planting. The second method would be to choose many different locations throughout the planting, and identify and count only the prairie plants that occur in a very small area (1 square feet) at each location. Prairie plant establishment could then be calculated by adding up all prairie plants found then dividing them by the total square feet that was sampled. This number, as with the number in the first method, can be compared with the recommended number of seedlings that are needed for adequate native plant establishment. Clearly, the second method is easier and saves time. If the second method is correctly done, the number of plants per square foot should be very similar to the first method. Sampling is an excellent assessment tool in prairie management.

How Much And Where To Sample

Determining how much vegetative sampling is needed depends upon the complexity of the landscape. For planting sites, regardless of size, that don't have much variation in topography and soil type, a minimum of 20 to 30 samples are needed to assess prairie plant establishment (Witmer 1999). In plantings that have varying habitats (such as varying slopes and aspects, rock outcrops, swales, or waterways), additional vegetative sampling is required. To accurately assess seedling establishment in plantings with a variety of habitats, areas of the site with similar environments should be sampled and analyzed separately. This is called stratified sampling. Stratified sampling requires dividing the site into habitat types based on environment and calculating prairie plant establishment for each habitat. We recommend a minimum of 20 to 30 samples be taken for each habitat type. An advantage of stratified sampling is that areas in the planting that have poor seedling establishment can be identified that may otherwise go undetected.

It is human nature to choose sampling locations with only a few plants present because it makes identification/counts much easier, but the results will not provide the accurate information needed to successfully manage the planting. Instead, vegetation should be sampled at random locations within habitats to obtain the most representative information of the plant species composition. The process is called randomized sampling. The following steps will help ensure that sampling is randomized before going into the field.

1. Review the site map and mark each distinct habitat type that should be sampled and analyzed separately.

2. On the map, select a starting point anywhere along the boundary of each habitat type to be sampled. Choose an end point on the opposite side of the habitat type that is furthest away from the starting point. With a pencil, connect the points. This line is called a transect. Measure the transect length using the map scale. Divide the number of samples (20 to 30) by the transect length. This will give you the distance between each sample to be taken along the transect in the field.

3. Measure your pacing distance using a normal walking speed.

4. Divide the distance between samples by your pace distance to determine how many paces are needed between samples.

Lower Right Photo: Rectangular open ended quadrats can be easily inserted into dense vegetation. Sample area inside each quadrat frame is $^1/_{10}$ m^2.

Collecting Vegetation Samples

Upper Left Photo: Circular quadrats made from PVC tubing – sampling area in the large quadrat is $^1/_4$ m^2 and $^1/_{10}$ m^2 for the small quadrat.

Vegetation sampling in grasslands is often done using a quadrat. A quadrat is a small frame with a known area measurement inside the frame. Seedling density and frequency can be accurately measured using a 1 square foot quadrat frame (Dayton 1988). Quadrats can be built from flexible PVC tubing, wood or wire.

Most grassland quadrats are three-sided, with one side left open for easy insertion into the sample area. The frame is inserted near the base of the plants at pre-selected locations along the transect and the vegetation inside the frame is identified and counted. One sample equals one quadrat of vegetation. The following steps should be used when entering the field to sample.

1. Using the site map as a guide, locate the transect line's starting and end points and mark with field flags.

2. Starting at one of the field flags walk a straight line towards the other flag the number of paces needed between samples (see above).

3. Place the quadrat at your feet and sample the vegetation.

4. Continue along the transect, walking the calculated number of paces and taking a quadrat sample until all the samples are taken.

For ease of seedling identification, the best time to sample a new planting is in late August to early September. By the end of summer, most prairie seedlings will have grown enough to be accurately identified.

Method 1: Assessing Stand Establishment Using Plant Density

There are several ways of sampling vegetation within the quadrat frame. A good way to assess prairie plant establishment in a newly reconstructed prairie is by measuring plant density. This involves identifying and counting each prairie plant within the quadrat frame. Plant density is an excellent sampling method in early reconstructions (Year 1) because prairie seedlings have not yet spread by rhizomes and/or produced multiple tillers and stems. Counting individual plants/stems is feasible. A native planting should have a minimum of 1 prairie plant/ square feet (Morgan 1995). A planting that has less than 1 prairie plant/ square foot by the end of Year 2 is susceptible to weed invasion and may require additional management to control weeds (see Initial Post Seeding in this series).

Table 1 – Plant Density Example

P - Present	Quadrat Samples (1 square foot area)																			
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Big bluestem	I		I	II			I	I										I		
Indian grass	II				I	I										I				
Switchgrass	I	I	I	II	I	I	I	I												
Side-oats grama					I	I														I
Black-eyed Susan	I	II		I	I	I	I					I	I							
Wild bergamot				I				I												
Stiff goldenrod			I			I	I				I									
Showy tick trefoil				I				I					III							
Compass plant				I																
TOTAL SEEDLINGS	5	3	3	7	5	5	4	3	1	0	1	1	1	3	0	1	0	1	0	1
Canada thistle	P		P	P	P						P	P						P		
Smooth Brome	P	F	P	P	P			P	P		P	P	P		P		P	P	P	

Developing a good data sheet is critical to any sampling method. Use a spreadsheet format to create a data sheet for the field. The data sheet should be identical to the spreadsheet on the computer. This will reduce mistakes when entering data from the field into the computer. Organize the data sheet by rows and columns. Each column represents a quadrat sample and each row represents a plant species. Arrange the species first by grasses, then forbs and weeds. List all the native species seeded on the data sheet. They should be listed by number of seeds per square feet planted (highest to lowest). When data are entered in the computer spreadsheet, enter the number of hash marks. Recording the data is easier when the highest seeded species are clustered together on the data sheet. Record only the presence of persistent perennial weed species (Table 1) on the data sheet; it is not necessary to count their seedling numbers. Any persistent perennial weeds detected during quadrat sampling should trigger a scouting of the field to locate and map these plants for weed control (see Scouting section).

Place the quadrat at each random sample location (as previously described above) and record every prairie plant inside the frame. When identifying seedlings, follow the order listed on the data sheet; identify the native grasses first, followed by the native forbs, saving the weeds for last. Quadrat sampling with another person can be efficient. With a two-person sampling team, one person records the data while the other person identifies the plants. Plants that are difficult to identify should be collected and bagged for later identification or flagged (label the flags A, B, C, etc.) and returned to in a couple of weeks. When collecting unknown species in bags, assign each plant a letter on its bag and record it on the data sheet so it can be changed on the sheet when identification is made. Periodically check the data sheet to make sure that the quadrat column that is recorded is the one that seedlings are sampled from.

To calculate prairie plant establishment (by density) for this example reconstruction, follow the three steps listed below.

Step 1 – Sum the total prairie seedlings recorded in all quadrats -
Total prairie seedlings = 5+3+3+7+5+5+4+3+1+0+1+1+1+3+0+1+0+1+0+1=45

Step 2 – Sum the total quadrat area sampled -
Total sampling area = 20 (quadrat samples) x 1 square foot (quadrat area) = 20 square feet (See Table 1)

Step 3 – Divide Total prairie seedlings by the Total sampling area -
Prairie seedling establishment = 45 seedlings/20 square feet = 2.3 seedlings per square foot

In this example, prairie plant establishment exceeds the minimum of 1 prairie plant per square foot, which is an adequate stand. Note: In this example, the presence of Canada thistle should trigger the need for control of this weed (See Initial Post Seeding in this series).