

Using Repeat Color Photography as a Tool to Monitor Rangelands

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5/98

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Introduction

“Boy, you should have seen this place 10 or 15 years ago. Things sure look better now! Cover has improved. There are more desirable plant species. Wildlife habitat is better than it used to be.”

Do these comments sound familiar? Unfortunately, often times there are no data to back them up. When it comes to convincing folks that your management practices have improved the range, you have to pretend for a moment that you are from Missouri, which is known as the “Show Me” state. It is especially important to show people that what you say is true when your critics weren’t around 10-15 years ago to see the changes you have seen. A series of photographs taken at the same spot through the years can vividly demonstrate change on the range. This article provides an introduction to repeat color photography and explains how it can be used as an important part of a comprehensive rangeland monitoring program.

Background

Why use repeat color photography?

Repeat color photography is a simple and relatively quick way to monitor rangelands. A properly located photo station can reveal changes over space and time in important rangeland attributes like plant growth, species composition, total plant cover, litter, spatial arrangement of plants, and soil erosion (i.e., all aspects that can be related to grazing management practices).

Are there permanent photo stations on public land grazing allotments?

If you are a Bureau of Land Management or United States Forest Service livestock grazing permittee, it is likely that photo stations have already been installed in permanent monitoring sites (called key areas) on your allotment. Ask your range management specialist for a map that depicts the location of key

areas and the types of monitoring activities conducted at these sites in the past. Some key areas will have photo stations established on them, while others may not.

Should I establish new photo stations? If so, where and how many?

If permanent photo stations have not been installed on your allotment you can set them up yourself, but involve your local rangeland management professional. Let resource managers know that you are serious about learning how grazing management, weather, or other factors (e.g., rodents, insects, fire) may be influencing rangeland attributes. They will help you locate photo stations in “key areas” which are locations that are typical and representative of larger areas. In grazing studies, key areas are chosen as a sample, a barometer of sorts, of the average grazing impacts in a pasture or vegetation type. Below are a few points to consider when establishing new key areas where photos will be taken.

As is true of all forms of rangeland monitoring, photography requires clear objectives and careful selection of places to monitor. In most rangeland monitoring studies, the objective is to detect changes in rangeland attributes due to grazing, fire, weather, and other environmental variables. An inventory of range sites, vegetation types, and utilization patterns helps determine where and how many key areas should be located.

Generally speaking, the more variable the rangeland the more key areas needed. One key area is probably adequate to monitor an irrigated pasture on flat terrain, but a typical Arizona ranch may need several key areas to adequately represent the different types of country and variation in grazing pressure.

Remember that key areas are intended to represent the typical grazing activities for a larger area. Consequently, don’t locate key areas where livestock never graze (e.g., more than a mile or two from water, steep slopes), or where livestock normally congregate (e.g., within 1/4-mile from watering points, fence lines, or at pasture corners). *Note: If your objective is to monitor an “environmentally sensitive area” (e.g., riparian area, endangered species, wildlife habitat), the area monitored is commonly referred to as a **critical area** rather than a key area.*

Spurious conclusions may result if a change occurs in a key area because of local events (like a fire or flood) but not in the larger area the site was chosen to represent. For this reason, it’s helpful to have more than one key area per pasture or vegetation type so that you can be confident a change is general rather than due to local conditions.

On the other hand, it is pointless to establish a key area if you don't have time to monitor it. Begin by establishing a few key areas within the highest priority areas of the ranch, and add more as time and your increasing experience allow. The important thing is to get started! As you gain experience, you may want to augment your photos with other more intensive rangeland monitoring techniques (e.g., frequency, dry-weight rank, cover).

What is the difference between a photo-plot and a photo-point?

Photo-plots, are close-up photos taken of a relatively small, permanently-marked plot on the ground within a key area. Photo-plots are useful if your objective is to intensively monitor changes in individual plant species or soil cover.

Photo-points are established to show a general landscape view of a key area. Their objective is to detect changes in major vegetation types, such as the degree of shrub encroachment, across landscapes.

Both of these monitoring methods are tools that can be used to show how rangeland attributes may change due to management and/or environmental factors.

Photo-Plots

What is the objective of using photo-plots?

To intensively monitor the changes in size and number of key plant species, and to monitor changes in soil attributes like cover, pedestalling, and rilling.

What size photo-plot should I use?

Photo-plots conventionally vary in size from 1 x 1-meters, to 3 x 3-feet, to 5 x 5-feet (see Illustrations 1-3). You will need a step ladder to ensure a high enough angle to photograph the 5 x 5-foot size. However, the latest interagency monitoring manual recommends using the 1m² size where new studies are being established (Interagency Technical Reference, 1996).

Where should I establish photo-plots?

As discussed earlier, photo-plots should be located in key areas. Each photo-plot is a small sample of the key area. It should include plant species of principal interest, such as the key forage species. If soil erosion is of concern photo-plots can be located in a rilled or gullied area. Because of the small area being monitored (i.e., the plot) it may be necessary to have several different photo-plots located within a key area to avoid making wrong conclusions based on too little information.

What materials do I need to establish a photo-plot?

1. Frame made of PVC pipe, steel rods, or similar material to delineate the photo-plot (Note: You can also use 2, 6-foot wooden carpenter rulers folded at right angles at the 3-foot marks to mark 3 x 3-foot photo-plots.)
2. Four rods to divide the 3 x 3-foot and 1 x 1-meter photo-plots into 9 square segments (optional, see Illustration 1)

3. Small step ladder (for 5 x 5-foot photo-plots only)
4. Half-inch angle iron stakes (rebar or PVC pipe will also suffice) at least 16-inches long (you will need 3 stakes/photo-plot). (Note: You may want to use PVC pipe to make stakes. Metal stakes can cause flat tires and injure animal hooves.)
5. Hammer
6. Photo identification form (see Illustration 4), or chalk board. (Note: Pastel-colored paper (e.g., gray or light green) works better than white paper because white paper can reflect light rendering the labeled form unreadable.)
7. Study location and documentation form (to record relocation information and other important data, see Illustration 5).
8. Two clip boards for holding forms
9. Broad felt tip pen with water-proof ink
10. Pencil
11. Compass
12. Map or aerial photo of the study site
13. Bright colored spray paint (yellow or orange)
14. Camera with a 28-mm wide angle lens and color film
15. Steel t-post or some other device to serve as a road-side marker (commonly called a "witness post")
16. Post driver

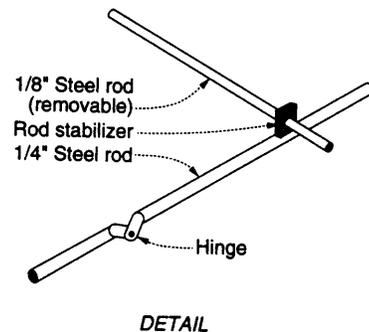
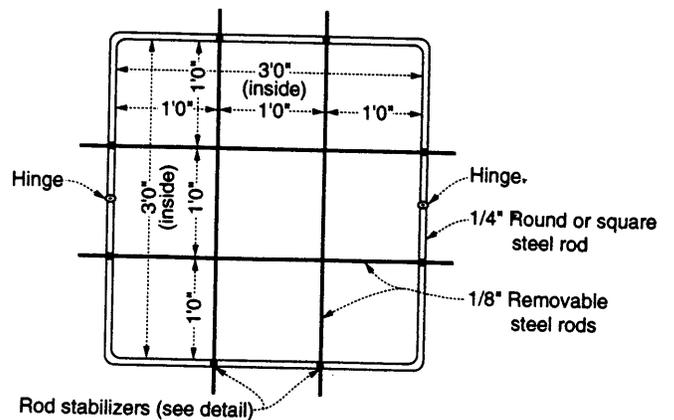


Illustration 1. Photo plot frame (3x3-foot).

How do I establish a photo-plot?

- Place photo-plot frame on the ground area you intend to photograph. Align the plot frame so the sides are aligned with the cardinal directions (i.e., north, south, east, and west). Drive 2 stakes into the ground at the diagonal corners of the frame, and 1 stake just outside the mid-point of the north side of the frame (*Illustration 3*).
- Label the photo identification form with water-proof felt tip pen to include date, photo-plot number, resource area (if on public land), allotment, and pasture. Be sure to write large and legibly. Place the photo identification form flat on the ground immediately outside of the photo-plot frame.
- Stand with your toes touching the stake on the north side of the photo-plot. Take your photo making sure the plot frame and photo identification form are included in the photo. (*Note: Taking photos from the north side helps reduce shadowing across the plot.*)
- Take a few “landscape photos” in different directions from the photo-plot (see next section) to show the surrounding landscape. This will help you relocate the photo-plot in the future, particularly if the witness post (see below) is removed.
- Place the steel t-post (commonly called a “witness post”) in a visible location from the photo-plot just off the road or trail.

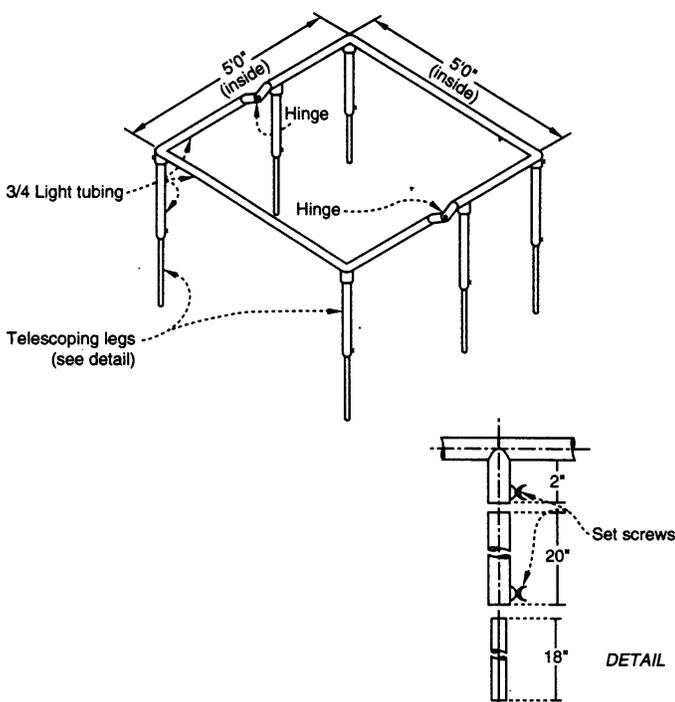


Illustration 2. Photo plot frame (5x5-foot).

- Record on the study location and documentation form all information that will help you relocate the photo-plot in the future, including:
 1. Compass bearing and distance of photo-plot from the witness post.
 2. Sketch of prominent physical features of the key area (roads, trees, fencelines, rock outcrops, streams). Be specific because it may be a year or more before you return to the plot.
 3. Record any observations you deem appropriate to the general area (e.g., actual use, animal concentration, wildlife sign/use, rodent sign/use, insect infestation, flood, fire, rainfall, water availability, open gates, vandalism).
 4. Record mileage to key area from prominent physical features (e.g., road intersections, other key areas).
 5. Jot down your rationale for locating the photo-plot in this particular area. (*Note: Photo-points (or landscape view photos, [see next section] can also be taken at each photo-plot location to aid relocation.*)
 6. Spray-paint stakes with bright-colored spray paint.
 7. Organize your photos and forms in a 3-ring binder by date and photo-plot identification number.

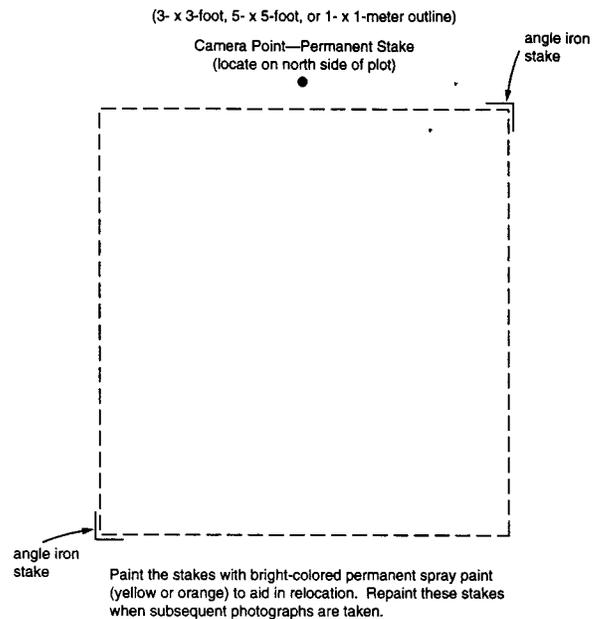


Illustration 3. Permanent photo plot location (3x3-foot, 5x5-foot, or 1x1 meter).

DATE _____
NO. _____
R.A. _____
ALLOT. _____
PAST. _____

Illustration 4. Photo identification form (actual size is 8.5" x 11").

Photo-Points

What is the objective of using photo-points?

To monitor how rangeland vegetation may change across space and/or time (e.g., grasses to shrubs, or vice versa). The landscape view is especially useful for detecting brush encroachment into grasslands, and for monitoring the spatial arrangement of trees and shrubs.

Where can I establish photo-points?

Photo-points can be established in upland areas to document changes in dominant plant life forms (e.g., grasses to shrubs, or vice versa). In hilly or mountainous country, it helps to locate photo-points so that views can be shot across narrow valleys and hill slopes. These views spread out vertically and aid in plant identification. Often a station can be located to allow a 360 degree panorama of a key area.

Photo-points are also commonly used in riparian areas to document changes in streamside attributes (e.g., bank cover, erosion, stream width, changes in number and size of trees and shrubs). The number of photo-points established depends on your objectives and the size of the riparian area, but a minimum of three (i.e., upstream, downstream, and across-stream) are usually recommended at each photo station.

What materials do I need to establish a photo-point?

You will need items 4-16 listed on pag 2. However, you will only need one, ½-inch angle iron stake (rebar or PVC pipe) at least 16-inches long for each photo-point.

How do I establish a photo-point?

- Drive the stake into the ground and spray paint the top to mark the permanent photo-point (i.e., point where you will stand each time to take photos).
- Label the photo identification form as explained for photo-plots. Have someone hold the photo identification form while you take the photo or prop it against a rock or tree, making sure that it is readable in your camera’s view finder.
- Take picture to include the photo identification form as well as prominent reference points (e.g., stream, fence post, fence line, prominent trees and/or rock outcrops, road) in the foreground and background.
- As with photo-plots, record all pertinent information that will help you relocate and interpret your photos. Again, several landscape photos taken in several directions will help you to relocate the photo-point in the future.
- Organize your photos and forms in a 3-ring binder by date and photo-point identification number.

Study Location & Documentation Data

Study Method						Study Number		
Allotment Name & Number					Pasture			
District				Resource Area				
Ecological Site				Plant Community				
Date Established		Established by (Name)			Map Reference			
Elevation		Slope		Exposure		Aerial Photo Reference		
Township		Range		Section		1/4	1/4	1/4
Location								Scale: ____ inches equals one mile
Key Species								
1								
2								
3								
Distance and bearing between reference post or reference point and the transect location stake, beginning of transect, or plot								
Distance and bearing between location stake and bearing stake								
Transect Bearing				Vertical Distance Between Ground & Aligned Tape				
Length of Transect				Plot/Frame Size				
Sampling Interval						Total Number of Samples		
Notes (Description of study location, diagram of transect/plot layout, description of photo points, etc. If more space is needed, use reverse side or another page.)								
Note: Depending on the study method, fill in the blocks that apply when a study is established. This documentation enables the examiners to conduct follow-up studies in a consistent manner to provide comparable data for analysis, interpretation, and evaluation.								

Illustration 5.
Study location and documentation data form.

How do I make sure that I am photographing the same landscape area each time I go into the field?

- On each subsequent sampling occasion, bring to the field your 3-ring binder that contains previous photos and forms. Use your previous photos and forms to relocate the photo-point stake.
- Prepare the photo identification form and place it in the photo area as described above.
- Refer back and forth between your camera's view finder and a previous photo until you are satisfied that your view finder includes the same landscape shown in the earlier photo. Take the photo.

General Recommendations

- Take photos at about the same season of year so that differences in plant growth and phenology (e.g., seed-set, flowering) or management activities (e.g., before vs. after grazing) do not confound photo interpretation.
- Whenever possible, establish comparison photo stations in both grazed and ungrazed key areas that are similar in every aspect except grazing (e.g., similar soils, topography, precipitation) to allow evaluation of grazing effects.
- Slide film lasts longer in storage than prints. Slides can be made into prints that can be used to illustrate changes to people in the field and to relocate photo-points.

- Weather permitting, use the same camera lens size, film type and speed each time you sample. We recommend using 100 or 200 ASA film for the bright and sunny days that are typical of Arizona.

Final Thoughts

Changes in rangeland attributes occur relatively slowly in the arid southwest, particularly in upland areas. Riparian areas have more potential to change rapidly in response to both management and precipitation. Be patient! Repeat color photography will help you document subtle rangeland changes but probably won't provide sufficient information to evaluate all of your goals and objectives. Consider also collecting quantitative data like precipitation, soil moisture, forage production and utilization, species frequency, vegetation cover, and actual use (i.e., stocking rates).

Repeat color photography should be an important part of any rangeland monitoring program. It is relatively fast and inexpensive, and can help tell a convincing story when implemented over several years. If you are not currently participating in a rangeland monitoring program repeat color photography is an excellent way to start. It may be the only type of monitoring you

have time for, at least initially. So the next time someone says "show me" how things have improved, show them your photos. Remember, **a picture can be worth a thousand words.**

Acknowledgements

We thank Derek Bailey, Kim McReynolds, George Ruyle, and Jim Sprinkle for reviewing this manuscript. Their comments and suggestions greatly improved earlier drafts of the paper.

All illustrations were originally published in identical or similar form in the Interagency technical reference manual (1996). They are reproduced here by permission of Bureau of Land Management's National Applied Resource Sciences Center, Denver, CO.

References

"How to" monitor rangeland resources. 1994. University of California, Cooperative Extension. Division of Agriculture and Natural Resources. Intermountain Working Group Publication 2.

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