Appendix C: Photo Monitoring Equipment

Contents

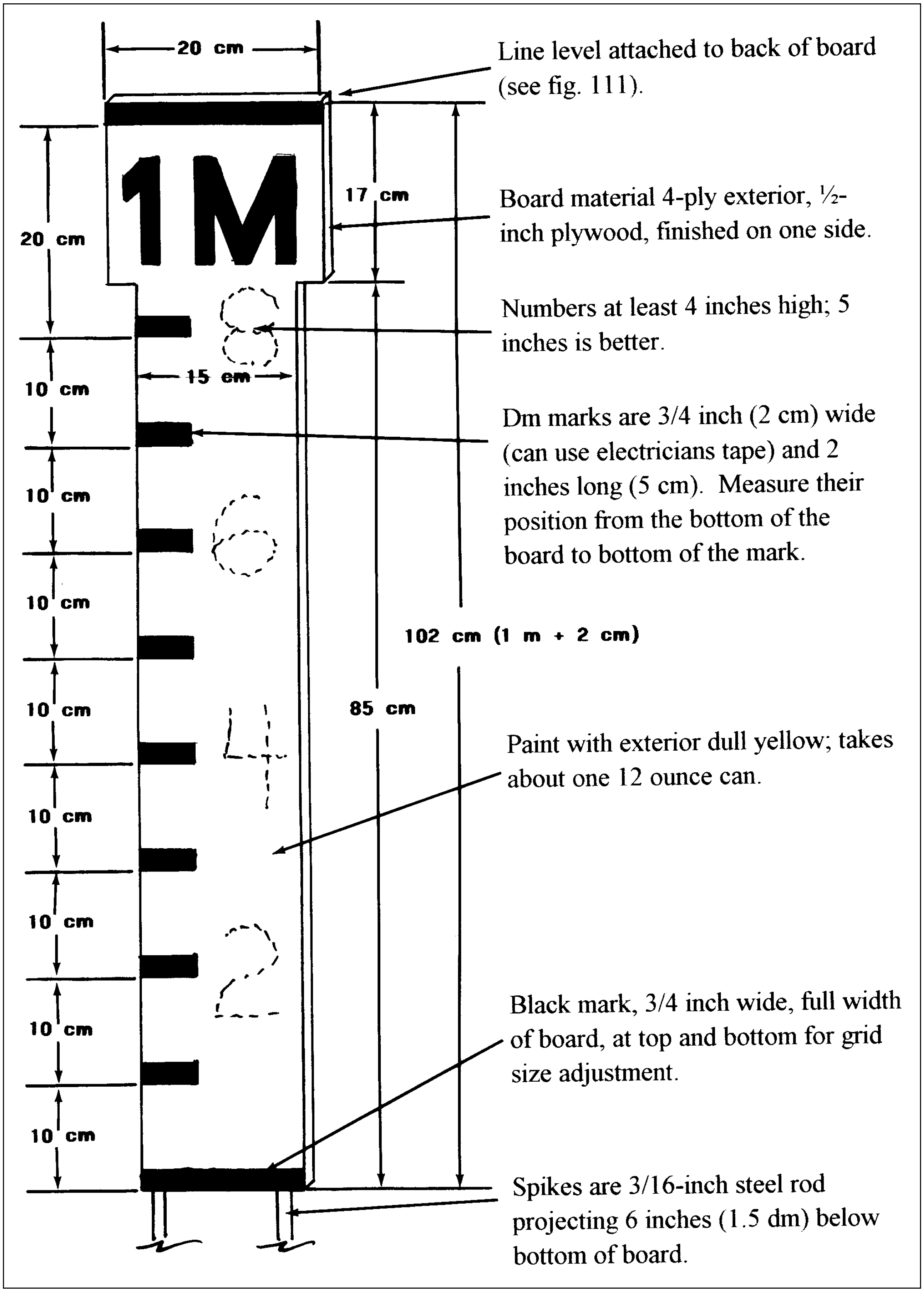

Figure 110—Construction details of a 1-m-tall meter board. The same measurements are used for the 1-m-tall folding board and for the 2-m folding board.

Meter Boards

Meter boards are used to mark photo points. They help in taking consistent repeat photographs if the camera is oriented on the "1M" of the board. Sharp exposure at the meter board is assured by focusing the camera on the "1M." Meter boards also provide a size control in photographs that can be used to adjust the analysis grids when measuring the attributes shown in a photo. This section described how to construct meter boards.

One-Meter Board

Materials	Cost[1]
	Dollars
1 piece 1/2-in 4-ply exterior or marine plywood, finished on one side, 1 by 4 ft @ $20/sheet	3
1 steel rod 3/16-in diameter, 36 inches long	1
Numerals:	
1 packet adhesive-backed numerals, 5-1/4 in tall, on a reflector, (need numbers 1, 2, 4, 6, 8)	4
(Alternative is 4-in nail-on numbers, 5 @ $2/numeral)	(20)
1 4- to 5-in-long line or pocket level	4
1 16-oz can dull yellow spray paint, exterior	4
Screws:	
2 #4 5/8-in line level screws	
9 #6 3/4-in spike plate screws	1
A few feet of black electricians tape	1
Total	18

Meter boards are constructed from 1/2-in, 4-ply plywood, at least exterior quality and preferably marine quality (waterproof glue). Waterproof glue is desirable when sampling riparian areas because the meter board often will be placed in water. (Dimensions and layout are shown in fig. 110). Cut out according to the measurements shown in figure 110.

Prime the front of the board before painting. Then apply two coats of dull, textured, yellow paint to reduce reflection from the sun. Yellow is used for visibility. If dull yellow paint is not available, do not sand or smooth the front of the board. Unsanded roughness causes the paint to be rough, thus reducing glare. Most of the 12-oz pressure can will be required for two coats.

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[1] Prices given are approximate as of 2000.

The numerals 2, 4, 6, and 8 should be black and at least 4 in tall. For good readability in projected slides, 5 in is even better. All illustrations in this publication show 5-in numbers. There are many sources for these, including paste-on numbers, numbers on a card that must be cut out, and nail-on numbers. I use 5-1/4-in-tall numbers on a reflective card with adhesive back. Each number must be cut out and applied to the painted surface. The “M” in “1M” is made from electricians tape, or it may be painted on.

Black marks at each decimeter and bands at top and bottom may be applied in one of two ways: paint them on at 2 cm wide or use black electricians tape, which is 3/4 in wide (1.8 cm). The top, bottom, and decimeter marks are used to adjust grid size before grid analysis of items in the photographs. Location of the marks on the meter board therefore must be positioned precisely (fig. 110).

A line level is attached to the back of the board at the top (fig. 111). This allows the board to be oriented vertically, which is essential for grid analysis, and it makes pictures look good.

Steel spikes are attached to the bottom of the board (fig. 112) to hold it in the ground. Steel rod, 3/16-in diameter, works well because it is strong enough to hold the board upright and small enough in diameter to be pushed into rocky soil. Spikes should extend 6 in below the bottom of the board (fig. 112). Rods come in 36-in lengths. About 30 in is required. Bend the rod into a “U” shape to match the dotted outline in figure 112.

For convenience, a carrying handle may be attached to the edge of the board near the 5-dm position.

Two-Meter Folding Board

Two-meter boards are used when shrubs or other vegetation exceeds the height of a 1-m board (fig. 113). They are, very simply, two single-meter boards attached by hinges and a barrel bolt so that either the 1-m or 2-m length may be used.

Figure 111—Aline level is used to orient the board vertically. Obtain a 4- to-5-in-long line level and drill a hole in each end for a screw. Attach one end of the line level to the back of the meter board ½ in (1 cm) from the top. Then orient the board vertically by using a carpenters level along one side. Hold the board in position, adjust the line level to horizontal, and carefully screw in the other end.

Materials	**Cost** *(see footnote 1)*
	Dollars
2 pieces 1/2-in 4-ply exterior or marine plywood, finished on one side, 1 by 4 ft @ $20/sheet	6
1 steel rod 3/16-in diameter, 36 in long	1
Numerals:	
2 packets adhesive-backed numerals, 5¼ in tall, on a reflector, (need 2 each of 1, 2, 4, 6, 8)	8
1 4- to 5-in-long line or pocket level	4
2 16-oz cans dull yellow spray paint, exterior	8
2 strap hinges, 4-in size, heavy duty	5
1 barrel bolt, 5-in size, heavy duty	8
Screws:	
2 wood screws, #4 5/8-in line level screws	
9 #6 3/4-in spike plate screws	
1 #10 1/2-in sheet metal screw, for below the barrel bolt (sheet metal needed for hardness);	
2¾-in washers	
10 #10 1-in hinge wood screws	
8 #10 1/2-in barrel bolt wood screws	2
Several feet of black electricians tape	1
Total	43

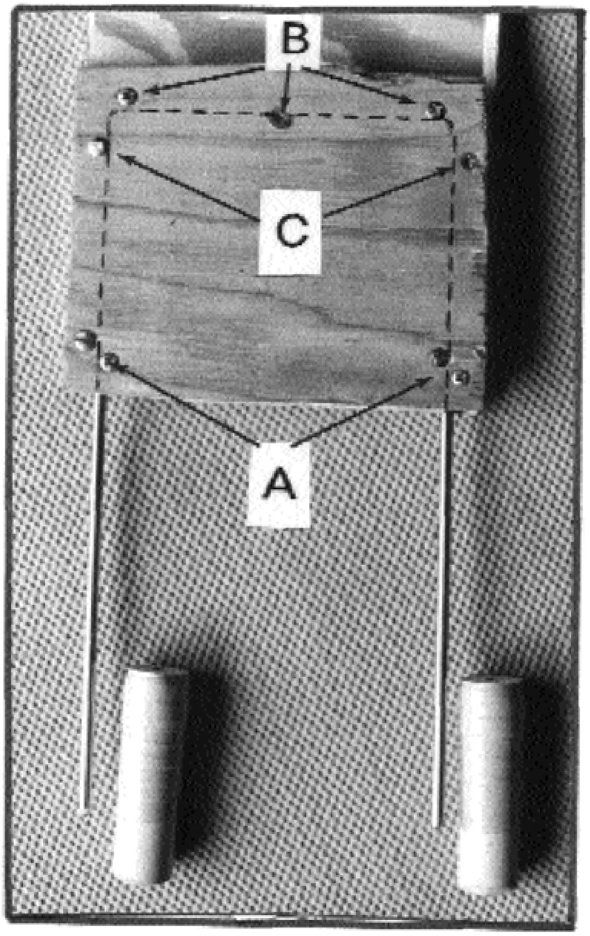

Figure 112—Spikes in the bottom of the board are pushed into the ground to hold the board upright. Use a 3/16-in diameter steel rod about 30 in long. Bend it into a U-shape as shown by the dotted line. It is placed under a plywood plate and held in place by nine screws. Leave about 6 in (1.5 dm) of rod below the board. Screws are positioned to hold the rod in place. (**A**) Insert a screw on each side of the rod at the bottom. (**B**) Insert three at the top to prevent upward and downward movement of the rod. (**C**) Place one at each side at top to prevent sideways movement. Drill out doweling to fit over the spikes for safety.

Figure 113—Use of a folding 2-m board to document height and growth of tall shrubs. This board is hinged in the middle and held upright by a barrel bolt. When folded together (fig. 109), it functions as a 1-m board. Here, the board has been unfolded to 2 m.

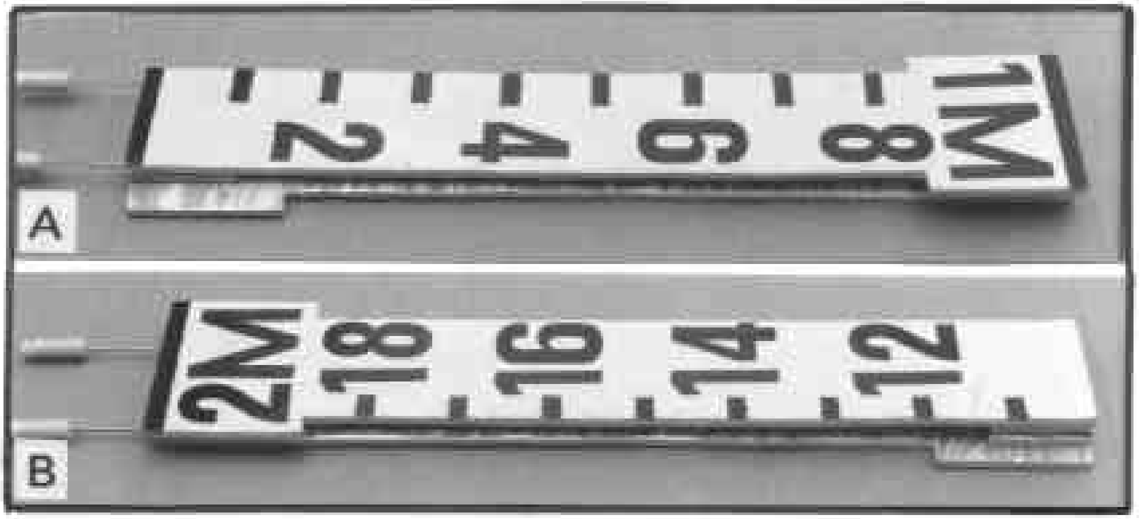

Figure 114—The 2-m board system. (**A**) Standard 1-m board with the top half folded underneath. (**B**) The folded board has been turned over to show the 2-m section.

Construct two 1-meter boards as discussed previously. On the first, construct with spikes at the bottom and numerals as shown. On the second, use “2M” at the top instead of “1M,” and add numeral “1” to each of the decimeter numbers as shown in figures 113 and 114. The numeral “1” can be made from electricians tape.

Figure 115 illustrates the hinge, barrel bolt, and position of the line level between the two halves of the meter board. Proceed as follows:

1. Refer to figure 115. Attach hinges (A) to plywood the same thickness as the barrel bolt and glued to both halves of the meter board. The 5-in bolt shown in figure 115 required 3/8-in plywood. These plywood blocks raise the meter board halves so that the barrel bolt will clear both its connecting strap (B) and the line level (D) when folded. Attach the hinge straps to the top board first. Then use a straight edge to align both halves in a straight line. Finally, attach the bottom straps to the bottom board while firmly holding both halves together.

2. Install the barrel bolt next. Position the barrel bolt at the very bottom of the upper meter board so the bolt drops down when the boards are erected. Place the barrel bolt strap (B) as close to the top of the bottom board as possible without the screws splitting the wood. The bolt should protrude about 3/8 in below the strap (figs. 115C and 116A). Insert a sheet metal screw and sufficient washers under the bolt end to hold it firmly against the strap to prevent flexing when the boards are unfolded (fig. 116B).

3. Position the line level on the bottom (1-meter) board where it can be seen from above when the boards are folded for 1-meter use, and from the back when unfolded for 2 meters (fig. 115D). The line level can be seen when the boards are folded by looking down through the strap holding the barrel bolt when it drops.

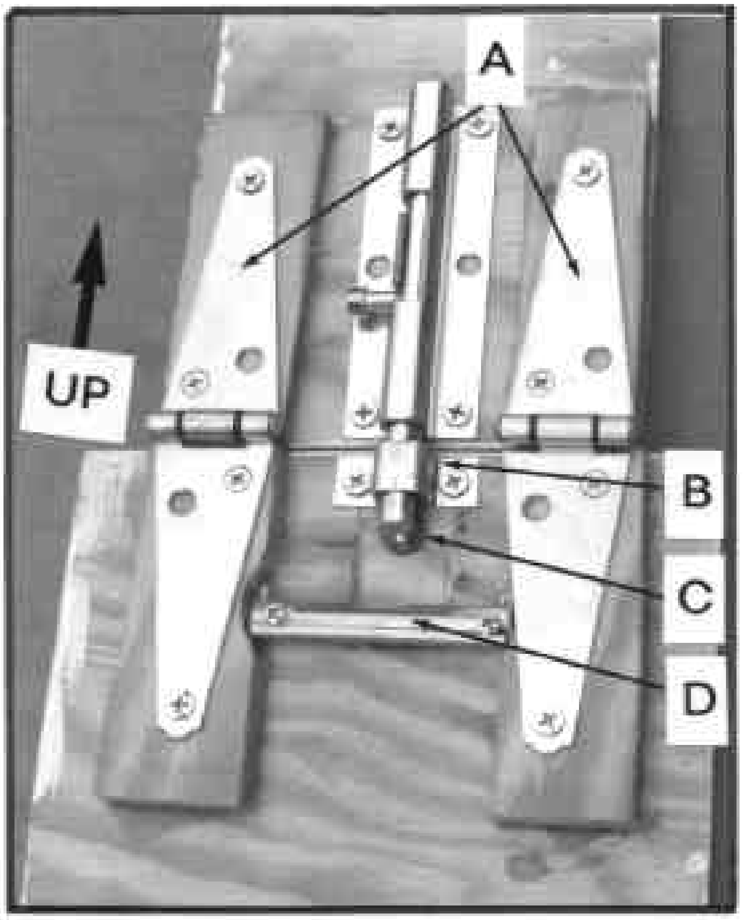

Figure 115—Hinges and a barrel bolt connect the halves of the 2-m board. (**A**) When installing hinges, attach to the top board first, carefully align the boards in a straight line, and then attach the lower straps of the hinges. (**B**) The barrel bolt should be oriented to fall down when the board is unfolded. Position the bolt and its strap at the edges of the board halves so that the bolt protrudes about 3/8 in below the strap. (**C**) Install an adjusting screw (fig. 116) to tighten the barrel bolt against its strap and stiffen the two boards when unfolded. (**D**) A line level is placed an inch below the barrel bolt on the lower board half such that it can be viewed from above when folded and from behind when unfolded, as shown.

Figure 116—Adjusting screw and washer used to remove play between the barrel bolt and its strap, which will stiffen the two halves when unfolded. (**A**) Measure the distance between the bolt and the board. (**B**) Insert a round-headed sheet metal screw with enough washers to make the bolt fit firmly under the flange. Sheet metal screws are preferred because of their hardness. Pound the flange down if necessary.

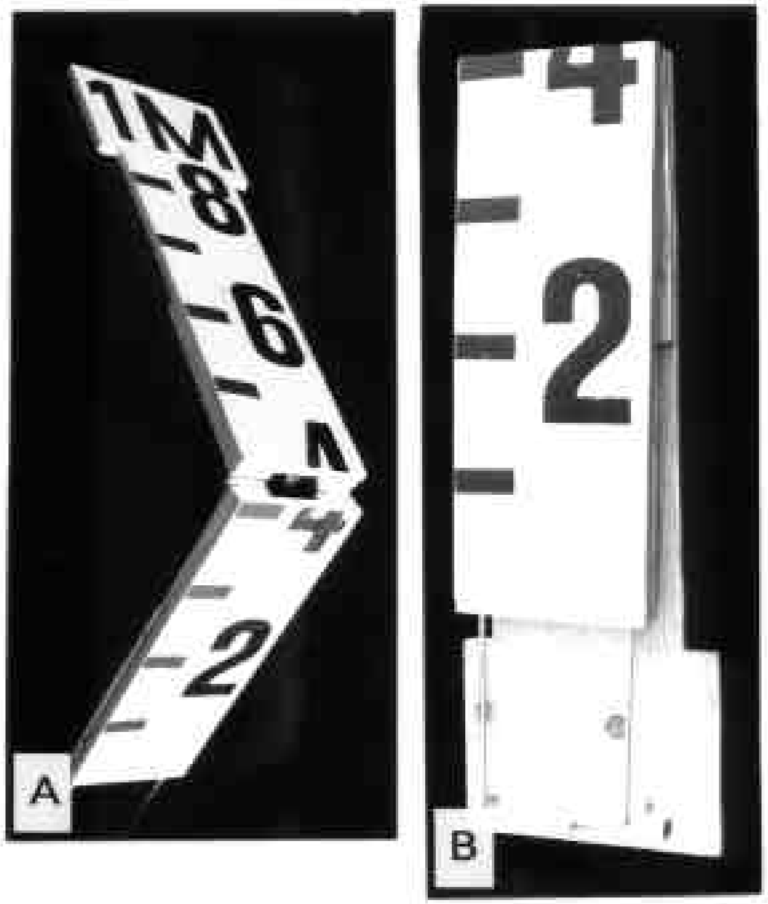

Figure 117—Folding 1-m board specifications. (**A**) Cut a standard 1-m board at 4 dm and install hinges and a barrel bolt. This offset is used to protect the spikes (**B**). Assemble the board before painting and application of decimeter marks to assure correct measurements.

One-Meter Folding Board

If field transportation of a meter board is a concern, the 1-meter board can be made to fold. The hinge system is described and shown in figures 115 and 116. Figure 117 illustrates dividing the board at 4 dm to provide protection for the spikes.

Photograph Identification-Sheet Holder

Each photograph taken in photo monitoring should be identified. Plot photographs are identified by a form attached to a clipboard and placed within view of the plot form. General and topic photos taken of the meter board are identified by a form attached to a clipboard and positioned between the camera and meter board. Making the clipboard and a post to hold it are described.

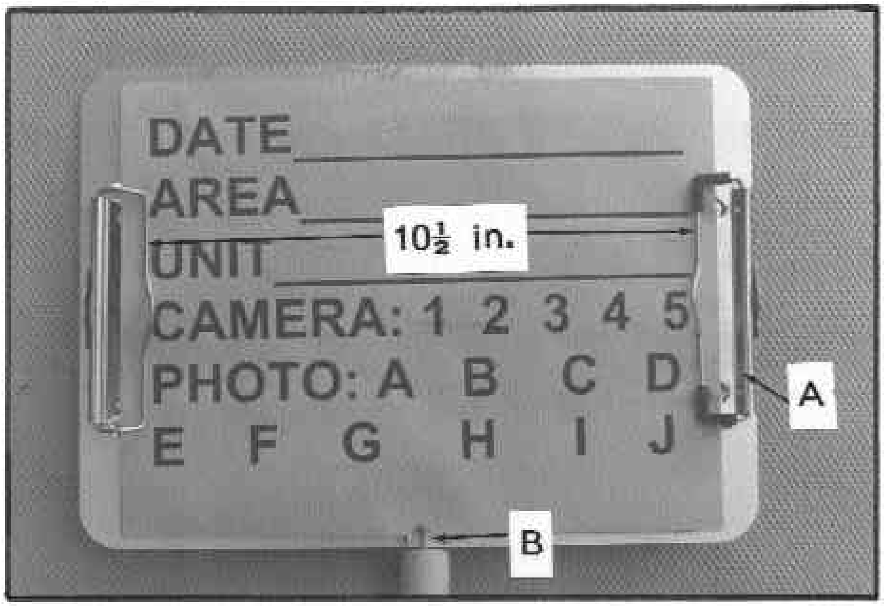

Figure 118—Clipboard for displaying photo identification forms. A second clip (**A**) is taken from another clipboard and either screwed or riveted to this clipboard. Distance between the clipboard clips should be 10½ in to do two things: (1) hold the sheet in windy conditions and (2) not cover essential information. The clipboard is placed on the ground for plot photos or on top of a clipboard post (see fig. 119) to be set in front of the camera. When placed on the post, a screw (**B**) is inserted into the wooden block holding the ¼-in rod behind the clipboard (see figs. 119 and 121) to prevent the clipboard from rotating in the wind.

The clipboard is shown in figure 118. It is a standard 12-in clipboard with the addition of a second clip removed from another clipboard and attached by rivets or screws as shown. The critical factor is to place the clips no closer than 10½ in to avoid covering any information on the identification paper. Two clips are required to prevent the identification sheet from blowing in the wind.

Materials *(see footnote 1)*	**Cost**
	Dollars
2 clipboards 12 in long @ $4.50/each; second clipboard for its clip	9
6 1/8-in diameter bolts or rivets to attach the second clipboard clip and straps for the clipboard post	1
2 1/4-in line guides or straps	1
Total	11

Remove the clip from the second clipboard and attach it to the first board with either two bolts or two rivets.

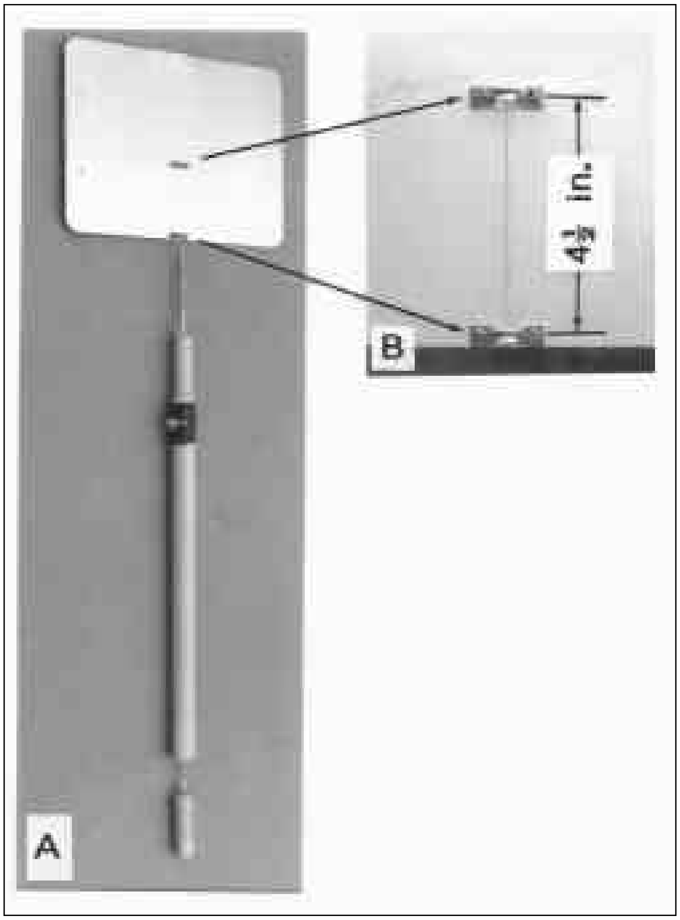

Figure 119—The clipboard post (**A**) in its compressed position ready to be inserted into the straps behind the clipboard. The ¼-in rod slides into two ¼-in straps on the clipboard. (**B**) These straps are positioned 4½ in apart and riveted (as shown) or bolted to the clip board with 1/8-in rivets or bolts.

Figure 119 shows the clipboard post in its compressed position. Two straps capable of having a 1/4-in diameter rod inserted are attached to the back of the clipboard in the middle, as shown. They are centered 6 in from each end and placed 4½ in apart so that the 5-in rod will engage each (fig. 119B).

The clipboard post is an adjusted pole, 1 in in diameter, with a spike on one end to push in the ground and a telescoping inside pole with a rod at the other end to which the clipboard is attached (fig. 119A). It is composed of telescoping plastic pipes each 18 in long (fig. 120A). It is 22 in long when compressed and 32 in long when extended (fig. 120B). An adjustable hose clamp is attached to the upper end of the larger pipe so that it may be compressed around the inside pipe to hold it in place (fig. 120).

Materials	**Cost** *(see footnote 1)*
	Dollars
1-in CL 200 PVC pipe @ $1/10 ft	1
3/4-in CL 200 PVC pipe @ $1/10 ft	1
1-in diameter hose clamp	1
1/4-in diameter, 36-inch steel rod; piece, cut two 7-in pieces`	1
Several feet of black electricians tape	4
Total	8

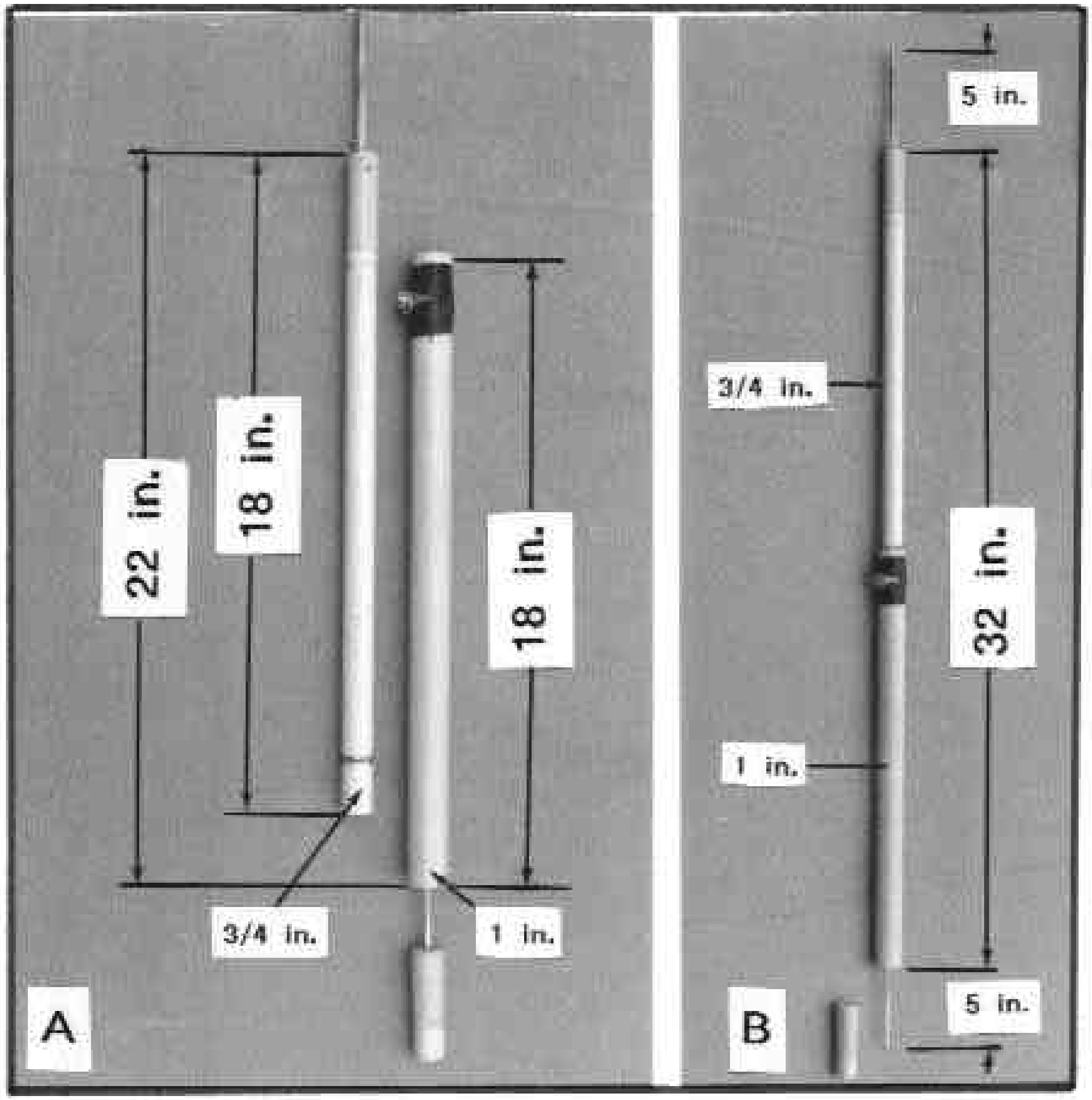

Figure 120—Details for constructing the clipboard post. (**A**) The 1-in PVC pipe CL200 and ¾-in PVC pipe CL200, which fits inside the 1-in pipe, are each 18 in long. When the ¾-in pipe is inserted into the 1-in pipe and compressed, they are 22 in long. (**B**) The 18-in inside pipe has been extended 14 of its 18 in, for 32 in. The ¼-in diameter spikes at the bottom and top both extend 5 in beyond the pipe and are imbedded into doweling inserted in the pipe.

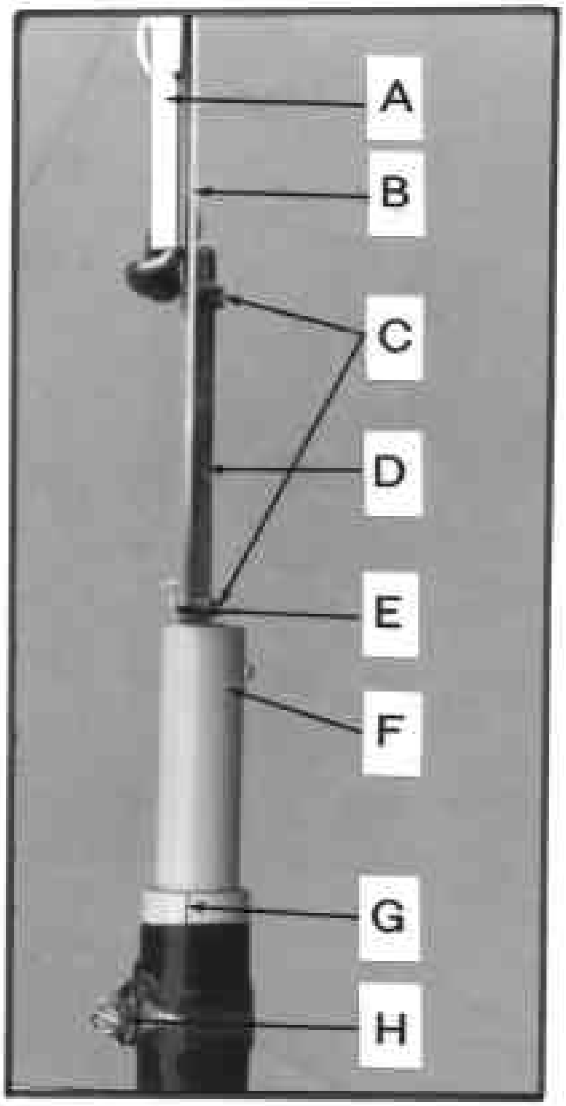

Figure 121—Details of how the clipboard is placed over the rod as viewed from the edge of the clipboard. (**A**) The clip of the clipboard. (**B**) The edge of the clipboard, in this case an aluminum board. (**C**) The ¼-in straps into which the ¼-in rod of the post is inserted. (**D**) The ¼-in rod of the post inserted into the clipboard straps. (**E**) A screw inserted into the wood doweling to hold the ¼-in rod, which prevents the clipboard from rotating in the wind (see fig. 118). (**F**) A piece of doweling fitted inside the ¾-in PVC pipe, which is drilled out for a ¼-in steel rod and held in place by a screw. (**G**) A sawcut 2 in into the 1-in PVC pipe so that the pipe can be compressed by the hose clamp (**H**) to hold the inside pipe at the desired height. At H, the hose clamp is secured with electricians tape.

The clipboard post is composed of two parts (fig. 121). One is 1-in CL 200 PVC pipe and the other is 3/4-in CL 200 PVC pipe, both 18 in long. The 3/4-in pipe fits inside the 1-in pipe with some slack. If pipe specifications other than these are used, be sure that one pipe will fit inside the other. When compressed, the clipboard holder is 22 in tall. When extended with 4 in of pipe inside, it is 32 in tall (fig. 120B).

To make the clipboard post adjustable, saw down 2 in into the end of the 1-in pipe (fig. 121G). Attach a 1-in hose clamp an inch below the top of the pipe and secure it with electricians tape (fig. 121H). Tighten the hose clamp so that the inside 3/4-in pipe can just be moved up and down to adjust height of the clipboard above vegetation or other obstructions.

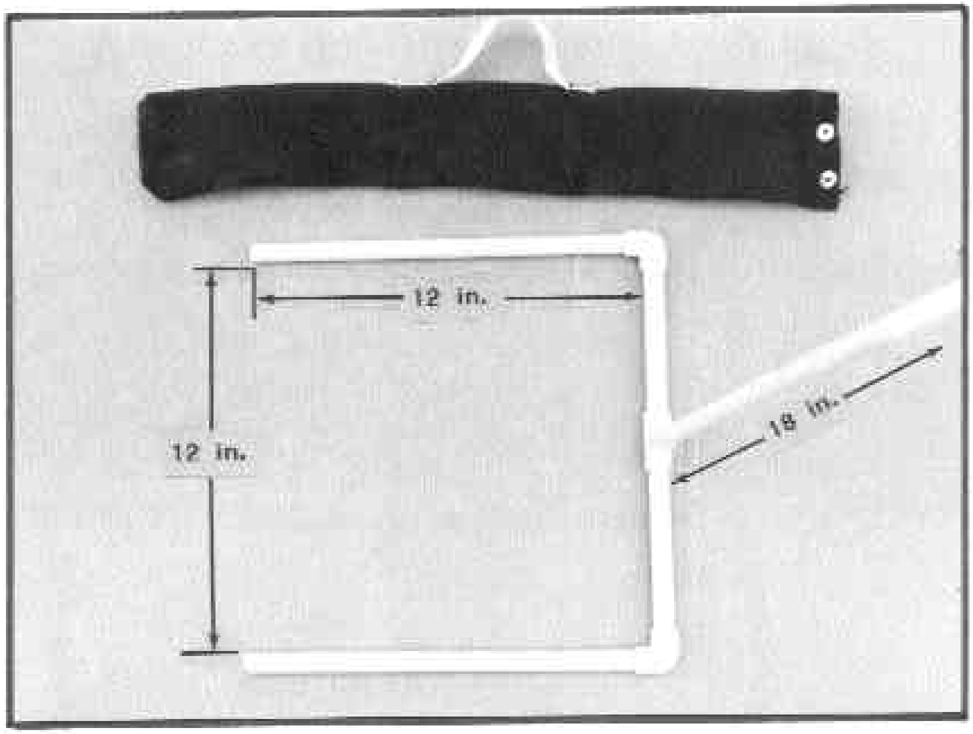

Figure 122—The 1-ft^2 sampling frame is made from ½-in PVC pipe. Inside measurement is 12 in square. The side opposite the handle is open to facilitate placement in shrubby vegetation. An 18-in-long handle facilitates placement of the frame.

One-Square-Foot Sampling Frame

The 1-ft^2 sampling frame is used with stereo photographic sampling. It is constructed from 1/2-in-diameter PVC pipe and measures 12 in square (fig. 122). An 18-in-long handle reduces effort when placing the frame.

Materials	**Cost** *(see footnote 1)*
	Dollars
1/2-in-diameter PVC pipe, 10 ft long @ $3/piece	3
2 90-degree, 1/2-in PVC elbows; 1 1/2-in PVC “T”	1
Total	4

Consider not cementing the elbows to the pipe so that the frame can be taken apart to transport. Figure 123 shows the frame disassembled with its carrying case. The case is made from canvas with a handle and two snaps at the open end.

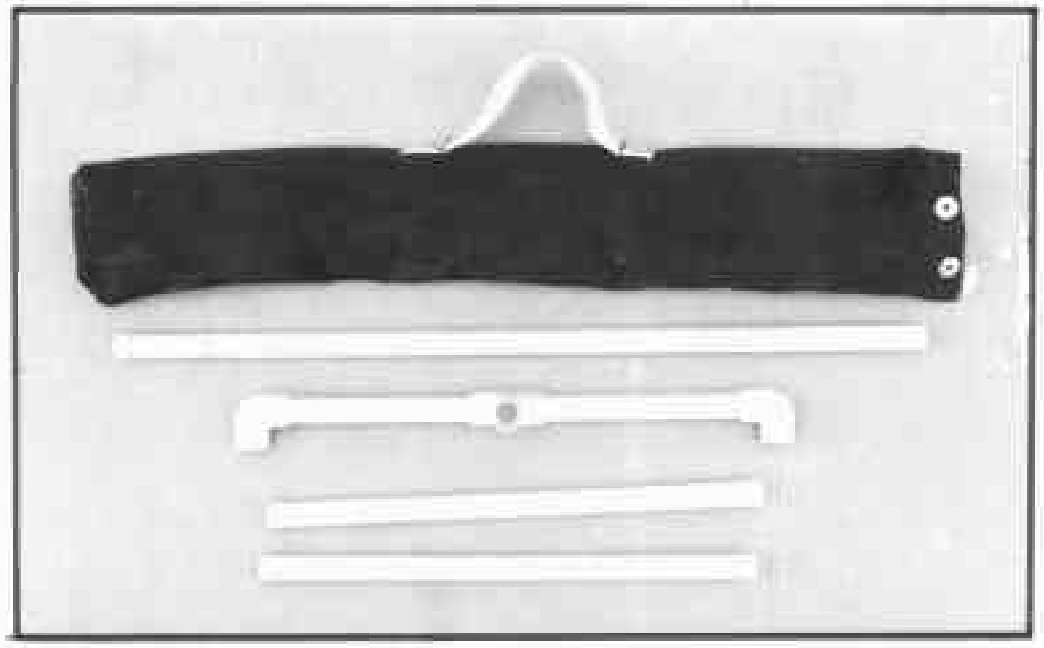

Figure 123—A1-ft^2 sampling frame disassembled with its carrying case. The case is made from canvas with a handle and two snaps at the open end.

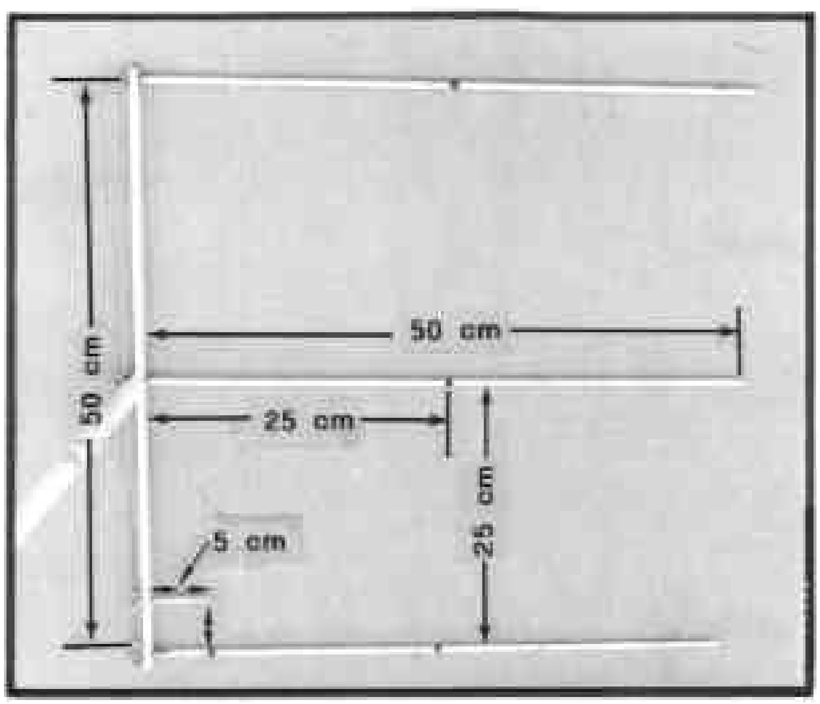

Figure 124—Nested frequency plot frame specifications. Measurements shown are inside dimensions. The four prongs must be cut 2 cm longer to provide for threading the ends and the aluminum back piece must be cut 2 cm longer to provide for ¼-in tapped drill holes for the edge prongs.

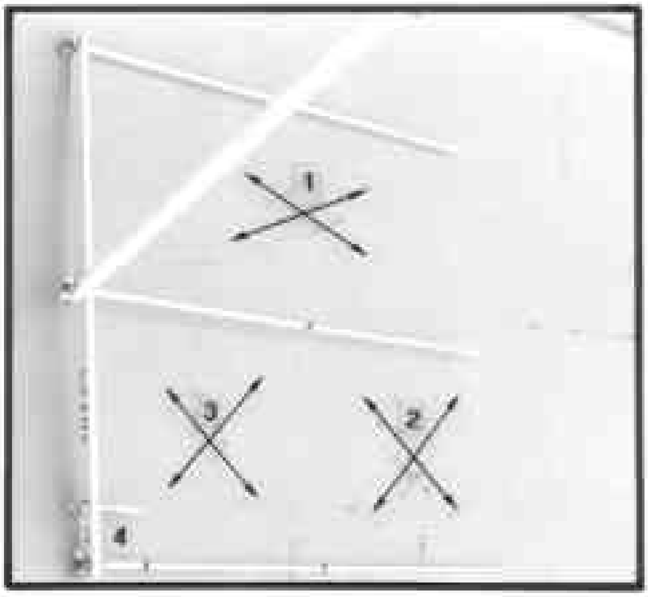

Figure 125—Plot locations in the nested frequency plot frame. The smallest is rated “4,” next largest a “3,” half the plot frame is rated “2,” and the rest a “1.” Plants rooted in each section are given the assigned rating, which is recorded by species.

Nested Frequency Sampling Frame

Nested frequency is a sampling system designed for low variability rates among observers; it is based on statistical analysis to detect change. A plot frame, 1/2-m square, with four sizes of nested plots is used (fig. 124). Species are recorded and given a value when rooted within any of the four subplots.

Values are assigned based on plot size (fig. 125). Species numerous enough to fall within the smallest subplot are rated highest to reflect their greater density. Species are recorded starting with the smallest subplot (4) and proceeding to larger subplots. Once a species is recorded, do not repeat its presence in a larger subplot.

Figure 124 specifies plot dimensions. Please note length requirements in the materials list below. The steel rods must be cut 2 cm longer so they can be threaded and screwed into the aluminum back piece. The aluminum back piece must be 2 cm longer than the dimensions shown in figure 124 to accommodate tapped holes for the outside rods.

Materials	**Cost** *(see footnote 1)*
	Dollars
1 tap and die set for 1/4-in steel rod	(borrowed)
3 1/4-in steel rods, 36 in long:	
3 pieces cut 52 cm long, threaded for 2 cm (effective length 50 cm)	
1 piece cut 7 cm long, threaded for 2 cm (effective length 5 cm)	3
1-in by 1/4-in aluminum bar stock cut 52 cm long @ $10/6 ft (drill and tap 4 holes, each 1/4-in diameter, at 1, 6, 26, 51 cm)	4
5 wing nuts for 1/4-in threaded steel rod	1
PVC pipe 1/2-in diameter SCH40 cut 50 cm long, @ $3/10 ft	1
Total	9

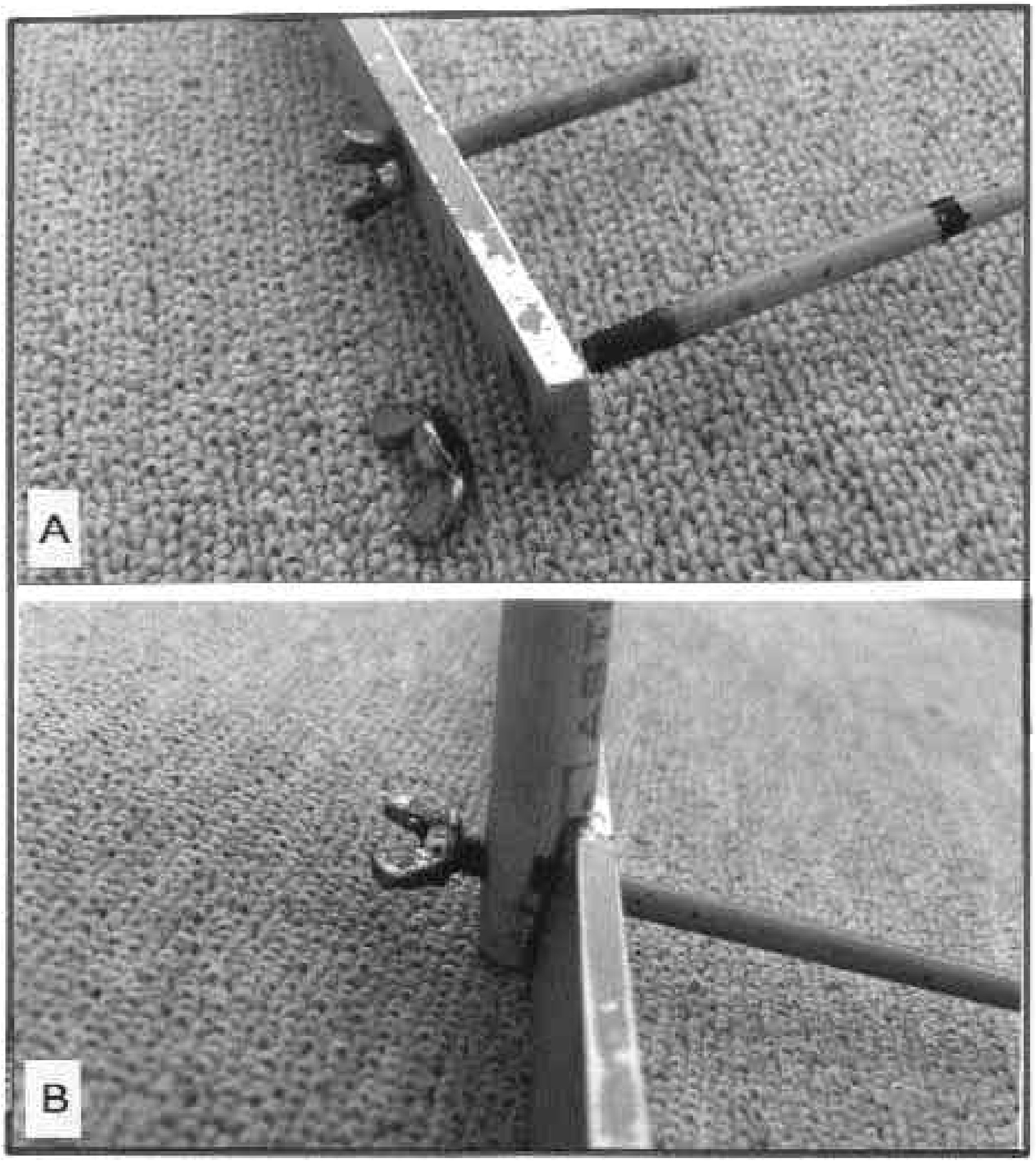

Figure 126—Method for attaching the nested frequency prongs to the 1-in by ¼-in aluminum back piece. (**A**) A 50-cm prong is shown threaded and ready to screw into the aluminum back piece. Next to it is the 5-cm-long prong attached. The 5-cm subplot is identified by the black mark on the 50-cm prong and the end of the 5-cm prong. (**B**) The center 50-cm prong is shown screwed into the aluminum back piece and through the 50-cm handle, with a wing nut ready to tighten the handle to the back piece.

Sharpen the ends of the four prongs to a 45-degree angle. These points are where ground cover items are recorded, such as bare ground, gravel, or rock.

Screw the threaded rods into the aluminum back piece (fig. 126A). Secure the rods with wing nuts. Be sure the measurements shown in figure 124 are met.

The 50-cm PVC handle is cut out and attached (fig. 126B). Cut one-third of the way through the pipe 1 in above its end to fit over the aluminum back piece. Then, from the bottom and starting in the center, cut at an angle to the upper cut. Finally, drill a 1/4-in hole to match the hole at 26 cm in the aluminum back piece (fig. 126B). Assemble as shown in figure 126B.

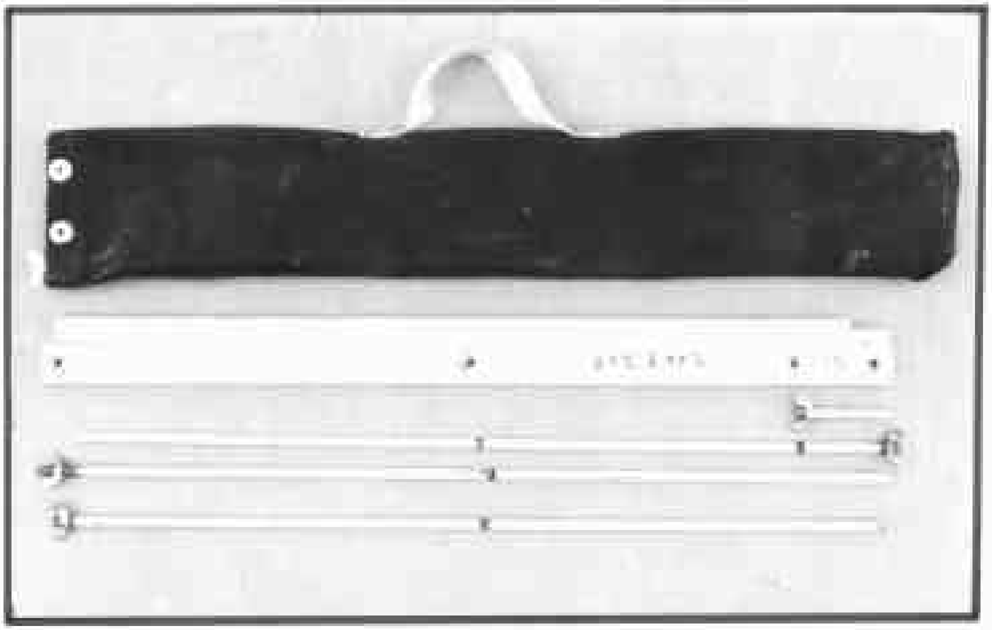

Figure 127—The disassembled nested frequency plot frame is shown with its carrying case. Notes on the aluminum back piece show percentage of the plot frame occupied by the 25- by 25-cm subplot (25 percent), 25- by 50-cm subplot (50 percent), and the 5- by 5-cm subplot (1 percent).

Paint the frame with dull yellow paint. When dry, paint the black marks at 5 and 25 cm on one prong and at 25 cm on the other prongs. These marks identify the various subplots sizes shown in figures 124 and 125.

The plot frame may be disassembled for carrying as shown in figure 127.

One-Square-Meter Sampling Frame

One-square-meter photo plot frames are designed to replace Parker's (1954) three-step method using a 3-ft by 3-ft plot frame. Both are used in photographs taken at an oblique angle. His plot frames were made from two 6-ft folding rulers, the joints of which could be used to draw a grid on a photograph. This 1-m^2 frame is marked off in 2-dm increments (fig. 128).

Materials	**Cost** *(see footnote 1)*
	Dollars
3/4-in SCH40 PVC pipe @ $2/10 ft, 2 required	4
90-degree 3/4-in PVC corners SCH40, 4 required	2
4 by 8 inch, 1/2-inch thick scrap plywood	(scrap)
2 screws #6, 1 in long	
Several feet of black electricians tape	4
Total	10

Cut the 3/4-in PVC pipe into four 1-m lengths (fig. 128A). Be precise because the pipes, when inserted into the elbows, fit at exactly the elbow corner. Do not glue the pipes to the elbows. The frame will be adequately stable with the pipes simply pushed into the elbows and then can be broken down for transport (fig. 128B).

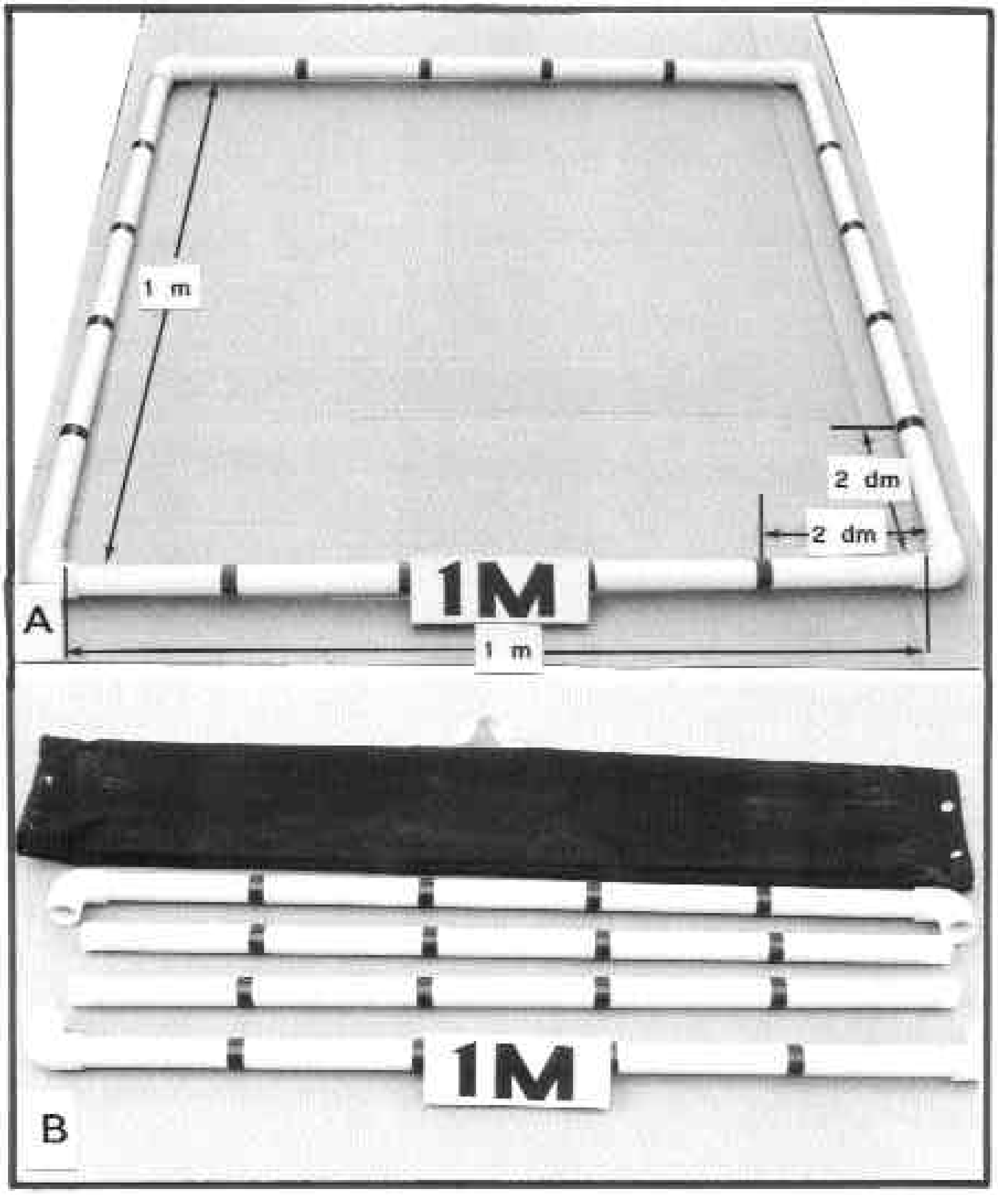

Figure 128—The 1-m^2 plot frame (**A**) is marked off in 2-dm increments. Inside measurements are 1-m per side. The ¾-in pipe may be measured precisely and inserted into the elbows because the elbows have a stop at the exact position of the elbow bend. Do not cement the elbows to the pipe because the plot frame can be disassembled for easy transport in its canvas carrying case (**B**).

Next, measure out 2 dm on all four pipes and circle the pipe at these locations with electricians tape to mark a 2-dm grid system (fig. 128).

In figure 128, a 1/2-in-thick piece of plywood measuring 4 by 8 in (1 by 2 dm) has been attached to identify the meter plot frame. The “1” and “M” are made with 3/4-in-wide electricians tape. The plywood is attached with two screws through the board and into the PVC pipe. I use the identification for slide talks to quickly identify the size of plot frame.

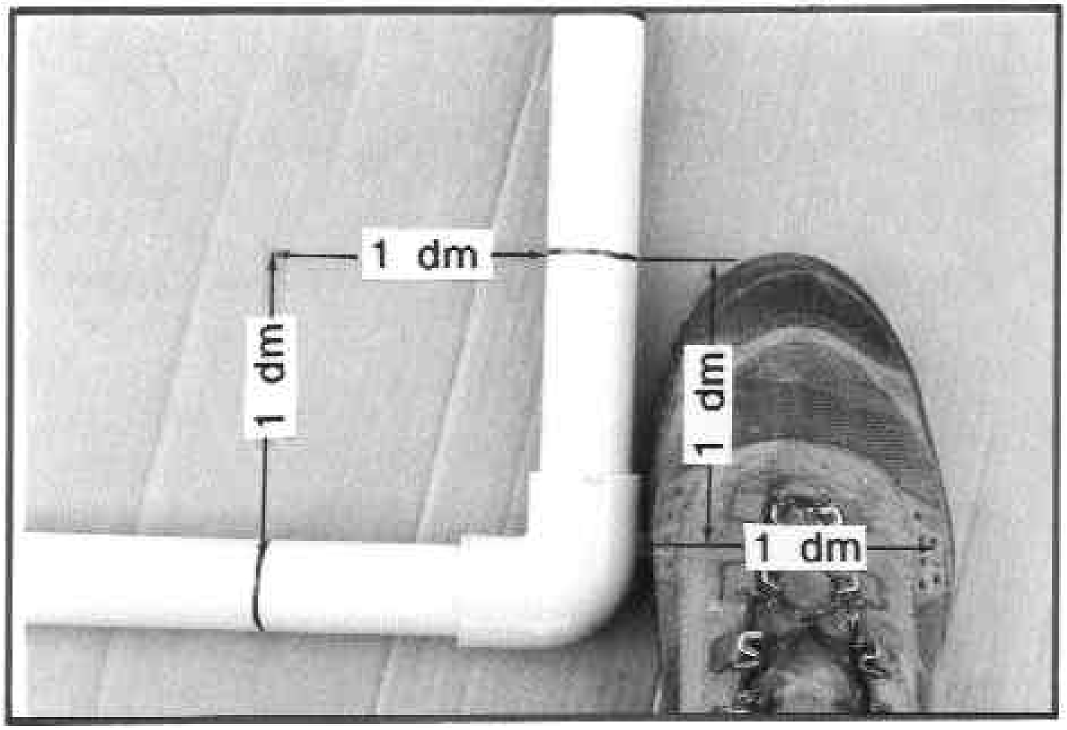

Figure 129—Amethod is shown for estimating small increments of cover. In a 1-m^2 plot frame, 1 dm^2 is 1 percent cover. This represents about the front one-third of my foot. Because a 1-m^2 plot is 3.4 feet on a side, each large step represents 1 percent cover so long as the cover is represented by each and every step. An area 2 by 2 dm is 4 percent cover, about 1.3 of my foot. I now have a measuring system for estimating cover of items I encounter while walking across an area.

Figure 129 reflects a system I have found useful in estimating cover of vegetation or soil surface items. An area 1 dm by 1 dm is 1 percent of a square-meter plot. A square-meter plot, being 3.4 ft on a side, is a little longer than the stride of a person about 6 ft tall. The front one-third of my foot is about 1 by 1 dm (fig. 129). Therefore, each time I take a long step, any vegetation that covers the front one-third of my foot is 1 percent of the cover. But the vegetation must approximate that area for *each and every step*. If it does not, then canopy cover of that item is less than 1 percent.

Each 2-dm area is 4-percent cover, a little more than one of my whole feet. Thus, when walking through an area, I have some reasonably firm idea of how to estimate cover of various items.

Robel Pole Sampling System

The Robel pole (Robel and others 1970) offers a way to document stubble height of herbaceous vegetation. They tested various systems for observing stubble height and settled on a pole marked in 1-in increments and set 4 m from an observation position 1 m high. Figure 130 shows specifications for making the Robel pole system.

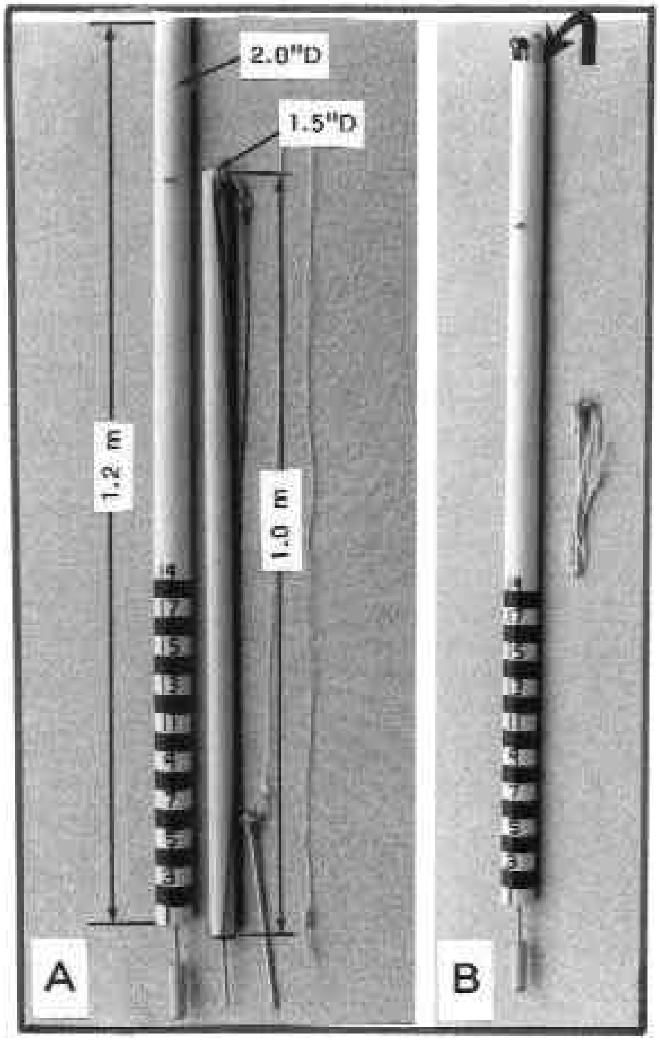

Figure 130—Robel pole specifications and criteria are shown. (**A**) A 2.0-in diameter PVC pipe is used for the Robel pole and 1½-in pipe for the camera height pole. These diameters permit the camera height pole to be inserted into the Robel pole (**B**) for carrying. A tent stake for supporting the Robel pole is carried in a person's pocket. In A, the Robel pole is 1.2 m tall with an eye at 1.0 m. The camera height pole is 1 m tall to which is fastened a 4-m measuring line. When working alone, use a tent stake with 2 m of line to hold the Robel pole vertically while pulling the 4-m line taunt.

Materials	**Cost** *(see footnote 1)*
	Dollars
2-in diameter CL200 PVC pipe @ $3/10 ft (cut 1 piece 1.2 m for the Robel pole)	3
1.5-in diameter CL200 PVC pipe @ $3/10 ft (cut 1 piece 1.0 m for the camera-height pole)	3
20 ft 1/8-in diameter nonstretch rope	1
1½-ft 1/4-in diameter steel rod (cut 2 pieces 8 in long)	1
2 #6 size eye screws; 1 6-in tent stake	2
1 snap with ring; several feet of black electricians tape	3
Total	13

The Robel pole system consists of two poles and a 4-m section of line attached between the poles. Figure 130 lists the specifications permitting the camera-height pole to be placed inside the Robel pole for carrying. Figure 131 illustrates construction and marking of the Robel pole and details.

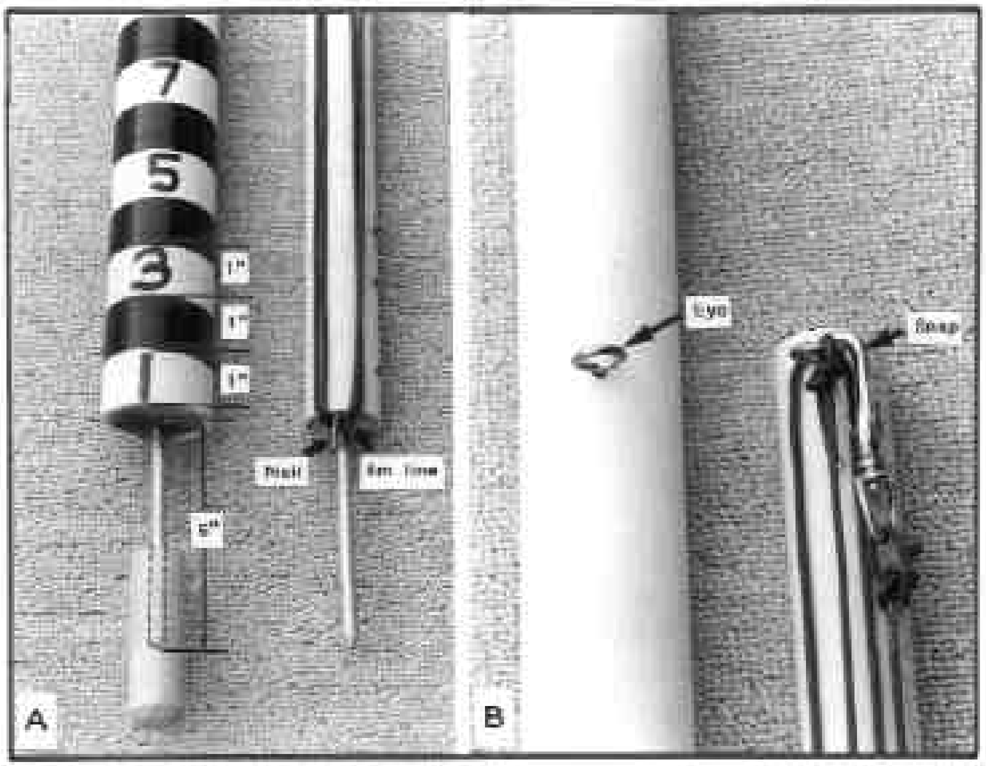

Figure 131—(**A**) The Robel pole is marked at 1-in increments with black electricians tape. Alternate inch increments are inscribed with permanent black markers for every odd-numbered inch. Steel rods ¼-in diameter extend 6 in below the Robel pole and the line pole. The Robel pole rod is protected by doweling drilled out for ¼-in steel rod. Steel rods are secured inside the PVC pipe by doweling. (**B**) An eye is attached to the Robel pole 1 m aboveground. After screwing in the eye, remove it and cut off the sharp end, then replace the eye. Cutting off the sharp end provides room for the camera height pole to be inserted into the Robel pole (fig. 130B). A 4-m line, secured by a nail, is wrapped around the camera height pole. It is snapped to the eye on the Robel pole to measure consistent distance between Robel pole and the camera. The camera height pole, 1 m tall, provides a consistent camera height when the camera is positioned at the top of the pole.

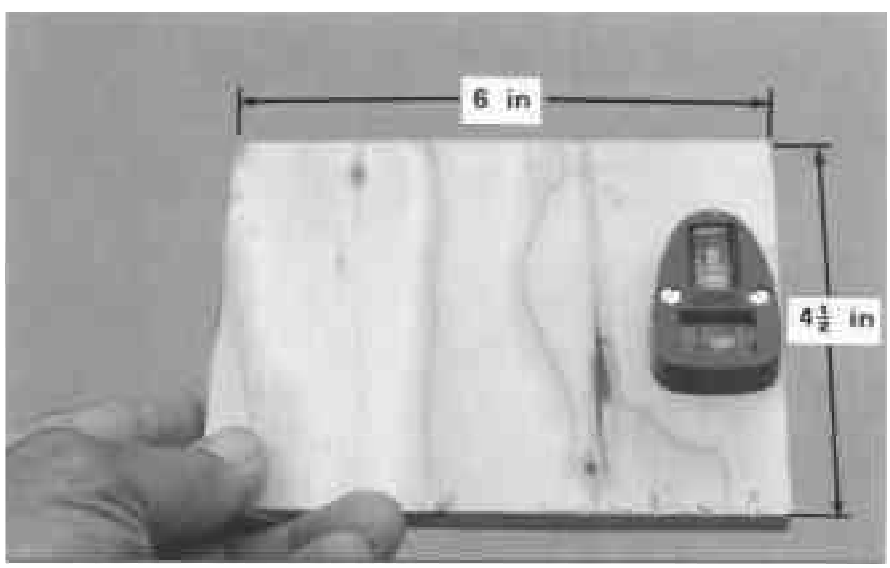

Figure 132—Aleveling board for taking overhead photos of tree canopy cover measures 4½ in by 6 in and has a two-way level attached. It is made from scrap ½-in plywood.

Figure 133—The camera leveling board is used to consistently rephotograph the tree canopy. Place the leveling board on top of the meter board for consistent height above the ground. Place the meter board at a right angle to the transect line. Move the meter board sideways to center the crosstransect bubble, then tilt the level board to center the downtransect bubble, and photograph.

Camera Leveling System

Photographs taken looking up at the tree canopy require a camera leveling system for consistent rephotography. The system described here uses the meter board top as one axis for consistently orienting the camera and a leveling board for the other axis (figs. 132 and 133).

Materials	**Cost** *(see footnote 1)*
	Dollars
1 2-way level or 2 line levels	4
4½- by 6-in, 1/2-in thick, scrap plywood	(scrap)
Total	4

Figure 132 illustrates the camera leveling board's dimensions and placement of the two-way level. Figure 133 illustrates uses of the leveling board. Place it on the top edge of the meter board, move the meter board left or right to center on the cross-transect level, then tilt the board to center the down-transect level. Move your head out of the way and photograph.

Figure 134—Double camera bracket for use when photographing in both color and black and white. The bracket is made from 1- by 1/8-in stock aluminum bar with holes drilled to mount the cameras. Identical cameras are recommended to simplify camera adjustment. Figures 135 and 136 illustrate construction details.

Double-Camera Bracket

Two cameras usually are needed to photograph in both color and black and white. A bracket holding both cameras together provides for simple and effective manipulation of the cameras (fig. 134). Identical cameras simplify adjustment. When ready to photograph, simply shoot with the top camera, then the bottom, and advance the films.

Materials	**Cost** *(see footnote 1)*
	Dollars
1 6-ft piece aluminum bar stock, 1 in wide by 1/8 in thick (cut a piece 18 in long)	8
Instant thumb screws:	
2 1/4-in diameter standard 20 thread, 3/8-in shank screws	1
2 instant thumb screws	1
Total	10

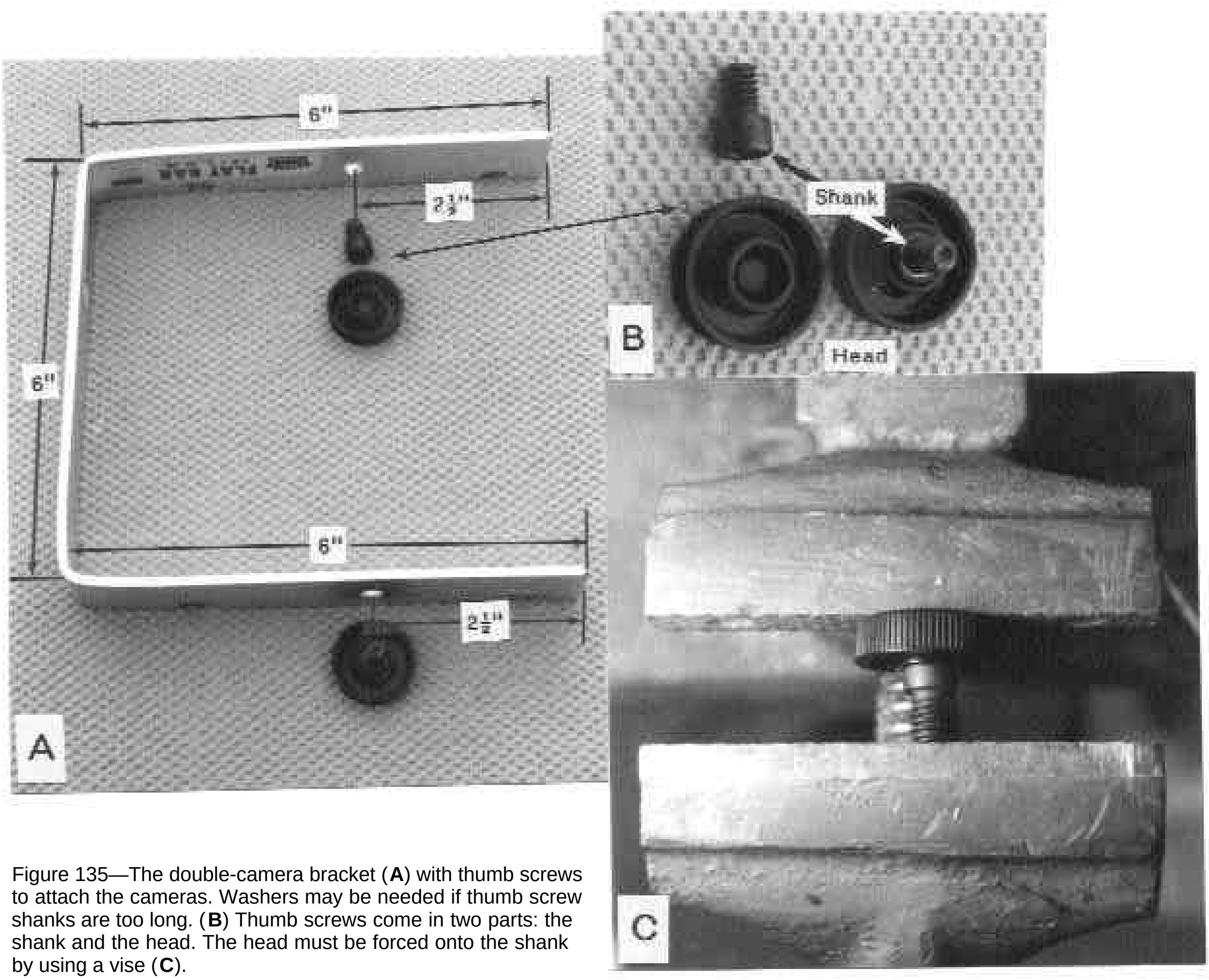

Figure 135—The double-camera bracket (**A**) with thumb screws to attach the cameras. Washers may be needed if thumb screw shanks are too long. (**B**) Thumb screws come in two parts: the shank and the head. The head must be forced onto the shank by using a vise (**C**).

The aluminum bar stock, cut to 18 in, is bent into equal 6-in segments to form a "U" (fig. 135A). Then, 1/4-in holes are drilled 2½ in from the ends (fig. 135A) to hold the cameras. Be sure the holes will place the cameras where the rewind buttons will be accessible (fig. 136B). Next, on the aluminum bar make two 1/4-in cuts, ½ in apart, into the aluminum toward the front of the camera and bend the 1/2-in piece upward to about a 30-degree angle (fig. 136A). Do not bend more than 30 degrees or the aluminum will break. These tabs will prevent the cameras from rotating on the bracket.

Assemble the thumb screws, which come in two parts — the shank and the thumb head (fig. 135B). Be sure the shank will fit the camera mounting socket. A 1/4-in diameter, 20-thread shank 3/8 in long will work. Press the head onto the shank as shown in figure 135C using a vise. Heavy pliers usually do not apply sufficient force to seat the thumb head.

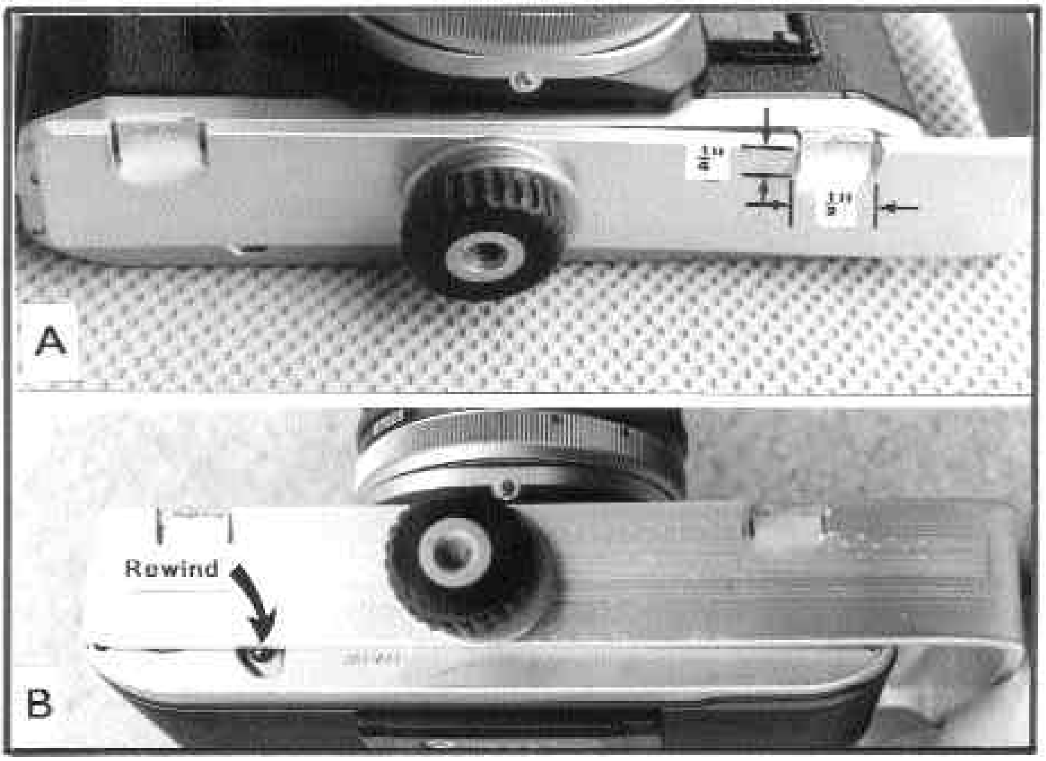

Figure 136—Two factors are important in attaching the camera to the bracket. (**A**) Make two ¼-in cuts into the front of the bracket, ½ in apart, and bend upward no more than 30 degrees to prevent rotation movement of the camera. (Bending them farther may break them off.) (**B**) Be sure the bracket clears the rewind button so that film may be changed while the camera is attached to the bracket.

Fenceposts

Flimsy fenceposts are available at builders supply outlets such as Home Depot©. They are listed as "light duty" stamped metal fenceposts. Measured across the top, the long axis is 1¼ in. Medium duty stamped fenceposts measure 2 in. Light duty posts may have to be ordered.

Identification Tags

Orange colored, aluminum tags suitable for installing on witness sites to identify a monitoring location may be obtained from:

Dixie Steel and Sign Co.
P.O. Box 54616
Atlanta, GA 30308
Phone: 404-875-8883
Fax: 404-872-5423

Obtain a tool-steel inscriber to inscribe directions and distances to camera locations and photo points directly on the tags. The tags are about 12 gauge thickness with black and orange paint.

Appendix D: Photo Monitoring Filing System

Contents

Introduction

The concept of photo monitoring implies repeat photography, which in turn suggests the need for a filing system where, over the years, one can regularly deposit their photographs and data. This appendix describes some attributes of filing systems I've found useful over the last 40 years.

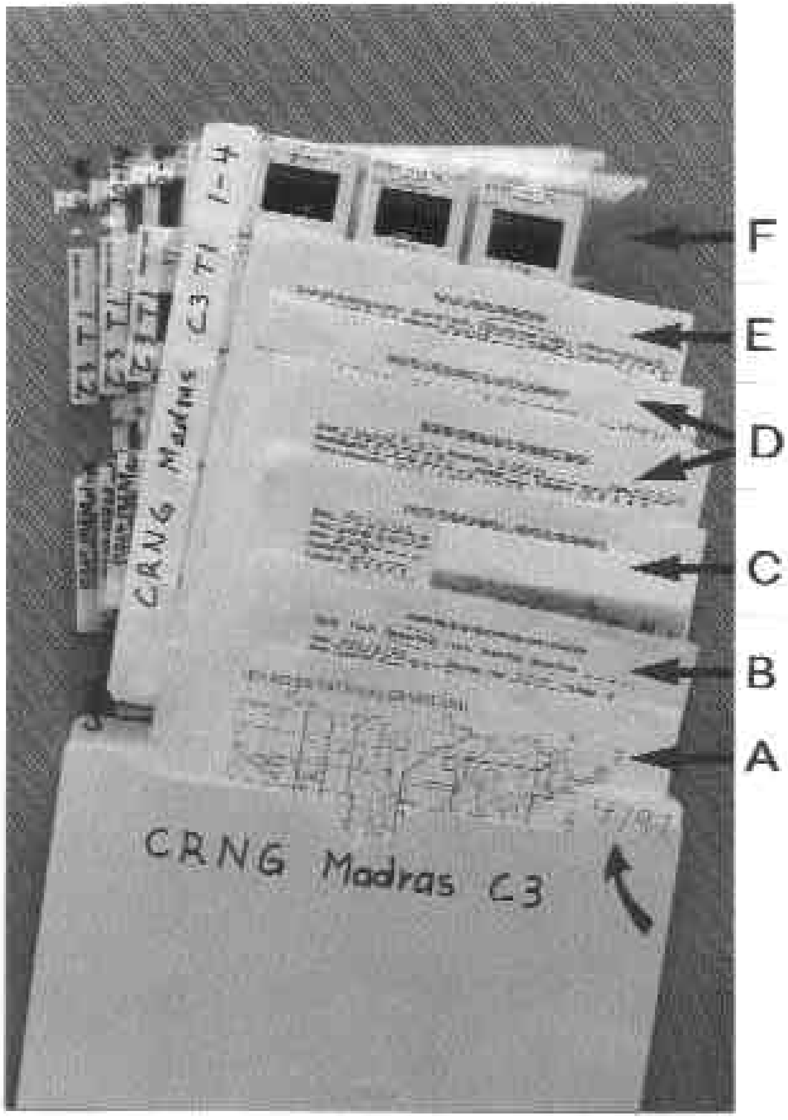

Figure 137—File folder contents for the Crooked River National Grassland trend cluster C3. I use several sizes of expanding folders: 2-fold shown here, 4-fold, and 8-fold to fit the file size. Each folder is labeled and the last date of sampling is attached to the upper right corner (arrow). All items pertaining to the sample location are included in the file: (**A**) general area map (fig. 72), (**B**) the form "Sampling Site Description and Location" for a plot layout map (fig. 82), (**C**) a form for attaching photographs and recording data shown here as the "Photo Trend Sample - Nested Frequency" (figs. 83-85), (**D**) data summary forms shown here as "Nested Frequency Transect Data" (figs. 86 and 87) and "Nested Frequency Cluster Summary" (figs. 88 and 89), (**E**) trend interpretation using "Range Trend Rereadings" (figs. 90 and 91), and (**F**) clear plastic holders for slides (fig. 139). Not shown are black-and-white negatives in their envelopes identified by date, cluster, and transect.

Office Filing System

Office organization of the filing system presumes that each monitoring location is completely contained in its own folder (fig. 137). Consider three alternatives for filing these folders: by (1) date of rephotography, (2) topic of the study, or (3) geographic location of the study.

Date of Photography

Date of photography may be season of year, such as Pole Camp in spring, summer, and fall (fig. 20); once each year at a specific date, such as herbage production (fig. 22); irregularly based on disturbance such as logging (figs. 29, 50, and 51); or at specified intervals, such as every 5 years—the three intervals between 1977 in figure 46 and 1991 in figure 48.

An advantage of organizing by date is having files immediately available each year according to their schedule. This means that topics of sampling and geographic locations are interspersed requiring search of all files. I place the date information on the upper right corner of the file rather than file by date.

Topic Being Monitored

The topic being monitored determines the purpose for monitoring and the kind of vegetation under consideration. Topics may be exclosures (fig. 137), livestock trend sampling (figs. 75, 83, and 92), sagebrush-grass (figs. 75, 83, and 92), logging effects (figs. 21, 50, and 51), herbage production (fig. 22), or livestock utilization (figs. 20 and 106-108).

Similar topics are filed together, such as logging with overstory removal (fig. 21) and a single light thinning (figs. 50 and 51) in ponderosa pine. All logging may be put together or all ponderosa pine may be located together. If logging is the topic, salvage of beetle-killed lodgepole pine (figs. 46-48) would be filed with it. Decisions must be made on organizing the files by topic, none of which will prove wholly satisfactory.

Geographic Location of the Study

Geographic location is determined by the closest available motel, access by major road, or distance to travel. My work from Portland, Oregon, covering two states, is organized by towns that gave good access and an acceptable motel. When going to an area on other work, I look in its geographic file to determine if any photo monitoring locations are due for sampling. What might be combined between current work activity and photo monitoring? Are there any monitoring sites in the neighborhood of the work area or on the route? Dates on the files are the first consideration. Is the work activity occurring about the same date as required for sampling? Consider organizing files by date and then by topic within a geographic file. Another approach is to allot several days for monitoring. Having files by location greatly facilitates travel planning and might save considerable time in visiting each site. Filing by location has been my choice for many years.

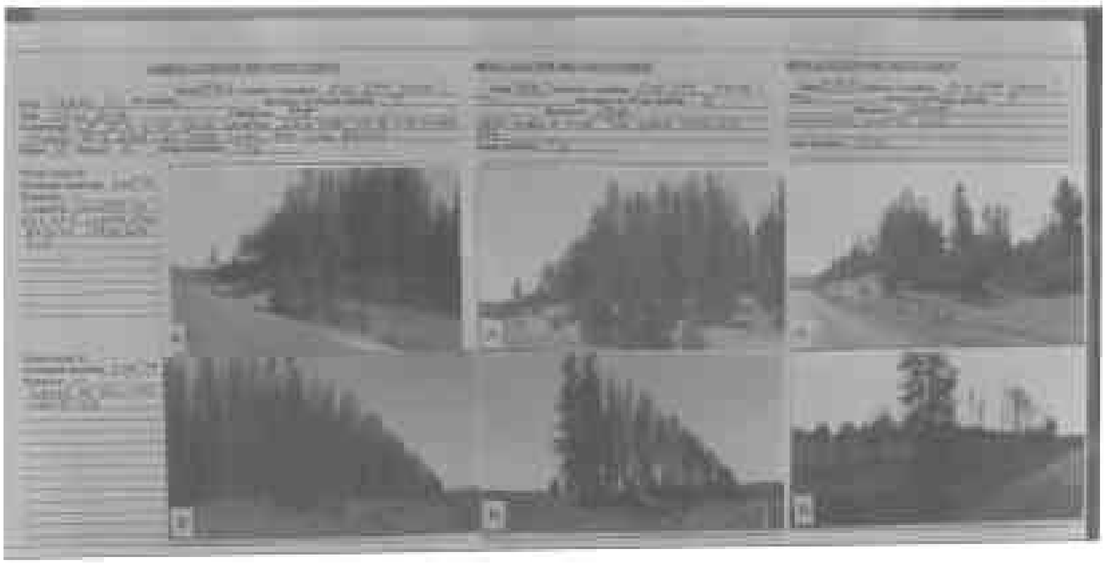

Figure 138—Three pages of filing system form “Camera Location and Photo Points” overlapped to compare changes between three dates. These are figures 46, 47, and 48 located by the map in figure 45. Essential information for making comparisons is in the upper right portion of the form: date and camera location. Overlay the forms so that photographs can be compared as shown. Camera orientation in close landscape photography can be a problem resulting from no meter board or permanent item on which to orient the camera. Compare photo B for 1977 and 1978 with B for 1991. The horizon is similar for the first two but quite different for 1991, a situation to be avoided. Also notice the variation in the road crest in the A photos.

File Contents

All information pertaining to a photo monitoring project should be placed in a single file. This may entail duplicate copies of some items, such as a request and authorization for a study, which might require filing in an office administration folder as well as in the project folder. Long-term investigation, like photo monitoring, is significantly enhanced when historical documents are included in the file.

Consider six kinds of items to include: (1) authorization, approval, or justification for the project; (2) maps to find the monitoring location—a general map noting the location and a site-specific map diagraming the sampling layout; (3) photo-mounting forms that also may be used to record data, such as transect sampling systems; (4) envelopes for negatives, either color or black-and-white, or both, digital memory cards, or compact discs (CDs); (5) summary forms when data are collected; and (6) plastic sheets for holding slides.

Authorization, Approval, or Justification

Document initiation of the photo monitoring project. This may entail copying instructions or policy from an organization, a written request to monitor and subsequent approval, or those parts of an environmental impact statement requiring monitoring of specific activities. If an environmental impact statement, or similar document, is required, include it. Assume that someone totally unfamiliar with your organization’s policy, protocol, or operational procedures may pick up the file and will have everything they need to understand and use the monitoring system. This has proven invaluable in monitoring projects older than 20 years because policy, protocol, and operational procedures change.

Maps

Two maps always should be included in the monitoring file (fig. 137): a general map showing how to find the monitoring site (fig. 72), and a detailed site map of the monitoring system (fig. 73). These maps should be in such detail that a person new to the area can find the monitoring location and do the rephotography.

Photo-Mounting Forms

Effective use of photographs in monitoring suggests that they should be mounted to facilitate comparison. The filing system forms in appendix B are organized so that photos are mounted on the right, underneath the date and camera location. Pages may be overlapped to compare any number of photos by date (fig. 138).

Two kinds of photo-mounting forms are provided: those for topic or landscape photography where measurements are not made (figs. 44, 45, 46-48, and 138), and those for transect sampling where measurements are recorded in the field (figs. 67-69, 75-77, 83-85, 93-95, 99-100, and 106-108). The form shown in figure 137 is a transect form (figs. 83-85). These forms have space for 3- by 5-inch photos.

Summary Forms

Summary forms are used with transect sampling to summarize and interpret the data. One important form is "Range Trend Rereadings," used to compare data among years (figs. 79-80 and 90-91). It may be used with several of the sampling systems. Other forms are designed for a specific system, such as nested frequency (figs. 86-89; tables 2 and 3) or Robel pole utilization (fig. 109).

A different kind of summary form is used with grid analysis. It is a piece of clear plastic (fig. 54) labeled with sampling date, site name, and item, on which outlines of items (shrubs in this illustration) are drawn (figs. 55-56, 60, and 68-69). The outlined sheet is placed on a grid (figs. 58 and 70), which is adjusted in size to the outline, and the number of intersects within each outline are recorded on a summary form (figs. 59 and 71). The photograph, sized grid, outline sheet, and summary form are all filed.

Envelopes for Negatives

Negatives, color or black-and-white, should be kept in the monitoring file. I find that keeping them in the envelopes from processing is quite satisfactory; there is a compartment for the negatives and one for the pictures. I routinely have two prints made: one for mounting and another as a spare. The envelope is labeled with date of photography, monitoring location, and camera-photo point identification.

Each picture on the negative should be identified by a photo identification sheet placed within the camera's view. After several sessions of rephotography, identifying which negative was taken in what year can be impossible. This becomes a serious threat to integrity of the project when prints are made simultaneously from several years of rephotography of the same photo point. How might the various negatives be returned to their proper envelope?

Digital images may be stored in the file by any of three methods: (1) memory cards with their containers, (2) transferred to a CD, or (3) stored on the hard drive of a computer with essential identifying information. Directions to find the computer filing system should be placed in the file.

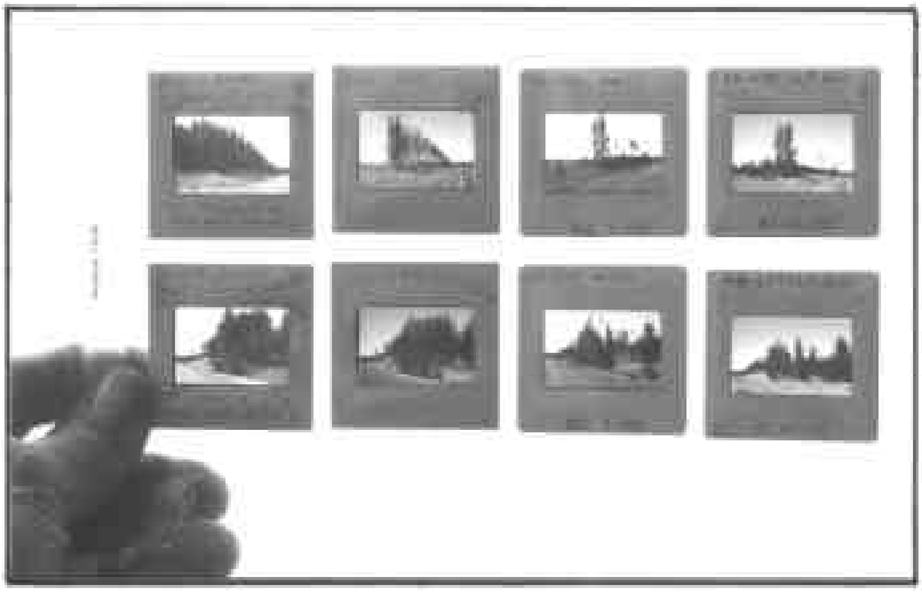

Figure 139—Slides filed in clear plastic sheets facilitate comparison among years. I use either of two systems: four columns by date using the slide holder in portrait view (shown here) or five columns by date using the slide holder in landscape view where five sets of slides are compared. Shown here are slides of figures 46 though 48 and 138. This system of four dated columns also was used in figure 137, where four sheets were required to hold slides for each date.

Slide Files

Slides may be filed in two kinds of holders: rigid opaque plastic or flexible clear plastic sheets. Rigid holders protect the slides on only one side, the other is open. Clear plastic have pockets (2 by 2 in) into which slides are placed (fig. 139). They are protected on both sides. A product **not** having PVC in its makeup will not damage the slide itself (for example, ClearView™). Some flexible pocket sheets will adhere to the slide and damage the emulsion. Slides do not fall out of rigid holders but they do tend to fall out of flexible pocket holders. Even so, my preference is for flexible pocket holders because they take only one-third the filing space of rigid ones.

Slides may be returned to you from processing in either paper or plastic mounts. Paper is less rigid and easier to write on but will hang up in projectors more often and is useless if ever dampened. Plastic requires felt-tip pens for effective writing such as Sanfords Sharpie® Ultra Fine Point Marker, the same one used for drawing outlines on clear plastic sheets. I specify “plastic mounts,” “number only,” and “do NOT date” when I have slide film processed.

All my slides are dated by when they were taken, not when processed. I use a “000” size date stamp with year, month, and day. A stamp significantly reduces time handling the slides. Each should be identified by a “photo identification” form within the view (figs. 26, 33, 67-68, 75, 83, 93, and 106). In addition, I label each slide for easy recognition and add any pertinent information (fig. 139).

Consider filing slides in columns by date (figs. 137 and 139). If there are five slides for a photo point, I file them in landscape orientation (horizontal) in the slide holder. This permits comparing five sets of slides from five different dates on one sheet. If there are four or less slides, I use columns in portrait (vertical) orientation (fig. 139) where four columns may be compared. Using a light table, one can view a number of photo points over considerable time. In figure 139, only photos A and B are shown covering a time span from 1977 to 1997.

Appendix E: Photo Techniques

Contents

Introduction

This appendix is devoted to several topics with much of the discussion occurring in the figure captions.

Hedgecoe (1994) introduces his treatise on landscape photography by discussing learning how to see. What the eye transmits to the brain is not what the camera records. The eye scans a topic for several seconds while the brain filters out the surroundings. Our eyes perceive fine detail over just a small area in the middle of the view. The camera records a fixed rectangular part of the scene with no overt identification of a topic. The view recorded has constrained edges, unlike the movement of eyes. A photograph, therefore, must be purposely oriented to record what the eye and brain see.

Johnson (1991) suggests asking several questions to help resolve eye and camera relations: Why am I taking this picture? What is the purpose of this picture? What will the picture demonstrate? What appeals to me in this scene? and What am I looking for? “Looking for,” the topic of interest, might occur in one of three planes: foreground, middle distance, and far distance. These are relative distances between the camera and the horizon. Close photography might have only 200 yards from the camera to the horizon or back of the scene (fig. 26), in contrast to 10 miles in a general landscape view (fig. 16). Composing the picture to focus on the topic is an important objective.

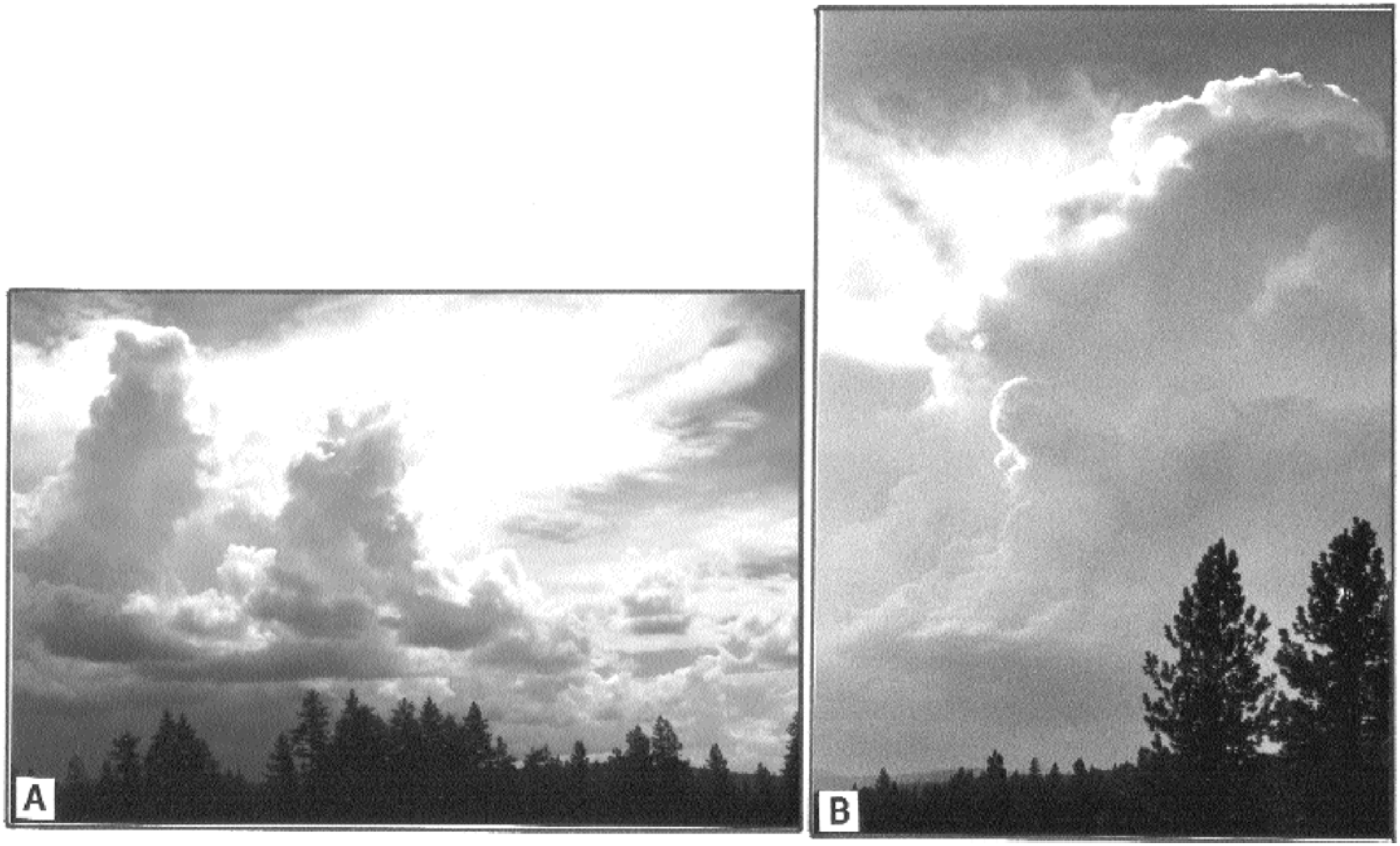

Figure 140—Comparison of (**A**) landscape and (**B**) portrait camera orientation. Hedgecoe (1994) considers landscape camera orientation as peaceful and stable and portrait orientation as active and unstable. Do you agree?

Composition of Photographs

Hedgecoe (1994) suggests that camera orientation helps to convey a message. Landscape (horizontal) orientation suggests peaceful and stable conditions, and portrait (vertical) orientation connotes active and unstable situations. Figure 140 compares these orientations.

Mobility of camera location is more valuable than a battery of lenses for photographic composition (Hedgecoe 1994). By moving around to view the topic, one can totally change the composition of the picture. Different foreground and background elements may be aligned, or detail close to the camera may be avoided or included. The point is to make the picture emphasize the chosen topic.

The next consideration is composition: First identify the topic of interest, and then position the camera to enhance the topic. Hedgecoe clearly discusses the "rule of thirds," which is based on the golden mean, a 1:1.62 ratio, about the dimensions of a 35-mm image, which seems to be the ratio most pleasing to people from western cultures (fig. 141). It suggests that about 33 percent is a valuable percentage to use for positioning the topic. In landscape photography, it is used to position the horizon: one-third sky to two-thirds land, or as shown in figure 135, one-third land and two-thirds sky. The next "third" is to frame the picture on at least one side with something. And the last "third" is to divide the land (or sky) into thirds by use of an angle. The angle may be a road, change in vegetation, crest of a hill, cloud formation (fig. 140), or other item. Perhaps the mnemonic "one-SAT" will help recall "one side, one angle, one-third."

Figure 142 begins a series illustrating this adage. Figure 143 is a broad view of the landscape used for illustration. Figure 144 is a common type of camera orientation, placing the horizon in the center of the picture. Lowering the camera, as in figure 145, illustrates a one-third horizon; in figure 146, the camera moves to the right to frame the scene. One angle is represented by the slope. Figure 147 is the actual scene taken near the Snake River in Oregon, showing the topic of terracing on the near slope resulting from livestock grazing and no terracing on gentler slopes.

Figure 148 illustrates the "thirds" concept but reverses one-third sky for one-third land to emphasize the topic of spring rain showers in the Great Basin. (In reality, only one-fourth is land.) In photo (B) the camera was repositioned to frame the picture with sagebrush and to include a fence for the "angle" and as a perspective on scale.

Pattern is use of contrasting objects such as a house in a field, row of trees, hills and a valley, or dramatic differences in vegetation as shown in figure 149. The topic was a meadow and its adjacent forest. Pattern also is illustrated in figure 150 but in a dramatically different way. Here pattern is related to texture of the siding compared to the roof and ground.

Text continues on page 313.

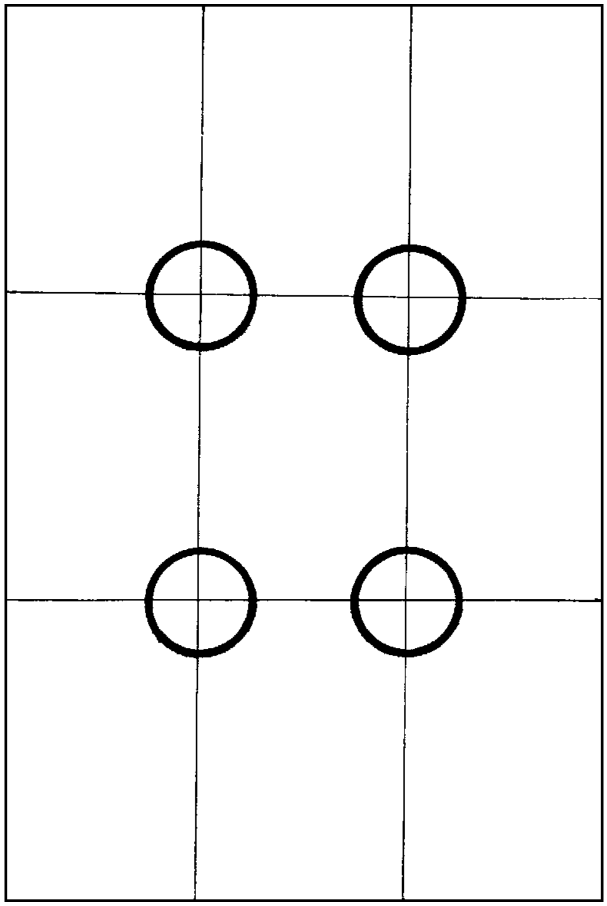

Figure 141—The “rule of thirds” depicted with a 35-mm image. Divide the image into thirds and use the intersection of the lines as a guide for topic location. In portrait photography, a person’s face or other item of interest is located at one of the circles. Landscape photography uses a modification as shown in figure 142.

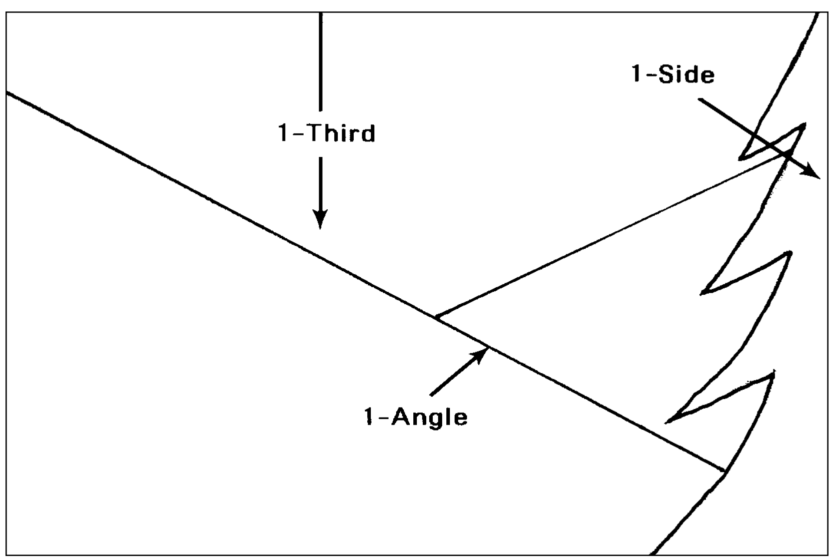

Figure 142—Figures 143 through 147 illustrate the concept of “thirds” (Hedgecoe 1994) or the concept of “one-third, one side, one angle” for placing the topic of interest in a photograph. “One-third” suggests that only one-third of the picture should be sky or land. In figure 142, only one-third is sky. “One side” suggests framing the picture in some way, here with a tree. “One angle” calls for some line in the picture at an angle. This diagram is expanded to a real landscape diagram in figure 143.

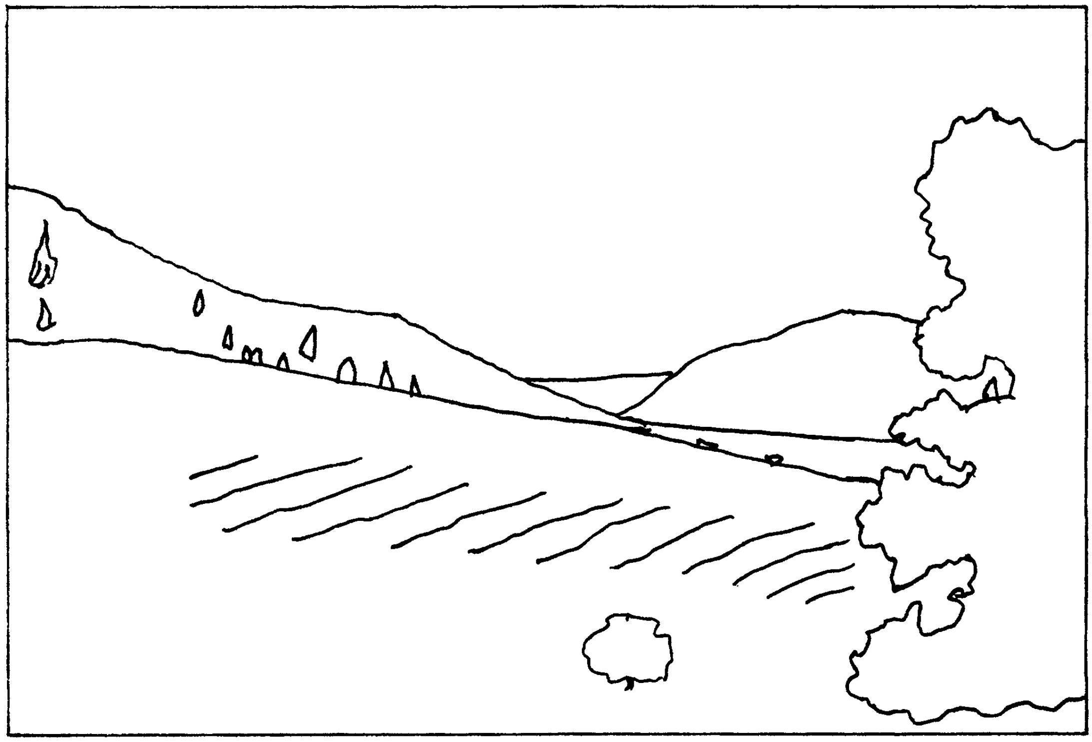

Figure 143—Abasic scene. Orientation of the camera will be further illustrated in figures 144 through 146.

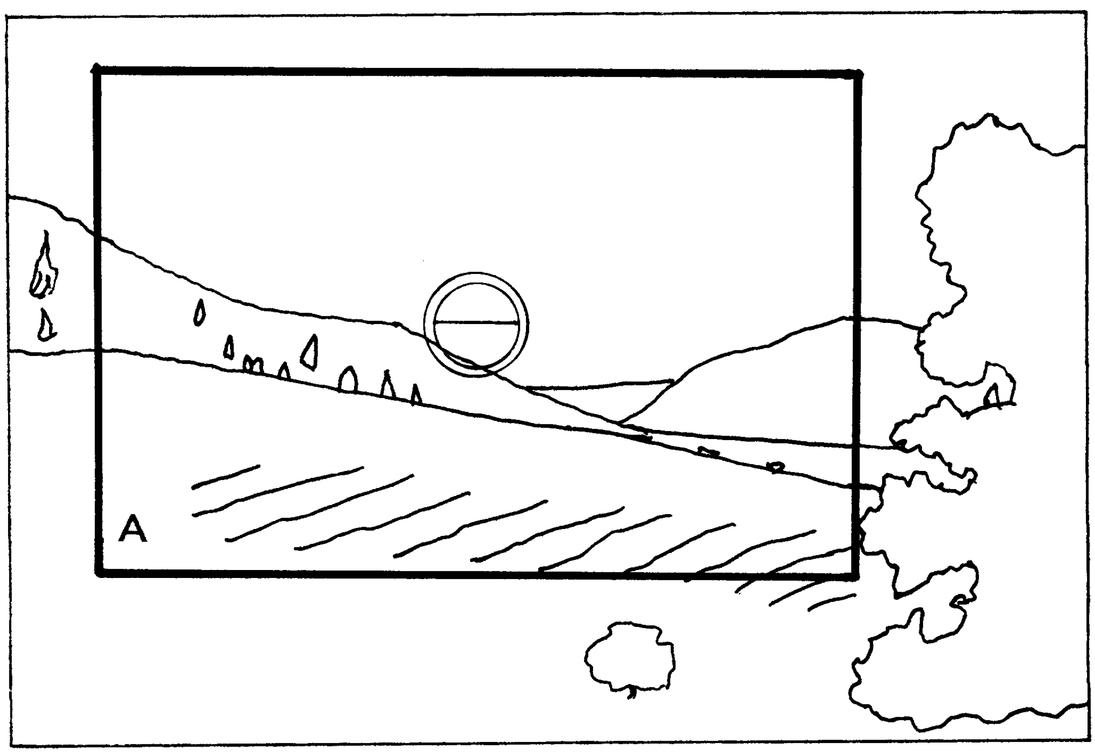

Figure 144—Here the camera focus has been placed on the horizon resulting in half sky and half land. Compare to figure 147A.

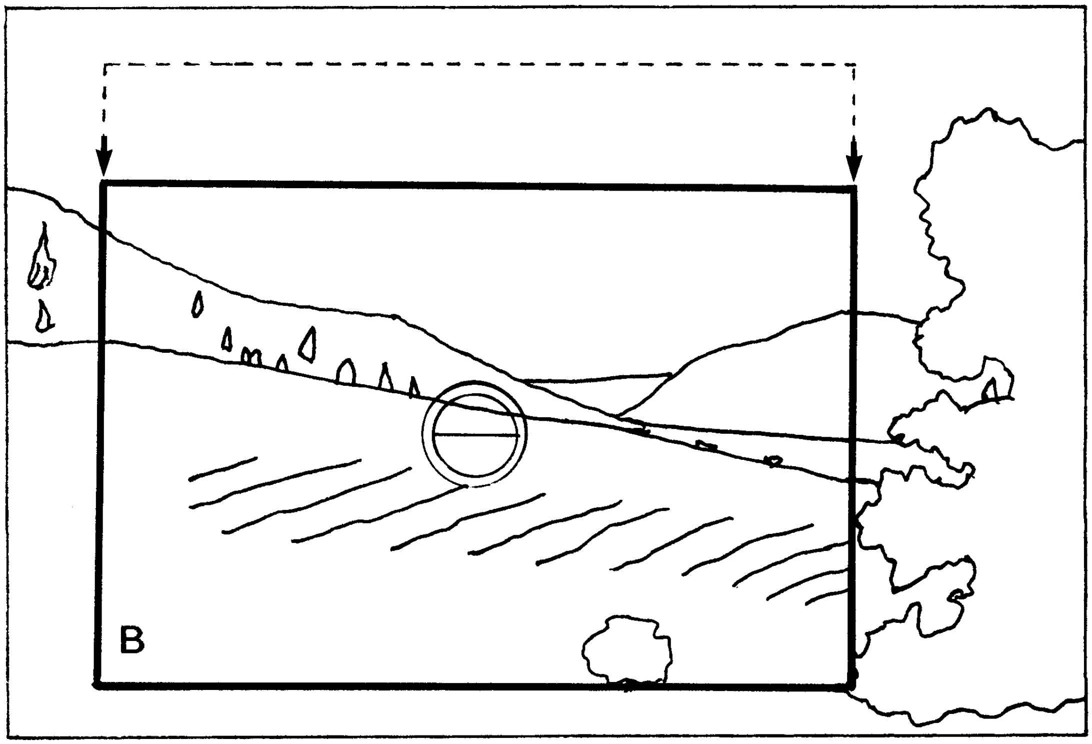

Figure 145—The camera has been lowered to one-third sky providing some focus on the foreground topic of a rippled slope. Compare to figure 147B.

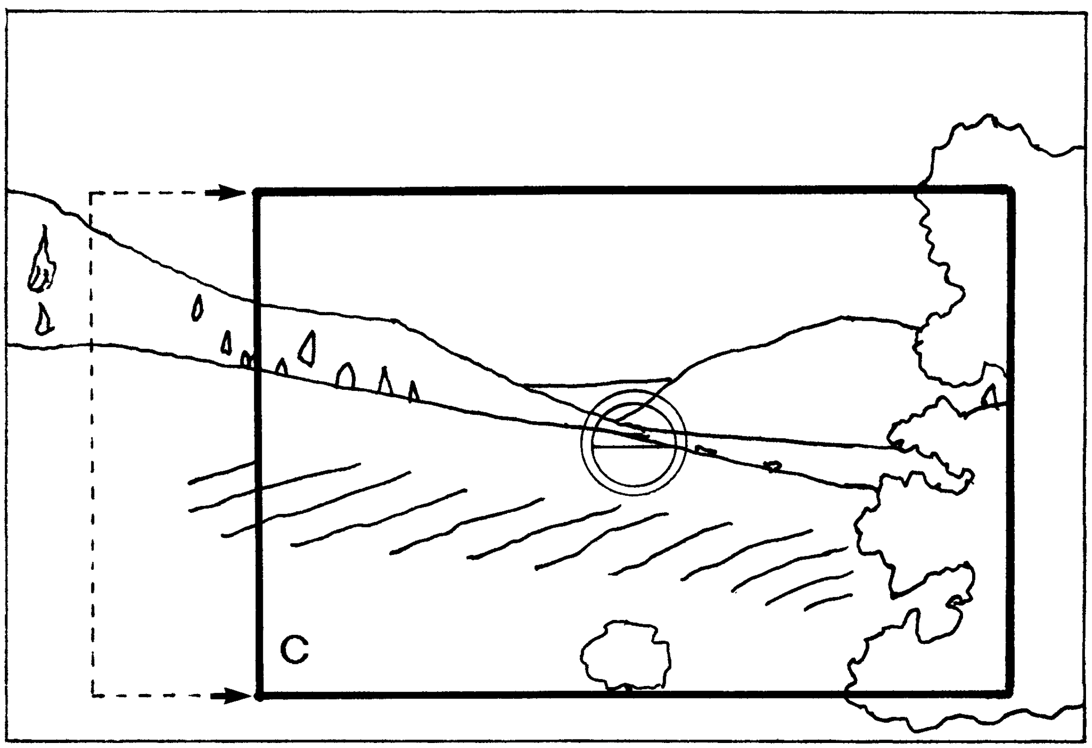

Figure 146—The camera was moved sideways to the right so that a tree would frame the picture. Here, four landscape photography concepts are illustrated: (1) one-third sky; (2) one-side framing; (3) one angle, the crest of the foreground slope; and (4) topic of the foreground rippled slope. The rippling (terracing) was caused by livestock use. These views are shown in figure 147.

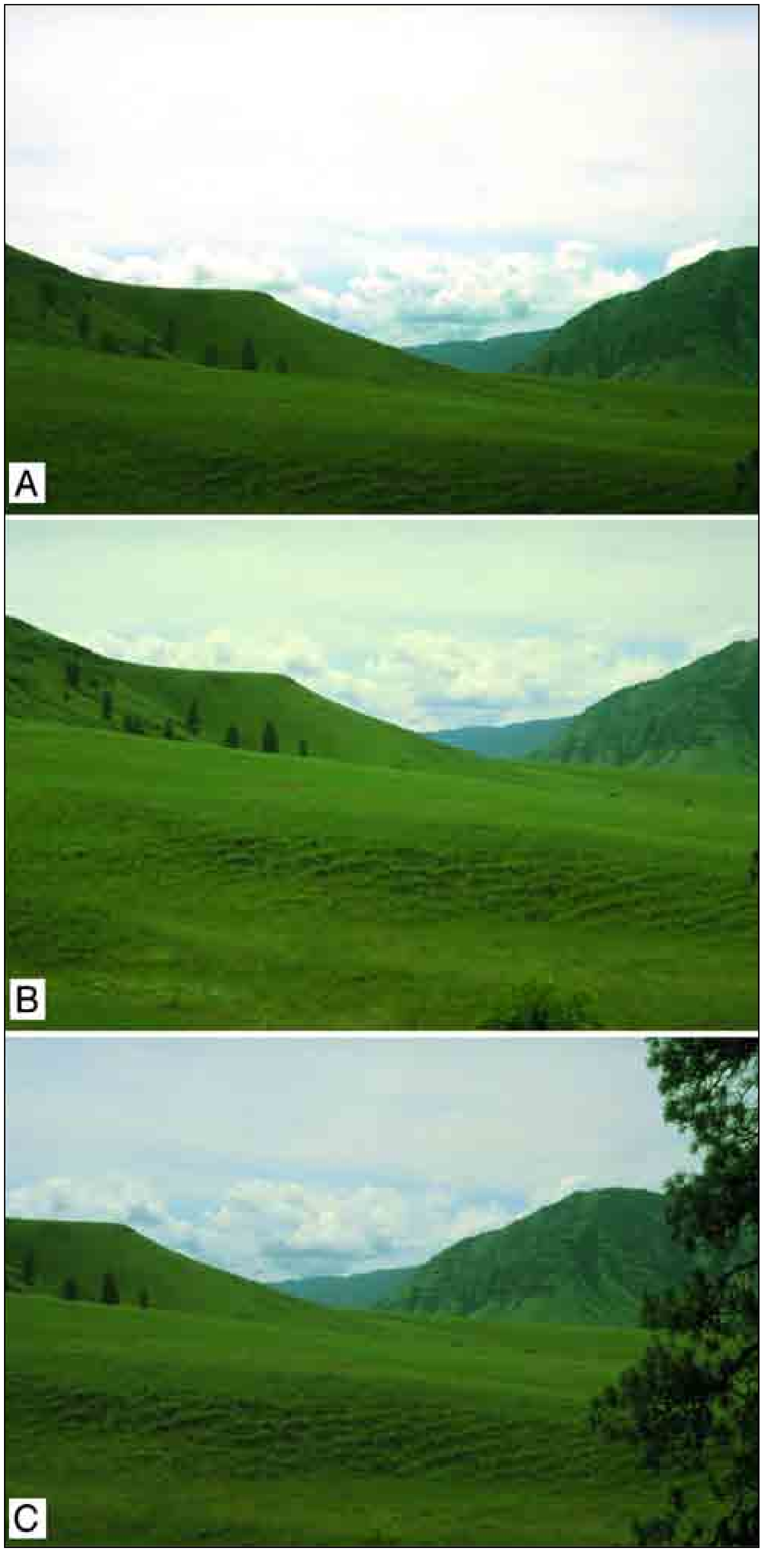

Figure 147—**A**, **B**, and **C** correspond to figures 144, 145, and 146, respectively. Exposure is an important consideration in landscape photography. In A, the land has been underexposed because the camera light meter was overly influenced by the bright sky. Expose for the topic of interest. If serious photography is contemplated, always take at least three exposures: one at what the meter says, one an f-stop less, and one an f-stop more.

Figure 148—Reversing the “one-third sky” rule is necessary when the topic is weather. (**A**) Land was reduced to about 25 percent to emphasize spring rain clouds over the Great Basin. (**B**) Moving the camera a few feet uphill provided framing with sagebrush and a fence line, which provides scale and an angle. Also see figure 140.

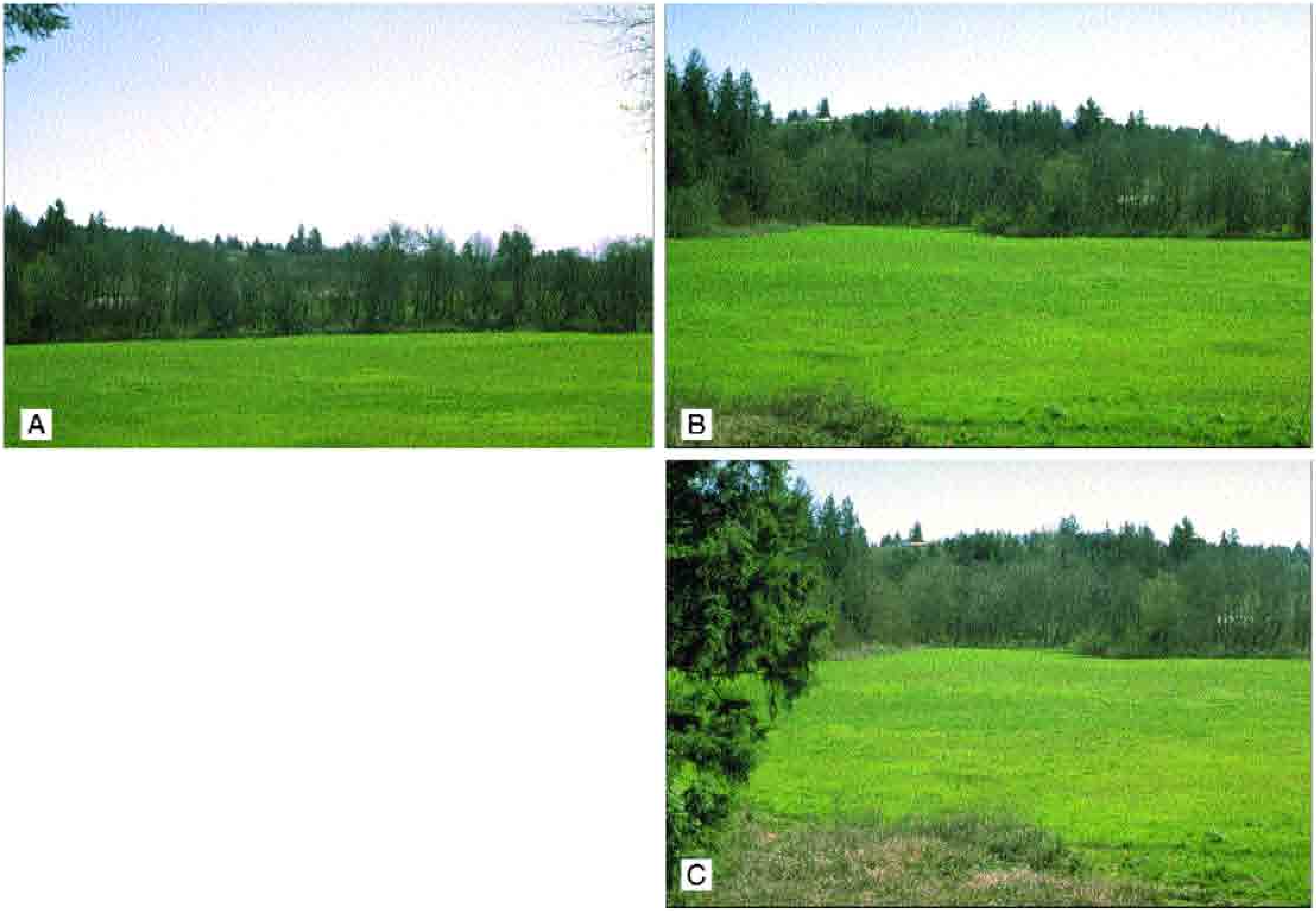

Figure 149—The topic here is a meadow. (**A**) The horizon halves the picture. (**B**) The camera was turned 20 degrees to the left and orientation lowered for one-third sky to show an extension of the meadow into the distance. This provided a break in the meadow edge and functions as an “angle.” (**C**) The scene was framed by a tree. This figure also illustrates pattern by the forested hill and smooth pasture.

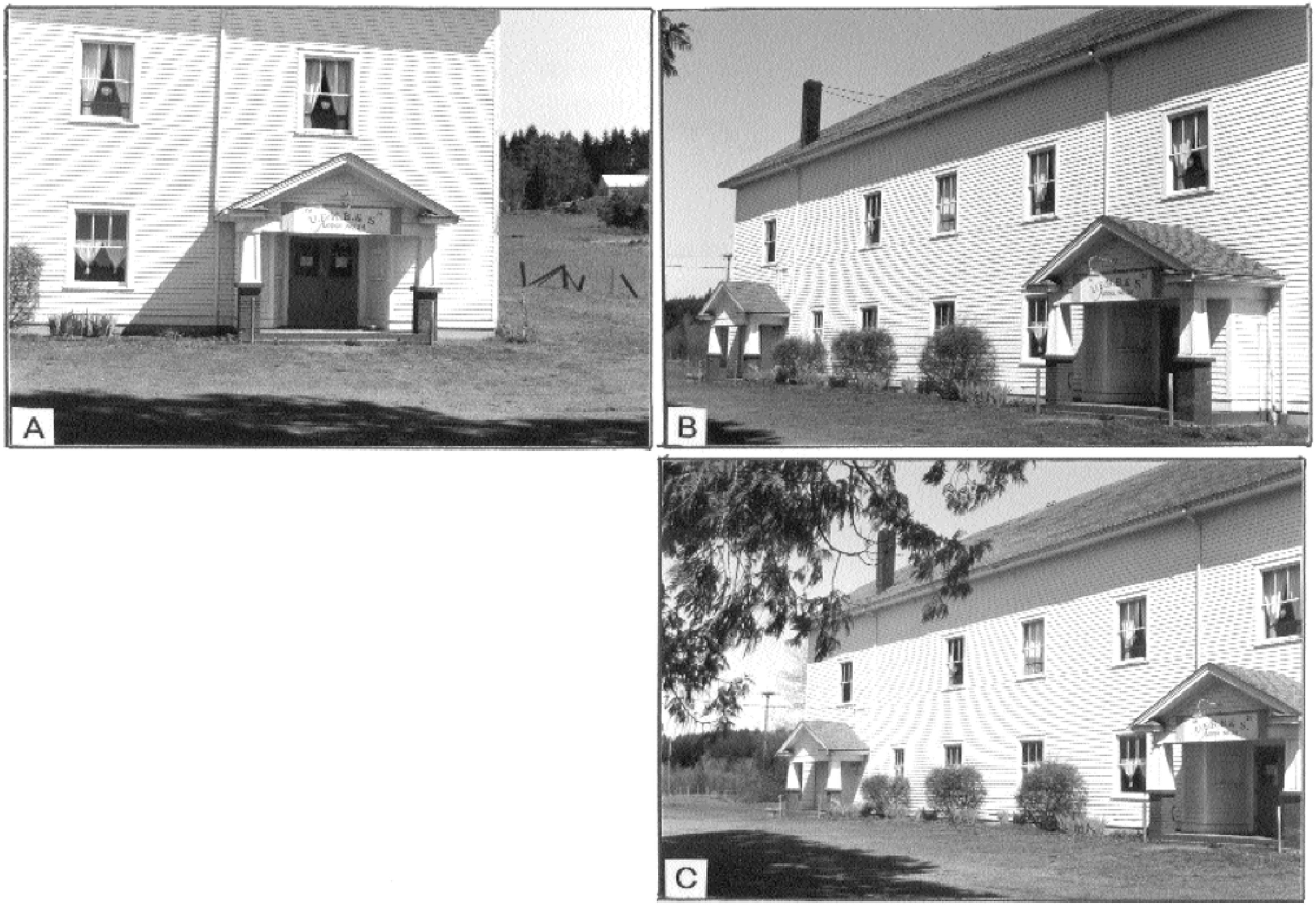

Figure 150—A totally different application to define the topic with one-third, one side, and one angle is shown with a structure. (**A**) A perfectly nice documentary of a country organizational building with one-third ground. (**B**) Adds a converging angle while preserving the name. (**C**) Simply frames the picture.

CONTINUE