Resource Inventory Notes

BLM 22

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PREPARATION OF MAPS FOR
MANUAL DIGITIZING

by

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ABSTRACT: This paper describes some basic concepts and methods in preparing maps for entry into automated information systems. Data entry through manual digitizing methods is assumed.

Introduction: Currently there is a great deal of interest in capturing and storing geographic (map) data for purposes of manipulation and retrieval in computerized information systems. The purpose of this paper is to discuss some concepts in the manual preparation of maps or overlays for capture by the digitizing process. Different systems will have a variety of input methods, such as automatic scanning of maps, and will handle geographic data in different ways. An example of the latter case is the so called "island polygon." In many automated systems the "island" is required to be connected to the surrounding polygon, while others can deal with the polygon as it exists. Certain changes in mapping requirements occur as a result of these differences. The purpose here is not to explore these differences, but rather to use a single system to explain some of the procedures necessary to prepare a map for automation.

Basic Concepts: In order to enter geographic (map) data into a computer, it is necessary to convert a location into X and Y coordinates. To keep this XY information simple all coordinates will be assigned a positive value. To illustrate this we will set up an XY coordinate system and put a simple polygon on it to show how points are located. The coordinates for rectangle R (figure 1) are; point A, X4Y2, point B, X4Y2, point C, X10Y5, and point D, X10Y2. A data processing accessory called a digitizer is used to record coordinate locations for entry into a computer.

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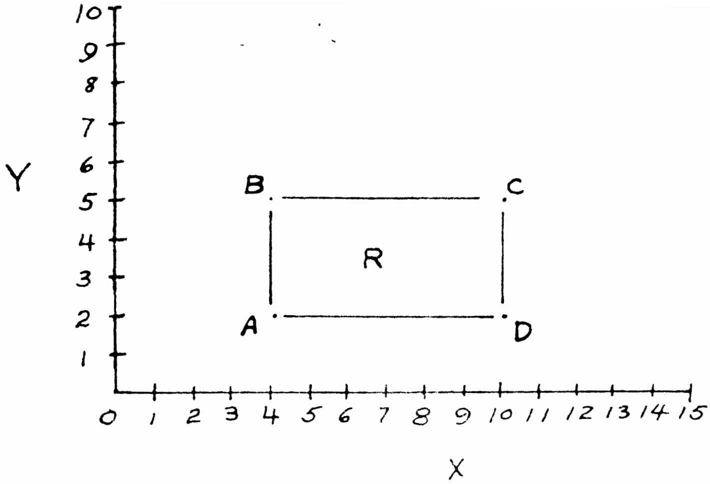

Figure 1

A digitizer is an electronic device which can detect and record the locati of specified points on a paper placed on its surface. In the case of poly R it records the XY values for four points. By storing these points in a computer and recalling them in a proper sequence, the corners of the poly can be recalled an infinite number of times. The digitizer records XY values in its own coordinates, which can be converted to latitute and long tude, UTM coordinates, or whatever control is used on the input map.

The same principles hold true for map information other than polygons. A line, such as a road, is represented by a series of dots or points. Other information, such as a spring or culvert location can be represented by a discrete point.

The use of points and connecting lines will give straight lines and some fairly sharp angles. In reality much of the map information which we deal with has curved lines. A little experimentation will show that a curved line can adequately be represented by a series of straight lines (Figure 2).

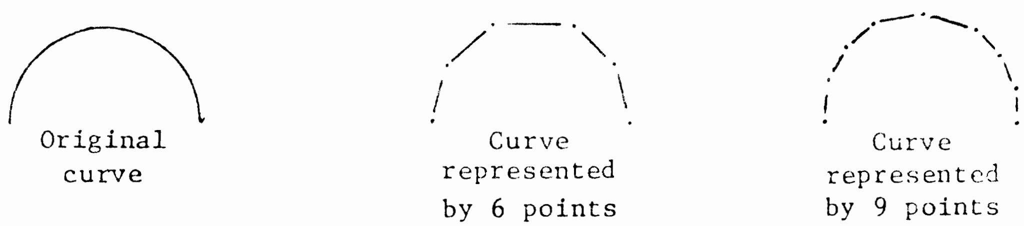

Figure 2

The choice of representation of non-linear map material must be left to the discretion of the individual preparing the overlay or map. The value of exact representation must be weighted against the additional cost of preparing a map and digitizing it. Generally speaking, the more points, higher the cost of automation in terms of preparation, input and storage.

In the digitizing process it is necessary not only to record the location of a polygon, point, or path, but to assign it some sort of attribute or identifier. Thus, a polygon shown as has little or no meaning. Wha is it? A soil pedon, a forest stand or a range site? If it is labeled

LP8M it may be identifiable to a forester as a stand of lodgepole pine, pole size with medium stocking. The digitizing process also requires identification of each and every line segment as to what is right and left of each arc segment.

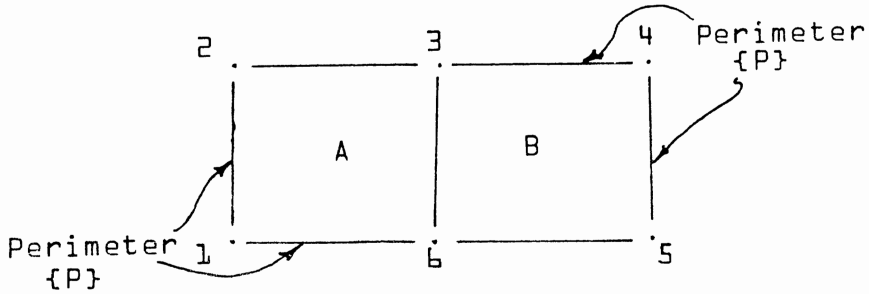

Figure 3

In figure 3 above, going in a clockwise, direction beginning at point #1, segment 1-2 has attributes AP, 2-3 AP, 3-4 BP, 5-6 BP, 6-1 AP, and 3-6 has attributes AB. Along with the coordinates, these attributes will describe polygons A and B. This example is quite simple and many polygons will have a large number of arc segments with a resultant variety of attributes. In many instances the amount of data for a point, path or polygon will be so great as to preclude entry onto the input overaly. In this case it is necessary to assign a number to the figure, and then enter the data on a code sheet having that same number.

Control and Identification: For purposes of discussion we will assume that data is to be entered at a scale of 1:24,000, using the United States Geological Survey 7 1/2' quad sheets as a base map. Overlays of the various data theme should be put onto mylar sheets. Mylar provides a strong and stable medium for recording geographic data. If mylar sheets are unavailable or impractical the person preparing the map overlay may record data directly on the original base maps. Reproductions of the 7 1/2' quads made by copy machines should not be used. Experience indicates that they have too much paper stretch to digitize accurately.

We will assume that: 1) 7 1/2' quad sheets are available and will be used. 2) Data entries will be for a single data theme. 3) Entries will be on mylar overlays. The first step is to place the base map on a table or surface large enough to hold it without folding or bending, and then tape it flat. The mylar should be placed on top of the base map and taped down, keeping the edges as much parallel to the edges of the base map as possible.

The first item to enter on any overlay should be the four corners of the perimeter of the quad sheet. These should be entered as a single point using a fine line such as a #00 Rapidiograph[1/]. If a #00 is not available a #0 can be substituted, but no higher pen number should be used. The point made by these pens becomes too large to accurately digitize. The

1/ Mention of trade names or products does not constitute an endoresement by the Bureau of Land Management geographic reference values at each of those corners should then be entered, keeping the data outside of the map area. The finished corner will typically look like Figure 4 shown below.

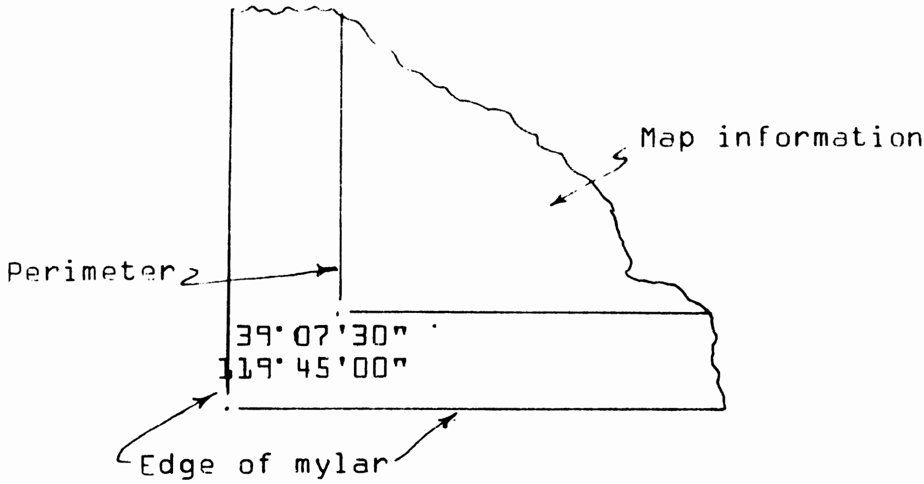

Figure 4

The overlay identification should have 4 items put into the lower right hand corner of each overlay. The first item is the name of the 7 1/2' quad, exactly as it appears on the quad sheet. Thus in the case of a 7 1/2' quad sheet it would be listed as QUAD NAME: Sagebrush Park.

The next item to appear should be the state. This is found in conjunction with the name on the quad sheet. In entering this item it is probably easiest to use some standard alpha codes simialr to those used by the Postal Service. In the case of the Sagebrush identification is entered as STATE: WY.

The third item of identification will be the Overlay Identification Number. The number appearing on the quad sheet on the line below the quadrange name and state may be used. It will appear similar to N3907.5-W11037.5/7.5. This number is actually the latitude and longitude of the lower right hand (southeast) corner of the quad sheet. This number would be entered for overlay identification purposes as N3907.5W1137.5. Note that the hyphen between latitude and longitude has been omitted, as has the 7.5. The reason for leaving out the latter is that we assume all overlays are entered at the 7.5' quad format.

When entering this number care should be taken to enter the even latitudes and longitudes as .0. Thus, a quad sheet having a latitude of 42.15'N, longitude 107°37'30"W in its southeast corner has a code number of N4215-W1073.4/7.5 on the quad sheet. The actual Overlay Identification number to be entered would be N4215.0W1037.5. Note that 42.5W shows the last zero.

The final item of the overlay identification is the theme, or themes being recorded on the overlay. Where no codes are standard for this, it is suggested that codes be developed which will readily identify the themes, or write them out completely. Examples of themes might be DATA TYPE: Cadastral Grid for a single theme overlay, or DATA TYPE: Cadastral Grid, County, Roads, Fences for a multiple theme input overlay. Mappers may wish to create a rubber stamp which will insure that the proper identification is attached to each map or overlay.

Data Entry: The example of data theme which we will use to illustrate data entry will be Forest Resources. This theme will serve to represent a variety of forestry mapping information including, but not limited to; stands, past treatment, future sale areas, and some less detailed information about non-forested areas intermingled with forested area.

All overlays will use the USGS 7 1/2' quads as a base map, and will be identified by quad name, state, overlay identification number, and the type. In this case data type will be "Forest Resources." The first step in overlay preparation should be the marking of map control and identification described previously. Once the appropriate coordinates and map identifications have been made, the forestry information can be entered.

Figure 5 is a portion of an orginal source map for some forestry information. Figure 6 is the same portion of the map prepared for digitizing.

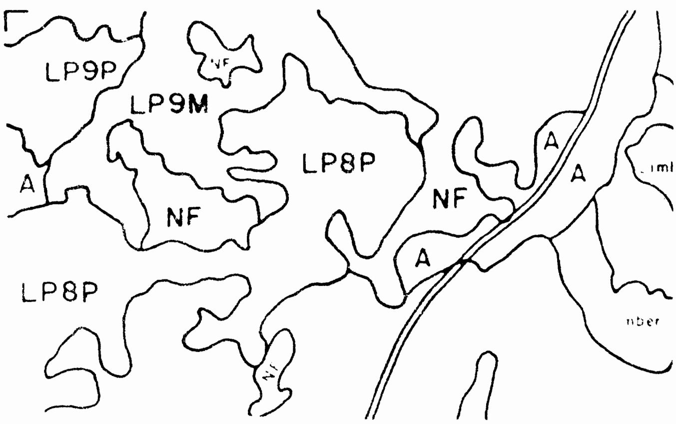

Figure 5

Notice that the polygons in Figure 5 are labled with species, size class and a stocking designation. If this were all of the information available about these polygons it would be possible to simply enter this data through the keyboard on the digitizer. As it happens, a great deal more information about these polygons is probably available through inventories or personal knowledge. Generally this volume of information is large enought to preclude either writing into the polygon or expecting the digitizer operater to make the entry. The alternative is to label each polygon with some sort of identifier, in this case a four digit number. For the sake of convenience, we will call this the Stand Number. This same number is then

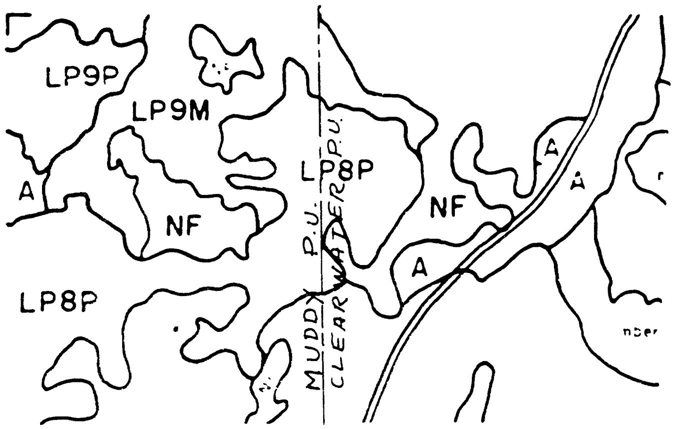

Figure 7

Figure 8

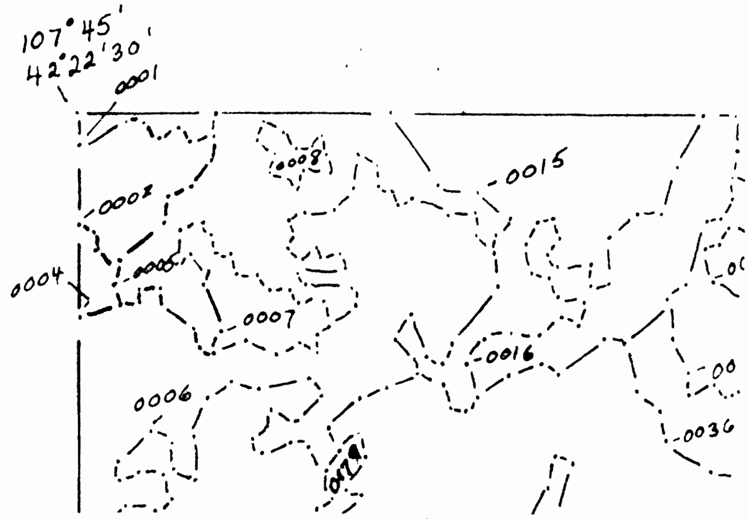

Figure 6

entered on regular data input sheets to tie the alpha-numeric and geographic (map) information together.

The stand numbers must be unique within a specified area. This area could be a map, a township, section or any other geographic or administrative area which has been designated. By way of illustration, we will assume that it has been decided to keep the identification numbers (stand numbers) and data unique within an area called a Planning Unit. Figures 7 and 8 indicate what happens when a map of forestry information has a planning unit boundary running through it. The overlay, Figure 8 shows what changes are necessary when the planning unit changes. Polygons must be broken by the boundary and a new series of numbers must be assigned. It would thus be possible for the same overlay to have the same Stand Number, but obviously could be separated by the planning unit code. Note that Figure 8 has two stand numbers 0001 and 0002.

In the preparation of the Forest Resources overlay some decisions are required. Note that in Figure 7 a road is shown going through the map area. Generally, while such information would have a good deal of value to a resource manager, a road would not be considered to be forestry information. It would be entered on a separate overlay labeled "Road System" or "Transportation." What if a power line with a fairly wide right of way traverses the area with a substantial loss of forest acreage? The preparer of the overlay must decide whether to include this in the Forest Resources overlay, or prepare another overlay showing "Rights of Way," etc.

Returning to Figure 2, note that the Forest Resources overlay is prepared using the dot-dash format. A #00 Rapidiograph pen was used to make this overlay. The Stand Numbers are entered in the lower left hand corner of each polygon (where possible) along with a small tic mark pointing at one of the points in the polygon. This tic mark serves a starting and ending point for the digitizer operator.

There are certain items in overlay preparation which should be noted. One of the most important of these is edge matching. Any map which has its information crossing the edge of one map and going to another will require a fair amount of work to insure that: 1) Lines match from one map to another and, 2) The same number is assigned to the matching polygon on each sheet. This can be fairly time consuming and tedious, but necessary process.

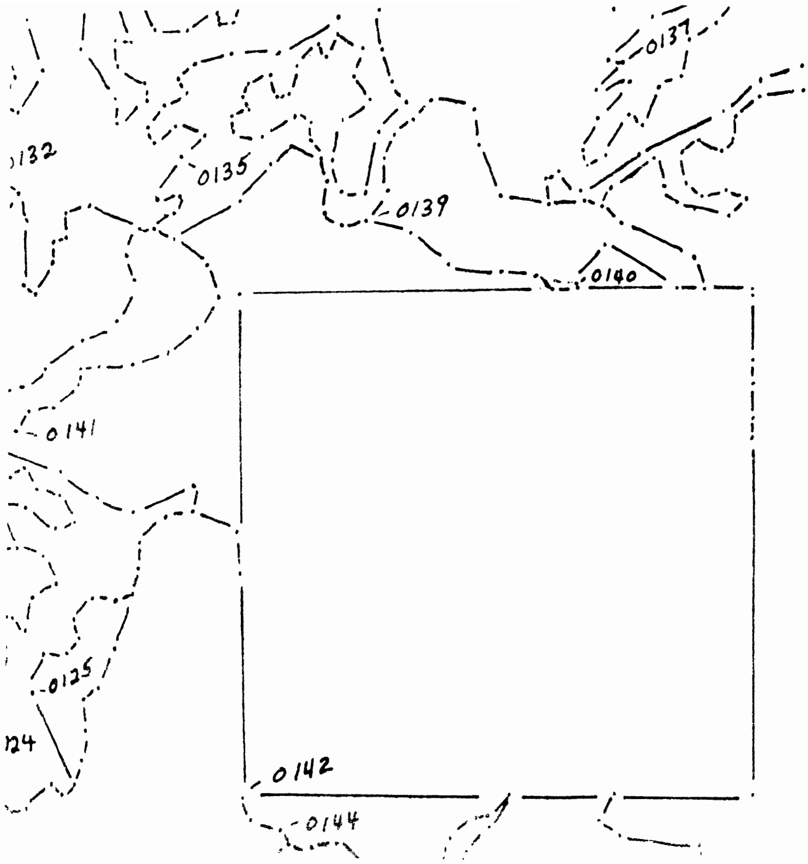

Figure 9

On many maps it is usual to omit some information such as vegetation information on lands administered by other agencies or companies. When such an omission is made, the excluded area must still be accounted for in some manner. Figure 9 illustrates this situation and how it is handled. This is a portion of a forest resource map which has a section of State-owned land on it. Since we are not interested in its resources the whole section is outlined and labeled as Stand Number 0142. In this case "Stand Number" is hardly descriptive, and some appropriate description of the area will be rquired on the data entry sheet. in some instances it may be desirable to include information on private, state, federal, or other lands outside of the main area of interest of the individual preparing the overlay. In such cases simply ignore the ownership boundaries for mapping purposes, and then overlay the Forest Resources overlay with an Ownership overlay.

Other items to be noted in preparing overlays for digitizing are checking to insure that all polygons are closed figures, all polygons must be numbered, all polygons contain only one serial number, and area or points do not confuse the digitizer operator.

Summary: The assumption has been made that the preparation will be for manual digitizing, and that digitizing will be from point to point. Some other technical assumptions have been made were not discussed here. If some of these assumptions are changed, some changes in mapping will be required. The purpose of this paper has been to illustrate some methods and problems of overlay preparation.

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Unequal Probability Sampling With Replacement and Without Replacement

by

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This paper is based on research funded by a grant from the Office of Water Research and Technology, U. S. Department of the Interior, through the Virginia Water Resources Center under Project Number 7580457.

ABSTRACT

Simulated unequal probability samples were drawn from a known population to compare with replacement and without replacement sampling procedures. Results indicate that the gains in variance from without replacement sampling are not sufficient to offset the computational difficulties.

INTRODUCTION

Unequal probability sampling can often be used to advantage when estimating natural resource population characteristics when there is a wide disparity between the size of the sampling units. A choice must be made, however, between with replacement and without replacement sampling. This paper is intended to assist those using unequal probability sampling to choose between those two selection techniques.

METHODS

We compared with and without replacement unequal probability sampling using a two stage sample design with the first stage sample units being selected with unequal probability, first with replacement and then without replacement. Repeated samples using both sampling methods were drawn from a known population. The population used was based on a 1976 survey of Virginia riparian landowner attitudes to recreational use of rivers bordering their property. For this survey the state was stratified into three geographic regions. The rivers in each stratum were identified and the number of miles in each river determined. The river miles in each stratum were accumulated and uniform random numbers between one and the total number of river miles per stratum were selected to identify mile-long segments of rivers. All landowners within each identified river segment received a questionnaire designed to explore attitudes about recreational use of the river.

For the experimental samples the original strata were maintained and rivers were considered as first stage sampling units. The originally sampled segments within rivers were treated as subsamples selected without replacement. The subsamples did not vary; when a particular river was selected as a first stage sampling unit the entire subsample was considered as having been sampled. The number of rivers, miles per river, and total river miles per stratum for the experimental population are shown in Table 1. All questionnaire responses examined concerned the proportion of landowners agreeing or disagreeing with a particular statement or the proportion falling in a particular group. Thus, estimates of proportions and the variances of the proportions were required.

Table 1. Number of rivers, miles per river, and total river miles per stratum for the simulated population.

Stratum 1		Stratum 2		Stratum 3	
River	Miles per River	River	Miles per River	River	Miles per River
1	18	1	14	1	15
2	15	2	6	2	6
3	13	3	2	3	6
4	7	4	9	4	11
5	17	5	6	5	17
6	27	6	18	6	10
		7	6	7	9

Formulas to estimate proportions, $\hat{p}$, and variance of proportions, $v(\hat{p})$ for a stratum for the unequal probability with replacement case were derived from the results presented by Cochran (1977, p. 295, 306-307):

$$\hat{p} = \frac{1}{n} \sum_{i=1}^{n} \hat{p}_i$$

$$v(\hat{p}) = \sum_{i=1}^{n} \frac{(\hat{p}_i - \hat{p})^2}{n(n-1)}$$

where $\hat{p}_i$ = proportion of landowners in a segment of river i agreeing with a statement,

n = number of rivers sampled per stratum.

For unequal probability sampling without replacement the equivalent equations are (Cochran, 1977, p. 261, 301):

$$\hat{p} = \frac{1}{M_o} \sum_{i}^{n} \frac{M_i \hat{p}_i}{\pi_i}$$

$$v(\hat{p}) = \left\{ \frac{1}{M_o^2} \sum^n \sum_{i<j} \left(\frac{\pi_i \pi_j - \pi_{ij}}{\pi_{ij}} \right) \left(\frac{M_i \hat{p}_i}{\pi_i} - \frac{M_j \hat{p}_j}{\pi_j} \right)^2 + \sum_{i}^{n} \frac{\hat{\sigma}_{2i}^2}{\pi_i} \right\}$$

where M_i = number of miles in river i,

M_o = total number of river miles in the stratum,

π_i = probability that river i is in the sample,

π_{ij} = probability that rivers i and j are in the sample,

$\hat{\sigma}_{2i}^2$ = second stage variance of $\hat{p}_i$,

and $\hat{p}_i$ is as previously defined.

Five questions were selected for analysis. Ten thousand samples were simulated for each question, with two rivers per stratum being selected for each simulated sample. The average $\hat{p}$ and $v(\hat{p})$ for the 10,000 simulated samples for each question examined are shown in Table 2.

RESULTS AND CONCLUSIONS

Both sampling procedures produced nearly identical estimates of $\hat{p}$ when sampling was replicated 10,000 times. The variances differ slightly between sampling methods, the with replacement variances being generally larger than the without replacement variances. This result is as predicted by sampling theory. The sizes of the variances have generally the same order within question and across strata.

Although the without replacement method yields the smaller variances, it can be a difficult procedure to use. For a first stage sample size greater than two, calculating π_{ij} -- the probability that first stage units i and j are in the sample -- is extremely difficult and increases in difficulty with increasing sample size. Implementing the method is hard since a selection method must be chosen that yields the correct probabilities π_{ij}.

Unequal probability with replacement sampling is the better choice in this situation, despite the disadvantages of larger variance estimates and the intuitively unpleasant habit of selecting a unit more than once for the same sample. The method is easy to implement and analyze and variances are only slightly larger. Also, samples of size can be handled easily.

Table 2. Average $\hat{p}$ and $v(\hat{p})$ for 10,000 simulated samples by question and sampling method.

		Stratum 1		Stratum 2		Stratum 3	
Question		with rep.	without rep.	with rep.	without rep.	with rep.	without rep.
1	$\hat{p}$	.68584	.68782	.83069	.83116	.68550	.68504
	$v(\hat{p})$	.03290	.02893	.01729	.01734	.01267	.00936
2	$\hat{p}$	.24810	.24789	.35904	.35901	.29643	.29583
	$v(\hat{p})$	.00172	.00135	.00556	.00503	.01328	.01103
3	$\hat{p}$	.21031	.21101	.11196	.11177	.24090	.24128
	$v(\hat{p})$	.00726	.00561	.00574	.00439	.00687	.00580
4	$\hat{p}$	.35297	.35253	.40736	.40795	.51533	.51502
	$v(\hat{p})$	.00644	.00536	.01384	.01106	.00776	.00732
5	$\hat{p}$	.53678	.53759	.56671	.56711	.43216	.43241
	$v(\hat{p})$	.00531	.00358	.01391	.01143	.00444	.00465

LITERATURE CITED

Cochran, W.G. 1977. Sampling Techniques, 3rd Ed., John Wiley and Sons.

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Uniformly Distributing Samples Within a Type Island

by

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ABSTRACT

This paper describes a procedure and gives formulas for uniformly distributing sample plots throughout a stand, type island or map polygon. A procedure using equilateral triangles is suggested.

INTRODUCTION

Distributing samples plots throughout a mapped stand or other type island is often a problem in conducting resource inventories.

Various techniques such as random sampling, line transects, zig-zags, etc., have been used. Random samples may not adequately cover the type island; line transects may be biased depending on how they are laid out and zig-zags techniques may be difficult to describe and carry out.

Basically we want an unbiased system that is easy to follow and insures adequate coverage of the type island. This paper describes a system that uses a systematic sample layout using equilatural triangles and a random start.

The mechanism for distributing the plots is similar to that used by the U.S. Forest Service's Resources Evaluation work units' 10-point cluster. The difference is that the given procedure allows for fewer or more points to be uniformly distributed in any size polygon or type island.

PROCEDURE

The procedure in brief is to use equilateral triangles to insure the plots are distributed throughout the stand. We determine the average area per plot and equate that to the area of a hexagon.

Next we determine the distance between centers of the hexagons. This provides sides of equilateral triangles and the distance between plots.

A starting or initial plot (IP) is randomly chosen within the stand. This may be done by means of a grid or any other mechanical method. The initial plot will be plot No. 1. The rest of the plots are systematically laid out in relation to this starting plot at 60° angles and at the distance between the hexagons.

The resulting distribution of the sampled points is a skewed systematic sample. The end result is similar to constructing a custom grid for each polygon - although the grid may need not be physically drawn out.

EXAMPLE

To use the procedure, we need three things - a map of the stand or type island; the area of the stand and the number of plots to be established.

Assume that we have Stand X (figure 1) which consists of approximately 12.5 acres and that we want to establish 10 plots in the stand.

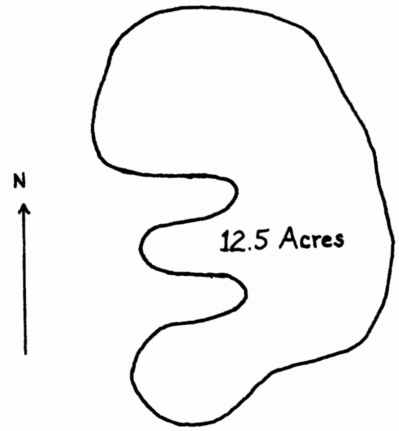

Figure 1 - Stand X

A. Determine the distance (D) between plots.[1/]

$$D = 224.272\sqrt{\frac{AT}{N}}$$

where D = distance between points in feet.

AT = area of type island in acres.

N = Number of plots to be established.

1/ See appendix for formula development.

From the example above

$$D = 224.272 \sqrt{\frac{12.5}{10}}$$

D = 250.74' or 250 feet (rounded down).

We can locate the 10 plots in Stand X if the plots are established 250 feet apart and at 60° angles to one another.

B. The next step is to select a random starting point or plot. See figure 2. This is plot 1.

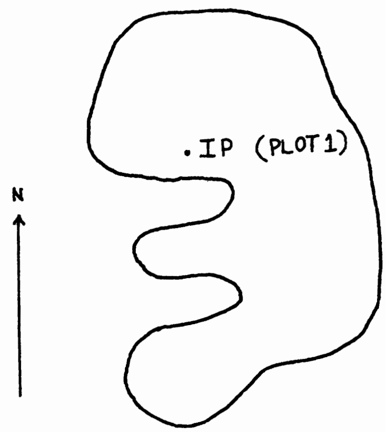

Figure 2 - Random Location of IP and Plot 1

C. To locate plot 2 start with an azimuth of due north and see if at the distance of 250' a plot can still be located within the stand. If it cannot - proceed in a clockwise direction until a plot can be established within the type island. Additional plots are located at 60° angles to the plot 1-2 base line. In the example - plot 2 can be located due north of plot 1 (figure 3).

D. Plot 3 is located at 60° from the 1-2 base line and at a distance of 250' from plot 1. Plots 4 and 5 are similarly located (figure 4). Plots 6 & 7 fell outside the type island so they need to be relocated.

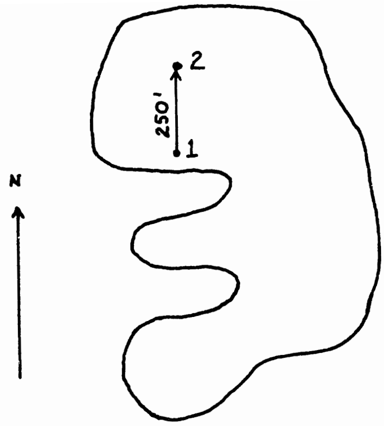

Figure 3 - Location of Plot 2

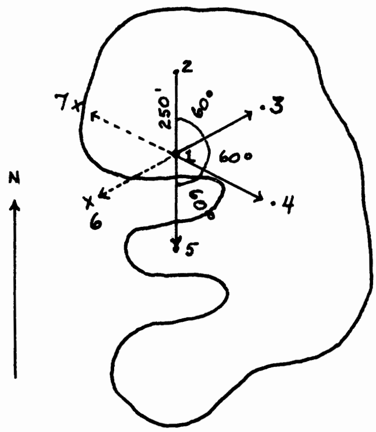

Figure 4 - Location of plots 3, 4, & 5. Plot 6 & 7 fall out-side type and have to be relocated.

E. Plots 6 & 7 can be relocated from the highest numbered plot falling within the type. Hence plot 6 & 7 will be located from plot 5, again at 60° to the base line and at a distance of 250' (figure 5).

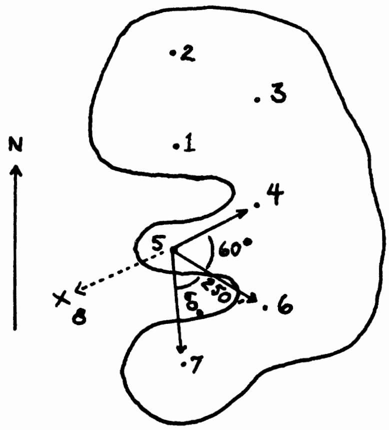

Figure 5 - Location of plots 6 & 7 from plot 5.

F. The location of plots 8 and 9 must be determined. Since we cannot establish any more plot locations from plot #5, we must establish plots 8 and 9 from point 6, again at 60° and 120° from our base line azimuth and at a distance of 250 feet (figure 6).

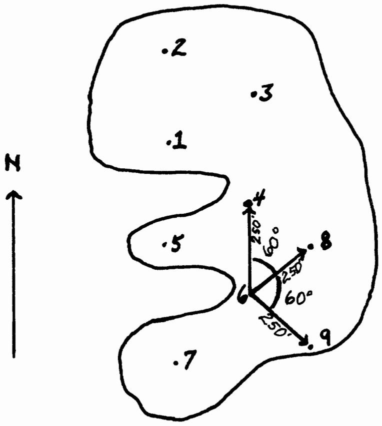

Figure 6 - Location of plots 8 and 9 from plot 6.

G. Plot 10 is located on the true azimuth line, 250 feet due north of plot 8 (figure 7).

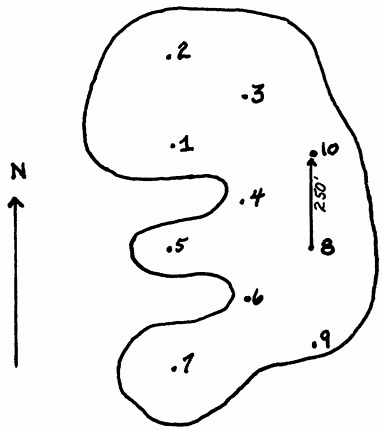

Figure 7 - Location of plot 10 from plot 8.

H. Figure 8 shows the complete distribution of plots. These can be laid out on the map or aerial photos before going to the field, or can be done while in the field (figure 8).

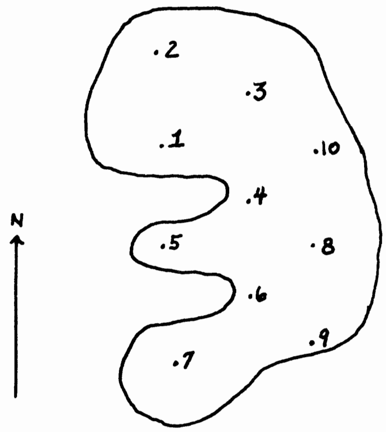

Figure 8 - Final distribution of plots within stand.

Occasionally it may be necessary to locate the plots by using temporary plots outside the type island. This will be particularly true in stringer types, i.e., the type island is narrower than the distance between sample plots. Figure 9 shows just such a situation. Again the type island is 12.5 acres is size, we need to establish 10 plots and the plots are located 250' at 60° from each other. Plots 5, 7, 8 and 10 are located from temporary or dummy plots a, b, c, d, and e outside the type island.

For example plot 5 cannot be located in the type island from plot 1, 3, or 4. We locate a temporary plot "a" from plot 2 and then locate plot 5 from plot "a" at 60° to the base line and at a distance of 250°. Plot 6 is located from plot 5, plot "b" from plot 6, plot 7 from b, etc.

SUMMARY

The above procedure guarantees an unbiased method of locating sample plots in type islands, It is one of several such methods available. This system also insures a uniform distribution of the plots throughout the stand. The plots can be laid out on maps or photos prior to going to the field. Thus reducing maneuvering time on the ground. Data normally collected on pace transects (such as in range surveys) can be collected along the portions of the azimuth lines to the plots if needed.

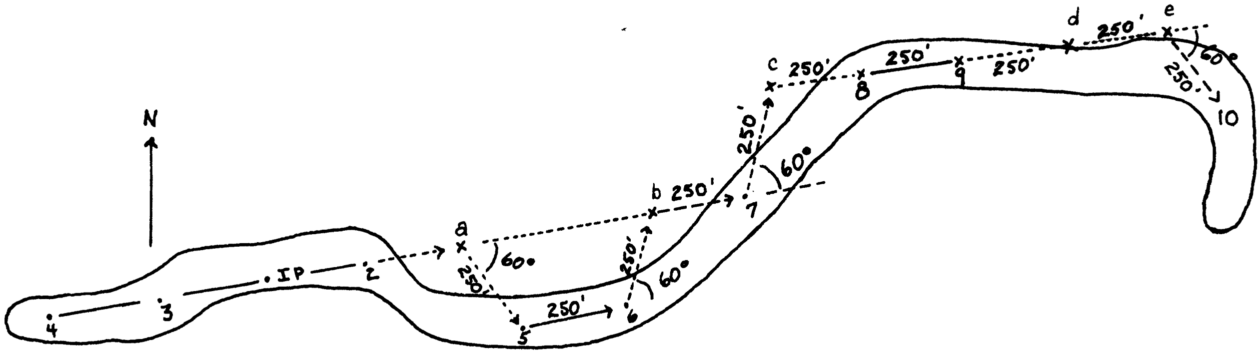

Figure 9 - **Locating plots in a stringer** from temporary plots a, b, c, d **and** e outside the **type island.**

APPENDIX

Formula Development

1. Area plot represents (A_P)

   $A_P = A_{T/N}$

   Where: AT = Total area in type island

   N = Number of plots to be established

2. Area of hexagon (A_H)*

   $A_H = 2.59808 \ L^2$

   Where: L = Length of one side of the hexagon. (L^2 & A_H in same units of measure).

3. Therefore

   $L = \sqrt{A_H/2.59808}$

4. If we make $A_H = A_P$ then

   $L = \sqrt{(AT/_N)/2.59808}$

5. The radius (R_H) of an inscribed circle in the hexagon*

   $R_H = 0.86602L$

*Source: Mathematical Tables from Handbook of Chemistry and Physics. 10th edition Chemical Rubber Publishing Company, Cleveland, Ohio p. 313.

6. The distance (D) between centers of adjoining equal size hexagons

$$D = 2\,R_H = 1.73204L$$

7. Substituting formula 4 for L

$$D = 1.73204\left(\sqrt{(AT/_N)/2.59808}\right)$$

8. a. For acres and feet this translates to

$$D\text{ feet} = 1.73204\left(\sqrt{\frac{A_T\text{ (acres) X 43560 sq. feet}}{\text{N X 2.59808}}}\right)$$

which simplifies to

$$D\text{ feet} = 224.272\left(\sqrt{\frac{A_T\text{ (acres)}}{N}}\right)$$

b. For hectares and meters formula 7 translates to

$$D\text{ meters} = 1.73204\left(\sqrt{\frac{A_T\text{ (Hectares) X 10000 sq. meters}}{\text{N X 2.59808}}}\right)$$

which simplifies to

$$D\text{ meters} = 107.456\left(\sqrt{\frac{A_T\text{ (Hectares)}}{N}}\right)$$

Example A. Given a type island of 35 acres
Assume we want to establish 10 plots.

Using formula $8_{a.}$ - we find

$$D\text{ feet} = 224.272\sqrt{\frac{35}{10}}$$

OR

D = 419.57 feet

This would be the distance between plots at 60° to each other.

Example B. Given a type island of 14.24 hectares (35 acres)

Using formula $8_{b.}$ we find

$$D\text{ meters} = 107.456\sqrt{\frac{14.24}{10}}$$

OR

D = 128.23 meters

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Current Literature

Please order directly from sources given.

General

"Bosques y Fauna" is a new periodical of the Mexican Forest Service. For subscription rates etc - contact Servicio Forestal Mexicano, Av. Mexico 190, Coyoacan 21, D.F., Mexico.

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Res. Paper PSW 100 - "One-sided Truncated Sequential T-test: Application to Natural Resource Sampling.

Special Dept. EM 7100-11 "A Statistical Approach to Instrument Calibration."

Both from Pacific S.W. Forest and Range Exp. Station, P.O. Box 245, Berkeley, CA 94701.

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Sp. Rept. 321. Methods of Soil Analysis Used in the Soil Testing Laboratory at Oregon State Univ. from Dept. of Soil Science, Oregon State Univ., Corvallis, OR 97331.

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Gen. Tech. Rept. INT-47 "Measuring Cross Sections Using a Sag Tape: A Generalized Procedure."

Res. Paper INT 192 "Rationing Wilderness Use: Methods, Problems and Guidelines."

Reprint: "Nature of Land and Resource Classification-A Reveiw" by Bailey, Pfister and Henderson.

All from Intermountain Forest and Range Exp. Sta., 507 25th St., Ogden, UT 84401.

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Drop us a line (Atten. D-340) for a copy of Tech Note 331 "3P Sampling Theory, Examples, and Rationale" by L.R. Grosenbaugh. This was originally published in Spanish in the "proceedings of the 4(1975) National Conference on CFI" by the Mexican Government.

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FORESTRY

West Virginia Forestry Notes No. 7 contains two articles of interest-"Are Separate Weight Equations Needed for Appalachian Hardwoods?" and "Equations for Predicting Weights of Some Appalachian Hardwoods"-Order from Division of Forestry, West Virginia University, Morgantown, WV 26506

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DNR Rept. No. 39. "Evaluation of Regeneration Sampling Methods: A Monte Carlo Analysis Using Simulated Stands" from: Charles J. Chambers, Lead Biometrician, Dept. of Natural Resources, Division of Technical Services, Operations Research Section FN-11, Olympia, WA 98504.

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State Forest Notes No. 70 "Weight Tables for Hardwoods in Central Coast Counties California." from Calif. Dept. of Forestry, 1416 Ninth St., Sacramento, CA 95814

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Reprint-"The Dead Timber Resource-Amounts and Characteristics" by Van Sickle and Benson. From Pacific N.W. Forest and Range Exp. Sta., P.O. Box 3141, Portland, OR 97208

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Pub. No. 33. "Memoria de la Cuarta Reunion Nacional Sobre Inventario Forestal Continuo." Write Direccion General del Inventario Forestal, Av. Progreso No. 5, Mexico, D.F. for availability.

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Res. Bull PNW 73. "Timber Resources of the Sacramento Area, CA 1972."

Gen Tech. Rept. PSW 32 "Operational Forest Management Planning Methods: Proceeding-Meeting of Steering Systems Project GP., IUFRO."

Res. Bull. PNW 75. "Forest Area and Timber Resource of the San Joaquin Area, CA."

All from Pacific S.W. Forest and Range Exp. Sta., P.O. Box 245, Berkeley, CA 94701.

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Res. Paper INT 210 "Comprehensive Tree Volume Equations for Major Species of New Mexico and Arizona: II. Tables for Unforked Trees"

Res. Note INT-250 "Estimating Light Beneath Coniferous Forest Canopies: Simple Field Method."

From Intermountain Forest and Range Exp. Sta., 507 25th St., Ogden, UT 84401.

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REMOTE SENSING AND INFORMATION SYSTEMS

"A System Using Aerial Photography to Estimate Area of Root Disease Centers in Forests" by Williams and Leaphart. In Canadian Journal of Forest Research, 8(2): 214-219. at your local conservation library.

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FWS/OBS-77/21 "User Needs Assessment for an Operational Geographic Information System."

FWS/OBS-77/54-"Comparison of Selected Operational Capabilities of Fifty-four Geographic Information Systems."

FWS/OBS-77/55-"Natural Resource Geographic Data Bases for Montana and Wyoming"

FWS/OBS-78-64 "Map Indexing System User's Manual"

Write USDI Fish and Wildlife Serivce, WELUT, Drake Creekside BLDG, 2625 Redwing Rd., Fort Collins, Colorado 80521

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Res. Rept. 1198. "Evaluation of a Map Interpretation and Terrain Analysis Course for NAP-of-The Earth Navigation." from U.S. Army Research INST. for the Behavioral and Social Sciences, PERI-P, 5001 Eisenhower Ave., Alexandria, VA 22333

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RF Monograph 76-11 IES RPT 88. "A Resource Data Management System, GRASP: Description of a Land Resource Data Base."

RF Monograph 76-12 IES RPT 89. "...Bitplane Data Organization"

RF Monograph 76-13 IES RPT 90. "...Description and Documentation of Software"

from Institute for Environmental Studies. Univ. of Wisconsin-Madison, Communications Office, 610 Walnut Street, 120 WARF BLDG, Madison, WI 53706.

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"Predicting Slope Stability from Aerial Photos" by Foggin and Rice in Journal of Forestry, March 1979 p. 152-155 at your local conservation library.

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WATERSHED and WETLANDS

Report No. 26. "Proceedings: Third Wetlands Conference."

Report No. 28. "Inland Wetland Definitions"

Report No. 29. "Trasition Zones of Forest Inland Wetlands in Northeastern CT"

from Inst. of Water Resources, Univ. of Connecticut, Storrs, CT 06268

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Res. Note PSW 328. "Improvement Insect Emergence Trap for Stream Community Population Sampling."

from Pacific S.W. Forest and Range Exp. Sta., P.O. Box 245, Berkeley, CA 94701.

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Regional Research Series No. 2. "Problem Identification and Ranking-An Assessment of a River Basin Planning Process" from Water Resource Research Center, Univ. of Minnesota, Room 106, Hubbard BLDG, 2675 University Ave., St. Paul, MN 55114.

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WILDLIFE

FWS/OBS-78/76. "Classification, Inventory and Analysis of Fish and Wildlife Habitat-The Proceedings of a National Symposium" Contact Superintendent of Documents, US Gov't Printing Office, Washington D.C. for price and availability of this 604 paged publication. Stock No. 024-010-00503-3

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Bull. No. 6-"Equipment and Techniques for Radio Tracking Mountain Lions and Elk"

from Forest, Wildlife and Range Exp. Station, Univ. of Idaho, Moscow, ID 83843

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Res. Bull. 23. "Movement and Home Range of Deer as Determined by Radio Telemetry" from Iowa Conservaiton Commission, Des Moines, Iowa 50319.

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MEETINGS

1979 Forest Inventory Workshop. This workshop is designed to appeal to land managers, inventory specialists, practitioners, data analysts and biometricians. This national meeting is sponsored by the SAF Inventory and Biometrics Working Groups, IUFRO Subject Groups S4.02 and S6.02 and by Colorado State University. Over 84 papers will deal with such subjects as Multi-Resource inventories, Biometrics, Inventory Projection and Growth, Inventories on Successive Occasions, Sampling Techniques, Sampling Aspects of Aerial Photograpy, Computer Uses in Resource inventories, Tropical Inventories, Biomass Measurement, Biomass Inventory, Metric Conversion Strategies, Product Estimation and a series of contributed papers. Registration fee $75. The dates are July 23-27 1979, at Colorado State University. For details contact Office of Conference and Institutes, Residential Conference Center, Colorado State University, Fort Collins, Colorado 80523.

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Soil Conservation Society of America Annual Meeting. July 29-August 1, Ottawa Ontario. Theme "Resource-Constrained Economics: The North American Dilemma" Contact SCSA 7515 N.E. Ankeny Rd., Ankey, IA 50021

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Remote Sensing for Natural Resources. Sept, 19-14, 1979. Registration $50 before July 1, $60 after. Contact The University of Idaho, Office of Continuing, Education, Moscow, ID. 83843

1979 Society of American Foresters National Convention. Oct. 14-17. Boston, Mass. Theme: "Town Meeting Forestry - Issues for the 80's." Contact E.F. Robie, SAF, 5400 Grosvenor Lane, Washington, D.C. 20014.

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Coming in 1980. Arid Land Resource Inventories. Nov. 30 - Dec. 6. Sponsored by the Mexican Forest Service, SAF inventory working Group, IUFRO Subject Group S4.02, The U.S. Forest Service and The Bureau of Land Management. The tenative topics to be discussed include inventory planning, classification schemes, economical mapping system, cost efficient sampling and measurement techniques and resource data anaylsis systems. Watch the Notes for future developments.

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A new Division of Resource Inventory Systems has been established at BLM's Denver Service Center. The Division is responsible for developing Resource Inventory Procedures and systems to meet the requirements of the Federal Land Policy Management Act. (FLPMA). The Division will coordinate the development of Inventory Systems with BLM's Headquarters Office Divisions and the Office of Planning Inventory and Environmental Coordination. The Division is especially interested in establishing liasion with other resource agencies, insitutions, and groups to obtain common use and understanding of information about inventory procedures and methods. For those wishing to contact the Division their address is: Division of Resource Inventory Systems (D-460), BLM BLDG. 50, Denver Service Center, Denver, Colorado 80225.

GPO 850-381

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