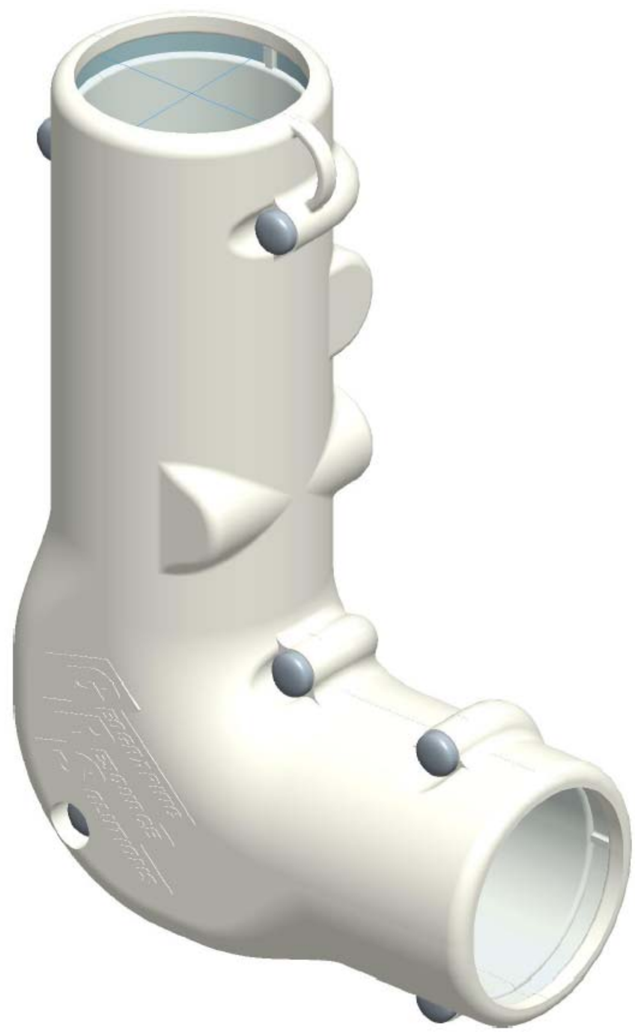
THE

GRS DENSITOMETER



COVER MEASUREMENT USING THE GRS DENSITOMETER (TM)

The **GRS** densitometer, when used with line-point transect sampling, combines horizontal and vertical vegetation sampling thereby enabling the collection of resource information across the landscape (horizontally) at different canopy levels (vertically). This technique provides estimates of cover for any element in a vegetated environment such as: trees, shrubs, herbaceous plants, down woody material, fuels, snags, and so forth. This method of sampling has been shown to be accurate, objective, and repeatable between observers.

The cover estimates generated using the **GRS** densitometer are based on an evaluation of cover features (data) collected at sample points evenly spaced along transects. For example, trees are determined to be "cover" trees by sighting through the densitometer and determining whether any portion of a tree crown intersects the vertical line of sight through the densitometer (note: the actual definition of “cover” depends on your use of the data you are collecting, so that the cover estimates are consistent with relationships and data developed or used by others). The vertical line of sight is obtained by leveling both of the densitometer's bubble-levels and then sighting through the instrument so that the sighting marks (cross-hairs/dot in far lens is at center of circle in near lens) are aligned. The GRS Densitometer can be oriented to sight either up or down, to sample the canopy above and/or the ground cover/condition below.

Transects of several different forms and lengths may be used, depending on the characteristics of the sample area. If the sample area is too small to effectively place a straight-line transect within, then a diamond-shaped or triangle-shaped transect can be used. The transect layout should avoid any potential bias and error that may result from the systematic orientation of the transect with respect to physiographic (terrain) features or the vegetation features; for example, you would not want a side of a triangle-shaped transect to align with rows of trees in a machine-planted plantation.

The point-transect sampling methodology provides estimates of the cover contribution of the different characteristics measured at each point along the transect. Estimated distributions of species composition, tree size, age, crown diameter, and any other sampled characteristics are easily generated by dividing the number of points tallied for each recorded characteristic by the total number of sample points. For example, if 100 points are sampled along the transect and 29 of the sample points are covered by Douglas-fir trees, then the estimated cover of Douglas-fir is 29 percent. If 17 of the 100 sample points indicate cover is provided by trees equal to or greater than 36" dbh then the estimated cover of the 36"+ size class is 17 percent. If 74 sample points indicate conifer cover and 9 points indicate hardwood cover then the total tree cover estimate is 83 percent ((74+9)/100) and the estimated percent conifer composition is 89.2 percent (74/83).

Sampling at multiple layers of the forest stand is accomplished by noting the characteristics at different levels of the stand and recording the layer of the sampled characteristic. Transect points covered by multiple trees of the same canopy position, but of different species or size, have multiple tree characteristics recorded, one for each of the "cover" trees.

Understory and ground cover features of the sample point can be identified by using a code that identifies the appropriate characteristic(s). Ground cover features include shrub and herbaceous cover, large organic debris, fine woody debris, duff and litter, bare soil, soil-type, and exposed rock. Characteristics may be further detailed if desired. Duff and litter estimates may include an estimate of the depth of the organic layer. The decay status of woody debris can be recorded. Other information, such as soil parent material, landform, slope, aspect, and elevation may also be recorded at each point.

Since the data being collected using this technique are binomially distributed (for each feature of interest there is a "yes" or "no" answer at every transect sample point), the statistical reliability of our sample, for different sample sizes, is known and is shown in the following table. A cover estimate based on a sample of one hundred points will yield a 95 percent confidence interval width between ± 6.0 percent and ±10.1 percent cover. An estimate based on 200 points will yield a 95 percent confidence interval width between ± 4.3 percent and ±7.1 percent cover.

95 Percent Confidence Interval (Two Standard Deviations)
Relative to Sample Size(n) and Population Estimate(p)

	------------------------- Population Estimate(p) -------------------------								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
Sample Points									
10	20.0%	26.7%	30.6%	32.7%	33.3%	32.7%	30.6%	26.7%	20.0%
25	12.2%	16.3%	18.7%	20.0%	20.4%	20.0%	18.7%	16.3%	12.2%
50	8.6%	11.4%	13.1%	14.0%	14.3%	14.0%	13.1%	11.4%	8.6%
100	6.0%	8.0%	9.2%	9.8%	10.1%	9.8%	9.2%	8.0%	6.0%
200	4.3%	5.7%	6.5%	6.9%	7.1%	6.9%	6.5%	5.7%	4.3%
400	3.0%	4.0%	4.6%	4.9%	5.0%	4.9%	4.6%	4.0%	3.0%

The data collected using the GRS Densitometer can be recorded on tally sheets or in hand-held data collectors. GRS provides two programs for the collection and summary of transect data. ***trans_in*** is a data collection program compatible with many hand-held data collectors. ***covmatrixSum*** is a transect data summary program for Windows-based computers.

Sample Transect Summary

Cover Density Summary:
Training Polygon: 154

Size Class:	0-5"	6-10"	11-23"	24-35"	36"+	Tree Cover	Non-Tree Cover	Total Cover
Species								
Doug-fir	10.0%	12.0%	0.0%	3.0%	4.0%	29.0%		28.9%
redwood	6.0%	10.0%	9.0%	2.0%	13.0%	40.0%		40.1%
white fir	0.0%	2.0%	3.0%	0.0%	0.0%	5.0%		5.1%
tanoak	2.0%	3.0%	4.0%	0.0%	0.0%	9.0%		8.9%
salal							1.0%	1.0%
vaccinium sp.							1.0%	1.0%
woody debris							3.0%	3.0%
bare soil							12.0%	12.0%
Total Cover	18.0%	27.0%	16.0%	5.0%	17.0%	83.0%	17.0%	100.0%
Total Tree Cover						83.0%		

Tree Density Summary:
Training Polygon: 154

Size Class:	0-5"	6-10"	11-23"	24-35"	36"+	Tree Cover
Species						
Doug-fir	11.9%	14.4%	0.0%	3.6%	4.9%	34.8%
redwood	7.2%	12.0%	10.9%	2.4%	15.7%	48.3%
white fir	0.0%	2.4%	3.6%	0.0%	0.0%	6.1%
tanoak	2.4%	3.6%	4.8%	0.0%	0.0%	10.8%
Total Tree Cover	21.6%	32.4%	19.3%	6.0%	20.6%	100.0%

Quadratic Mean DBH Summary:
Training Polygon: 154

Size Class:	0-5"	6-10"	11-23"	24-35"	36"+	Tree Cover
Species						
Doug-fir	3.9"	7.1"	0.0"	28.3"	41.1"	18.5"
redwood	3.7"	8.6"	14.3"	32.0"	43.6"	27.2"
white fir	0.0"	9.5"	15.7"	0.0"	0.0"	13.6"
tanoak	4.0"	9.4"	12.0"	0.0"	0.0"	9.8"
Quad Mean DBH	3.9"	8.1"	14.1"	29.9"	43.1"	22.3"
Quad Mean DBH-Con	3.8"	8.0"	14.7"	29.9"	43.1"	23.3"
Quad Mean DBH-Hwd	4.0"	9.4"	12.0"	0.0"	0.0"	9.8"

THE ESTIMATION OF FOREST VEGETATION COVER DESCRIPTIONS USING A VERTICAL DENSITOMETER[1]

K.A. Stumpf[2]

ABSTRACT: The estimation of vegetation cover or canopy closure can be difficult and costly. The utilization of a vertical sampling tool, such as a canopy densitometer, along linear transects provides a reasonable means of generating reliable cover estimates. Estimates represent both the horizontal and vertical diversity of sample areas and may represent descriptions of species composition, size, and canopy structure as well as non-tree characteristics, such as ground surface conditions and shrub or herbaceous cover.

INTRODUCTION

The concept of ecosystem management is replacing the traditional approaches to forest management. The effects of land management practices are being monitored and evaluated to determine impacts on wildlife habitat, water quality, fisheries, aesthetics, and other forest ecosystem benefits, as well as timber inventory and harvest levels. One of the most important characteristics currently used as an indicator of the status and condition of the forest ecosystem is crown closure or vegetation canopy cover. Vegetation cover or canopy closure estimates are developed and used to characterize forest vegetation and enable the assignment of attributes or descriptive information regarding species type, composition, and even stand structure (Brown and Fox, 1992). Efforts using cover estimates are frequently associated with remote sensing/image processing efforts that involve aerial photography or satellite imagery. These efforts are significant in both the development of characteristics and the testing of map accuracy relative to ground truth (Hill, 1993). Without an accurate and reliable methodology for estimating vegetation cover, the development and accuracy assessment of cover-based vegetation databases is quite suspect.

The quantification of cover estimates may be accomplished in one of several ways: cover (versus non-cover) may be mapped; cover may be photographed, scanned, and image processed; cover may be estimated based on samples collected with a spherical densitometer; or cover may be estimated using data collected with a vertical point sampling device. Crown mapping may yield very precise and detailed estimates of cover characteristics, but it is not a methodology that may be applied on a very broad scale or at a low cost relative to sampling with spherical or vertical densitometers. Photo scanning and image processing may also be costly and subject to potential biases due to the non-vertical nature of the photo image. Species and tree size recognition may be difficult and the cost may be relatively high.

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[1] A paper presented at the joint Inventory and Biometrics Working Groups session at the SAF National Convention held at Indianapolis, IN, on November 8-10, 1993.

[2] Kenneth A. Stumpf, Geographic Resource Solutions, 1125 16th Street, Suite 213, Arcata, CA 95521, (707)-822-8005.

The spherical densitometer is useful for developing estimates based on only a few sample locations and therefore at a lower cost. However, these cover estimates also do not reflect a true vertical depiction of the cover characteristics, nor is it easy to differentiate the cover estimates by vegetation characteristics such as size or specie. The development of cover characteristics using a vertical densitometer relies on a greater number of sample points than the spherical densitometer, but requires a significantly lower amount of effort than crown mapping or photo scanning. Vertical sampling also enables the development of very detailed information regarding species composition, size, and stand structure with a high degree of reliability at a relatively low cost.

VEGETATION DATA COLLECTION USING THE CANOPY DENSITOMETER

The canopy-densitometer, when used with line-point transect sampling, combines horizontal and vertical stand sampling thereby enabling the collection of resource information across the landscape (horizontally) at different canopy levels (vertically) in the forest canopy. Stand characteristics are sampled in proportion to the differing amounts of cover that each characteristic contributes to the sample stand. For example, an individual large tree with a large crown area has a higher probability of being sampled than a small tree with a small crown area. However, a few large trees that encompass 10 percent cover will have as equal a probability of being sampled as a large number of small trees that also comprise ten percent cover.

This sampling methodology provides estimates of the cover contribution of the different characteristics measured at the transect (sample) points. Estimated distributions of species composition, tree size, age, crown diameter, and any other sampled characteristics are easily generated by dividing the number of points tallied for each recorded characteristic by the total number of sample points. For example, if 100 points are sampled along the transect and 29 of the sample points are covered by Douglas-fir trees, then the estimated cover of Douglas-fir is 29 percent. Other characteristics, such as the average diameter and crown width may also be recorded for sample trees. If 17 of the 100 sample points indicate cover is provided by trees equal to or greater than 36" dbh then the estimated cover of this size class is 17 percent. If 74 sample points indicate conifer cover and 9 points indicate hardwood cover then the total tree cover estimate is 83 percent (74+9) and the estimated percent conifer composition is 89.2 percent (74/(74+9)). An example of the stand estimates generated for an area sampled using this methodology is shown in Table 1.

Table 1
Training Area/ Accuracy Assessment Transect Summary

Transect Cover Density Summary:
Training Polygon: 154

Size Class:	0-5"	6-10"	11-23"	24-35"	36"+	Tree Cover	Non-Tree Cover	Total Cover
Species								
Doug-fir	10.0%	12.0%	0.0%	3.0%	4.0%	29.0%		28.9%
redwood	6.0%	10.0%	9.0%	2.0%	13.0%	40.0%		40.1%
white fir	0.0%	2.0%	3.0%	0.0%	0.0%	5.0%		5.1%
tanoak	2.0%	3.0%	4.0%	0.0%	0.0%	9.0%		8.9%
salal							1.0%	1.0%
vaccinium sp.							1.0%	1.0%
woody debris							3.0%	3.0%
bare soil							12.0%	12.0%
Total Cover	18.0%	27.0%	16.0%	5.0%	17.0%	83.0%	17.0%	100.0%
Total Tree Cover						83.0%		

Transect Tree Density Summary:
Training Polygon: 154

Size Class:	0-5"	6-10"	11-23"	24-35"	36"+	Tree Cover
Species						
Doug-fir	11.9%	14.4%	0.0%	3.6%	4.9%	34.8%
redwood	7.2%	12.0%	10.9%	2.4%	15.7%	48.3%
white fir	0.0%	2.4%	3.6%	0.0%	0.0%	6.1%
tanoak	2.4%	3.6%	4.8%	0.0%	0.0%	10.8%
Total Tree Cover	21.6%	32.4%	19.3%	6.0%	20.6%	100.0%

Transect Quadratic Mean DBH Summary:
Training Polygon: 154

Size Class:	0-5"	6-10"	11-23"	24-35"	36"+	Tree Cover
Species						
Doug-fir	3.9"	7.1"	0.0"	28.3"	41.1"	18.5"
redwood	3.7"	8.6"	14.3"	32.0"	43.6"	27.2"
white fir	0.0"	9.5"	15.7"	0.0"	0.0"	13.6"
tanoak	4.0"	9.4"	12.0"	0.0"	0.0"	9.8"
Quad Mean DBH	3.9"	8.1"	14.1"	29.9"	43.1"	22.3"
Quad Mean DBH - Con	3.8"	8.0"	14.7"	29.9"	43.1"	23.3"

TRANSECT CONFIGURATION

The cover estimates generated using the canopy-densitometer are based on an evaluation of data collected at sample points evenly spaced on transects placed within sample areas. Transects of several different forms and lengths may be used, depending on the characteristics of the sample area. Shapes may be altered in an attempt to provide the most representative sample of the area subject to data collection goals. The transects are configured in either a straight line, triangle, or diamond shape (see Figure 1), depending on the size and shape of the sample area.

The transects are situated so that all the sample points fall within the sample area. The triangle shaped transects are used to sample smaller areas that the larger diamond shaped transect do not fit within. The straight line transects are typically used to sample the larger areas in which the triangle or diamond shaped transect might provide sample estimates that are too localized and potentially not representative of the sample area. Multiple transects, located randomly or systematically may be used to develop multiple estimates of stand characteristics, as well as stand estimates and variances. It is important that a given configuration be applied consistently to avoid any potential bias due to changing the form of the transect.

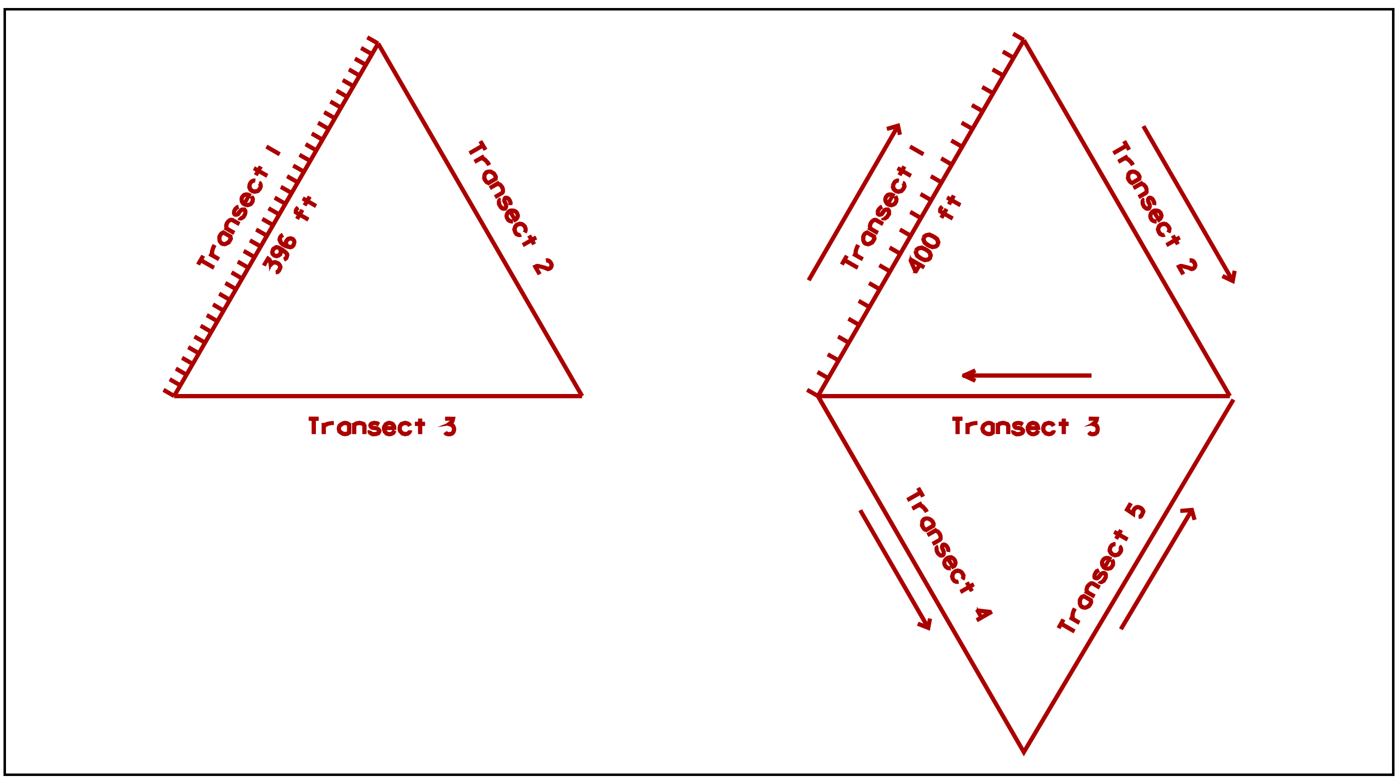

Figure 1. Transect configurations for triangular and diamond shaped transects.

95 Percent Confidence Interval (Two Standard Deviations) Relative to Sample Size(n) and Population Estimate(p)									
	------------------------- Population Estimate(p) -------------------------								
Sample Points	10%	20%	30%	40%	50%	60%	70%	80%	90%
10	20.0%	26.7%	30.6%	32.7%	33.3%	32.7%	30.6%	26.7%	20.0%
25	12.2%	16.3%	18.7%	20.0%	20.4%	20.0%	18.7%	16.3%	12.2%
50	8.6%	11.4%	13.1%	14.0%	14.3%	14.0%	13.1%	11.4%	8.6%
100	6.0%	8.0%	9.2%	9.8%	10.1%	9.8%	9.2%	8.0%	6.0%
200	4.3%	5.7%	6.5%	6.9%	7.1%	6.9%	6.5%	5.7%	4.3%
400	3.0%	4.0%	4.6%	4.9%	5.0%	4.9%	4.6%	4.0%	3.0%

Table 2 Estimated confidence interval width of sample data based on number of sample points and sample estimates.

In previous efforts, we have used transects of either 1188 feet or 2000 feet long. Sample data are collected along the transect at points spaced either twelve (12) feet (straight-line or triangle transect) or twenty (20) feet (diamond transect) apart. A total of one-hundred (100) transect points are sampled along each transect. More points may be collected by changing either the spacing of the points or the total length of the transect. A sample size of one-hundred points is by no means the optimal sample size but is based on sampling requirements that consider personnel, cost, and statistical reliability. Since the data being collected using this technique are binomially distributed (for each feature of interest there is a "yes" or "no" answer at every transect sample point), the statistical reliability of our sample, for different sample sizes, is known and is shown in Table 2. A cover estimate based on a sample of one-hundred points will yield a 95 percent confidence interval of a width of between ± 6.0 percent and ±10.1 percent cover. An estimate based on 200 points will yield a 95 percent confidence interval width between ± 4.3 percent and ±7.1 percent cover.

The initial (starting) point of a sample transect should be located within each sample polygon in an unbiased manner. Locations should also be located on imagery, aerial photographs, corresponding digital maps, and/or orthophotography that are used to record data collection sites and assist field personnel in locating the transect starting points. During image processing and training and accuracy assessment projects, it is important that the field position of a transect is located as close as possible to the position identified on the image and photography. The improper location of sample transects can be a major source of error in the subsequent application of sample data to mapped vegetation conditions. If there is uncertainty regarding the accurate location of field data collection sites then Global Positioning System (GPS) devices should be used to properly locate sample sites and sample transects.

The direction of a sample transect is systematically determined so that, if possible, the transect falls entirely within the mapped boundaries of the study area. When this is not possible, the transect may be broken and an additional direction(s) may be selected for the remaining portion(s) of the transect to assure that all transect points fall within the boundaries of the sample area. If the sample area is too small to effectively locate the straight-line transect within, then a diamond-shaped or triangular shaped transect should be used. This transect layout avoids any potential bias and error that may result from the systematic orientation of the transect with respect to physiographic (terrain) features.

VEGETATION MEASUREMENT DETAILS AND STANDARDS

Both quantitative and qualitative data may be collected at all sample points along a transect. The presence or absence of any given vegetative cover characteristic is determined at each sample point along the transect using the vertical canopy-densitometer. A sighting is taken with the canopy-densitometer and the characteristics of that point are recorded. A tree that covers a sample point is a "cover" tree. Trees are determined to be "cover" trees by sighting through the canopy-densitometer and determining whether any portion of a tree crown intersects the vertical line of sight through the densitometer. The vertical line of sight is obtained by leveling both of the densitometer's vials and then sighting through the instrument so that the cross hairs are positioned between the sighting marks on the mirror.

Data are collected to be compatible with satellite imagery or aerial photo interpretation, methods that represent a "bird's eye" or top down view of the forest canopy. For transect points covered by tree crown(s), tree specific characteristics are recorded for the tree(s) providing the top level (as seen from above) of crown cover. Transect points covered by multiple trees of the same canopy position, but of different species or size, have multiple tree characteristics recorded, one for each of the "cover" trees.

The specific data that are collected at each transect point include the species code, dbh, crown diameter or area, and the canopy layer of the cover feature. Tree dbh is estimated using conventional forest inventory techniques and is recorded to the nearest inch. Tree crown diameter or area is estimated as accurately as possible using a tape and vertical canopy-densitometer; diameter is recorded to the nearest foot; while area, if recorded, is estimated to the nearest ten (10) feet. Sample point features that are definitely overstory contributors (top layer characteristics) are identified by recording an "**O**" (overstory) in the spectral contribution (SC) column. Those features that are definitely <u>not</u> contributors are identified by recording the proper canopy layer designation in this column (this information is useful for segregating the cover data that contribute to the spectral data of the satellite imagery and aerial photography from those characteristics that are covered and do not contribute to the spectral data as sensed from above the stand). Understory and ground vegetation features of the sample point are identified by using a species code that signifies the appropriate vegetation characteristic(s). Sampling at multiple layers of the forest stand is accomplished by noting the characteristics at different levels of the stand and designating the layer of the characteristic. Canopy layer classes, such as "**S**" and "**G**" are used to indicate subordinate and ground level layers of the stand. Any set of codes that would signify different types or levels of characteristics that are sampled can be recorded and used to summarize the sample data. Sample point data are recorded on the Transect Data Collection Form shown in Figure 2.

Many non-tree characteristics may also be recorded to provide a description of the non-tree characteristics of the sample area. Characteristics include such features as shrub and herbaceous cover and ground condition descriptions such as duff and litter, bare soil, soil-type, and exposed rock. Characteristics of duff and litter estimates may include an estimate of the depth of the organic layer and the size and decay status of dead and down woody debris if it intersects a transect point. Other information, such as parent material, if observable, may also be recorded at each point, as well as estimates of the landform such as ridge top, shoulder, valley bottom, concave slope, or alluvial fan.

Qualitative data are also observed and recorded. These are field observations that supplement the field measurements. Ocular estimates of vegetation type, quadratic mean tree size(dbh), canopy closure class, and stand age may be recorded for the area represented by each transect. Non-tree estimates involving the presence of understory vegetation, snags, litter/duff, woody debris, and parent material may also be indicated. These estimates reflect the field personnel's evaluation of the sample area and are based on their general impressions of the vegetation and non-vegetation characteristics of the area encompassing the transect(s) and of the general area that has been sampled. This information may be significant in understanding and interpreting the field data collected on individual transects and for the sample area as a whole. Individual transects may describe polygon variation and explain differences between map descriptions and field observations, thereby indicating horizontal diversity within the sample area. Other conditions of the sample transects, such as the logging history, slope percent, and aspect, also may be described.

SUMMARY

The vertical densitometer provides a useful means of collecting and estimating crown canopy closure estimates. The combination of the line-point transect sampling method and the collection of vegetation and non-vegetation characteristics at different positions within the forest canopy result in a sampling methodology that considers the horizontal diversity present across the landscape <u>and</u> the vertical diversity present within the sample area. Accurate and reliable estimates may be developed that include descriptions of species composition, cover by tree size, percent conifer and hardwood, and canopy structure.

LITERATURE CITED

Brown, G. and L. Fox III, 1992. Digital classification of thematic mapper imagery for recognition of wildlife habitat characteristics. <u>Proc: 1992 ASPRS/ACSM Convention</u>, American Society of Photogrammetry and Remote Sensing, Bethesda, Maryland, Vol. 4, pp. 251-260.

Hill, T.B., 1993. Taking the " " Out of "Ground Truth": Objective Accuracy Assessment. <u>Proc: 1993 Pecora 12, A Symposium on: Land Information from Space-Based Systems</u>, American Society of Photogrammetry and Remote Sensing, Bethesda, Maryland, in printing.

VEGETATION TRANSECT

Cluster: _____ Transect: 1 - 2 - 3 Page:__of__

Location: T____ R____ S____ ____BM Poly#_____

Date ________ Crew: __________ Azimuth: ____________

Elevation: __________ft Owner: ____________________

Transect Point Sample					Transect Point Sample				
Pt #	SP	dbh	CD	SC	Pt #	SP	dbh	CD	SC

SP: Species/Cover Code
dbh: Diameter Breast Height, 1" size classes
CD: Crown Diameter to nearest 1'
SC: O (overstory), S (subordinate), or G (ground)

Figure 2. Sample Area Transect Data Collection Form

GRS Densitometer Maintenance

The **GRS** densitometer is designed to resist breakage and requires minimal care and maintenance. However, accidents do happen, so here are some guidelines for maintenance. We recommend storing your densitometer in a sealed plastic bag to protect the lenses from scratching and reduce exposure to condensation, dirt, and dust. Do not expose your densitometer to high temperatures. This may damage the housing and/or cause leakage in the level vials. For instance, leaving your densitometer on the dashboard of your vehicle on a hot day ***will*** damage it. ***Using*** the densitometer on a hot day in over 100-degree temperatures ***will not*** damage it. When using the densitometer in heavy rain, condensation will likely form on the inside. This will not damage the densitometer but will make it difficult to use. Leave your densitometer in a warm dry location overnight and it should be ready to use the next day.

CARE AND CLEANING

Since Densitometers are used in the field, they can get dirty and dusty quickly, especially if proper care and storage procedures are not followed. The densitometer may be cleaned. If you want to clean your densitometer yourself: Simply remove the six screws that hold the two sides of the housing in place. You should then be able to remove the lenses, vials, and mirror. When you have finished removing the lenses or mirror, clean them by wiping with glass cleaner. The rest of the densitometer can be washed by hand or even placed in the dishwasher.

When you reassemble the densitometer make sure that the printed side of the lenses are facing the inside.

If you want **GRS** to clean or recondition the densitometer for you, you can send it to us with your payment for $35 + shipping. Just carefully package and send the densitometer to:

GRS Densitometer Maintenance
1125 16th St., Suite 213
Arcata, CA 95521.

BREAKAGE or REPAIR

In the unlikely event that your densitometer breaks or needs repair, GRS can provide repair or replacement parts. If you would like us to repair it, please contact us first for an estimate.

LIMITED WARRANTY

If your densitometer has a defect due to faulty parts or workmanship, GRS will repair it free of charge within one year of purchase date. Please contact GRS for a return authorization and not our reseller. NOTE: Failure to contact GRS may result in voiding this Limited Warranty

We would like to know what you think about our densitometer and would be happy to entertain any suggestions you may have to improve it. Please contact us at:

Geographic Resource Solutions
1125 16th Street, Suite 213
Arcata, CA 95521
Voice: (707) 822-8005 FAX: (707) 822-2864
E-mail: grs@grsgis.com

Visit our web site at http://www.grsgis.com to learn more about **GRS** and the services we provide.
Register your densitometer at http:// http://www.grsgis.com/grs-densitometer-registration.html

Do You Want To Capture Land Cover/Vegetation Cover Data in the Field !!!!

Data Consistency with Increased Productivity

A new degree of accuracy and consistency for gathering land cover/vegetation information is available thanks to the **GRS** densitometer. **GRS** can simplify your life even more, while increasing your levels of efficiency and productivity, with our software tools ***TransIn*** and ***TransSum***.

In all likelihood you need to accurately collect and evaluate more and more data with tighter time frames and limited resources. How would you like a tool that allows you to enter and validate data on the fly? ***TransIn*** was developed specifically for natural resource professionals to facilitate the input of point-transect data into hand-held data collectors.

Remember the last time you got back to the office after a long day in the woods only to realize your data was incomplete or not accurately recorded. **GRS** recognized the need to eliminate the collection of erroneous data, such as invalid species codes, illogical codes, or out-of-sequence points. ***TransIn*** can identify and flag these error situations as they occur, so you can verify and enter the correct data while you are still in the field rather than back in the office. Numeric standards, such as specie code values and repetitive tasks that are skipped and filled in later often cause the most mistakes while in the field. If you are tired of redundant data entry, then you need to download and install ***TransIn*** on your handheld system today.

Immediate Feedback

Would viewing your data in easy to read and understandable reports immediately after you return from the field be beneficial to you? ***TransSum*** was developed in conjunction with ***TransIn***, so you can view your land cover/vegetation data layer-by-layer in report form immediately after returning from the field. Data is summarized by species and size classes for each layer of the canopy that observations are recorded, thereby providing you with a summary of the horizontal layers of the sampled area. Species composition is computed, as well as average tree size (dbh and height). This software was developed and tested by a forester who understands the need for an accurate and reliable method to record and report data logically and systematically. Don't run the risk of waiting so long to process your data that you have forgotten where you were or what you saw. While ***TransIn*** will flag data that is out of range or suspect, preventing you from capturing incorrect data, ***TransSum*** will allow you to quickly review your observations and associate field observations with the processed land cover information.

Request Free Software

Demo versions of the software may be downloaded from our website at www.grsgis.com. If you have any questions about the use of either program contact **GRS** at (707) 822-8005, or email us at grs@grsgis.com.