SUSITNA
HYDROELECTRIC PROJECT

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TERRESTRIAL PROGRAM
1983 BROWSE PILOT STUDY

UNIVERSITY OF ALASKA
- PALMER

UNDER CONTRACT TO

HARZA-EBASCO
SUSITNA JOINT VENTURE

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TERRESTRIAL PROGRAM 1983 BROWSE PILOT STUDY

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Under Contract to
Harza-Ebasco Susitna Joint Venture

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NOTICE

ANY QUESTIONS OR COMMENTS CONCERNING THIS REPORT SHOULD BE DIRECTED TO THE ALASKA POWER AUTHORITY SUSITNA PROJECT OFFICE

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1 - INTRODUCTION

One means of assessing a potential impact of the proposed Susitna Hydroelectric Project on wildlife is to inventory available winter browse for moose (Alces alces gigas) in the vicinity of the impoundment zones. A preliminary study was performed during 1983 to investigate efficient methods of sampling browse in this area. The primary objective of this study was to look at techniques while a secondary objective was to look at sample allocation for sampling units among sites, vegetation types, and geographical areas (impoundment versus non-impoundment).

Previous studies by Steigers et al. (1983) and the Cooperative River Basin Study of the United States Forest Service and the Soil Conservation Service could be used to provide additional information on the sample allocation problem, although the latter data are not included in this report. Steigers et al. (1983) conducted a browse inventory of the middle Susitna River basin during July and August 1982 using 47 sites. Measurements included canopy cover, stem density, twig counts, average dpb, and current annual growth in 1-m^2 quadrants. The Cooperative River Basin Study covers many of the drainages of the Susitna River from Cook Inlet to the glaciers in the Alaska range. Approximately 85 locations were sampled in the middle and upper Susitna basins for timber inventory, ground cover, productivity, stem density, soils, and wildlife habitat information. Two basic approaches were taken to estimate browse/unit area: (1) density times weight per individual and (2) clipped plots. Plots were assumed to be the best technique for sampling density of several species as based on Oldemeyer and Regelin (1980). The sample allocation problem was addressed only for sites and vegetation types, not for geographical areas.

1.1 - Abridged Literature Review

Many studies have been performed to assess efficient methods of sampling browse or other components of woody species. This literature may represent a biased sample of all such studies because most researchers report positive findings. Many dimension analysis studies regress total weight or total current growth against shrub measurements, rather than using total twig weight (browse) as the dependent variable.

A few studies have investigated plot sizes for clipped plots. Parker and Morton (1978) compared contiguous subplots 2x1 m to evaluate plots of size 2 to 10 m^2. They found 6 m^2 was the best plot size but predicted that over 200 plots may be required to adequately sample moose forage within 20% of the mean 95% of the time across all sites. Twig counts were used for deciduous shrubs, and height times basal diameter was used for balsam fir. Logarithmic transforms of both dependent and independent variables were used for twigs while untransformed data were used for the balsam fir data (r^2=0.93). Overall dimensions rather than the twig count method were used for balsam fir because of the number of twigs to count.

Barrett and Guthrie (1969) counted browse tips and clipped browse in 484 1-milacre plots on a 0.484-acre area in a 40- to 60-year old mixed oak-pine stand in Virginia. Browse was the current annual terminal growth of all woody species from the ground to 5 ft (1.5 m). Optimum plot size increased with increased hypothetical location time with a two-member crew with plot sizes of 1, 2, 4, and 9 milacres. Simple random sampling was superior to double sampling. A one-man crew was superior to a two-man crew for 1-milacre plots.

Bobek and Dzieciolowski (1972) (cited) studied browse by plot harvest technique in several deciduous forest types. Plots 21 m^2 in size appeared most useful. The effect of site was demonstrated by the variability in sample size requirements for adequate sampling i.e. 5 plots in plantations, 9 in thickets, 14 in timber stands, and 19 in pole-sized stands.

Shafer (1963) used the twig count method of measuring deer browse while Telfer (1969) used twig weight-diameter relations to estimate browse. Many other studies have used similar techniques, however Bobek and Bergstrom (1978) found that twig count methods did not work well when browse was dense as in thickets. Similarly Parker and Morton (1978) used twig counts on deciduous shrubs but used dimension analysis on balsam fir because of the number of twigs. Twig counts used by Steigers et al. (1983) in 1982 were time consuming and were not considered for this study.

Many studies have successfully used shrub dimensions to estimate various components of shrub biomass, including browse. Bobek and Bergstrom (1978) measured height and stem diameter at 5 to 10 cm heights above the ground for pine, spruce, and birch on a young forest plantation in central Sweden. They obtained r^2 values in the range of 0.96 to 0.98. Parker and Morton (1978) obtained an r^2 of 0.93 relating oven dried twig weight to height times diameter for balsam fir in northcentral Newfoundland. Whisenant and Burzloff (1978) obtained r^2 = 0.87 for green weight of mesquite versus the stem area at 60 cm above the ground. The weight of individual trees was not correlated with the density. Ohmann et al. (1976) used stem diameters as the best predictor of weight using both linear and allometric forms of the equation. Their r^2 values were in the 0.11 to 0.60 range. Actual diameters produced better results than diameter classes. Height was only measured in 15-cm increments which may have accounted for its low correlations.

Uresk et al. (1977) found volume and area best to predict live wood weights of 20 big sagebrush plants (r^2=0.80). Peek (1970) used volume and area as the best predictors also. Ludwig et al. (1975) used area and volume to obtain high r^2 (0.99) values for 10 shrubs of each species. Bentley et al. (1970) used crown volume classes to decompose the variability and obtain r^2 values ranging from 0.93 to 0.96. Many of these studies used logarithmic transformations to stabilize the variances.

Chew and Chew (1965) selected shrubs that were symmetrically shaped while Peek (1970) also commented on the advantages of a symmetrical canopy. Other studies selected nonrandom shrubs across a range of size classes. Observers may have had a conscious or unconscious tendency to select well-formed individuals. This could result in the high correlations found. Also, many researchers do not report low r^2 or all the independent variables that might have been tried unsuccessfully. This brief review is meant only to give a little perspective and not to be a complete synthesis of the literature on browse sampling.

We would like to thank Dr. Wayne L. Regelin of the Alaska Department of Fish and Game (ADF&G) for his input in determining the objectives and methods of this pilot study, and for his assistance in collecting field data. James G. MacCracken and Patrick V. Mayer assisted in planning, collecting field data, and processing laboratory samples. Suzanne Miller, ADF&G, provided statistical consultation. Randal L. Fairbanks and Dr. Roseann Densmore assisted in the planning and implementation of this study. Granville Couey organized logistical support for field operations at Watana Base Camp. Niki T. Wood and Kathleen Wells provided clerical services for preparation of this manuscript.

2 - STUDY AREA

The study area is located in the Susitna River Basin upstream of Gold Creek (Fig. 1). It is bounded on the west by Devil Canyon and on the east by the Maclaren River and extends approximately 16 km on either side of the Susitna River. Elevations range from about 333 m on the river at Devil Canyon to 2085 m at the top of Mt. Watana. The river elevation rises to approximately 800 m at the confluence with the Maclaren River.

Topography of the study area has been strongly influenced by past glacial action and associated creek and river erosion. Generally, the area is a broad U-shaped valley with a relatively narrow V-shaped valley occupied by the Susitna River. Upstream glaciers probably previously extended into the area. Numerous creeks and rivers drain into the Susitna River along its course in the middle Basin. The channel slopes are very steep near Devil Canyon, rising approximately 333 m vertically in about 1 km horizontal distance. The benches above the river channel are approximately 666 - 833 m in elevation and make up a majority of the study area. At the eastern end of the middle Basin, the river channel is relatively less steep and much wider.

Various plant communities are found in the middle Basin study area. McKendrick et al. (1982) mapped 16 vegetation types in the middle Susitna River Basin at Levels III or IV of Viereck and Dyrness (1980). The plant communities are strongly influenced by site topography, soils, and moisture regimes. The steep, well drained river channel slopes are dominated by forest communities such as the mixed birch-spruce forest and open coniferous forests on both sides of the river. The benches above the river contain primarily shrub communites on the drier sites, followed by white spruce (Picea glauca) forests on well-drained slopes, and black spruce (*Picea mariana*) forests on the wetter sites. Alpine vegetation types exist at the highest elevations.

3 - METHODS

3.1 - Field

General areas representative of the vegetation types to be sampled were selected from aircraft over-flights and prior familiarity with the vegetation composition. Specific sites were selected based on presence/absence of key plant species considered important as moose browse. Six vegetation types visually classified to Level IV of Viereck et al. (1982) were sampled from August 10-22, 1983. The 6 types were woodland black (*Picea mariana*) - white spruce (*Picea glauca*), woodland black spruce, open mixed white spruce-paper birch (*Betula papyrifera*), open tall willow, open low dwarf birch (*Betula glandulosa*) - willow (*Salix* spp.), and open low willow. Seven shrub species were investigated: *Alnus sinuata* (sitka alder), *Betula glandulosa*, *B. papyrifera*, *Salix alaxensis* (felt leaf willow), *S. glauca* (glaucous willow), *S. lanata* (lanate willow), and *S. pulchra* (diamondleaf willow).

At each site, 2 parallel 50-m line transects were established from a randomly chosen starting point. The transects were spaced approximately 15 m apart and were located within the homogeneous area.

3.1.1 - Stem Density

Ten plots of each of 3 circular plot sizes were sampled with 15 plots located along each transect. The 3 plot sizes used were : 1 m^2 with 56 cm radius, 4 m^2 with 113 cm radius, and 10 m^2 with 178 cm radius. Plot sizes were randomly drawn from the pool of 30 total plots, without replacement, and then randomly assigned to the 15 points along each transect. Plots were spaced far enough apart to prevent overlap. Circular plots were delineated by rotating a rope marked at the appropriate radius around a metal rod inserted into the ground at each point along the transect measured using a 50-m tape.

All stems of the selected shrub species rooted within the plot were counted. Only stems that exceeded a height of 40 cm were counted for Betula glandulosa. A stem was defined as a lone branch protruding from ground level. A single observer counted stems in the 1-m^2 and 4-m^2 plots while a second researcher recorded data. Both observers counted stems in the 10-m^2 plot.

Stems of each shrub species in each plot were counted separately and in the following sequential order: Betula glandulosa, Salix pulchra, S. glauca, S. lanata, S. alaxensis, Alnus sinuata, and Betula papyrifera. Beginning and ending time to search the plot and count the stems of each species was recorded in the field while elapsed times were calculated later. The total time required to count stems for all species was also calculated for each plot. The elapsed time required to move to the next plot and set it up was calculated at 28 of 30 points; move time was not recorded for the first plot of each transect. Density of shrub stems was not counted at sites 1 and 2.

3.1.2 - Weight Per Individual

At 10-m intervals along each transect, the nearest stem of each selected shrub species within approximately 5 m was selected for measurement and harvest of current annual growth. For Betula glandulosa, only stems that exceeded 40 cm in maximum vertical height were selected for measurement. Stems were measured for basal stem diameter at ground level in millimeters, maximum vertical height in centimeters, maximum depth of the leaf canopy along the longitudinal axis of the stem in centimeters, maximum horizontal length (labelled "width" in Polycorder and printouts) of the leaf canopy in centimeters, and maximum horizontal width (labelled "right angle" in Polycorder and printouts) of the leaf canopy measured at right angle to the length in centimeters.

Total weight of current annual growth of twigs and leaves from ground level to 250 cm in height was ocularly estimated in grams, or to the nearest tenth gram for small values. Current annual growth twigs and leaves were then clipped and bagged together by height categories. Each stem was divided into the following 3 vertical height categories: ground level - 40 cm, 41 - 80 cm, and 81 - 250 cm. Plant material exceeding 250 cm in height was not measured. Total wet weights to the nearest gram, or tenth of a gram for small values, were obtained from each bagged sample the same day and recorded. Bagged samples were partially dried in the field to prevent spoilage and later oven dried at 60 C for 48 hours. Dried samples were separated in the laboratory into leaf and twig components and then weighed to the nearest tenth of a gram.

Beginning and ending times in seconds were recorded for measuring basal diameter; measuring height, depth, length, and width of the leaf canopy as a single time unit; ocularly estimating total current annual growth; and clipping and bagging current annual growth twigs and leaves. Elapsed time was then calculated for each of these categories and movement to the next consecutive point along the transect and/or search for another shrub.

Measurements for biomass at sites 1 and 2 were identical to those at the remaining sites with the following exceptions: maximum height was measured along the longitudinal axis of the stem rather than vertically; ocular estimates of the current annual growth of twigs and leaves were made for each height category; and twigs and leaves were clipped for each height category and weighed separately in the field.

3.1.3 - Clipped Plots

Up to 10 1-m^2 circular plots spaced 10 m apart along a line transect were clipped for current annual growth of twigs and leaves at each site. These plots were located independently of any other plots. Current annual growth of shrubs within the vertical projection of the plot boundary was clipped by species from ground level - 250 cm and bagged. Total wet weights to the nearest gram, or tenth gram where appropriate, were obtained for each bagged sample. Bagged samples were partially dried in the field to prevent spoilage, and later dried at 60 C for 48 hours. Dried samples were separated in the laboratory into leaf and twig components and then weighed to the nearest tenth of a gram.

The total elapsed time to clip all species in each plot and the time required to move to the next plot were recorded. No plots were clipped at sites 1 and 2.

3.2 - Data Preparation and Analysis

3.2.1 - Stem Density and Plot Size

Files containing density of stems by species and plot size for each site were first edited then concatenated into one file containing all sites. Raw time data were then converted to elapsed time by subtracting the times recorded that occurred prior to and after the stems were counted for each species. The total time elapsed to count all stems from all species was computed, as well as the time required to move between plots. These move times were multiplied by a constant of 3 to simulate the time required to sample 10 plots along 2 transects as if only a single plot size had been used. Twenty-eight move times were recorded at each site; the first plot established on each transect did not have an accompanying move time. These computations were included with the original density values in a reformatted file for use by programs from statistical packages. This file was then checked for errors, negative times, and missing data through several means: by program control that flagged negative times, by reformatting the raw data into labelled output, and by hand.

Density of stems were analyzed for mean, standard error, variance, and estimated sample size to adequately sample within 20% of the mean with 80% confidence. Density of stems for all 3 plot sizes were converted to a 10-m^2 basis for purposes of comparison among plot sizes. This area was selected to make the density values easier to discuss. Statistics were calculated for individual shrub species and total stems for all species in each plot with plots averaged for each site, and with sites combined into Level IV vegetation types (Viereck et al. 1982).

Time in seconds to count stems was analyzed for mean, standard error, variance, and estimated sample size to adequately determine the time within 20% of the mean with 80% confidence for each species, move time, and all species combined including move time. Elapsed time to search the plot for each species was averaged regardless of the presence or absence of the species in a given plot. Sites were combined into Level IV vegetation types using a nested analysis of variance. These mean squares can be used to calculate sample sizes although results may be somewhat biased because sites were not randomly located.

Average time required to count the stems of each species was multiplied by the estimated number of plots required to adequately sample the density of stems at each site to derive an estimate of the time that would be required to sample that many plots. This calculation was also performed between total time and the estimated adequate sample size for all species combined. Analysis of variance using a repeated measures nested design across the 3 plot sizes was conducted to determine if a statistical difference could be detected.

3.2.2 - Weight Per Individual

Raw field data from individual shrub measurements in each site were first edited then concatenated into one file containing all sites. Dry weights of field-collected plant samples were obtained in the laboratory and entered into a data file. Field wet weights of plant samples were edited and entered into a data file. These 3 files were then reformatted and merged into a single file which also contained elapsed times. The merged file was then checked for errors and for unpaired wet and dry weight data under both program control and by hand. Dependent variables of dry twig plus leaf weight and dry twig weight were plotted against individual shrub dimensions and ocular estimates. Appropriate transformations of data were performed in cases where relationships were non-linear. Stepwise regression analysis was used to determine which individual shrub measurements, singly and in combination, were the best estimators of current annual growth. More details on these methods are included in Results because of the stepwise nature of the analysis.

3.2.3 - Clipped Plots

Dry weights of field-collected plant samples were obtained in the laboratory and entered into a data file. Field wet weights of plant samples were edited and entered into a data file. These 2 files were reformatted and merged with the elapsed time to clip plots. Clipped plot data were analyzed for means, standard errors, variance, and the estimated number of clipped plots required to adequately sample the current annual growth within 20% of the mean with 80% confidence. All biomass values were multiplied by a constant of 10 to produce biomass estimates on a 10-m^2 basis. Total time to clip each plot and move time between plots were also calculated. Total time was multiplied by the estimated sample size calculated for total biomass of all species to estimate the time required to adequately sample a site. Sites were combined into Level IV vegetation types using nested analysis of variance. These mean squares can then be used to calculate estimated average number of plots within sites and number of sites within vegetation types. Non random selection of sites, however, may limit the usefulness of these estimates.

4 - RESULTS

Seventeen sites were sampled in the study area during August 1983. The sites were visually classified and grouped into Level IV vegetation types described by Viereck et al. (1982) (Table 1). The allocation of effort to each vegetation type, expressed by the number of sites sampled, was based on both the extent of the area in relation to the study area as well as its importance to moose. Importance to moose was assumed to be directly related to the abundance of willows. The locations of the 17 sites are shown in Figure 2.

4.1 - Stem Density and Plot Size

The average number of stems counted for each species in 1-m^2, 4-m^2, and 10-m^2 plot sizes are shown in Appendix A. Stem densities were averaged across all plots of each plot size within a site, and then converted to a stems per 10-m^2 basis for comparison among plot sizes. This area was selected to make discussion and comparisons of the 3 plot sizes easier. Standard errors ($s_{\bar{x}}$), variances (s^2), number of plots (N), and estimated samples size (NHAT) are also shown for each species (Appendix A). Sample sizes were calculated for estimates of the required number of plots to sample density of stems within 20% of the mean with 80% confidence. The average number of stems for all shrub species combined in each plot was also calculated for each site and vegetation type.

Stem densities were averaged across sites and combined into Level IV vegetation types for each plot size (Appendix A). In addition to the same statistics calculated for individual sites, within site (WITHIN) and between site (BMS) variances were calculated. The number of sites required to adequately sample the density for each shrub species and for the sum of all stems was also calculated (BNHAT). Caution should be used when interpreting these values since the nonrandom location of sites may affect these variances.

A summary of mean stem densities taken from Level IV vegetation types for the 3 plot sizes in Appendix A is shown in Table 2. With a few exceptions, stem density of dominant species numerically decreased as the area of the plot increased, although this was not tested statistically. Lower stem densities in the 10-m^2 plot size may be due in part to stems missed in counting. Care was necessary with the 10-m^2 plot size to insure that all stems were counted exactly once. Two persons counting in the 10-m^2 plot size facilitated this effort. Low density species (e.g., 1-5 stems/10 m^2) occasionally had lower densities in the smaller plot sizes. Examples of these were Betula glandulosa in the open mixed spruce-paper birch vegetation type, Salix pulchra in the woodland black-white spruce type, and Alnus sinuata in the open tall willow type. Individual stems of the selected shrub species tended to be clumped, probably belonging to one parent root system. Smaller plot sizes such as the 1-m^2 plot can be expected to more frequently miss low density species, particularly if the actual scale of clumping of that species is substantially larger than 1 m^2. Higher variance can also be expected under these circumstances (Table 3). Variance decreased with increasing plot size in most cases. But for some low density species variance did not follow a trend with respect to plot size.

Stem density estimates from data collected in 1982 by Steigers et al. (1983) for comparably classified Level IV vegetation types were usually lower than estimates obtained from this study, particularly for abundant species (Table 2). Stem density estimates for 1982 were obtained using a 4-m^2 circular plot. Density differences were probably a result of selecting particular sites in 1983, rather than the random site selection of 1982. Sites in 1982 were randomly selected from a grid overlaying a vegetation map of the Susitna River Basin. Because only certain vegetation types were to be sampled during 1983, sites were selected for certain species composition in the specified vegetation types. Density estimates were probably biased because of this selection. Between-site variances were large because sites were only classified to Level IV of Viereck et al. (1982). These variances could be reduced by further stratification based on slope, aspect, elevation, or species composition (Level V).

Appendix B summarizes the number of seconds to count and record the number of stems of each shrub species, the time required to move to and establish a subsequent plot, and the total time to count all stems and move to a new plot in 1-m^2, 4-m^2, and 10-m^2 plot sizes. Elapsed time was averaged across sites and combined into Level IV vegetation types for each plot size (Appendix B). Other statistics are also given, as described for Appendix A.

A summary of mean times taken from the Level IV vegetation types for the 3 plot sizes in Appendix B is shown in Table 4. Time to count stems increased with the size of the plot because more stems were present. One person counted stems in the 1-m^2 and 4-m^2 plot sizes while a second person recorded the data. However, 2 persons counted the stems in the 10-m^2 plot size with one of those persons recording the data. If only one person had counted the stems in a 10-m^2 plot, approximately twice as much elapsed time would be required relative to one person. Having a second person record data for any plot size saves a little elapsed time, but probably results in more man-hours spent.

Problems encountered with only one person counting in the 10-m^2 plot were most obvious when many tall, woody stems impeded movements within the plot. With two people, one could count one semi-circle and the second could count the other half. It was difficult to keep track of which stems had been counted in the 10-m^2 plot. Use of 2 people made movement easier, but it compounded the problem of keeping track of which stems have been counted. Two persons would probably be most efficiently used when counting in the 1-m^2 and 4-m^2 plots if each counted separate plots or took other measurements. Two persons counting stems in the 10-m^2 plot size would finish faster, although more errors may be introduced. For this study, however, elapsed time rather than man-time was used for comparison among the 3 plot sizes. Two persons were always present during the density sampling and both contributed to the extent needed to maximize the efficiency of the team. In a more realistic situation, one would probably be working on a different plot to maximize data obtained in a given period of time.

Average time in minutes required to count stems for an estimated adequate number of plots in 1-m^2, 4-m^2, and 10-m^2 plot sizes was estimated for each species sampled in the 6 Level IV vegetation types (Table 5). These estimates were calculated by multiplying the mean time in seconds by the within-site estimated sample size, and then dividing by 60 to obtain minutes. Within-site estimated sample size was obtained by taking the sum of the number of sites included in the vegetation type and WNHAT from Appendix A, and then dividing that by the number of sites. No single plot size consistently required less time to sample the estimated adequate number of plots than the other two plot sizes (Table 5). The 1-m^2 plot size appears to require slightly less time to sample _Betula glandulosa_ in the woodland black-white spruce and woodland black spruce vegetation types, and _Salix pulchra_ in the woodland black spruce and open tall willow vegetation types. The 4-m^2 plot size appears more efficient for _Betula glandulosa_ in the open mixed spruce-paper birch type, and _Salix pulchra_ and _Salix glauca_ in the woodland black-white spruce type. The 10-m^2 plot size may work well on low growing _Salix pulchra_ in the open low willow vegetation type (Table 5). When the total time for all stems including move time was calculated, however, the 4-m^2 or 10-m^2 plot sizes generally had lower overall time requirements than the 1-m^2 plot size (Table 5).

Travel time may affect the relative efficiency of the different size plots. It may require less time to count stems in the required number of plots for a 1-m^2 plot versus a 10-m^2 plot, but because more 1-m^2 plots are needed, more time is spent moving between plots. This is evident for the open low dwarf birch-willow type where the 1-m^2 plot requires approximately the same or less time than the 10-m^2 plot for most species (Table 5). It was only slightly higher in the one exception. The times to count all species plus move between the plots was almost twice as much for the 1-m^2 plot as for the 10-m^2 plot. These numbers are not directly comparable, but they do represent the presented argument.

When average time in minutes required to sample the density of shrub stems for an estimated adequate number of plots at each site was averaged across all 17 sites for each non-zero plot size, the 4-m^2 plot size had the lowest average time for 5 of the 7 shrub species (Table 6). The 1-m^2 plot size had the lowest required time for Salix pulchra and Alnus sinuata while the 10-m^2 plot size had the lowest required time for total elapsed time including move time (Table 6). This probably resulted because fewer 10-m^2 plots are required, hence fewer move times are added.

To determine if the mean required sampling times were significantly different among the 3 plot sizes, an analysis of variance was conducted using a univariate repeated measures design (Hull and Nie 1981). In this analysis, sites were nested within vegetation types and plot sizes were crossed with sites and vegetation types. The model used was as follows:

$$Y_{ijk} = u + V_i + S_{(i)j} + P_k + VP_{ik} + SP_{(i)jk}$$

where V = Vegetation type (1 through 6)

S = Site (1 through 6)

P = Plot size (1 through 3).

Vegetation type (V_i) was tested with the site ($S_{(i)j}$) error term while plot size (P_k) and the interaction of plot size and vegetation type (VP_{ik}) were tested with the site-plot size ($SP_{(i)jk}$) interaction error term. There was no true error term in this model because there was no true replication.

Using this model, mean time to sample an estimated adequate number of plots was significantly different among the 3 plot sizes for Salix pulchra, Salix glauca, and Alnus sinuata (Table 7). Mean time for the 10-m^2 plot was numerically larger than for either the 1-m^2 or 4-m^2 plots for these 3 species (Table 6), although this was not tested statistically with a mean separation test. The vegetation type - plot size interaction term was also significantly different for Salix glauca, Salix alaxensis, and Alnus sinuata. The mean response of the 3 plot sizes was different among the specific vegetation types. Mean times among the 6 vegetation types were significantly different for Betula glandulosa. This analysis supported the conclusion that the time required to count stems for adequate sample sizes was different among the 3 plot sizes. Statistical evaluation suggested that differences exist for some species. Small sample sizes, and specific selection of particular sites and vegetation types, limited the usefulness of the statistics. Hence, evaluation of plot size based on experience with its use in the field is necessary.

One person could efficiently count stems in the 4-m^2 or smaller plot size. With a radius of 1.13 cm, the 4-m^2 plot approaches the upper limit of the ability of a person to mentally keep track of stems previously counted or those not yet counted. It was easier to use two persons with the 10-m^2 plot but it would be difficult to insure that all stems were counted exactly once with either 1 or 2 obeservers. The 1-m^2 and 4-m^2 plots have small enough radii that an observer can see from the center to the outer boundary without moving their feet. Perimeter judgments were also more easily made by leaning to the end of the rope rather than having to walk to the end of the rope as was the case for the 10-m^2 plot size. Both the 1-m^2 and 4-m^2 plot sizes were faster to set up and use than the 10-m^2 plot size, particularly when maneuvering the rope in tall vegetation such as Salix alaxensis, Alnus sinuata, and Picea spp. The 10-m^2 plot size can be eliminated from further consideration because of potential inaccuracies and difficulty of use.

The 4-m^2 plot size required the least time to adequately sample plots at a site for more shrub species than the 1-m^2 plot size (Table 6). The 4-m^2 plot size also had lower variance of stem density estimates for most dominant species in the vegetation types sampled (Table 3). The 4-m^2 plot was also consistent with density data previously collected from the Susitna River Basin as well as data collected from the nearby Alphabet Hills (Steigers et al. 1983) and U.S.D.A. Institute of Northern Forestry (INF) pre- and post-burn fire inventories. Considering both statistical and practical evaluations of the plot sizes under consideration in this study, we recommend the 4-m^2 plot size as the best of the 3 we tested to use for estimating stem densities in the middle Susitna River Basin. Therefore, only data collected using the 4-m^2 plot size were considered in all subsequent analyses and discussion.

4.1.1 - Allocation of the Density Sample

Although sample sizes in this study were inadequate, we calculated the approximate allocation of sampling effort in terms of relative number of sites within the 6 vegetation types sampled. Using a between-site variance calculated from this study and sample allocation equations from Mendenhall et al. (1977; 64), we estimated the percentage of total sites to sample in a vegetation type to minimize variance for a given cost or to minimize cost for a given variance. For the optimum allocation equation:

$$n_i = (n) \frac{\frac{N_i s_i}{\sqrt{C_i}}}{\sum_{i=1}^{L} \frac{N_i s_i}{\sqrt{C_i}}}$$

where N_i = size of the i-th vegetation type = percentage of hectares in each vegetation type in the Watana and Devil Canyon impoundments and construction zones (McKendrick et al. 1982; 102, 106) from Table 8,

s_i = sample variance between sites within vegetation type i = between mean squares from vegetation type density estimates for total stems of all species combined (Appendix A), and

C_i = the cost at each site = total time per plot including move time (Appendix B) multiplied by average number of plots needed per site for adequate sampling (Appendix A).

Using the approximate allocation formula which minimizes the cost for a fixed variance, 15% of the effort in terms of the percentage of total sites sampled for density estimates among the 6 vegetation types would be conducted in the woodland black-white spruce type. Similarly, 66% of the sites would be conducted in the woodland black spruce vegetation type, 1% in the open mixed spruce-paper birch type, 0.03% in the open tall willow type, and 18% in the open low dwarf birch-willow type. The open low willow vegetation type was not used in the equation because there was only one site sampled and no between-site variance. Similarly, other vegetation types which were not sampled did not appear in the equation. This exercise was a method to allocate cost given reasonable variance estimates. Validity of the between-site variances computed for the data collected in this study should be weighed against the limited number of sites sampled in each vegetation type.

Given the allocation of the percentage of total cost that should be accomplished within each vegetation type, a maximum cost based on the maximum amount of work that could feasibly be executed out of Watana

Base Camp could be estimated. Assuming the 7 week period from July 16 - August 31, 1984 and a 5-day work week, 34 total work days would be available. Further, assuming 10 2-person work crews that could complete 1 site per day (density plus clipping individual shrubs), up to 340 sites could be sampled for density of shrub stems during that time period. Using the percentage of cost allocated to each vegetation type and 340 sites as the maximum cost, density would be sampled at 51 sites within the woodland black-white spruce vegetation type. Similarly, 222 sites would be sampled in the woodland black spruce type, 4 sites in the open mixed spruce-paper birch type, a minimum of 2 sites in the open tall willow type, and 61 sites in the open low dwarf birch-willow vegetation type.

A number of problems are apparent with the use of the foregoing allocation of cost estimates. As mentioned previously, not all vegetation types considered important for supplying forage for moose are represented in the analysis. A related problem is that for the vegetation types that are included, the area of the middle Susitna River Basin that is the basis for their size or importance (N_i) in the equation is the percentage of the Watana and Devil Canyon impoundments and construction zones occupied by that type. This disregards vegetation adjacent to the impoundments that may be important to moose. A more realistic approach may be to weight certain areas or certain vegetation types based on their locale or vegetative composition. Areas or vegetation types that are of greater importance to moose could be weighted more heavily in the allocation of sites while their converses could be weighted less heavily. Additionally, the fixed variance estimate used in the optimum allocation equation was for total stems of all species, including <u>Betula glandulosa</u>. If food habits studies document that <u>Betula glandulosa</u> is not a significant food item in moose diets, this species may not be sampled during the full-scale browse inventory. If <u>Betula glandulosa</u> were excluded from the analysis, the between mean squares (BMS) as well as the within site estimated adequate sample size (WNHAT) would probably increase for the vegetation types in which it occurred (Appendix A). Finally, the cost estimates from Appendix B do not include travel time to a site and the time required to set up each transect. Travel time is directly dependent on the location of the site and, on an average, may be similar among most vegetation types. Transect set-up time may be considered a constant among the vegetation types for this exercise although in practice is probably takes longer in the denser and taller vegetation with profuse undergrowth.

4.1.2 - <u>Another Approach for the Density Sample</u>

A more realistic approach to the problems of the preceding allocation of density plots would be to consider other information that would increase the usefulness of the estimates. One way would be to remove <u>Betula glandulosa</u> from consideration as an important forage item for moose. Although moose food habits research from this study area has not yet documented the relative importance of <u>Betula glandulosa</u> in moose diets, other studies such as those in Denali National Park have suggested that this species is a minor component relative to other shrub species (V. Van Ballenberghe, <u>personal communication</u>). Steigers et al. (1983) reported low utilization of <u>Betula glandulosa</u> twigs in 9 of 10 vegetation types in the middle Susitna River Basin. Based on the results of those studies, the anticipated results of the moose food habits study, as well as personal observation of the utilization of Betula glandulosa relative to other shrub species, B. glandulosa will probably not be sampled in the full-scale browse inventory. Thus it will be deleted from consideration in this section for stem density estimates as well as for the elapsed time to sample density plots.

Another method to provide a more realistic sample size estimate would be to decrease the width of the confidence interval around the mean by decreasing the confidence level from 80% to 67%. For these types of studies, being correct 2 out of 3 times is a realistic level considering the extent of sampling effort, the inherent variation in the variables we have sampled, and the level at which sites were grouped into vegetation types.

The results of deleting Betula glandulosa from the pilot study 4-m^2 density and elapsed time analysis and using 67% confidence for both are shown for vegetation types in Appendices C and D, respectively. The number of plots required per site and the number of sites required per vegetation type to adequately sample increased substantially for total stems of all species in most types over those shown in Appendix A. This occurred in spite of the decrease in level of confidence from 80% to 67% in vegetation types where Betula glandulosa was a major component of the sampled species composition. As expected, however, these estimates more closely approximated the variability associated with sampling density of the rarer species such as the Salix spp. and Betula papyrifera. Average elapsed time to count all stems and move to the subsequent plot decreased by the number of seconds required to count Betula glandulosa stems (Appendix D).

Allocation of sites to the 5 vegetation types for this pilot study (open low willow type dropped out because there was only 1 site) could be expanded by utilizing modified stem density information from studies conducted in 1982 by Steigers et al. (1983). Although sampling times are not available for the vegetation types sampled in that study, total times to count stems in 4-m^2 plots were probably close to the times required for vegetation types with similar species composition and stem densities sampled in this pilot study. Average stem density for the shrub species sampled in this study, exclusive of Betula glandulosa, for 3 vegetation types not sampled during this pilot study but sampled in 1982 are shown in Appendix E. The vegetation types sampled for density in 1982 using 4-m^2 plots were the open white spruce, open black spruce, and open low dwarf birch types.

A summary from Appendices C, D, and E of number of sites sampled, elapsed time per plot including move time, and number of 4-m^2 plots per site, minutes required to sample a site, and number of sites per vegetation type required to sample total stem density within 20% of the mean with 67% confidence is shown in Table 9. Information from both this pilot study and data modified from Steigers et al. (1983) are given in Table 9. Time to count stems, exclusive of Betula glandulosa, and move to the subsequent plot for the 3 vegetation types sampled during 1982 was estimated from pilot study vegetation types similar in species composition and density.

A modification of Table 8 to reflect the 3 additional vegetation types is shown in Table 10. The Watana and Devil Canyon impoundments and construction zones were retained in Table 10 rather than expanding the area because these zones will receive maximum impact from installation of the dams. Additionally, the area estimates for these zones were taken from 1:24,000 scale vegetation maps which are the largest scale and most precise vegetation maps currently available for the area.

The use of estimated sample sizes for total stem density rather than sample sizes estimated for individual species may be justified by assuming that, with the exclusion of Betula glandulosa and possible exception of Alnus sinuata, the remaining shrubs we sampled are equally utilized for forage by moose. With few exceptions, every dominant species of Salix is browsed by moose in the middle Susitna River Basin. Steigers et al. (1983; 192) reported up to 33% utilization of available twigs on Alnus sinuata in the study area. Although browsing pressure is localized and a function of the availability of other plant species, we will assume here that total stem density can be used because browsing pressure is relatively constant across all remaining shrub species that we sampled.

Optimum allocation of the cost for sampling density of the 8 vegetation types given in Table 9 can now be undertaken. Using between-site variances from Appendices C and E, the percentage of cost in terms of effort expended to sample density in the 4-m^2 plots is shown in Table 11. Seventy-three percent of the total effort would be expended in the 3 vegetation types included from Steigers et al. (1983) (Table 11). Using this formula for allocation of effort based on variances calculated from available data, 79% of the total effort would be concentrated in spruce forests and approximately 21% in the shrub types. The open low willow vegetation type was not included in this allocation.

Based on time required to sample an estimated adequate number of plots per site within 20% of the mean with 67% confidence for the 8 vegetation types for which data is available, density estimates could be conducted by 1 person within 2 hours (Table 9). If we assume that individual shrubs would also be clipped at each site, 2-person crews were working at each site, crews could be moved by helicopter or walk to a second site at least once each day, 10 2-person crews worked 5 days per week, and 34 work days were available, then up to 680 sites could be sampled. Narrowing the confidence limit around the mean would decrease the number of sites that could be accomplished if the number of required plots/site increased over that which could be accomplished in ½ day. The time to clip individual shrubs needs to also be considered in the time estimate to accomplish all phases of the work required at each site. Table 11 shows the allocation of the 680 sites to the 8 vegetation types for which data is available in the middle Susitna River Basin. A minimum of 2 sites are required in each vegetation type considered important to moose.

4.2 - Weight Per Individual

The primary statistical analysis for the weight per individual involved stepwise regression analysis relating dry current growth twig weight or dry twig plus leaf weight to various independent variables. Potential dependent variables included wet weights for twigs and leaves combined for each height category or dry weights for twigs and leaves separately for each height category or combinations. Dry weights were selected to eliminate the effects of variable moisture. Twig weights were emphasized rather than total or leaf weights, since winter browse was the primary area of concern although total dry weights were used in some analyses. Height categories were not considered in the analysis in order to reduce the number of computer runs needed.

Height categories were also ignored in the initial analysis because of assumptions made in the field. Initial ocular estimates were made for twigs and leaves separately for each height category, and each component was bagged that way in the field. This was extremely time consuming and tedious (particularly in the rain). In the interest of obtaining data on a number of shrubs in a number of sites, we decided to estimate total weight, clip and bag by height category, and separate twigs and leaves after they were dried. We assumed that a percentage of the total weight could be assigned to each component. Initial regression analyses indicated very different results for total dry weight and dry twig weight. Hence, our assumption of constant proportions appeared to be false. This could be further analyzed using the initial data where components were individually estimated and sampled. However, this has not been done yet because of the overall poor results of the double sampling.

Dry weight versus ocular estimate was plotted for each observer for each species (Appendix F). There was no indication of nonlinearity so untransformed estimates were used in future analyses. Slopes and intercepts of lines derived from least-squares estimates appeared different for different observers. However, many times the slopes appeared similar (Table 12). To simplify initial regression analysis, runs were made without distinguishing observers for the ocular estimate. A later section will deal with a more detailed analysis of this.

Raw independent variables included basal diameter, height of plant, crown depth, width, right angle, and ocular estimate of total current growth. Dry weight was plotted against each independent variable for the four major species (*Betula glandulosa*, *Salix pulchra*, *S. glauca*, and *S. lanata*) to determine what mathematical transformations might be appropriate, if any (Appendix G). Most graphs appeared relatively linear with only slight curvature. Basal diameter, width, and right angle measurements showed some tendencies toward curvature but it was not consistent with all species (Table 13). One objective that we were trying to accomplish was to use the same techniques regardless of species so there would be consistency of measurements for the full-scale inventory.

The original crown dimensions were transformed into simple crown area and crown volume estimates by multiplying width by right angle and this area by height or depth. Stepwise regression analyses were performed for dry twig weight of each species using the original and transformed variables. Ocular estimates were used without regard to observer for these initial runs. Results are summarized in Table 14. Later runs included dummy variables to account for intercept differences among observers, but results were not greatly improved.

Ocular estimates consistently gave the best results or were a close runner-up with few exceptions particularly for the more common species (Table 14). This appears to be the one best measurement that is useful for all species. Results for Betula glandulosa and Salix pulchra were not very good for any variables (Table 14). These species are probably the most abundant and the most time consuming to clip. In other words, where double sampling could be the most benefit it did not seem to help much as evidenced by the clipped to estimated ratios (Table 15). Note that these times are field times only and do not include laboratory or data analysis time.

Residuals were plotted against the predicted values for each species. All plots indicated increasing variance of the residuals with increasing predicted values. This violated the assumption of homogeneity of variances and suggested the usage of logarithmic transforms or weighted regression analysis (Draper and Smith 1966). The logarithm of dry weight and dry twig weight were used as dependent variables while the original shrub measurements and their logarithmic transformations were used as independent variables in a stepwise regression analysis. Results are summarized in Table 16. The residual plots appeared random but the correlations were smaller than in the original model in most cases. This transformation of the dependent variable (dry weight, dry twig weight) introduced a bias when converting data back to the untransformed data space. This could be corrected using the formula in Baskerville (1972) and others. However, it was never calculated because of the low r^2. The transformed equations would have been selected for final analysis since they did not violate the assumption of homogeneity of variances even though the model did not appear to be greatly improved. This was at the suggestion of a biometrician (Suzanne Miller, ADF&G).

Regressions using the logarithmic transform were analyzed and were summarized in Table 16. The plots of residuals for all species appeared relatively random; however, the correlations and standard error of estimates were generally not improved with the logarithmic transformation. Betula glandulosa correlations for dry twigs dropped from 0.48 to 0.11, Salix pulchra went from 0.69 to 0.20, S. glauca stayed about the same, S. lanata went from 0.89 to 0.72, Alnus sinuata went from 0.70 to 0.51, and S. glauca, Betula papyrifera, and S. alaxensis remained about the same. Ocular estimate, basal diameter, and depth appeared to be the best variables.

Differences among observers for ocular estimates were further analyzed using covariance analysis for each species separately since the ocular estimate appeared to be the best single variable. The dependent variable was the log of dry twig weight, covariate was ocular estimate of current fresh weight, and groups were observers. Table 17 summarizes the slopes by observer and for all observers for each species while Table 18 summarizes the degrees of freedom and probability levels for testing the hypotheses of equality of adjusted means, significance of covariate (zero slope), and equality of slopes between groups.

Slopes of the covariate were significantly different for observers for Betula glandulosa, Salix alaxensis, and Betula papyrifera (Table 17). The relatively small sample sizes for the last two species should be noted. The slopes for Salix glauca showed a tendency toward inequality among observers while those for S. pulchra and S. lanata appeared to be not significantly different. Comparison of the actual calculated slopes, however, indicated that the slopes were numerically different. Hence, regression estimates would be improved by taking the observers into account. The dummy variable analysis that was actually performed accounted only for different intercepts, not different slopes, into account for observers. This could by why the addition of dummy variables for observers did not improve results, especially since the intercept should have an expected value of zero.

The negative slopes for two observers for Betula glandulosa were interesting and might be an artifact of the ocular estimates being made for total leaves and twigs, rather than just dry twigs (dependent variable). The negative slopes also occurred with untransformed data. This might also account for some of the poor correlations. No good explanation has surfaced yet.

Analysis of covariance results indicated that the dry twig weight clipped generally did not vary among observers except for Salix alaxensis and some tendency for S. lanata and S. glauca (Table 18). The covariate of ocular estimate (slope not equal to 0) was very significant in almost all cases while the differences in slopes were significant about half the time. Since inequality of slopes (regression coefficient of ocular estimate for each observer) violated an assumption this actually invalidated the other conclusions of the covariance analysis.

An interesting sidelight of this analysis developed when the "time to ocularly estimate the total fresh weight" rather than "dry twig weight" was used as the dependent variable for the covariate analysis. This assessed whether observers differed in their estimation times and whether the size of the ocular estimate affected the time. A glance at the results indicated that sometimes observers were significantly different in their estimation times, regardless of the size of the estimate (Table 19). At other times observers were not different, but the size of the estimate was significant in affecting estimation time. Sometimes site differences were confounded with the observer for less common species such as Salix alaxensis. The slopes of the regressions were generally statistically constant with respect to observers. This analysis was not critical to the computation of biomass; however, when expanded to other measurements besides the ocular estimates, it might indicate some human engineering factors that should be included in training sessions.

4.2.1 - Discussion of Shrub Dimension Data

Overall the results of the double sampling aspects of the study were not as good as one might hope in order to save field time in a future full-scale inventory. Correlations of inexpensive measurements with expensive weights were lowest where costs were highest. Two people in the USFS who have done similar studies were contacted to see if they had any success in double sampling Alaskan shrubs. One reported negligible success in predicting current growth for several shrub species while the other reported excellent success for the one species, Salix barclayi, that he measured. The second researcher observed that the shrubs he used had a consistent growth form and were generally unbrowsed. He suspected that browsing would alter the growth form and would make prediction equations less precise and less accurate. Most of our shrubs were browsed. Perhaps better fit could be obtained by using shrub characteristics such as degree of browsing or size class or environmental factors such as slope, aspect, or surrounding shrub density as grouping factors.

Each shrub species had its own structural characteristics which affected clipping. Betula glandulosa usually had many short, thin current growth twigs which were tedious to clip. The leaves were attached to small, stiff protrusions that made stripping leaves from twigs difficult. Many branches existed because the shrub is strongly branching. Salix pulchra was similar in having many short twigs but the leaves were easier to strip. These characteristics made those two species time consuming to clip. Salix glauca and S. lanata were similar in having more robust current growth that was easier to clip and strip leaves from twigs. Larger leaves and twigs may have made estimation easier. Salix alaxensis was the most robust of all the willow species with current twigs reaching lengths of over 1 m. Hand clippers could be used efficiently to cut these twigs. For the amount of material on an individual, it was probably the fastest to clip. Alnus sinuata and Betula papyrifera had more widely scattered twigs and leaves than the other species. Betula papyrifera was frequently hedged. These growth factors may have affected the prediction equations and efficiencies.

4.2.2 - Weight Per Individual Times Stem Density

Means of dry weight per individual and dry twig weight per individual were calculated for each species on a vegetation type basis

(Tables 20-25). Means and crude variances for the weight per area were calculated by multiplying the average weight per individual of a species in a site by the average density (4-m^2 plots) per site and grouping sites by vegetation types. These calculations were crude at best because within-site variances were not taken into account. The variance of the product was obtained by treating the product of weight per individual and density for a site as actual measurements (no variance) as opposed to considering their variance within a site and their covariance. The variance could only be reported where the species was sampled in more than one site per vegetation type. Data from clipped plots are also considered here for comparison, but these data are also very limited by sample size. Hence, comparisons of weight per area are crude. Sometimes means and/or variances were reported for the product but not for clipped plot (Tables 20-25). This occurred because the species might have occurred in clipped plots but individuals were not clipped or vice-versa.

No statistical analyses were used to test differences between the product and the clipped plot weights, so all comparisons are based on numerical and not statistical differences. Clipped plots for Salix pulchra in the woodland black-white spruce type contained an average of 1 g dry twigs/10 m^2 while weight times density indicated 31 g/10 m^2 (Table 20). The estimates for Salix glauca were close, however.

The two techniques produced similar values for Salix pulchra in the woodland black spruce type although the clipped plot variance was much larger (Table 21). Salix lanata dry twig weights were much smaller for the clipped plots than for the weight times density technique. Alnus sinuata had larger dry twig weights (5 g) in the clipped plots than in the weight times density for open mixed spruce-paper birch type (Table 22).

The clipped plot technique resulted in larger weight estimates for Alnus sinuata, Betula papyrifera, and Salix alaxensis in the open tall willow vegetation type, although the latter values were comparables (Table 23). Values for Salix pulchra were smaller. Variances for clipped plots were generally much larger; however, the limitations of the input data may account for a large proportion of the differences.

Clipped plots resulted in larger weight estimates for Salix pulchra and Betula papyrifera in the open low dwarf birch-willow vegetation type while values were smaller for Salix glauca and S. lanata (Table 24). Responses of variance differed: Salix pulchra had larger values for clipped plot, S. glauca variances were about the same, and S. lanata had larger variances for weight times density.

Because of the extremely small sample size (n=19) for the weight times density method and the crude variance calculations, it was not considered reasonable to carry the analysis beyond this point at this time. This study and ensuing discussions with statisticians have revealed many problems with techniques for using a product of 2 random variables with proper sampling designs as well as with later calculations. Considering the small sample sizes in this study, perhaps a future analysis could be performed without regard to vegetation type (although it would still be very limited). Each species at each site would then be represented by a density, twig weight per individual, and clipped plot parameter. Overall means and variances could be calculated and compared.

4.3 - Clipped Plots

Current annual growth twig and leaf biomass for shrubs in clipped plots is shown by site and vegetation type in Appendix H. Means are shown on a grams per 10 m^2 basis for comparison with density/clipped individual estimates. Other statistics are also given, as described for Appendix A. A summary of clipped biomass for vegetation types in Appendix H is shown in Table 26. Betula glandulosa was a dominant component of clipped twig and leaf biomass in the woodland black-white spruce, woodland black spruce, and open low dwarf birch-willow vegetation types. Approximately one third of the total twig and leaf biomass in the open low dwarf birch-willow type was Salix pulchra, whereas 100% of the biomass occurring in the open low willow type was S. pulchra. Approximately 83% and 15% of the twig biomass and 79% and 18% of the leaf biomass was Salix alaxensis and Alnus sinuata, respectively, in the open tall willow vegetation type (Table 26). The open tall willow and open low willow vegetation types had the greatest total twig and leaf biomass of the 6 types sampled, whereas the open mixed spruce-paper birch had the least (Table 26).

The open low willow vegetation type required the longest average time to clip 1-m^2 plots (Table 27). This was partially due to the dense growth of Salix pulchra (Table 26) at the single site in this vegetation type (Table 1). However, this site (3) was also the first site sampled; thus, some time for organization and discussion of techniques was undoubtedly hidden within the clip time for the 6 plots conducted there. Plots in the open low dwarf birch-willow vegetation type required about 7-8 minutes longer to clip than plots in either of the spruce-dominated types (Table 27). This was probably partly because of the dominance of both Betula glandulosa and Salix pulchra in the open low dwarf birch-willow vegetation type and also because this type had an average current growth approximately twice as great as either of the spruce types (Table 27). Although the open tall willow type had the greatest average twig and leaf biomass, only one vegetation type had a lower average time to clip (Table 27). Salix alaxensis and Alnus sinuata, both predominant within the 2 sites sampled in the open tall willow type, were substantially easier to handle and less time consuming to clip than other shrubs because of their robust growth of new leaders.

The open mixed spruce-paper birch vegetation type required the least time to clip plots (Table 27). The average time to clip 10 plots at site 16 was 117 seconds, but was 0 seconds at site 17. Few of the shrubs we sampled were found in this vegetation type, and then they only occurred in low density (Table 2). Many of the clipped plots in this type were devoid of the shrub species we sampled.

The time required to move 10 m to the subsequent plot, establish it, and prepare to clip it ranged from 2-2.4 minutes at 4 of the vegetation types (Table 27). Move time averaged 1.5 minutes at the 4 sites in the woodland black spruce vegetation type. Only 54 seconds was required in the open mixed spruce-paper birch type (Table 27). A move time of about 2 minutes could be used as a general average for all vegetation types if clipped plots were spaced 10 m apart.

Average time in minutes required to clip an estimated adequate number of plots was obtained for each measured species in the 6 sampled vegetation types (Table 28). Calculations were performed as described for Table 5. All estimated times for individual species in Table 28 are approximations because only the total elapsed time to clip the vegetation in each plot was recorded. The time required to clip twigs and leaves of each species was allocated based on the percentage of total dry weight clipped. Although this is a rather crude approach, it is probably a fairly accurate approximation for most species except Salix alaxensis and Alnus sinuata in the open tall willow vegetation type. Both of these shrubs growing in this type produced robust leaders that were relatively easily handled and quickly clipped. The allocation of time to clip these 2 species might have been too high had other species that were more time-consuming to clip (e.g. Betula glandulosa and Salix pulchra) made up a substantial proportion of the total biomass (Table 26). However, the only other species clipped within the open tall willow type were minor components of the total biomass (Table 26). Betula glandulosa was the most tedious shrub to clip and required the most time input per unit weight of biomass collected. Thus the time required to clip Betula glandulosa is probably underestimated relative to its percentage of the total biomass clipped.

4.3.1 - Allocation of the Clipped Plot Sample

The approximate allocation of sampling effort in terms of number of sites within the 6 vegetation types sampled could be calculated even though the sample size was very inadequate. Using a between-site variance calculated from this study and Mendenhall et al.'s (1977; 64) sample allocation equation described previously, minimum cost estimates were calculated in terms of a percentage of a maximum number of sites could be allocated to each vegetation type. Using this formula which minimizes cost for a fixed variance, 24% of the effort in terms of the percentage of total sites sampled for clipped plots among the 6 vegetation types sampled would be conducted in the woodland black-white spruce type. Similarly, 56% of the sites would be conducted in the woodland black spruce vegetation type, 8% in the open mixed spruce-paper birch type, 2% in the open tall willow type, and 10% in the open low dwarf birch-willow type.

As previously discussed, the open low willow vegetation type dropped from the equation because there was only a single site. Again assuming a maximum of 340 sites as described for the 4-m^2 density plots, 82 sites would be sampled using clipped plots within the woodland black-white spruce vegetation type. Up to 190 sites would be sampled in the woodland black spruce type, 27 sites in the open mixed spruce-paper birch type, 7 sites in the open tall willow type, and 34 sites in the open low dwarf birch-willow type.

4.3.2 - Another Approach for the Clipped Plot Sample

Discussions with project personnel subsequent to collection of pilot study data have revealed the priority of information on winter forage for moose. In this pilot study both twig and leaf current annual growth was clipped. Leaf current annual growth was clipped to determine summer biomass. The time required to clip 1-m^2 plots could be substantially reduced if leaves were not taken. The elimination of Betula glandulosa as a viable source of forage for moose would also substantially reduce clipping time, especially in vegetation types dominated by this shrub species (e.g. open low dwarf birch type). As previously discussed for the density plots, decreasing the confidence interval around the mean by decreasing the level from 80% to 67% may give more realistic sample size estimates.

The results of deleting Betula glandulosa and the leaf current growth of all shrubs from the clipped plot analysis, and using 67% confidence, are shown for each vegetation type in Appendix I. The interpretation of differences in sample sizes for the two techniques is difficult because of the limited sample size and the adequacy of current sampling. For a reliable interpretation, the paired values of N, NHAT; WN, WNHAT; and BN, BNHAT should have the first number as the larger. In other words, the existing sample size should be at least as large as the estimated sample size, or somewhere near there. If 20 plots were sampled as for the open mixed birch-spruce type and the estimated sample size was 209, the reliability is questionable (Table H11). Similarly one would not sample 820 sites based on a number calculated from 2 sites. Woddland black spruce and low dwarf birch-willow were the only types with a reasonable estimate of current annual growth within a site (Tables H8, H20). A reasonable number of sites was sampled only in the low dwarf birch-willow vegetation type (5 sites sampled, estimated that 5 sites were needed, Table H20).

However, in the second analysis without *Betula glandulosa* and leaves, none of the numbers appear acceptable based on estimated sample size, with the possible exception of those for dwarf birch-willow (Appendix 2). It appears that more plots per site will be needed if *Betula glandulosa* and leaves are not clipped, however, each plot will be sampled much more rapidly. The ubiquitousness of *Betula glandulosa* apparently reduced variances and increased means so that estimated sample sizes were smaller.

Data collected from 0.5-m^2 clipped plots collected by Steigers et al. (1983) in the middle Susitna River Basin was modified to reflect total twig current annual growth of the shrubs sampled in this pilot study (Appendix J). The same 3 vegetation types included in the density analysis, and summarized in Table 10, were used here for expanding the number of sampled vegetation types. For this analysis, the 0.5-m^2 and 1-m^2 clipped plots from the two years data were not differentiated.

Elapsed time to clip twigs of all species, except *Betula glandulosa*, was calculated as a percent of total time to clip twigs and leaves (Table 29). A minimum of 30 seconds to clip a plot was established. Elapsed time to clip plots includes move time (Table 29). A summary of Appendices I and J showing plots per site and sites per vegetation type required to sample twig current annual growth within 20% of the mean with 67% confidence is depicted in Table 29. Time required to sample an adequate number of clipped plots ranged from 22 to 169 minutes among the 9 vegetation types sampled. Sites in 6 vegetation types could be sampled within approximately 1 hour (Table 29). The average time across the 8 vegetation types was 71 minutes. In actuality, it would probably take at least ½ day to sample a site including travel and set-up time.

Optimum allocation of the cost to clip plots in the 8 vegetation types given in Table 29 can be derived. Using between site variances from Appendices H and J, the percentage of cost in terms of effort expended to sample clipped plots is shown in Table 30. Using these variances and excluding Betula glandulosa, 70% of the total effort would be expended in the spruce-dominated forests. Approximately 29% of the effort would be concentrated in the shrub types (Table 30).

Assuming 680 sites were the maximum that could be sampled for clipped plots, as described for 4-m^2 density plots, approximately 90% of the sites would be allocated to the open white spruce, open black spruce, and open low dwarf birch types (Table 30). These 3 vegetation types were sampled using random placement of sites by Steigers et al. (1983). A combination of between site variation and the planar area dominance of these 3 vegetation types among the types sampled resulted in the allocation of effort shown in Table 30.

5 - DISCUSSION OF DENSITY-WEIGHT PER INDIVIDUAL AND CLIPPED PLOTS

5.1 - Density-Weight Per Individual

The 4-m^2 plot was selected as the overall most efficient size to use for sampling density of the selected shrubs in the middle Susitna River Basin. It was chosen considering both the statistical and practical implications of the 3 plot sizes investigated, as well as its consistency with previous and related studies. Average time required to count stems in the 4-m^2 plot could be substantially reduced if Betula glandulosa stems were not counted where it occurs as a dominant species. One observer can efficiently count stems and record the information while using the 4-m^2 plot.

A number of problems exist with using density estimates for the intended purpose of combining them with weight per individual to produce weight per area. Stems in a 4-m^2 plot cannot efficiently be counted by height category. Some knowledge of the heights of species in the density plots is required unless it is assumed that the average distribution of heights within density plots is the same as the distribution of heights of individuals selected to be clipped. The number of shrubs of each species required to adequately sample total twig biomass would probably be greatly increased if the variability associated with clipping by height category were introduced. The results of this pilot study have shown that maximum height of a clipped individual is poorly related to total current annual growth dry weight of twigs, and even more poorly related to twig dry weight of the 3 height categories we used. Average height of each species within the density plot is a gross measure and is probably no better related to twig biomass than maximum height. Crown shapes of the shrubs of interest in the middle Susitna River Basin have been altered, severely in many cases, by browsing. Plant heights result from the degree of browsing, growth during the summer, and to summer browsing of terminal twigs. Because of site variation, it is necessary to sample weights of individuals in the same area (site) as the density estimates were taken. Within-site variances will not be available if they are not sampled at the same site. These questions of statistical independence have yet to be resolved. Counting stems by basal diameter is time consuming and, as we have shown in this study, basal diameter is poorly related to twig biomass. Basal diameter classes could be a form of stratification, but this was not examined in this study.

Overall average weight by height category of a species multiplied by the average stem density per area of the "average size" individual counted in a 4-m^2 plot will produce at best only the average weight per area of a height category based on those average-sized individuals. And unless density and weight per individual sample are taken at the same site, this information will be available only on a vegetation type basis. Better methods are available.

Each individual stem for each species requires up to 3 labelled bags for the clipped twigs if the same 3 height categories are used in the main browse inventory. Each bag must be handled individually and it, or its associated number, must go through no fewer than the following 6 steps: 1) weigh and record wet weight (if required in field); 2) clean leaves from twigs; 3) oven dry; 4) weigh and record dry weight; 5) enter data into computer; 6) and data analysis. More laboratory time will be required if the number of bags of samples generated from clipped individuals exceeds those generated by clipped plots. This would occur if the number of clipped individuals of all species required at a site exceeded the number of required clipped plots. This would probably be the case if individuals were clipped by height category. Dry weights of twigs clipped from individual stems were often very small (e.g. below 0.05 g). Variability can be excessive when fluctuations in weight of twigs in height categories range from very small values to relatively larger values. It is also difficult to clip to this fine accuracy and overestimations can be made if values are rounded up.

Density data files must also be merged with individual stem weight data files to multiply the 2 estimates together. This merging is an extra step not required for the clipped plot data. Extra analysis costs should be expected with the density-weight per individual data sets. The files will be larger, take more time to organize, require more manipulations to produce the desired result, and there are still unresolved questions about combining the variances. We have probably spent at least 5 times longer on these data sets, excluding the plot size and double-sampling analysis, than on the clipped plot data.

5.2 - Clipped Plots

Only the 1-m^2 clipped plot was tested for this pilot study. Steigers et al. (1983) used a 0.5-m^2 rectangular plot for clipping current annual growth of forbs, graminoids, and shrubs. Although the 0.5-m^2 plot required less time to clip, the 1-m^2 plot may be better where only shrubs are of interest. The larger size plot is more important where branching is open and diffuse, and where many of the shrubs of interest are relatively rare in many areas. The pattern of clumping should be investigated before the size of clipped plots is decided.

Plot size and shape may be worth some further consideration. Circular plots were chosen because we could use a rope on a stake to delimit the area. This minimized field equipment that we needed to transport in the helicopter. The rope was frequently pulled hard enough against a sometimes wobbly stake to expand the area slightly. Also the observer had to hold the rope to find the boundary, then clip, then hold the rope again. Sometimes the rope was even clipped. The rope could also be raised and lowered which affected the radius. Circular plots minimize boundary decisions because a circle provides the smallest perimeter:area ratio. Circles, however, tend to encompass less variability than long, narrow plots under many vegetation patterns, although this is not always true. The size may also affect this.

Rectangular or square plots could be delimited using folding frames, as opposed to fixed frames used by Steigers et al. (1983), but these would introduce errors comparable to pulling on the stake. These shapes increase the boundary decisions but more variability is frequently encountered in one long, narrow plot than one circular plot of the same area. This would reduce the between-plot or within-site variance.

Depending on the scale and type of pattern, a different size plot from 1-m^2 may be beneficial. If the scale of clumping is much larger than 1 m^2, 0.5-m^2 plots may not have a much larger variance, but the clipping time would be reduced. A plot sufficiently large to reduce the variance greatly may require an unreasonable time to clip, so no benefits would be gained. Changing the size or shape of the plot may be a consideration, but we know of no studies in the boreal forest regions that have evaluated this.

Average time to clip 1-m^2 plots would be substantially reduced if <u>Betula glandulosa</u> was excluded from the species of interest and if only twigs were clipped. Leaves would probably still need to be separated from twigs clipped for some species (e.g. <u>Salix pulchra</u>) because the twigs are small and frail and the leaves are tightly attached. This separation will be necessary either in the field or laboratory regardless of whether plot or individual stems are clipped. Two persons would work more efficiently at clipping 1-m^2 plots than would only one person, if the vegetation were dense. Generally, one person would probably be more efficient in a 1-m^2 plot in these vegetation types to reduce interference between people.

Estimates of average weight per area and associated variances for clipped plots are based on sample sizes ranging from 3 to 10 plots per site. Eleven of the 16 sites sampled had less than 10 clipped plots, one site was not sampled. Hence, less information is present in these results than in the density-weight per individual results. Larger sample sizes for all measures would give a better basis for comparing the methods.

A number of problems also exist for the clipped plots. Plots were not clipped by height category in this pilot study. Clipping by height category may increase total clipping time by up to 2 times. Part of this would be due to the time required to establish the height categories in the plot as well as the increased number of bags to be labelled. Similar to the density and weight per individual, adding height categories will also probably increase the estimated sample size. However, with the time saved by not clipping Betula glandulosa or leaves, the time increase required to clip by height categories may be more than offset.

Fewer bags may be required to be dried and weighed if the number of clipped plots to adequately sample a site is less than the number of individual stems for all species required to adequately sample weight per individual.

One of the most important advantages of clipped plots is that weight by species per plot is converted to weight per larger area simply by multiplying by a constant. This also holds true for weight per area by height category if plots are clipped by height cateogry. Data files are smaller and conversions to biomass per area are very straight forward using data collected from clipped plots. Data file manipulation and analysis to achieve the desired result is minimal. Variances are relatively easy to calculate.

6 - RECOMMENDATIONS

Clipped plots are recommended for use in the main browse inventory based on results of this browse pilot study, our experience in the analysis of these data, our past experience in sampling vegetation in the area, and accepted inventory techniques. We cannot recommend a plot size since no comparisons were made.

If the density x weight per individual method were selected, as might be if there were existing density information or if density were needed for some other purpose, then we recommend the following:

1) Use 4-m^2 circular plots spaced systematic-randomly at least 10 m apart for counting stems. Longer distances between plots would maximize within-site variability and minimize between-site variability. A viable method to relate stems counted in density plots to clipped individuals, but having independent samples short of clipping all individuals (or a random sample thereof) in the density plot, could not be determined. No double-sampling technique we tested held good predictive ability, especially when height category was considered.

2) Clip twigs of systematic-randomly chosen individual stems of each species by height category. A large enough sample should be taken to ensure the range of stem sizes has been sampled.

Since a large scale browse inventory is being contemplated for the middle Susitna River Basin, and because this pilot browse study had such low sample size, we examined what techniques were being used in large-scale inventories in the state; in particular the Cooperative River Basin study conducted by the USFS (United States Forest Service) and SCS (Soil Conservation Service). This study was conducted in the Susitna River basin, and is currently being carried out in the Tanana, and will be performed in other major river drainages. The original techniques used in the Susitna portion were based on past experience and an expectation of how much could be accomplished in a day. Techniques are being improved as more experience is acquired and better determinations of time and estimated sample size are determined. Although the data have not been published, some are in draft publication form and the data are available to the Susitna Hydroelectric Project based on a Cooperative Agreement written in 1980.

All current growth and browse measurements obtained in the Cooperative River Basin Study were procured in plots. Low vegetation below 4.5 ft (1.5 m) was sampled using 2 ft x 2 ft (0.6 x 0.6 m = 0.37 m^2) plots to estimate and clip the current year's growth (twigs plus leaves) for range production. Tall brush information was recorded in 10 ft x 10 ft (3 x 3 m = 9.3 m^2) plots and included productivity and browse (at 5 mm diameter) information. The 5-mm diameter was the assumed diameter-at-point-of-browsing. They used ocular estimates to estimate a weight of some unit (e.g. a branch) in the 100-ft^2 plot, count the number of units, then clip and weigh the one unit to obtain an adjustment factor. They were able to use large plots because they did not clip the entire plot.

Most other environmental assessment sampling procedures with which we are familiar use plots rather than weight per individual times density. We presume this is for simplicity and reliability of data. Weight per area by clipped plots has only the one source of variation while the product of 2 random variables has 2 sources of variation. This is just considering sampling error, and not the very real errors associated with actual measurements.

Since the Cooperative River Basin study included productivity and browse data collected from approximately 80 randomly located sites, we think these variances should also be examined for allocation of sites to vegetation types. One Susitna Plant Ecology team member assisted in the collection of these data in 1980 as part of a cooperative agreement with the Alaska Power Authority. We believe as much existing information as possible should be used in planning for the full-scale inventory.

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TABLES

TABLE 1. Level IV classification of 17 sites (3-19) sampled for the Browse Pilot study during August 1983 in the middle Susitna River Basin.

Level IV	Site #
Woodland Black-White Spruce	10, 11
Woodland Black Spruce	14, 15, 18, 19
Open Mixed Spruce-Paper Birch	16, 17
Open Tall Willow	8, 9
Open Low Dwarf Birch-Willow	4, 5, 6, 7, 12, 13
Open Low Willow	3

TABLE 2. Average density of stems per 10 m^2 for shrubs in level IV vegetation types in the middle Susitna River Basin. Stem density was calculated for 1-m^2, 4-m^2, and 10-m^2 plot sizes in 1983. Stem density from 4-m^2 plots sampled during 1982 (from Steigers et al. 1983) were included for comparison.

	Level IV Vegetation Type [a]																					
				1982							1982							1982				1982
	WB-WS			WS	WBS			MS-B			OS-B	TW			DB-W			DB-W	LW			LW
Species	1	4	10	4	1	4	10	1	4	10	4	1	4	10	1	4	10	4	1	4	10	4
Betula glandulosa	70	65	61	28	93	98	75	1	4	2					68	56	53	38				
Betula papyrifera		1	1						1	1			2	1		1						
Salix pulchra	1	7	3	2	16	11	17		1	1		21	12	8	27	26	20	5	186	116	94	53
Salix glauca	6	3	2	1										1	2	2	3					
Salix lanata						10	2							1	15	11	7					
Salix alaxensis												49	40	30					4	6		
Alnus sinuata				1					<1	<1		3	7	11								
Total stems	77	74	66	32	109	118	94	1	6	5	0	73	60	51	112	96	83	43	190	123	94	53

[a] WB-WS = Woodland Black-White Spruce; WS = Woodland Spruce; WBS = Woodland Black Spruce; MS-B = Open Mixed Spruce-Paper Birch; OS-B = Open Spruce-Paper Birch; TW = Open Tall Willow; DB-W = Open Low Dwarf Birch-Willow; LW = Open Low Willow.

TABLE 3. Within-site variance of stem density estimates in 1-m^2, 4-m^2, and 10-m^2 plot sizes for shrubs in level IV vegetation types in the middle Susitna River Basin.

	Level IV Vegetation Type [a]																	
	WB-WS			WBS			MS-B			TW			DB-W			LW		
Species	1	4	10	1	4	10	1	4	10	1	4	10	1	4	10	1	4	10
Betula glandulosa	3834	1209	1671	5966	3476	1787	5	80	48				4835	1475	801			
Betula papyrifera		1	1					1	6		21	2		4				
Salix pulchra	20	172	52	1178	476	1275		15	2	476	114	69	1686	1108	218	30712	8653	2104
Salix glauca	425	17	15									6	93	45	68			
Salix lanata					352	26						8	1410	484	138			
Salix alaxensis										3915	749	496				208	180	
Alnus sinuata								5	18	35	110	253						
Total stems	3514	1865	1816	6987	4001	2114	5	92	73	4104	1113	339	7850	2300	1051	30655	8324	2104

[a] WB-WS = Woodland Black-White Spruce; WBS = Woodland Black Spruce; MS-B = Open Mixed Spruce-Paper Birch; TW = Open Tall Willow; DB-W = Open Low Dwarf Birch-Willow; LW = Open Low Willow.

TABLE 4. Average time (seconds) to count stems in 1-m^2, 4-m^2, and 10-m^2 plot sizes for 6 level IV vegetation types in the middle Susitna River Basin. Values for individual species do not include time to move between plots and no values include time to locate and establish the transects.

	Level IV Vegetation Type [a]																	
	WB-WS			WBS			MS-B			TW			DB-W			LW		
Species	1	4	10	1	4	10	1	4	10	1	4	10	1	4	10	1	4	10
Betula glandulosa	17	48	64	24	54	69	6	16	10				21	52	67			
Betula papyrifera		1	1					1	7		5	16		2				
Salix pulchra	5	16	20	6	13	25		3	4	9	19	22	14	34	44	91	102	131
Salix glauca	2	5	11									12	4	8	17			
Salix lanata					9	5						4	8	10	13			
Salix alaxensis										30	65	67				5	10	
Alnus sinuata								2	10	5	21	35						
Move time	100	102	80	66	77	94	78	73	101	124	127	127	176	148	158	174	260	251
Total time including move	128	177	250	99	158	197	90	96	137	176	255	313	227	257	303	280	401	420

[a] WB-WS = Woodland Black-White Spruce; WBS = Woodland Black Spruce; MS-B = Open Mixed Spruce-Paper Birch; TW = Open Tall Willow; DB-W = Open Low Dwarf Birch-Willow; LW = Open Low Willow.

TABLE 5. Average time (minutes) to count stems for an estimated adequate number of plots at each site in 1-m^2, 4-m^2, and 10-m^2 plot sizes for 6 level IV vegetation types in the middle Susitna River Basin. Values for individual species do not include time to move between plots and no values include time to locate and establish the transects.

	Level IV Vegetation Type [a]																	
	WB-WS			WBS			MS-B			TW			DB-W			LW		
Species	1	4	10	1	4	10	1	4	10	1	4	10	1	4	10	1	4	10
Betula glandulosa	5	6	11	3	4	5	41	23	44				3	4	3			
Betula papyrifera		7	7					7	10		16	45		14				
Salix pulchra	34	22	42	5	9	19		21	16	4	6	9	4	7	4	56	46	22
Salix glauca	10	4	11									58	8	7	14			
Salix lanata					6	5						27	6	5	4			
Salix alaxensis										17	11	14				41	30	
Alnus sinuata								14	46	10	18	26						
Total all species incl. move time	29	24	40	12	11	11	617	86	155	50	32	21	20	12	11	163	154	70

[a] WB-WS = Woodland Black-White Spruce; WBS = Woodland Black Spruce; MS-B = Open Mixed Spruce-Paper Birch; TW = Open Tall Willow; DB-W = Open Low Dwarf Birch-Willow; LW = Open Low Willow.

TABLE 6. Summary of average time in minutes required to sample the density of shrub stems for an estimated adequate number of plots at each site. Means are by species across all sites for each non-zero plot size.

Species/Time	# Cases	Plot Size 1-m^2	Plot Size 4-m^2	Plot Size 10-m^2
Betula glandulosa	39	22	18	20
Betula papyrifera	10	--	20	32
Salix pulchra	41	25	27	37
Salix glauca	18	18	14	39
Salix lanata	12	48	21	23
Salix alaxensis	8	33	23	27
Alnus sinuata	7	16	30	57
Move time	51	2	2	2
Total time including move	50	130	89	67

TABLE 7. Summary of results of analysis of variance for the time required to sample the density of shrub stems for an estimated adequate number of plots. Sites were nested within vegetation types and plot sizes were crossed with sites and vegetation types.

			Significance of F		
Species	# Sites	# Cases	Vegetation Type	Plot Size	Interaction
Betula glandulosa	13	39	0.01*	0.78	0.26
Betula papyrifera	6	18	0.89	0.22	0.92
Salix pulchra	16	48	0.36	0.01*	0.07
Salix glauca	8	24	0.28	0.03*	0.02*
Salix lanata	5	18	0.29	0.85	0.69
Salix alaxensis	3	9	0.36	0.08	0.05*
Alnus sinuata	3	9	0.48	0.02*	0.04*
Total time	17	51	0.001*	0.51	1.0

* alpha $\leq$ 0.05

TABLE 8. Comparison of vegetation types between the pilot study and McKendrick et al. (1982). Percentages of total mapped area in the Watana and Devil Canyon impoundments and construction zones from McKendrick et al. (1982; 102, 106) are also given.

Pilot Vegetation Type	1982 Vegetation Type	Area (ha)	% of total area
Woodland Black-White Spruce	Woodland Spruce-White	1,633	7.22
Woodland Black Spruce	Woodland Spruce-Black	2,743	12.13
Open Mixed Spruce-Paper Birch	Mixed Open Conifer-Deciduous	732	3.24
Open Tall Willow	--	11[a]	0.05[a]
Open Low Dwarf Birch-Willow	Mixed Low Shrub	1,391	6.15
Open Low Willow	Willow Shrub	289[b]	1.28[b]
TOTAL AREA	22,609	100.00	

[a] Estimated percentage derived from the Open Low Willow vegetation type

[b] Reduced by 0.05% which was assigned to the Open Tall Willow vegetation type.

TABLE 9. Average elapsed time/plot including move time in seconds, and number of 4-m^2 plots/site, minutes/site, and sites/level IV vegetation type required to sample total stem density within 20% of the mean with 67% confidence. Estimates are for selected shrub species in 9 level IV vegetation types in the middle Susitna River Basin. Betula glandulosa has been excluded. Includes data modified from Steigers et al. (1983).

Level IV Vegetation Type	# Sites Sampled	Time/Plot (Seconds)	Plots/ Site	Minutes/ Site	Sites/Vegetation Type
Open White Spruce[a]	7	120[b]	5	10	193
Open Black Spruce[a]	10	110[b]	5	9	366
Woodland Black-White Spruce	2	129	31	67	237
Woodland Black Spruce	4	104	15	26	223
Open Mixed Spruce-Paper Birch	2	81	94	127	240
Open Tall Willow	2	242	5	20	9
Open Low Dwarf Birch[a]	18	158[c]	15	40	1,544
Open Low Dwarf Birch-Willow	6	205	5	17	76
Open Low Willow	1	398	8	53	--[d]

(Table 9 continued.)

[a] Data modified from Steigers et al. (1983).

[b] Estimated time based on similarity of species composition and density to the pilot study woodland black spruce vegetation type.

[c] Estimated time based on similarity of species composition and density to the pilot study open low dwarf birch-willow vegetation type.

[d] Only 1 site sampled.

TABLE 10. Comparison of vegetation types between the 1983 pilot study and 1982 browse inventory (Steigers et al. 1983), and McKendrick et al. (1982). Percentages of total mapped area in the Watana and Devil Canyon impoundments and construction zones from McKendrick et al. (1982; 102, 106) are also given.

Level IV Vegetation Type	1982 Vegetation Type	Area (ha)	% of total area
Woodland Black-White Spruce	Woodland Spruce-White	1,633	7.22
Woodland Black Spruce	Woodland Spruce-Black	2,743	12.13
Open White Spruce	Open Spruce-White	5,166	22.85
Open Black Spruce	Open Spruce-Black	2,615	11.57
Open Mixed Spruce-Paper Birch	Mixed Open Conifer-Deciduous	732	3.24
Open Tall Willow	--	11[a]	0.05[a]
Open Low Dwarf Birch	Birch Shrub	3,673	16.25
Open Low Dwarf Birch-Willow	Mixed Low Shrub	1,391	6.15
Open Low Willow	Willow Shrub	289[b]	1.28[b]
TOTAL AREA		22,609	100.00

[a] Estimated percentage derived from the Open Low Willow vegetation type

[b] Reduced by 0.05% which was assigned to the Open Tall Willow vegetation type.

TABLE 11. Percentage of cost to sample density in 4-m^2 plots, and allocation of 680 maximum sites among 8 level IV vegetation types. Betula glandulosa has been excluded.

Level IV Vegetation Type	% of Cost	Allocation
Open White Spruce	39	264
Open Black Spruce	23	155
Woodland Black-White Spruce	3	20
Woodland Black Spruce	14	94
Open Mixed Spruce-Paper Birch	0.15	2[a]
Open Tall Willow	0.04	2[a]
Open Low Dwarf Birch	11	75
Open Low Dwarf Birch-Willow	10	68

[a] Minimum of 2 sites required.

TABLE 12. Summary of plots of dry weight versus ocular estimate by observer for each species.

Betula glandulosa

Observer	N	Corr.	Res. MS	Std. Dev.	Slope	Inter.	Curvature	Approximate Low	Approximate High
1	40	0.78	25.35	3.46	1.81	1.24	None	1	32
2	33	0.94	1.13	3.17	0.44	0.29	None	1	29
3	43	0.90	1.80	3.09	0.37	0.50	None	1	28
4	27	0.96	1.72	4.43	0.35	0.65	None	1	57

Salix pulchra

Observer	N	Corr.	Res. MS	Std. Dev.	Slope	Inter.	Curvature	Approximate Low	Approximate High
1	40	0.79	7.40	4.34	0.40	1.10	None	1	30
2	25	0.95	0.94	3.16	0.54	0.29	None	1.5	24.5
3	45	0.83	8.71	5.27	0.41	0.70	None	1	48
4	26	0.89	12.17	7.45	0.84	-2.83	Quad[a]	2	33

Salix glauca

Observer	N	Corr.	Res. MS	Std. Dev.	Slope	Inter.	Curvature	Approximate Low	Approximate High
1	27	0.90	8.88	6.74	0.38	+0.20	None	2	65
2	15	0.94	7.22	7.50	0.68	-0.79	None	2	42
3	20	0.93	4.73	5.95	0.39	+0.83	None	2	49
4	15	0.97	1.98	6.04	0.38	-0.02	None	2	56

(Table 12 continued.)

Salix lanata

Observer	N	Corr.	Res. MS	Std. Dev.	Slope	Inter.	Curvature	Approximate Low	Approximate High
1	5	0.95	30.58	14.79	0.63	-5.30	Slight quad	8	62
2	15	0.93	3.35	4.73	0.56	+0.43	None	1	31
3	14	0.94	5.10	3.47	0.51	-0.13	None	1	21
4	5	0.98	3.27	7.80	0.55	-3.41	None	12	42

Betula papyrifera

Observer	N	Corr.	Res. MS	Std. Dev.	Slope	Inter.	Curvature	Approximate Low	Approximate High
1	8	0.97	9.73	12.10	0.55	+2.37	None	4	68
2	5	0.999	1.91	22.51	0.24	+1.79	None	1	230
3	5	0.98	25.33	20.96	0.97	-2.32	None	3	49
4	9	0.98	4.92	10.00	0.41	+0.72	None	3	78

Alnus sinuata

Observer	N	Corr.	Res. MS	Std. Dev.	Slope	Inter.	Curvature	Approximate Low	Approximate High
1	2	1.00	0.00	5.66	0.76	-0.80	None	2.5	13
2									
3	10	0.97	7.14	11.07	0.91	-5.05	None	8	44
4	2	1.00	0.00	10.82	0.56	1.78	None	15	42

(Table 12 continued.)

Salix alaxensis

Observer	N	Corr.	Res. MS	Std. Dev.	Slope	Inter.	Curvature	Approximate Low	Approximate High
1	8	0.98	16.43	21.68	0.36	1.25	None	5	175
2									
3	14	0.84	71.29	15.13	0.21	5.39	None	15	195
4	8	0.98	72.19	43.53	0.46	-2.33	None	12	205

[a] The largest estimated value was about 33 and appeared to be an outlier. If this were eliminated, the largest value would be about 23, there would be no curvature, correlation would probably be higher, and slope would be smaller.

TABLE 13. Summary of plots of dry weight versus untransformed shrub dimensions and ocular estimates by species for 4 major species.

Betula glandulosa n=124 Std. Dev. = 3.26

Variable	Corr.	Res. MS	Slope	Inter.	Curvature	Approximate Low	Approximate High
Basal diameter(mm)	0.80	3.89	0.09	-3.22	quad	30	160
Height(cm)	0.73	5.02	0.12	-2.70	none	18	135
Depth(cm)	0.68	5.69	0.15	-2.01	none	13	104
Width(cm)	0.70	5.49	0.14	-1.02	quad	6.5	104
Right angle(cm)	0.75	4.73	0.24	-.91	quad	2	56
Ocular estimate(g)	0.91	1.82	0.39	+.54	none	1	58

Salix pulchra n=136 Std. Dev. = 5.19

Variable	Corr.	Res. MS	Slope	Inter.	Curvature	Approximate Low	Approximate High
Basal diameter(mm)	0.70	13.72	0.07	-2.19	quad	16	224
Height(cm)	0.59	17.65	0.16	-2.88	none	13	105
Depth(cm)	0.64	16.04	0.27	-2.25	slight quad	5	58
Width(cm)	0.56	18.54	0.17	+0.32	slight quad	5	135 (55)[a]
Right angle(cm)	0.68	14.50	0.40	-2.24	quad	3.4	49
Ocular estimate(g)	0.81	9.14	0.48	+0.29	none	1	49

(Table 13 continued.)

Salix glauca n=65 Std. Dev. = 3.26

Variable	Corr.	Res. MS	Slope	Inter.	Curvature	Approximate Low	Approximate High
Basal diameter(mm)	0.85	11.26	0.11	-4.54	none	25	225
Height(cm)	0.77	16.27	0.20	-5.89	slight quad	26	131
Depth(cm)	0.73	18.30	0.26	-2.09	slight quad	6	89
Width(cm)	0.79	15.01	0.40	-5.45	quad	8	60
Right angle(cm)	0.71	19.61	0.36	-1.18	none	5	70 (50)
Ocular estimate(g)	0.89	8.39	0.38	+0.84	none	2	65

Salix lanata n=39 Std. Dev. = 7.24

Variable	Corr.	Res. MS	Slope	Inter.	Curvature	Approximate Low	Approximate High
Basal diameter(mm)	0.69	28.38	0.09	-5.00	slight quad	53	265
Height(cm)	0.83	16.67	0.28	-9.91	quad	20	116
Depth(cm)	0.87	13.43	0.40	-5.84	none	10	86
Width(cm)	0.64	32.12	0.29	-2.50	none	7	77
Right angle(cm)	0.72	25.69	0.53	-3.87	quad	4	42
Ocular estimate(g)	0.94	6.73	0.51	-0.20	none	1	65

[a] All values except one were less than 55.

TABLE 14. Stepwise regression summaries by species for total dry weight (leaves plus twigs) and dry twig weight versus all shrub measurements including transformations and volumes.

Betula glandulosa N=117

Dry weight

Step	r^2	Standard error of estimate	Variables Added
0		3.63	
1	0.79	1.68	estimated width
2	0.83	1.50	width
3	0.85	1.43	basal diameter

Dry twigs

Step	r^2	Standard error of estimate	Variables Added
0		0.67	
1	0.33	0.55	estimated weight
2	0.37	0.54	$depth^2$
3	0.44	0.51	$height^2$
4	0.48	0.49	height

Salix pulchra N=126

Dry weight

Step	r^2	Standard error of estimate	Variables Added
0		5.24	
1	0.65	3.09	estimated weight
2	0.67	3.04	width
3	0.69	2.97	vol. 2=height x width x right angle

(Table 14 continued.)

Dry twigs

Step	r^2	Standard error of estimate	Variables Added
0		1.05	
1	0.37	0.84	estimated weight
2	0.40	.82	depth

Salix glauca N=74

Dry weight

Step	r^2	Standard error of estimate	Variables Added
0		6.50	
1	0.80	2.96	estimated weight
2	0.89	2.23	basal diameter^2
3	0.90	2.07	vol 1.=depth x width x right angle

Dry twigs

Step	r^2	Standard error of estimate	Variables Added
0		2.13	
1	0.64	1.29	estimated weight
2	0.73	1.11	basal diameter^2
3	0.78	1.03	depth^2
4	0.82	0.93	height^2
5	0.84	0.87	width

(Table 14 continued.)

Salix lanata N=38

Dry weight

Step	r^2	Standard error of estimate	Variables Added
0		7.27	
1	0.87	2.63	estimated weight
2	0.94	1.87	vol. 1=depth x width x right angle
3	0.95	1.73	depth^2

Dry twigs

Step	r^2	Standard error of estimate	Variables Added
0		2.28	
1	0.82	0.97	estimated weight
2	0.89	0.79	depth^2
3	0.90	0.74	basal diameter^2

Betula papyrifera N=25

Dry weight

Step	r^2	Standard error of estimate	Variables Added
0		15.41	
1	0.82	6.69	height^2
2	0.89	5.40	estimated weight
3	0.92	4.66	observer 1
4	0.95	3.66	vol. 4=basal diameter^2
5	0.96	3.42	

(Table 14 continued.)

Dry twigs

Step	r^2	Standard error of estimate	Variables Added
0		2.35	
1	0.57	1.57	height

Alnus sinuata N=21

Dry weight

Step	r^2	Standard error of estimate	Variables Added
0		51.65	
1	0.97*	8.45	width^2

*(may be an artifact-largest value hit right on)

Dry twig

Step	r^2	Standard error of estimate	Variables Added
0		7.87	
1	0.38	6.34	1/width
2	0.54	5.60	1/right angle
3	0.70	4.65	1/basal diameter
4	0.64	5.01	remove 1/width

(Table 14 continued.)

Salix alaxensis N=35

Dry weight

Step	r^2	Standard error of estimate	Variables Added
0		25.42	
1	0.83	10.50	estimated weight
2	0.89	8.57	vol. 2= height x width x right angle
3	0.91	8.17	width

Dry twigs

Step	r^2	Standard error of estimate	Variables Added
0		11.51	
1	0.74	5.96	vol. 2
2	0.85	4.67	$width^2$
3	0.87	4.32	estimated weight
4	0.90	3.97	vol 1= depth x width x right angle

TABLE 15. Times to obtain measurements including clipping on each individual of a species and the approximate optimum ratio of estimated individuals to clipped individuals based on ocular estimate as the only measurement. All observers were combined.

	Field Times (seconds/individual)					
Species	Ocular Est.	Clip	Diam.	Crown(4)[a]	Move	Approximate n/n'=est./clip
Betula glandulosa	34	170	12	29	69	3/2
Salix pulchra	37	224	9	28	65	3/2
Salix glauca	27	132	7	26	40	5/2
Salix lanata	22	88	12	29	77	5/2
Salix alaxensis	31	245	14	27	319	7/1
Alnus sinuata	29	170	11	40	51	13/2
Betula papyrifera	50	351	10	48	97	2/1

[a] Crown measurements included height of plant, depth of crown, width, and right angle.

Table 16. Stepwise regression summaries by species for log (dry weight) and log (dry twig weight) versus all shrub measurements, untransformed or logarithmic transforms only.

Betula glandulosa N=68

Log (dry)

Step	r^2	Standard error of estimate	Variables Added
0		.318	
1	0.73	.166	log (est.)
2	0.79	.147	log (basal diam)
3	0.81	.140	log (width)

log twigs

Step	r^2	Standard error of estimate	Variables Added
0		.332	
1	0.11	.316	depth

Salix pulchra n=31

log (dry)

Step	r^2	Standard error of estimate	Variables Added
0		.260	
1	0.60	.168	log (est.)

(rest of printout not available)

log (twig)

Step	r^2	Standard error of estimate	Variables Added
0		.325	
1	0.20	.296	log (basal diameter)

(Table 16 continued.)

Salix glauca n=57

Log (dry)

Step	r^2	Standard error of estimate	Variables Added
0		.355	
1	0.82	.151	log (est.)
2	0.85	.139	log (right angle)
3	0.87	.132	basal diameter
4	0.88	.128	log (height)

log (twig)

Step	r^2	Standard error of estimate	Variables Added
0		.432	
1	0.69	.241	log (est.)
2	0.75	.221	basal diameter
3	0.76	.210	depth
4	0.81	.196	log (height)

Salix lanata n=27

log (dry)

Step	r^2	Standard error of estimate	Variables Added
0		.317	
1	0.72	.172	log (est.)
2	0.85	.126	log (width)
3	0.89	.114	log (right angle)
6	0.93	.092	all vars.=right angle, est. log

(Table 16 continued.)

log (twig)

Step	r^2	Standard error of estimate	Variables Added
0		.419	
1	0.64	.256	log (est.)
2	0.72	.230	log (depth)

Salix alaxensis n=35

log (twig)

Step	r^2	Standard error of estimate	Variables Added
0		.475	
1	0.79	.222	log (right angle)
2	0.85	.192	est.
3	0.87	.180	log (depth)

log (twig)

Step	r^2	Standard error of estimate	Variables Added
0		.578	
1	0.78	.275	log (depth)
2	0.83	.248	log (right angle)

Betula papyrifera n=22

log (dry)

Step	r^2	Standard error of estimate	Variables Added
0		.453	
1	0.77	.192	log (est.)
2	0.85	.158	log (basal diameter)

(Table 16 continued.)

log (twig)

Step	r^2	Standard error of estimate	Variables Added
0		.453	
1	0.56	.309	log (basal diameter)

Alnus sinuata n=20

log (dry)

Step	r^2	Standard error of estimate	Variables Added
0		.470	
1	0.81	.210	log (depth)
2	0.87	.177	log (width)

log (twig)

Step	r^2	Standard error of estimate	Variables Added
0		.462	
1	0.51	.333	log (basal diameter)

Table 17. Comparison of slopes of regression estimates by observer and across all observers for each species. Results were obtained using analysis of covariance with log (dry twig weight) as the dependent variable.

Observer	1		2		3		4		All		
Species	N	Slope	N	Slope	N	Slope	N	Slope	N	Slope	Prob.
Betula glandulosa	18	-.0039	13	.0367	21	-.0044	16	.0159	68	0.0108	.003
Salix pulchra	25	.0139	11	.0300	22	.0165	15	.0344	73	0.0197	.327
Salix glauca	21	.0262	11	.0388	13	.0183	12	.0202	57	0.0243	.120
Salix lanata	5	.0267	9	.0283	8	.0510	5	.0309	27	0.0295	.559
Salix alaxensis	8	.0107	5	.0067	14	.0032	8	.0089	35	0.0072	.013
Betula papyrifera	7	.0122	4	.0028	4	.0315	7	.0085	22	0.0053	.020
Alnus sinuata	1	--[a]	7	--[a]	10	--[a]	2	--[a]	20	0.0025	--[a]

[a] Slopes could not be calculated for all four observers because observer 1 had only one observation. The analysis could be rerun with only three observers.

Table 18. Results of analysis of covariance with log (dry twig weight) as dependent variable, observer as the groups, and ocular estimate as the covariate.

	Equality of Adj. Means		Zero Slope		Equality of Slope	
Species	df	Prob.	df	Prob.	df	Prob.
Betula glandulosa	3,63	0.825	1,63	0.008	3,60	0.003
Salix pulchra	3,68	0.980	1,68	0.000	3,65	0.327
Salix glauca	3,52	0.219	1,52	0.000	3,49	0.120
Salix lanata	3,22	0.115	1,22	0.000	3,19	0.559
Salix alaxensis	3,30	0.099	1,30	0.000	3,27	0.013
Betula papyrifera	3,17	0.668	1,17	0.023	3,14	0.020
Alnus sinuata	3,15	0.890	1,15	0.091	--[a]	--[a]

[a] Equality of slopes could not be tested for all four observers because one observer had only one observation. The analysis could be rerun with only three observers.

Table 19. Results of analysis of covariance with time to estimate an individual as the dependent variable, observer as the groups, and ocular estimate as the covariate.

	Equality of Adj. Means		Zero Slope		Equality of Slope	
Species	df	Prob.	df	Prob.	df	Prob.
Betula glandulosa	3,63	0.903	1,63	0.627	3,60	0.842
Salix pulchra	3,68	0.426	1,68	0.016	3,65	0.995
Salix glauca	3,52	0.012	1,52	0.453	3,49	0.970
Salix lanata	3,22	0.036	1,22	0.061	3,19	0.310
Salix alaxensis	3,30	0.316	1,30	0.006	3,27	0.331
Betula papyrifera	3,17	0.013	1,17	0.002	3,14	0.166
Alnus sinuata	3,15	0.927	1,15	0.024	--[a]	--[a]

[a] Equality of slopes could not be tested for all four observers because one observer had only one observation. The analysis could be rerun with only three observers.

Table 20. Summaries of dry weights per individual, densities, and dry weight/area based on weight x density and clipped plots for the woodland black-white spruce vegetation type.

Species	Dry Wt/Ind. (g/Stem)	Dry twig/Ind. (g/Stem)	Density (Stem/$10m^2$)	Dry WtxDensity ($g/10m^2$) Mean	Var.	Dry twigxDensity ($g/10m^2$) Mean	Var.	Dry twig Clipped Plots ($g/10m^2$) Mean	Var.
Salix pulchra	5.3	2.4	13	69	--	31	--	1	--
Salix glauca	2.6	0.6	3	8	10	2	0.2	2	--
Betula papyrifera	10.9	2.3	1	11	--	2	--	--	--

Table 21. Summaries of dry weights per individual, densities and dry weight/area based in weight x density and clipped plots for the woodland black spruce vegetation type.

Species	Dry Wt/Ind. (g/Stem)	Dry twig/Ind. (g/Stem)	Density (Stem/$10m^2$)	Dry WtxDensity ($g/10m^2$) Mean	Dry WtxDensity ($g/10m^2$) Var.	Dry twigxDensity ($g/10m^2$) Mean	Dry twigxDensity ($g/10m^2$) Var.	Dry twig Clipped Plots ($g/10m^2$) Mean	Dry twig Clipped Plots ($g/10m^2$) Var.
Salix pulchra	2.5	1.1	10	23	634	11	136	11	2058
Salix lanata	2.6	0.4	38	99	--	15	--	0	0.1

Table 22. Summaries of dry weights per individual, densities, and dry weight/area based on weight x density and clipped plots for the open mixed spruce-paper birch vegetation type.

Species	Dry Wt/Ind. (g/Stem)	Dry twig/Ind. (g/Stem)	Density (Stem/$10m^2$)	Dry WtxDensity ($g/10m^2$) Mean	Var.	Dry twigxDensity ($g/10m^2$) Mean	Var.	Dry twig Clipped Plots ($g/10m^2$) Mean	Var.
Betula papyrifera	4.4	0.2	1	4	--	0.2	--	--	--
Alnus sinuata	3.3	1.1	1	3	--	1.1	--	5	--

Table 23. Summaries of dry weights per individual, densities, and dry weight/area based on weight x density and clipped plots for the open tall willow vegetation type.

Species	Dry Wt/Ind. (g/Stem)	Dry twig/Ind. (g/Stem)	Density (Stem/10m^2)	Dry WtxDensity (g/10m^2)		Dry twigxDensity (g/10m^2)		Dry twig Clipped Plots (g/10m^2)	
				Mean	Var.	Mean	Var.	Mean	Var.
Salix pulchra	1.2	0.3	23	28	--	7	--	3	166
Salix alaxensis	19.3	7.8	41	750	39200	301	5910	393	1342000
Betula papyrifera	1.3	0.3	2	1	3	0.3	0.2	5	296
Alnus sinuata	2.1	0.7	7	20	613	6	50	73	59800

Table 24. Summaries of dry weights per individual, densities, and dry weight/area based on weight x density and clipped plots for the open low dwarf birch-willow vegetation type.

Species	Dry Wt/Ind. (g/Stem)	Dry twig/Ind. (g/Stem)	Density (Stem/$10m^2$)	Dry WtxDensity ($g/10m^2$)		Dry twigxDensity ($g/10m^2$)		Dry twig Clipped Plots ($g/10m^2$)	
				Mean	Var.	Mean	Var.	Mean	Var.
Salix pulchra	3.2	0.4	26	69	1420	7	17	22	1800
Salix glauca	9.0	2.0	4	35	743	8	65	2	71
Salix lanata	21.8	6.1	22	661	848000	190	70200	2	150
Betula papyrifera	4.8	1.3	2	10	--	3	--	8	809

Table 25. Summaries of dry weights per individual, densities, and dry weight/area based on weight x density and clipped plots for the open low willow vegetation type.

Species	Dry Wt/Ind. (g/Stem)	Dry twig/Ind. (g/Stem)	Density ($Stem/10m^2$)	Dry WtxDensity ($g/10m^2$) Mean	Var.	Dry twigxDensity ($g/10m^2$) Mean	Var.	Dry twig Clipped Plots ($g/10m^2$) Mean	Var.
Salix pulchra	3.5	0.5	116	406	--	58	--	217	--
Salix alaxensis	29.2	11.2	6	175	--	67	--	--	--

Table 26. Average current annual growth twig and leaf biomass in grams per 10 m^2 for shrubs in 6 level IV vegetation types. A 1 m^2 circular plot was used.

Species	Level IV Vegetation Type [a]											
	WB-WS		WBS		MS-B		TW		DB-W		LW	
	Twig	Leaf	Twig	Leaf	Twig	Leaf	Twig	Leaf	Twig	Leaf	Twig	Leaf
Betula glandulosa	22	157	24	123	2	15			36	192		
Betula papyrifera							5	14	8	12		
Salix pulchra	1	4	11	25			3	10	22	104	217	655
Salix glauca	2	3							2	8		
Salix lanata			<0.5	<0.5					2	5		
Salix alaxensis							394	550				
Alnus sinuata					5	31	73	125				
TOTAL	25	164	36	148	7	46	475	699	70	321	217	655

[a] WB-WS = Woodland Black-White Spruce; WBS = Woodland Black Spruce; MS-B = Open Mixed Spruce-Paper Birch; TW = Open Tall Willow; DB-W = Open Low Dwarf Birch-Willow; LW = Open Low Willow

Table 27. Elapsed time in seconds required for 2 persons to clip current annual growth twigs and leaves from shrub species in 1-m^2 plots, and then move to and establish a subsequent plot.

Vegetation Type	Elapsed Time (seconds) Clip	Move	Total
Woodland Black-White Spruce	703	138	841
Woodland Black Spruce	649	92	741
Open Mixed Spruce-Paper Birch	59	54	113
Open Tall Willow	504	137	641
Open Low Dwarf Birch-Willow	1,124	122	1,246
Open Low Willow	1,800	141	1,941

TABLE 28. Average time (minutes) to clip an estimated adequate number of 1-m^2 plots at a site for 6 level IV vegetation types. Plots were clipped by 2 persons. Time required to clip each species was allocated based on percentage of total dry weight clipped.

	Level IV Vegetation Type [a]																	
	WB-WS			WBS			MS-B			TW			DB-W			LW		
Species	Twig	Leaf	Total[b]	Twig	Leaf	Total	Twig	Leaf	Total	Twig	Leaf	Total	Twig	Leaf	Total	Twig	Leaf	Total
Betula glandulosa	22	117	133	17	94	112	4	43	48				33	92	110			
Betula papyrifera										6	18	24	93	139	232			
Salix pulchra	17	57	72	34	48	70				5	14	18	17	55	66	127	180	240
Salix glauca	25	34	57										22	82	102			
Salix lanata				9	2	5							20	49	69			
Salix alaxensis										45	51	88						
Alnus sinuata							16	102	119	30	55	88						
Total all species incl. move time			182			99			168			150			104			324

[a] WB-WS = Woodland Black-White Spruce; WBS = Woodland Black Spruce; MS-B = Open Mixed Spruce-Paper Birch; TW = Open Tall Willow; DB-W = Open Low Dwarf Birch-Willow; LW = Open Low Willow

[b] Total = total of twig + leaf using leaf estimated sample size.

TABLE 29. Approximate average elapsed time including move time in seconds for 2 persons to clip current annual growth twigs in 1-m^2 plots, and number of 1-m^2 and 0.5-m^2 plots/site, minutes/site, and number of sites/level IV vegetation type required to sample clipped plots within 20% of the mean with 67% confidence. Estimates are for selected shrub species in 9 level IV vegetation types in the middle Susitna River Basin. Betula glandulosa has been excluded. Includes data modified from Steigers et al. (1983).

Level IV Vegetation Type	# Sites Sampled	Time/Plot[a] (Seconds)	Plots/ Site	Minutes/ Site	Sites/Vegetation Type
Open White Spruce[b]	7	122[c]	16[d]	33	328
Open Black Spruce[b]	10	122[c]	27[d]	55	783
Woodland Black-White Spruce	2	168	8	22	2
Woodland Black Spruce	4	153	32	82	401
Open Mixed Spruce-Paper Birch	2	89	114	169	501
Open Tall Willow	2	322	10	54	220
Open Low Dwarf Birch[b]	18	172[e]	23[d]	66	2,095
Open Low Dwarf Birch-Willow	5	218	13	47	9
Open Low Willow	1	589	11	108	--[f]

(Table 29 continued.)

[a] Estimated time based on the percent twig weight of total twig plus leaf weight. A minimum of 30 seconds/plot was used.

[b] Data modified from Steigers et al. (1983).

[c] Estimated time based on similarity of species composition to the pilot study woodland black spruce vegetation type.

[d] 0.5-m^2 clipped plot size; 15 plots/site.

[e] Estimated time based on similarity of species composition to the pilot study open low dwarf birch-willow vegetation type.

[f] Only 1 site sampled.

TABLE 30. Percentage of cost to clip plots, and allocation of 680 maximum sites among 8 level IV vegetation types. *Betula glandulosa* has been excluded.

Level IV Vegetation Type	% of Cost	Allocation
Open White Spruce	46	313
Open Black Spruce	18	121
Woodland Black-White Spruce	0.05	2[a]
Woodland Black Spruce	6	41
Open Mixed Spruce-Paper Birch	1	7
Open Tall Willow	1	7
Open Low Dwarf Birch	26	175
Open Low Dwarf Birch-Willow	2	14

[a] Minimum of 2 sites required.

FIGURES

FIGURE 1

Location of Susitna River Basin study area in southcentral Alaska.

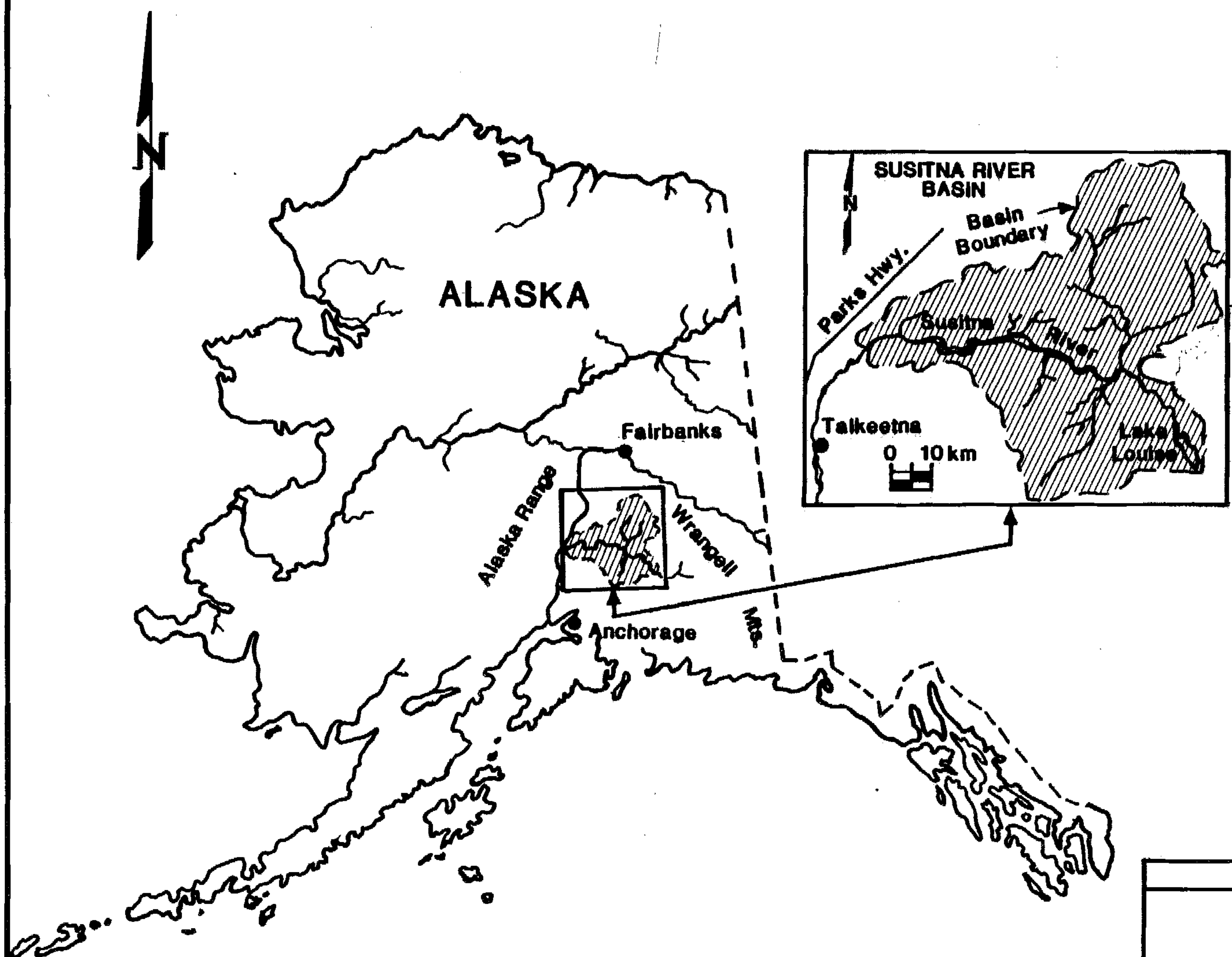

FIGURE 1

LOCATION OF STUDY AREA IN THE STATE OF ALASKA

FIGURE 2

Location of 17 sites sampled during the browse pilot study in the middle Susitna River Basin.

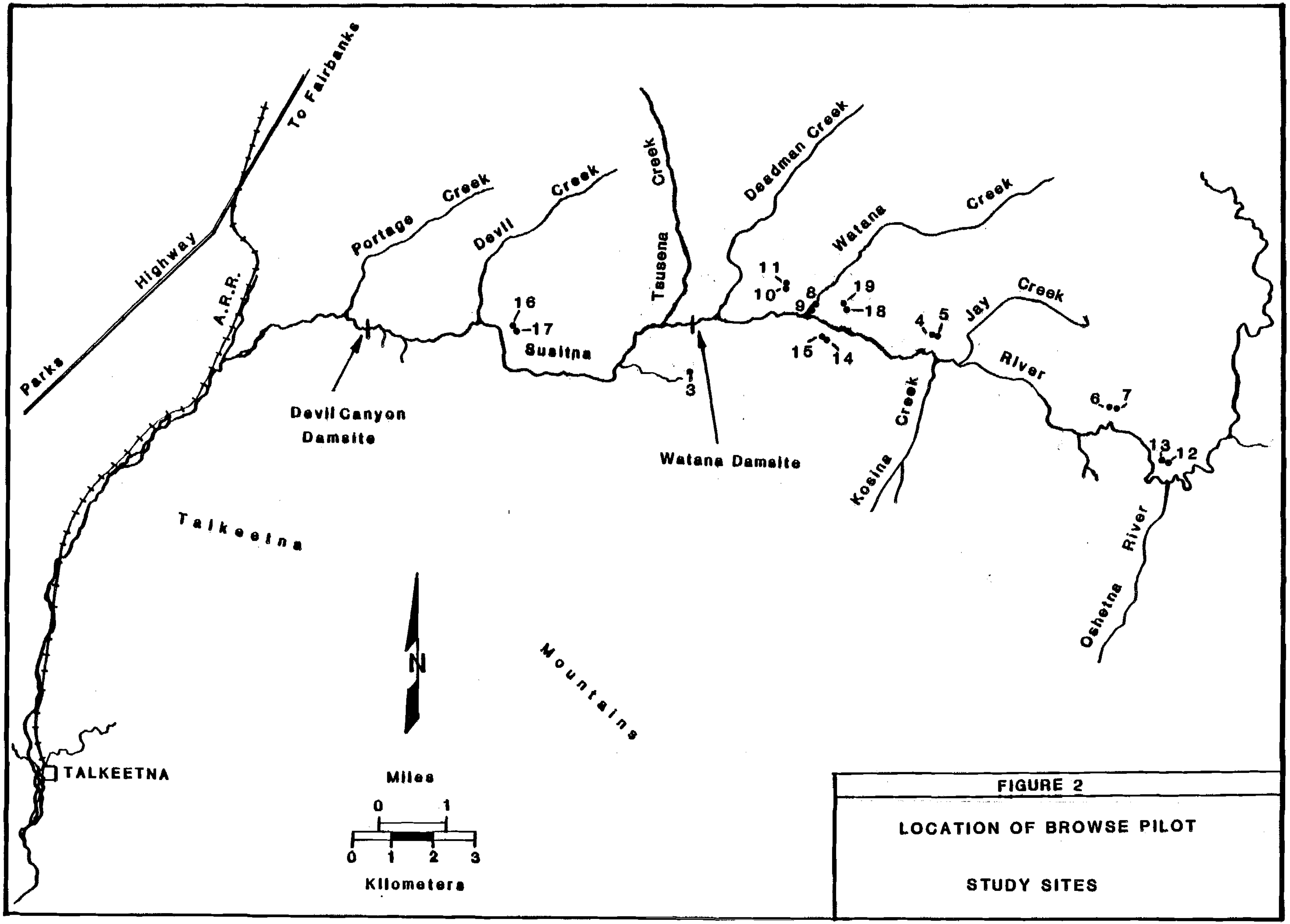

FIGURE 2

LOCATION OF BROWSE PILOT

STUDY SITES

APPENDIX A

DENSITY STATISTCS-3 PLOT SIZES

Means, standard errors, variances, and estimated sample sizes for 1-m^2, 4-m^2, and 10-m^2 plot size density estimates for shrub species. Density estimates are presented by site, with sites grouped into level IV vegetation types. The within estimated sample size (WNHAT) is the number of plots of the respective size required to sample the density in the vegetation type within 20% of the mean with 80% confidence. These density plots are then evenly allocated to the number of sites sampled in the type.

TABLE A1. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 10. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN
BETULA GLANDULOSA	63.	14.1	2001.1	10	21		
SALIX PULCHRA	2.	2.0	40.0	10	410		
SALIX GLAUCA	2.	2.0	40.0	10	410		
TOTAL ALL SPECIES	67.	14.5	2090.0	10	20		

TABLE A2. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 11. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	W
BETULA GLANDULOSA	77.	23.8	5667.8	10	40			
SALIX GLAUCA	9.	9.0	810.0	10	410			
TOTAL ALL SPECIES	86.	22.2	4937.8	10	28			

TABLE A3. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK-WHITE SPRUCE TYPE. N IS NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA	70.	13.6	3684.2	20	31	3834.44	18	33	980.00	1	9
SALIX PULCHRA	1.	1.0	20.0	20	820	20.00	18	820	20.00	1	820
SALIX GLAUCA	6.	4.6	415.5	20	563	425.00	18	576	245.00	1	332
TOTAL ALL SPECIES	77.	13.1	3423.9	20	24	3513.89	18	25	1805.00	1	13

TABLE A4. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 14. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA	88.	27.5	7573.3	10	41			
TOTAL ALL SPECIES	88.	27.5	7573.3	10	41			

TABLE A5. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 15. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT
BETULA GLANDULOSA	173.	30.0	9023.3	10	13
SALIX PULCHRA	19.	13.7	1876.7	10	213
TOTAL ALL SPECIES	192.	32.1	10328.9	10	12

TABLE A6. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 18. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA	47.	16.5	2712.2	10	51			
SALIX PULCHRA	27.	13.4	1801.1	10	102			
TOTAL ALL SPECIES	74.	19.6	3826.7	10	29			

TABLE A7. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 19. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA	63.	21.3	4556.7	10	48			
SALIX PULCHRA	19.	10.2	1032.2	10	118			
TOTAL ALL SPECIES	82.	24.9	6217.8	10	38			

TABLE A8. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK SPRUCE TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 40)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 4	BN	BNHAT
BETULA GLANDULOSA	93.	14.1	7928.1	40	38	5966.39	36	29	31469.17	3	150
SALIX PULCHRA	16.	5.5	1188.1	40	185	1177.50	36	183	1315.83	3	205
TOTAL ALL SPECIES	109.	14.9	8829.7	40	31	6986.67	36	25	30946.67	3	107

TABLE A9. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 16. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA	1.	1.0	10.0	10	410			
TOTAL ALL SPECIES	1.	1.0	10.0	10	410			

TABLE A10. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR
SITE 17. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA

TABLE XII. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN MIXED SPRUCE-BIRCH TYPE. N IS NUMBER OF SAMPLING UNITS. ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA	1.	0.5	5.0	20	820	5.00	18	820	5.00	1	820
TOTAL ALL SPECIES	1.	0.5	5.0	20	820	5.00	18	820	5.00	1	820

TABLE A12 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 8. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
SALIX ALAXENSIS	90.	30.0	8100.0	9	41			
ALNUS SINUATA	6.	2.9	77.8	9	104			
TOTAL ALL SPECIES	96.	28.0	7077.8	9	32			

TABLE A13 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 9. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 11)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
SALIX PULCHRA	38.	8.8	856.4	11	25			
SALIX ALAXENSIS	15.	7.2	567.3	11	98			
TOTAL ALL SPECIES	54.	12.5	1725.5	11	25			

TABLE A14 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR TALL WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
SALIX PULCHRA	21.	6.4	830.5	20	78	475.76	18	45	7216.36	1	671
SALIX ALAXENSIS	49.	16.1	5156.8	20	88	3915.15	18	67	27507.27	1	470
ALNUS SINUATA	3.	1.4	40.8	20	268	34.57	18	227	152.78	1	1002
TOTAL ALL SPECIES	73.	14.7	4346.1	20	34	4104.26	18	32	8698.23	1	68

TABLE A15 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 12; N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA	26.	21.0	4426.7	10	269			
SALIX PULCHRA	17.	11.6	1334.4	10	190			
SALIX LANATA	25.	20.8	4316.7	10	283			
TOTAL ALL SPECIES	68.	33.7	11373.3	10	101			

TABLE A16 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 13. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT

TABLE A17 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 41 N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA	46.	18.5	3077.8	9	61			
SALIX PULCHRA	34.	8.4	627.8	9	22			
SALIX LANATA	9.	7.7	536.1	9	278			
TOTAL ALL SPECIES	89.	20.6	3811.1	9	20			

TABLE A18 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 57 N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA	81.	19.7	3898.9	10	25			
SALIX PULCHRA	77.	24.6	6045.6	10	42			
TOTAL ALL SPECIES	158.	30.0	8995.6	10	15			

TABLE A19 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 6. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA	110.	19.4	3777.8	10	13			
SALIX PULCHRA	19.	8.7	765.6	10	87			
SALIX GLAUCA	1.	1.0	10.0	10	410			
TOTAL ALL SPECIES	130.	19.7	3888.9	10	10			

TABLE A20 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 7. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA	53.	19.7	3867.8	10	57			
SALIX PULCHRA	16.	11.1	1226.7	10	197			
SALIX GLAUCA	12.	7.3	528.9	10	151			
SALIX LANATA	53.	18.7	3512.2	10	52			
TOTAL ALL SPECIES	134.	30.0	9004.4	10	21			

TABLE A21 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW DWARF BIRCH-WILLOW. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 59)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 6	BN	BNHAT
BETULA GLANDULOSA	68.	9.4	5248.5	59	47	4834.95	53	44	9632.27	5	86
SALIX PULCHRA	27.	6.0	2155.3	59	121	1686.27	53	94	7127.59	5	397
SALIX GLAUCA	2.	1.3	104.6	59	762	93.21	53	679	225.56	5	1641
SALIX LANATA	15.	5.3	1677.0	59	324	1410.36	53	272	4503.10	5	869
TOTAL ALL SPECIES	112.	11.8	8177.5	59	27	7849.98	53	26	11649.21	5	39

TABLE A22 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 3. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 12)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
SALIX PULCHRA	186.	50.6	30772.0	12	37			
SALIX ALAXENSIS	4.	4.2	208.3	12	492			
TOTAL ALL SPECIES	190.	50.5	30654.5	12	35			

TABLE A23 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (1M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 12)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 1	BN	BNHAT
SALIX PULCHRA	186.	50.6	30772.0	12	37	30771.97	11	37	-0.00	0	0
SALIX ALAXENSIS	4.	4.2	208.3	12	492	208.33	11	492	0.00	0	1
TOTAL ALL SPECIES	190.	50.5	30654.5	12	35	30654.55	11	35	0.	0	1

TABLE A24 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 10. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA	79.	9.7	936.4	10	7			
SALIX PULCHRA	13.	5.9	344.5	10	81			
SALIX GLAUCA	3.	1.5	21.9	10	100			
TOTAL ALL SPECIES	95.	14.6	2140.9	10	10			

TABLE A25 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 11. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA	51.	12.2	1481.7	10	24			
BETULA PAPYRIFERA	1.	0.5	2.5	10	410			
SALIX GLAUCA	3.	1.1	11.1	10	73			
TOTAL ALL SPECIES	54.	12.6	1589.2	10	23			

TABLE A26 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK WHITE SPRUCE TYPE. N IS NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA	65.	8.2	1351.7	20	14	1209.03	18	12	3920.00	1	39
BETULA PAPYRIFERA	0.	0.3	1.3	20	820	1.25	18	820	1.25	1	820
SALIX PULCHRA	7.	3.2	209.4	20	196	172.26	18	161	877.81	1	820
SALIX GLAUCA	3.	0.9	15.7	20	86	16.53	18	90	1.25	1	7
TOTAL ALL SPECIES	74.	10.5	2214.7	20	17	1865.03	18	14	8507.81	1	64

TABLE A27 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 14. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA	157.	26.5	7043.7	10	12			
SALIX PULCHRA	2.	2.0	40.0	10	410			
TOTAL ALL SPECIES	159.	28.1	7884.8	10	13			

TABLE A28 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR

SITE 15. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA	147.	17.8	3166.7	10	7			
SALIX PULCHRA	15.	9.6	917.3	10	162			
TOTAL ALL SPECIES	162.	14.5	2099.7	10	4			

TABLE A29 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 18. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA	45.	9.6	916.4	10	19			
SALIX PULCHRA	9.	3.1	93.1	10	45			
SALIX LANATA	38.	11.9	1406.7	10	40			
TOTAL ALL SPECIES	92.	18.8	3527.8	10	18			

TABLE A30 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 19. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA	43.	16.7	2778.9	10	62			
SALIX PULCHRA	17.	9.2	854.2	10	125			
TOTAL ALL SPECIES	60.	15.8	2492.3	10	29			

TABLE A31 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK SPRUCE TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 40)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 4	BN	BNHAT
BETULA GLANDULOSA	98.	12.5	6228.1	40	27	3476.42	36	15	39247.71	3	168
SALIX PULCHRA	11.	3.4	474.2	40	167	476.16	36	167	450.16	3	158
SALIX LANATA	10.	3.9	602.3	40	274	351.67	36	160	3610.00	3	1639
TOTAL ALL SPECIES	118.	11.9	5672.8	40	17	4001.16	36	12	25731.82	3	76

TABLE A32 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 16. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA	9.	4.0	160.1	10	86			
SALIX PULCHRA	2.	1.8	30.6	10	410			
ALNUS SINUATA	1.	1.0	10.0	10	410			
TOTAL ALL SPECIES	12.	4.3	182.2	10	57			

TABLE A33 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 17. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA PAPYRIFERA	1.	0.5	2.5	10	410			
TOTAL ALL SPECIES	1.	0.5	2.5	10	410			

TABLE A34 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN MIXED SPRUCE-BIRCH TYPE. N IS NUMBER OF SAMPLING UNITS. ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA	4.	2.2	96.0	20	206	80.03	18	172	382.81	1	820
BETULA PAPYRIFERA	0.	0.3	1.3	20	820	1.25	18	820	1.25	1	820
SALIX PULCHRA	1.	0.9	15.3	20	820	15.31	18	820	15.31	1	820
ALNUS SINUATA	1.	0.5	5.0	20	820	5.00	18	820	5.00	1	820
TOTAL ALL SPECIES	6.	2.4	119.3	20	136	92.36	18	106	605.00	1	689

TABLE A35 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 8. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA PAPYRIFERA	3.	2.1	42.3	10	230			
SALIX PULCHRA	1.	0.8	5.6	10	410			
SALIX ALAXENSIS	53.	9.2	845.6	10	13			
ALNUS SINUATA	12.	4.3	189.0	10	57			
TOTAL ALL SPECIES	68.	10.1	1026.5	10	10			

TABLE A36 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 9. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA PAPYRIFERA	0.	0.3	0.6	10	410			
SALIX PULCHRA	23.	4.7	222.2	10	18			
SALIX ALAXENSIS	28.	8.1	653.4	10	35			
ALNUS SINUATA	2.	1.8	30.6	10	410			
TOTAL ALL SPECIES	52.	11.0	1199.2	10	18			

TABLE A37 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR TALL WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA PAPYRIFERA	2.	1.0	22.0	20	401	21.46	18	391	31.25	1	569
SALIX PULCHRA	12.	3.4	232.4	20	71	113.92	18	35	2365.31	1	717
SALIX ALAXENSIS	40.	6.6	877.8	20	23	749.48	18	19	3187.81	1	81
ALNUS SINUATA	7.	2.6	130.3	20	118	109.79	18	99	500.00	1	450
TOTAL ALL SPECIES	60.	7.5	1121.6	20	13	1112.85	18	13	1280.00	1	15

TABLE A38 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 12. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA	52.	13.9	1918.3	10	30			
SALIX PULCHRA	7.	1.7	30.3	10	26			
SALIX GLAUCA	4.	2.2	47.5	10	122			
SALIX LANATA	15.	7.7	590.3	10	108			
TOTAL ALL SPECIES	78.	15.1	2290.3	10	16			

TABLE A39 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 13. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA	38.	12.9	1653.4	10	48			
BETULA PAPYRIFERA	2.	1.5	22.5	10	410			
SALIX PULCHRA	6.	2.0	41.9	10	48			
SALIX GLAUCA	4.	4.0	158.4	10	360			
TOTAL ALL SPECIES	50.	14.1	1978.9	10	34			

TABLE A40 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 4. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 11)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA	53.	8.4	779.3	11	12			
SALIX PULCHRA	45.	11.0	1340.6	11	28			
SALIX LANATA	6.	3.3	123.0	11	125			
TOTAL ALL SPECIES	104.	11.7	1503.0	11	6			

TABLE A41 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 5. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNI
BETULA GLANDULOSA	80.	11.6	1340.0	10	9			
SALIX PULCHRA	55.	20.1	4025.6	10	56			
SALIX GLAUCA	1.	0.5	2.5	10	410			
TOTAL ALL SPECIES	135.	19.5	3820.1	10	9			

TABLE A42 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 6. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA	80.	15.8	2509.0	10	16			
SALIX PULCHRA	25.	7.2	519.4	10	35			
TOTAL ALL SPECIES	105.	16.6	2759.0	10	11			

TABLE A43 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 7. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA	34.	8.5	725.3	10	26			
SALIX PULCHRA	18.	8.1	662.2	10	84			
SALIX GLAUCA	6.	2.6	68.1	10	85			
SALIX LANATA	45.	14.9	2231.7	10	47			
TOTAL ALL SPECIES	102.	12.4	1535.3	10	7			

TABLE A44 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW DWARF BIRCH-WILLOW. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 61)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 6	BN	BNHAT
BETULA GLANDULOSA	56.	5.3	1683.3	61	23	1474.67	55	20	3978.70	5	53
BETULA PAPYRIFERA	0.	0.2	3.7	61	2499	3.68	55	2495	3.76	5	2549
SALIX PULCHRA	26.	4.7	1355.3	61	81	1107.66	55	66	4079.80	5	243
SALIX GLAUCA	2.	0.9	47.0	61	341	45.25	55	329	65.82	5	478
SALIX LANATA	11.	3.4	697.9	61	241	484.13	55	167	3049.67	5	1052
TOTAL ALL SPECIES	96.	6.8	2807.7	61	13	2299.66	55	11	8395.97	5	38

TABLE A45 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR
SITE 3. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
SALIX PULCHRA	116.	31.0	8653.3	9	27			
SALIX ALAXENSIS	6.	4.5	179.9	9	181			
TOTAL ALL SPECIES	123.	30.4	8324.1	9	23			

TABLE A46 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 1	BN	BNHAT
SALIX PULCHRA	116.	31.0	8653.3	9	27	8653.30	8	27	0.00	0	1
SALIX ALAXENSIS	6.	4.5	179.9	9	181	179.86	8	181	0.00	0	0
TOTAL ALL SPECIES	123.	30.4	8324.1	9	23	8324.13	8	23	0.00	0	1

TABLE A47 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 10. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA	78.	13.5	1819.8	10	13			
SALIX PULCHRA	5.	3.1	95.0	10	163			
SALIX GLAUCA	2.	1.6	24.9	10	255			
TOTAL ALL SPECIES	84.	15.1	2272.9	10	14			

TABLE A48 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 11. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA	44.	12.3	1521.6	10	32			
BETULA PAPYRIFERA	1.	0.5	2.5	10	410			
SALIX PULCHRA	1.	0.9	8.1	10	410			
SALIX GLAUCA	2.	0.6	4.0	10	29			
TOTAL ALL SPECIES	48.	11.7	1359.7	10	25			

TABLE A49 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK-WHITE SPRUCE TYPE. N IS NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA	61.	9.7	1872.8	20	21	1670.70	18	19	5511.20	1	61
BETULA PAPYRIFERA	0.	0.3	1.3	20	820	1.25	18	820	1.25	1	820
SALIX PULCHRA	3.	1.6	53.0	20	259	51.54	18	252	80.00	1	390
SALIX GLAUCA	2.	0.8	13.7	20	117	14.47	18	123	0.80	1	7
TOTAL ALL SPECIES	66.	10.2	2067.5	20	20	1816.29	18	17	6588.45	1	62

TABLE A50 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 14. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA	97.	14.6	2127.1	10	10			
SALIX PULCHRA	13.	13.1	1716.1	10	410			
TOTAL ALL SPECIES	110.	15.7	2466.3	10	9			

TABLE A51 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 15. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA	121.	19.0	3619.6	10	11			
SALIX PULCHRA	29.	16.2	2620.4	10	126			
TOTAL ALL SPECIES	150.	18.1	3285.5	10	6			

TABLE A52 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 18. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA	33.	4.9	238.3	10	10			
SALIX PULCHRA	18.	7.9	620.9	10	76			
SALIX LANATA	8.	3.2	102.0	10	61			
TOTAL ALL SPECIES	59.	11.8	1381.6	10	17			

TABLE A53 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR
SITE 19. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA	48.	10.8	1161.5	10	21			
SALIX PULCHRA	9.	3.8	141.4	10	81			
TOTAL ALL SPECIES	57.	11.5	1321.8	10	17			

TABLE A54 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK SPRUCE TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 40)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 4	BN	BNHAT
BETULA GLANDULOSA	75.	8.6	2954.9	40	22	1786.63	36	14	16974.09	3	125
SALIX PULCHRA	17.	5.6	1237.7	40	170	1274.71	36	175	793.00	3	109
SALIX LANATA	2.	1.0	36.8	40	350	25.50	36	243	172.23	3	1639
TOTAL ALL SPECIES	94.	9.3	3484.0	40	17	2113.78	36	10	19926.57	3	93

TABLE A55 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 16. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA	4.	3.1	97.0	10	262			
BETULA PAPYRIFERA	1.	0.7	4.8	10	311			
SALIX PULCHRA	1.	0.6	3.7	10	239			
ALNUS SINUATA	2.	1.9	35.3	10	274			
TOTAL ALL SPECIES	8.	3.7	138.8	10	94			

TABLE A56 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 17. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA PAPYRIFERA	2.	0.9	7.8	10	111			
TOTAL ALL SPECIES	2.	0.9	7.8	10	111			

TABLE A57 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN MIXED SPRUCE-BIRCH TYPE. N IS NUMBER OF SAMPLING UNITS. ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA	2.	1.6	49.9	20	538	48.49	18	523	76.05	1	820
BETULA PAPYRIFERA	1.	0.6	6.2	20	163	6.32	16	166	4.05	1	107
SALIX PULCHRA	0.	0.3	1.9	20	496	1.87	18	478	3.20	1	820
ALNUS SINUATA	1.	1.0	18.1	20	562	17.67	18	546	26.45	1	820
TOTAL ALL SPECIES	5.	2.0	79.3	20	144	73.32	18	134	186.05	1	338

TABLE A58 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 8. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 11)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA PAPYRIFERA	1.	0.6	3.7	11	183			
SALIX PULCHRA	1.	0.9	9.1	11	313			
SALIX ALAXENSIS	46.	8.2	748.2	11	15			
ALNUS SINUATA	19.	6.4	451.2	11	52			
TOTAL ALL SPECIES	67.	5.9	387.8	11	4			

TABLE A59 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 9. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
SALIX PULCHRA	16.	4.0	143.4	9	23			
SALIX GLAUCA	1.	1.2	13.3	9	261			
SALIX LANATA	1.	1.4	18.8	9	369			
SALIX ALAXENSIS	11.	4.5	181.5	9	66			
ALNUS SINUATA	1.	0.8	5.3	9	216			
TOTAL ALL SPECIES	31.	5.5	276.9	9	12			

TABLE A60 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR TALL WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA PAPYRIFERA	1.	0.3	2.2	20	354	2.05	18	336	4.09	1	671
SALIX PULCHRA	8.	2.5	124.8	20	82	68.80	18	46	1133.34	1	744
SALIX GLAUCA	1.	0.6	6.1	20	595	5.90	18	573	10.33	1	1002
SALIX LANATA	1.	0.6	8.4	20	820	8.35	18	810	10.33	1	1002
SALIX ALAXENSIS	30.	6.3	800.5	20	36	496.34	18	23	6275.57	1	281
ALNUS SINUATA	11.	4.0	324.1	20	112	253.00	18	88	1603.80	1	553
TOTAL ALL SPECIES	51.	5.8	667.7	20	11	338.54	18	6	6592.81	1	105

TABLE A61 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2)

OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 12. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA	51.	8.2	667.8	10	11			
SALIX PULCHRA	14.	5.0	246.1	10	51			
SALIX GLAUCA	0.	0.2	0.5	10	208			
SALIX LANATA	10.	4.4	198.0	10	85			
TOTAL ALL SPECIES	75.	7.9	618.8	10	5			

TABLE A62 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 13. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA	41.	11.6	1356.9	10	33			
SALIX PULCHRA	4.	1.9	37.3	10	87			
SALIX GLAUCA	3.	1.4	20.1	10	86			
TOTAL ALL SPECIES	49.	12.1	1465.8	10	26			

TABLE A63 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 4. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA	51.	6.2	384.9	10	7			
SALIX PULCHRA	50.	8.1	663.8	10	12			
SALIX LANATA	8.	4.1	171.4	10	100			
TOTAL ALL SPECIES	109.	10.6	1118.9	10	4			

TABLE A64 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 5. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA	82.	12.8	1650.0	10	10			
SALIX PULCHRA	28.	4.6	211.2	10	11			
TOTAL ALL SPECIES	111.	13.8	1907.6	10	7			

TABLE A65 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2)

OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 6. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA	69.	6.0	366.0	10	4			
SALIX PULCHRA	17.	3.7	136.0	10	19			
SALIX GLAUCA	3.	1.5	22.5	10	127			
TOTAL ALL SPECIES	89.	6.2	384.0	10	2			

TABLE A66 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 7. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA	23.	6.2	381.7	10	30			
SALIX PULCHRA	6.	1.1	12.0	10	16			
SALIX GLAUCA	12.	6.0	363.6	10	99			
SALIX LANATA	25.	6.8	456.6	10	30			
TOTAL ALL SPECIES	66.	9.0	812.7	10	8			

TABLE A67 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW DWARF BIRCH-WILLOW. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 60)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 6	BN	BNHAT
BETULA GLANDULOSA	53.	4.3	1096.2	60	17	801.23	54	12	4281.75	5	63
SALIX PULCHRA	20.	2.7	444.8	60	47	217.73	54	23	2897.64	5	300
SALIX GLAUCA	3.	1.2	81.0	60	353	67.76	54	296	223.71	5	975
SALIX LANATA	7.	1.9	208.7	60	164	137.66	54	108	975.43	5	764
TOTAL ALL SPECIES	83.	4.9	1465.5	60	9	1051.30	54	7	5938.31	5	36

TABLE A48 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 3. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
SALIX PULCHRA	94.	15.3	2104.4	9	10			
TOTAL ALL SPECIES	94.	15.3	2104.4	9	10			

TABLE A69 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 1	BN	BNHAT
SALIX PULCHRA	94.	15.3	2104.4	9	10	2104.36	8	10	0.00	0	1
TOTAL ALL SPECIES	94.	15.3	2104.4	9	10	2104.36	8	10	0.00	0	1

APPENDIX B

APPENDIX B

TIME TO ESTIMATE DENSITY

Means, standard errors, and variances for 1-m^2, 4-m^2, and 10-m^2 plot size density time estimates. Time to count stems of each shrub species and move between plots is presented by site. Sites are grouped into level IV vegetation types. Estimated sample sizes for times are not used.

TABLE 86 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR
SITE 10. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	22.	3.2	104.2	10	9			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.3	10	11			
SALIX PULCHRA (SEC)	8.	2.4	58.7	10	35			
SALIX GLAUCA (SEC)	2.	1.1	12.2	10	104			
SALIX LANATA (SEC)	2.	0.4	1.3	10	20			
SALIX ALAXENSIS (SEC)	1.	0.2	0.5	10	82			
ALNUS SINUATA (SEC)	1.	0.2	0.2	10	20			
MOVE TIME BETWEEN PLOTS (SEC)	57.	12.6	1596.9	10	20			
TOTAL TIME PER PLOT W MOVE	94.	13.0	1691.2	10				

TABLE B2 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 11. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA (SEC)	13.	3.5	125.6	10	33			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.2	10	20			
SALIX PULCHRA (SEC)	2.	0.7	5.0	10	47			
SALIX GLAUCA (SEC)	2.	1.3	18.2	10	187			
SALIX LANATA (SEC)	1.	0.2	0.3	10	46			
SALIX ALAXENSIS (SEC)	1.	0.4	1.4	10	73			
ALNUS SINUATA (SEC)	1.	0.2	0.3	10	46			
MOVE TIME BETWEEN PLOTS (SEC)	143.	74.9	56164.5	10	114			
TOTAL TIME PER PLOT W MOVE	162.	73.3	53781.3	10				

TABLE B3 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK-WHITE SPRUCE TYPE. N IS NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA (SEC)	17.	2.6	133.1	20	19	114.89	18	16	460.80	1	63
BETULA PAPYRIFERA (SEC)	1.	0.1	0.3	20	16	0.28	18	15	0.80	1	41
SALIX PULCHRA (SEC)	5.	1.4	40.6	20	61	31.85	18	48	198.45	1	295
SALIX GLAUCA (SEC)	2.	0.8	14.4	20	134	15.20	18	142	0.20	1	2
SALIX LANATA (SEC)	1.	0.2	1.1	20	39	0.81	18	28	7.20	1	244
SALIX ALAXENSIS (SEC)	1.	0.2	1.0	20	81	0.97	18	81	0.80	1	67
ALNUS SINUATA (SEC)	1.	0.1	0.3	20	29	0.26	18	30	0.20	1	23
MOVE TIME BETWEEN PLOTS (SEC)	100.	38.3	29270.9	20	121	28880.70	18	119	36295.20	1	149
TOTAL TIME PER PLOT W MOVE	128.	37.1	27482.6	20		27736.25	18		22916.45	1	

TABLE B4 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 14. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA (SEC)	23.	3.6	129.1	10	11			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.3	10	17			
SALIX PULCHRA (SEC)	2.	0.5	2.0	10	33			
SALIX GLAUCA (SEC)	1.	0.3	0.9	10	76			
SALIX LANATA (SEC)	1.	0.2	0.2	10	20			
SALIX ALAXENSIS (SEC)	1.	0.3	0.8	10	39			
ALNUS SINUATA (SEC)	1.	0.2	0.3	10	46			
MOVE TIME BETWEEN PLOTS (SEC)	58.	10.9	1189.6	10	15			
TOTAL TIME PER PLOT W MOVE	86.	11.5	1319.6	10				

TABLE B5 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 15. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA (SEC)	25.	1.6	24.9	10	2			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.3	10	31			
SALIX PULCHRA (SEC)	6.	2.7	75.0	10	89			
SALIX GLAUCA (SEC)	1.	0.1	0.2	10	12			
SALIX LANATA (SEC)	0.	0.2	0.3	10	69			
SALIX ALAXENSIS (SEC)	1.	0.2	0.3	10	31			
ALNUS SINUATA (SEC)	1.	0.2	0.2	10	20			
MOVE TIME BETWEEN PLOTS (SEC)	90.	19.7	3892.9	10	20			
TOTAL TIME PER PLOT W MOVE	124.	20.7	4270.2	10				

TABLE B6 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 18. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	21.	4.3	183.8	10	18			
BETULA PAPYRIFERA (SEC)	1.	0.1	0.2	10	12			
SALIX PULCHRA (SEC)	12.	3.4	114.3	10	36			
SALIX GLAUCA (SEC)	2.	0.4	2.0	10	21			
SALIX LANATA (SEC)	1.	0.3	0.8	10	39			
SALIX ALAXENSIS (SEC)	1.	0.5	2.1	10	72			
ALNUS SINUATA (SEC)	1.	0.1	0.2	10	12			
MOVE TIME BETWEEN PLOTS (SEC)	49.	14.5	2110.4	10	36			
TOTAL TIME PER PLOT W MOVE	87.	15.8	2485.2	10				

TABLE B7 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 19. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA (SEC)	27.	9.3	874.2	10	50			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.3	10	46			
SALIX PULCHRA (SEC)	6.	2.7	71.7	10	85			
SALIX GLAUCA (SEC)	1.	0.2	0.3	10	31			
SALIX LANATA (SEC)	1.	0.2	0.3	10	46			
SALIX ALAXENSIS (SEC)	1.	0.1	0.2	10	12			
ALNUS SINUATA (SEC)	0.	0.2	0.2	10	107			
MOVE TIME BETWEEN PLOTS (SEC)	66.	7.7	590.0	10	6			
TOTAL TIME PER PLOT W MOVE	101.	4.4	194.9	10				

TABLE B8 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK SPRUCE TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 40)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 4	BN	BNHAT
BETULA GLANDULOSA (SEC)	24.	2.7	285.3	40	21	303.00	36	22	72.96	3	6
BETULA PAPYRIFERA (SEC)	1.	0.1	0.3	40	23	0.26	36	22	0.33	3	28
SALIX PULCHRA (SEC)	6.	1.4	73.4	40	78	65.74	36	70	164.76	3	175
SALIX GLAUCA (SEC)	1.	0.2	1.1	40	43	0.84	36	33	4.29	3	168
SALIX LANATA (SEC)	1.	0.1	0.4	40	42	0.39	36	41	0.49	3	52
SALIX ALAXENSIS (SEC)	1.	0.1	0.8	40	46	0.83	36	47	0.43	3	25
ALNUS SINUATA (SEC)	1.	0.1	0.3	40	32	0.23	36	29	0.49	3	61
MOVE TIME BETWEEN PLOTS (SEC)	66.	7.1	2030.4	40	20	1945.72	36	19	3046.43	3	29
TOTAL TIME PER PLOT W MOVE	99.	7.3	2149.8	40		2067.49	36		3137.27	3	

TABLE B9 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 16. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	9.	2.4	57.4	10	30			
BETULA PAPYRIFERA (SEC)	2.	0.9	8.8	10	100			
SALIX PULCHRA (SEC)	1.	0.2	0.3	10	31			
SALIX GLAUCA (SEC)	1.	0.2	0.3	10	31			
SALIX LANATA (SEC)	1.	0.2	0.5	10	12			
SALIX ALAXENSIS (SEC)	1.	0.4	1.7	10	57			
ALNUS SINUATA (SEC)	2.	0.5	2.5	10	35			
MOVE TIME BETWEEN PLOTS (SEC)	104.	60.7	36810.4	10	140			
TOTAL TIME PER PLOT W MOVE	120.	62.5	39079.0	10				

TABLE B10 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 17. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA (SEC)	3.	0.8	5.7	10	30			
BETULA PAPYRIFERA (SEC)	1.	0.3	1.0	10	51			
SALIX PULCHRA (SEC)	1.	0.2	0.3	10	31			
SALIX GLAUCA (SEC)	1.	0.1	0.1	10	6			
SALIX LANATA (SEC)	1.	0.2	0.5	10	39			
SALIX ALAXENSIS (SEC)	1.	0.2	0.3	10	46			
ALNUS SINUATA (SEC)	1.	0.1	0.2	10	12			
MOVE TIME BETWEEN PLOTS (SEC)	53.	11.6	1336.1	10	20			
TOTAL TIME PER PLOT W MOVE	60.	11.7	1366.5	10				

TABLE B11 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN MIXED SPRUCE-BIRCH TYPE. N IS NUMBER OF SAMPLING UNITS. ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA (SEC)	6.	1.4	39.7	20	48	31.58	18	38	186.05	1	223
BETULA PAPYRIFERA (SEC)	1.	0.5	4.9	20	103	4.88	18	102	5.00	1	105
SALIX PULCHRA (SEC)	1.	0.1	0.3	20	29	0.27	18	31	-0.00	1	0
SALIX GLAUCA (SEC)	1.	0.1	0.2	20	15	0.18	18	14	0.45	1	33
SALIX LANATA (SEC)	1.	0.2	0.5	20	22	0.46	18	19	1.80	1	74
SALIX ALAXENSIS (SEC)	1.	0.2	1.0	20	65	0.97	18	62	1.80	1	116
ALNUS SINUATA (SEC)	1.	0.3	1.5	20	39	1.32	18	35	4.05	1	107
MOVE TIME BETWEEN PLOTS (SEC)	78.	30.6	18745.8	20	125	19073.25	18	127	12852.45	1	86
TOTAL TIME PER PLOT W MOVE	90.	31.7	20093.1	20		20222.72	18		17760.80	1	

TABLE B12 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 8. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	1.	0.3	0.9	9	26			
BETULA PAPYRIFERA (SEC)	3.	1.0	9.5	9	36			
SALIX PULCHRA (SEC)	1.	0.1	0.2	9	14			
SALIX GLAUCA (SEC)	1.	0.1	0.1	9	6			
SALIX LANATA (SEC)	1.	0.2	0.3	9	11			
SALIX ALAXENSIS (SEC)	47.	13.0	1510.9	9	29			
ALNUS SINUATA (SEC)	9.	2.3	46.9	9	23			
MOVE TIME BETWEEN PLOTS (SEC)	90.	16.5	2451.3	9	13			
TOTAL TIME PER PLOT W MOVE	154.	14.7	1940.5	9				

TABLE B13 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 9. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N=11)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT
BETULA PAPYRIFERA (SEC)	1.	0.3	0.8	11	33
SALIX PULCHRA (SEC)	15.	2.3	60.4	11	11
SALIX GLAUCA (SEC)	2.	0.3	1.0	11	9
SALIX LANATA (SEC)	3.	0.9	9.1	11	58
SALIX ALAXENSIS (SEC)	16.	4.0	176.9	11	30
ALNUS SINUATA (SEC)	2.	0.3	1.0	11	12
MOVE TIME BETWEEN PLOTS (SEC)	152.	37.4	15388.9	11	28
TOTAL TIME PER PLOT W MOVE	194.	39.8	17437.2	11	

TABLE B14 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR TALL WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA (SEC)	3.	1.3	33.4	20	195	33.40	18	195	33.36	1	195
BETULA PAPYRIFERA (SEC)	2.	0.5	5.8	20	57	4.67	18	46	26.95	1	263
SALIX PULCHRA (SEC)	9.	2.1	86.6	20	47	33.65	18	19	1040.01	1	557
SALIX GLAUCA (SEC)	2.	0.2	1.1	20	17	0.62	18	10	9.48	1	143
SALIX LANATA (SEC)	2.	0.5	5.5	20	66	5.15	18	62	11.82	1	142
SALIX ALAXENSIS (SEC)	30.	7.0	983.7	20	46	769.75	18	36	4834.77	1	225
ALNUS SINUATA (SEC)	5.	1.3	34.6	20	54	21.40	18	34	271.36	1	420
MOVE TIME BETWEEN PLOTS (SEC)	124.	22.5	10110.6	20	27	9638.81	18	26	18602.41	1	50
TOTAL TIME PER PLOT W MOVE	176.	22.8	10418.3	20		10549.78	18		8052.55	1	

TABLE B15 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 12. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	17.	6.7	444.0	10	63			
BETULA PAPYRIFERA (SEC)	3.	1.6	24.8	10	106			
SALIX PULCHRA (SEC)	9.	5.0	248.5	10	135			
SALIX GLAUCA (SEC)	2.	1.4	20.6	10	175			
SALIX LANATA (SEC)	8.	4.9	245.0	10	153			
SALIX ALAXENSIS (SEC)	4.	2.2	46.5	10	99			
ALNUS SINUATA (SEC)	2.	0.3	0.7	10	12			
MOVE TIME BETWEEN PLOTS (SEC)	62.	12.1	1462.5	10	16			
TOTAL TIME PER PLOT W MOVE	107.	17.1	2911.6	10				

TABLE B16 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 13. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	19.	4.0	162.3	10	18			
BETULA PAPYRIFERA (SEC)	1.	0.1	0.2	10	12			
SALIX PULCHRA (SEC)	2.	0.4	2.0	10	17			
SALIX GLAUCA (SEC)	1.	0.3	1.1	10	28			
SALIX LANATA (SEC)	1.	0.2	0.2	10	20			
SALIX ALAXENSIS (SEC)	1.	0.1	0.2	10	12			
ALNUS SINUATA (SEC)	1.	0.2	0.3	10	46			
MOVE TIME BETWEEN PLOTS (SEC)	184.	41.8	17456.1	10	22			
TOTAL TIME PER PLOT W MOVE	210.	41.2	16944.7	10				

TABLE 8L7 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (/ M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR
SITE 4. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	21.	2.2	45.2	9	5			
BETULA PAPYRIFERA (SEC)	1.	0.3	0.8	9	16			
SALIX PULCHRA (SEC)	25.	3.8	128.0	9	9			
SALIX GLAUCA (SEC)	6.	2.3	45.8	9	59			
SALIX LANATA (SEC)	20.	17.0	2613.4	9	271			
SALIX ALAXENSIS (SEC)	2.	0.7	3.9	9	52			
ALNUS SINUATA (SEC)	1.	0.2	0.3	9	37			
MOVE TIME BETWEEN PLOTS (SEC)	85.	12.0	1295.5	9	8			
TOTAL TIME PER PLOT W MOVE	160.	22.7	4649.2	9				

TABLE B18 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 5. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA (SEC)	23.	2.7	72.8	10	6			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.4	10	26			
SALIX PULCHRA (SEC)	23.	5.5	305.8	10	24			
SALIX GLAUCA (SEC)	2.	0.6	3.6	10	58			
SALIX LANATA (SEC)	1.	0.2	0.3	10	46			
SALIX ALAXENSIS (SEC)	1.	0.2	0.2	10	20			
ALNUS SINUATA (SEC)	1.	0.2	0.3	10	11			
MOVE TIME BETWEEN PLOTS (SEC)	475.	314.6	989917.6	10	181			
TOTAL TIME PER PLOT W MOVE	525.	313.1	980120.9	10				

TABLE B19 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 6. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA (SEC)	33.	4.6	209.2	10	8			
BETULA PAPYRIFERA (SEC)	2.	0.4	1.6	10	30			
SALIX PULCHRA (SEC)	16.	1.9	37.8	10	7			
SALIX GLAUCA (SEC)	5.	2.1	45.4	10	78			
SALIX LANATA (SEC)	2.	0.6	4.0	10	57			
SALIX ALAXENSIS (SEC)	1.	0.4	1.7	10	50			
ALNUS SINUATA (SEC)	3.	1.7	29.8	10	181			
MOVE TIME BETWEEN PLOTS (SEC)	72.	15.4	2370.0	10	19			
TOTAL TIME PER PLOT W MOVE	133.	12.5	1554.3	10				

TABLE B20 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 7. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	14.	3.3	111.8	10	23			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.2	10	20			
SALIX PULCHRA (SEC)	10.	3.3	111.2	10	47			
SALIX GLAUCA (SEC)	9.	2.6	65.2	10	37			
SALIX LANATA (SEC)	15.	3.5	122.0	10	22			
SALIX ALAXENSIS (SEC)	2.	0.6	3.3	10	28			
ALNUS SINUATA (SEC)	1.	0.1	0.1	10	6			
MOVE TIME BETWEEN PLOTS (SEC)	169.	38.3	14690.1	10	22			
TOTAL TIME PER PLOT W MOVE	221.	40.5	16393.3	10				

TABLE B21 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW DWARF, BIRCH-WILLOW. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 59)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 6	BN	BNHAT
BETULA GLANDULOSA (SEC)	21.	1.8	197.1	59	18	176.66	53	17	413.46	5	38
BETULA PAPYRIFERA (SEC)	1.	0.3	5.0	59	107	4.73	53	101	8.22	5	175
SALIX PULCHRA (SEC)	14.	1.8	194.6	59	41	139.08	53	29	782.79	5	164
SALIX GLAUCA (SEC)	4.	0.8	34.4	59	88	29.99	53	77	81.52	5	207
SALIX LANATA (SEC)	8.	2.8	475.0	59	346	457.56	53	333	659.57	5	480
SALIX ALAXENSIS (SEC)	2.	0.4	10.2	59	123	9.41	53	113	18.95	5	228
ALNUS SINUATA (SEC)	1.	0.3	5.4	59	149	5.35	53	148	6.16	5	170
MOVE TIME BETWEEN PLOTS (SEC)	176.	55.3	180181.3	59	239	174404.35	53	232	241416.68	5	321
TOTAL TIME PER PLOT W MOVE	227.	55.0	178736.7	59		173556.93	53		233642.15	5	

TABLE B22 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 3. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 12)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNF
BETULA GLANDULOSA (SEC)	6.	3.4	140.8	12	141			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.5	12	23			
SALIX PULCHRA (SEC)	91.	33.9	13829.4	12	69			
SALIX GLAUCA (SEC)	2.	0.3	1.2	12	17			
SALIX LANATA (SEC)	1.	0.1	0.2	12	23			
SALIX ALAXENSIS (SEC)	5.	3.0	106.3	12	181			
ALNUS SINUATA (SEC)	1.	0.1	0.2	12	15			
MOVE TIME BETWEEN PLOTS (SEC)	174.	41.2	20343.0	12	28			
TOTAL TIME PER PLOT W MOVE	280.	56.7	38564.9	12				

TABLE B23 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (1 M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 12)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 1	BN	BNHAT
BETULA GLANDULOSA (SEC)	6.	3.4	140.8	12	141	140.81	11	141	-0.00	0	0
BETULA PAPYRIFERA (SEC)	1.	0.2	0.5	12	23	0.55	11	23	0.	0	1
SALIX PULCHRA (SEC)	91.	33.9	13829.4	12	69	13829.42	11	69	-0.00	0	0
SALIX GLAUCA (SEC)	2.	0.3	1.2	12	17	1.15	11	17	0.00	0	1
SALIX LANATA (SEC)	1.	0.1	0.2	12	23	0.24	11	23	-0.00	0	0
SALIX ALAXENSIS (SEC)	5.	3.0	106.3	12	181	106.27	11	181	-0.00	0	0
ALNUS SINUATA (SEC)	1.	0.1	0.2	12	15	0.20	11	15	0.	0	1
MOVE TIME BETWEEN PLOTS (SEC)	174.	41.2	20343.0	12	28	20343.00	11	28	0.	0	1
TOTAL TIME PER PLOT W MOVE	280.	56.7	38564.9	12		38564.93	11		0.	0	

TABLE B24 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 10. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	59.	3.8	145.4	10	2			
BETULA PAPYRIFERA (SEC)	1.	0.3	1.2	10	41			
SALIX PULCHRA (SEC)	29.	6.6	431.2	10	21			
SALIX GLAUCA (SEC)	7.	3.1	95.4	10	78			
SALIX LANATA (SEC)	3.	1.0	10.8	10	57			
SALIX ALAXENSIS (SEC)	2.	0.7	5.3	10	76			
ALNUS SINUATA (SEC)	1.	0.2	0.2	10	20			
MOVE TIME BETWEEN PLOTS (SEC)	97.	33.1	10924.4	10	48			
TOTAL TIME PER PLOT W MOVE	199.	38.7	14981.1	10				

TABLE B25 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 11. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	38.	6.7	445.6	10	13			
BETULA PAPYRIFERA (SEC)	2.	0.9	8.4	10	107			
SALIX PULCHRA (SEC)	4.	1.2	13.8	10	42			
SALIX GLAUCA (SEC)	3.	1.1	12.4	10	57			
SALIX LANATA (SEC)	1.	0.3	0.8	10	55			
SALIX ALAXENSIS (SEC)	1.	0.2	0.3	10	17			
ALNUS SINUATA (SEC)	1.	0.2	0.5	10	39			
MOVE TIME BETWEEN PLOTS (SEC)	107.	18.2	3327.6	10	12			
TOTAL TIME PER PLOT W MOVE	156.	22.5	5048.0	10				

TABLE B26 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK-WHITE SPRUCE TYPE. N IS NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA (SEC)	48.	4.5	400.5	20	8	295.50	18	6	2289.80	1	41
BETULA PAPYRIFERA (SEC)	1.	0.5	4.7	20	92	4.81	18	94	2.45	1	48
SALIX PULCHRA (SEC)	16.	4.4	380.6	20	58	222.50	18	34	3225.80	1	492
SALIX GLAUCA (SEC)	5.	1.7	55.5	20	90	53.94	18	87	84.05	1	135
SALIX LANATA (SEC)	2.	0.6	6.6	20	84	5.84	18	74	20.00	1	253
SALIX ALAXENSIS (SEC)	1.	0.4	2.9	20	70	2.83	18	69	3.20	1	78
ALNUS SINUATA (SEC)	1.	0.1	0.3	20	28	0.34	18	29	-0.00	1	0
MOVE TIME BETWEEN PLOTS (SEC)	102.	18.4	6778.3	20	27	7126.00	18	28	520.20	1	3
TOTAL TIME PER PLOT W MOVE	177.	22.3	9969.5	20		10014.53	18		9159.20	1	

TABLE B27 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 14. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA (SEC)	79.	8.4	708.5	10	5			
BETULA PAPYRIFERA (SEC)	1.	0.8	5.8	10	141			
SALIX PULCHRA (SEC)	6.	3.4	115.6	10	151			
SALIX GLAUCA (SEC)	1.	0.3	0.7	10	57			
SALIX LANATA (SEC)	1.	0.2	0.4	10	19			
SALIX ALAXENSIS (SEC)	1.	0.2	0.3	10	17			
ALNUS SINUATA (SEC)	1.	0.2	0.4	10	26			
MOVE TIME BETWEEN PLOTS (SEC)	36.	7.4	552.0	10	18			
TOTAL TIME PER PLOT W MOVE	125.	15.0	2237.8	10				

TABLE B28 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 15. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	63.	6.6	432.0	10	5			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.5	10	39			
SALIX PULCHRA (SEC)	12.	4.9	244.7	10	74			
SALIX GLAUCA (SEC)	1.	0.2	0.2	10	20			
SALIX LANATA (SEC)	1.	0.2	0.3	10	46			
SALIX ALAXENSIS (SEC)	1.	0.2	0.3	10	31			
ALNUS SINUATA (SEC)	1.	0.2	0.2	10	20			
MOVE TIME BETWEEN PLOTS (SEC)	125.	23.4	5473.6	10	15			
TOTAL TIME PER PLOT W MOVE	203.	21.7	4704.7	10				

TABLE B29 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR
SITE 18. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	43.	5.3	278.5	10	7			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.3	10	31			
SALIX PULCHRA (SEC)	24.	4.8	229.9	10	17			
SALIX GLAUCA (SEC)	3.	0.5	2.5	10	16			
SALIX LANATA (SEC)	34.	10.4	1072.3	10	38			
SALIX ALAXENSIS (SEC)	3.	0.8	6.9	10	32			
ALNUS SINUATA (SEC)	1.	0.1	0.1	10	6			
MOVE TIME BETWEEN PLOTS (SEC)	73.	12.5	1566.1	10	13			
TOTAL TIME PER PLOT W MOVE	181.	15.3	2344.7	10				

TABLE B30 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 19. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	31.	5.7	325.3	10	14			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.4	10	26			
SALIX PULCHRA (SEC)	11.	2.9	83.5	10	30			
SALIX GLAUCA (SEC)	1.	0.3	0.8	10	39			
SALIX LANATA (SEC)	1.	0.2	0.3	10	46			
SALIX ALAXENSIS (SEC)	1.	0.2	0.3	10	31			
ALNUS SINUATA (SEC)	1.	0.7	4.2	10	103			
MOVE TIME BETWEEN PLOTS (SEC)	74.	13.6	1851.6	10	14			
TOTAL TIME PER PLOT W MOVE	121.	15.7	2469.2	10				

TABLE B31 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK SPRUCE TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 40)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 4	BN	BNHAT
BETULA GLANDULOSA (SEC)	54.	4.3	748.4	40	11	436.09	36	7	4495.57	3	64
BETULA PAPYRIFERA (SEC)	1.	0.2	1.7	40	95	1.73	36	98	0.97	3	55
SALIX PULCHRA (SEC)	13.	2.2	201.6	40	49	168.42	36	41	600.33	3	146
SALIX GLAUCA (SEC)	1.	0.2	1.6	40	45	1.04	36	29	8.49	3	232
SALIX LANATA (SEC)	9.	3.4	466.6	40	231	268.32	36	133	2845.40	3	1408
SALIX ALAXENSIS (SEC)	1.	0.3	2.8	40	72	1.94	36	49	13.43	3	339
ALNUS SINUATA (SEC)	1.	0.2	1.2	40	58	1.24	36	60	0.69	3	34
MOVE TIME BETWEEN PLOTS (SEC)	77.	9.0	3216.9	40	23	2360.83	36	17	13490.03	3	93
TOTAL TIME PER PLOT W MOVE	158.	10.0	3998.8	40		2939.08	36		16715.07	3	

TABLE B32 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR
SITE 16. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	28.	4.1	165.8	10	9			
BETULA PAPYRIFERA (SEC)	1.	0.1	0.2	10	12			
SALIX PULCHRA (SEC)	5.	2.7	74.0	10	144			
SALIX GLAUCA (SEC)	1.	0.2	0.5	10	19			
SALIX LANATA (SEC)	1.	0.3	0.9	10	37			
SALIX ALAXENSIS (SEC)	1.	0.3	0.8	10	55			
ALNUS SINUATA (SEC)	3.	2.1	45.7	10	239			
MOVE TIME BETWEEN PLOTS (SEC)	74.	16.7	2798.5	10	22			
TOTAL TIME PER PLOT W MOVE	112.	17.3	3002.7	10				

TABLE B33 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 17. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA (SEC)	4.	1.6	24.1	10	65			
BETULA PAPYRIFERA (SEC)	2.	0.7	5.6	10	103			
SALIX PULCHRA (SEC)	1.	0.2	0.3	10	46			
SALIX GLAUCA (SEC)	1.	0.1	0.2	10	12			
SALIX LANATA (SEC)	1.	0.2	0.3	10	46			
SALIX ALAXENSIS (SEC)	1.	0.2	0.3	10	31			
ALNUS SINUATA (SEC)	1.	0.2	0.2	10	20			
MOVE TIME BETWEEN PLOTS (SEC)	72.	7.3	532.0	10	5			
TOTAL TIME PER PLOT W MOVE	81.	6.8	459.4	10				

TABLE B34 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN MIXED SPRUCE-BIRCH TYPE. N IS NUMBER OF SAMPLING UNITS. ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA (SEC)	16.	3.5	239.0	20	40	94.94	18	16	2832.20	1	465
BETULA PAPYRIFERA (SEC)	1.	0.4	2.9	20	89	2.89	18	90	2.45	1	76
SALIX PULCHRA (SEC)	3.	1.4	39.6	20	250	37.16	18	235	84.05	1	530
SALIX GLAUCA (SEC)	1.	0.1	0.4	20	17	0.36	18	17	0.45	1	21
SALIX LANATA (SEC)	1.	0.2	0.6	20	46	0.58	18	43	1.25	1	92
SALIX ALAXENSIS (SEC)	1.	0.2	0.5	20	45	0.56	18	47	0.20	1	17
ALNUS SINUATA (SEC)	2.	1.1	22.9	20	307	22.98	18	308	22.05	1	295
MOVE TIME BETWEEN PLOTS (SEC)	73.	8.9	1578.2	20	13	1665.25	18	13	11.25	1	1
TOTAL TIME PER PLOT W MOVE	96.	9.8	1906.0	20		1731.03	18		5056.20	1	

TABLE B35 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 8. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	24.	21.3	4517.8	10	322			
BETULA PAPYRIFERA (SEC)	10.	4.0	160.3	10	72			
SALIX PULCHRA (SEC)	2.	1.3	18.0	10	185			
SALIX GLAUCA (SEC)	1.	0.3	0.8	10	39			
SALIX LANATA (SEC)	1.	0.1	0.2	10	6			
SALIX ALAXENSIS (SEC)	99.	18.5	3439.1	10	15			
ALNUS SINUATA (SEC)	37.	6.9	476.2	10	15			
MOVE TIME BETWEEN PLOTS (SEC)	112.	20.0	3980.4	10	13			
TOTAL TIME PER PLOT W MOVE	286.	46.1	21243.8	10				

TABLE B36 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 9. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA (SEC)	2.	1.2	14.8	10	126			
BETULA PAPYRIFERA (SEC)	1.	0.3	0.7	10	28			
SALIX PULCHRA (SEC)	35.	6.7	450.6	10	15			
SALIX GLAUCA (SEC)	5.	1.5	23.2	10	37			
SALIX LANATA (SEC)	1.	0.3	1.2	10	25			
SALIX ALAXENSIS (SEC)	32.	8.4	708.8	10	29			
ALNUS SINUATA (SEC)	5.	2.7	73.1	10	136			
MOVE TIME BETWEEN PLOTS (SEC)	143.	9.1	832.5	10	2			
TOTAL TIME PER PLOT W MOVE	224.	18.1	3262.4	10				

TABLE B37 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR TALL WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA (SEC)	13.	10.7	2272.1	20	543	2266.31	18	541	2376.20	1	568
BETULA PAPYRIFERA (SEC)	5.	2.2	95.7	20	140	80.47	18	118	369.80	1	540
SALIX PULCHRA (SEC)	19.	5.1	512.0	20	61	234.31	18	28	5511.20	1	653
SALIX GLAUCA (SEC)	3.	0.9	16.0	20	73	11.99	18	55	88.20	1	402
SALIX LANATA (SEC)	1.	0.2	0.6	20	16	0.67	18	17	0.20	1	5
SALIX ALAXENSIS (SEC)	65.	12.5	3142.6	20	31	2073.92	18	20	22378.05	1	215
ALNUS SINUATA (SEC)	21.	5.2	539.9	20	51	274.68	18	26	5313.80	1	494
MOVE TIME BETWEEN PLOTS (SEC)	127.	11.2	2521.4	20	7	2406.45	18	7	4590.45	1	12
TOTAL TIME PER PLOT W MOVE	255.	25.1	12619.8	20		12253.11	18		19220.00	1	

TABLE B38 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 12. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	52.	8.8	777.8	10	12			
BETULA PAPYRIFERA (SEC)	3.	1.8	32.2	10	129			
SALIX PULCHRA (SEC)	27.	8.1	656.8	10	37			
SALIX GLAUCA (SEC)	6.	1.7	29.6	10	34			
SALIX LANATA (SEC)	17.	6.5	419.3	10	59			
SALIX ALAXENSIS (SEC)	1.	0.3	1.0	10	51			
ALNUS SINUATA (SEC)	1.	0.2	0.3	10	17			
MOVE TIME BETWEEN PLOTS (SEC)	65.	9.6	915.6	10	9			
TOTAL TIME PER PLOT W MOVE	173.	17.1	2936.2	10				

TABLE B39 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2)

OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 13. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA (SEC)	33.	5.9	350.8	10	14			
BETULA PAPYRIFERA (SEC)	2.	1.2	14.6	10	124			
SALIX PULCHRA (SEC)	9.	2.2	47.5	10	23			
SALIX GLAUCA (SEC)	5.	2.4	57.0	10	90			
SALIX LANATA (SEC)	1.	0.3	1.2	10	41			
SALIX ALAXENSIS (SEC)	0.	0.2	0.3	10	69			
ALNUS SINUATA (SEC)	1.	0.1	0.1	10	6			
MOVE TIME BETWEEN PLOTS (SEC)	194.	75.0	56313.6	10	62			
TOTAL TIME PER PLOT W MOVE	246.	74.5	55442.5	10				

TABLE B40 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 4. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 11)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	52.	6.9	525.9	11	9			
BETULA PAPYRIFERA (SEC)	4.	2.0	45.9	11	124			
SALIX PULCHRA (SEC)	50.	6.6	474.3	11	8			
SALIX GLAUCA (SEC)	14.	4.9	266.8	11	58			
SALIX LANATA (SEC)	2.	1.2	17.2	11	213			
SALIX ALAXENSIS (SEC)	1.	0.4	1.9	11	37			
ALNUS SINUATA (SEC)	1.	0.5	3.1	11	107			
MOVE TIME BETWEEN PLOTS (SEC)	189.	79.1	68854.4	11	80			
TOTAL TIME PER PLOT W MOVE	312.	77.7	66457.0	11				

TABLE B41 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 5. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA (SEC)	62.	10.3	1061.7	10	12			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.3	10	11			
SALIX PULCHRA (SEC)	50.	12.0	1437.7	10	24			
SALIX GLAUCA (SEC)	2.	0.6	3.6	10	58			
SALIX LANATA (SEC)	1.	0.2	0.4	10	26			
SALIX ALAXENSIS (SEC)	1.	0.2	0.3	10	31			
ALNUS SINUATA (SEC)	1.	0.2	0.3	10	31			
MOVE TIME BETWEEN PLOTS (SEC)	111.	14.8	2200.9	10	8			
TOTAL TIME PER PLOT W MOVE	227.	28.0	7843.9	10				

TABLE B42 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 6. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA (SEC)	75.	8.0	635.5	10	5			
BETULA PAPYRIFERA (SEC)	1.	0.3	1.1	10	31			
SALIX PULCHRA (SEC)	44.	7.7	596.1	10	13			
SALIX GLAUCA (SEC)	10.	3.3	108.5	10	50			
SALIX LANATA (SEC)	4.	2.8	78.7	10	175			
SALIX ALAXENSIS (SEC)	2.	1.1	12.2	10	104			
ALNUS SINUATA (SEC)	1.	0.1	0.2	10	12			
MOVE TIME BETWEEN PLOTS (SEC)	189.	110.0	120928.9	10	140			
TOTAL TIME PER PLOT W MOVE	325.	111.0	123273.8	10				

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TABLE B43 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 7. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA (SEC)	39.	5.5	306.0	10	9			
BETULA PAPYRIFERA (SEC)	1.	0.1	0.2	10	10			
SALIX PULCHRA (SEC)	25.	5.2	266.7	10	18			
SALIX GLAUCA (SEC)	11.	2.6	68.0	10	23			
SALIX LANATA (SEC)	36.	7.5	558.9	10	19			
SALIX ALAXENSIS (SEC)	1.	0.3	0.7	10	15			
ALNUS SINUATA (SEC)	1.	0.1	0.1	10	6			
MOVE TIME BETWEEN PLOTS (SEC)	139.	27.1	7355.6	10	16			
TOTAL TIME PER PLOT W MOVE	253.	25.6	6561.8	10				

TABLE B44 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW DWARF BIRCH-WILLOW. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 61)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 6	BN	BNHAT
BETULA GLANDULOSA (SEC)	52.	3.5	749.4	61	12	608.08	55	10	2304.26	5	35
BETULA PAPYRIFERA (SEC)	2.	0.5	16.2	61	147	16.27	55	147	15.67	5	142
SALIX PULCHRA (SEC)	34.	3.5	756.0	61	27	577.91	55	21	2715.21	5	95
SALIX GLAUCA (SEC)	8.	1.3	101.4	61	66	92.14	55	60	203.85	5	133
SALIX LANATA (SEC)	10.	2.3	323.6	61	134	176.33	55	73	1944.13	5	799
SALIX ALAXENSIS (SEC)	1.	0.2	2.8	61	86	2.70	55	82	4.39	5	133
ALNUS SINUATA (SEC)	1.	0.1	0.7	61	38	0.72	55	40	0.27	5	15
MOVE TIME BETWEEN PLOTS (SEC)	148.	26.2	41955.5	61	79	43235.92	55	81	27870.67	5	52
TOTAL TIME PER PLOT W MOVE	257.	26.6	43174.5	61		44165.34	55		32274.81	5	

TABLE B45 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 3. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	3.	1.1	10.0	9	58			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.4	9	13			
SALIX PULCHRA (SEC)	102.	22.6	4604.6	9	19			
SALIX GLAUCA (SEC)	22.	17.2	2662.5	9	219			
SALIX LANATA (SEC)	1.	0.4	1.5	9	62			
SALIX ALAXENSIS (SEC)	10.	4.5	178.4	9	70			
ALNUS SINUATA (SEC)	1.	0.4	1.8	9	35			
MOVE TIME BETWEEN PLOTS (SEC)	260.	129.1	150057.0	9	91			
TOTAL TIME PER PLOT W MOVE	401.	149.2	200246.7	9				

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TABLE B46 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 1	BN	BNHAT
BETULA GLANDULOSA (SEC)	3.	1.1	10.0	9	58	10.00	8	58	0.	0	1
BETULA PAPYRIFERA (SEC)	1.	0.2	0.4	9	13	0.44	8	13	-0.00	0	0
SALIX PULCHRA (SEC)	102.	22.6	4604.6	9	19	4604.61	8	19	0.00	0	1
SALIX GLAUCA (SEC)	22.	17.2	2662.5	9	219	2662.50	8	219	0.	0	1
SALIX LANATA (SEC)	1.	0.4	1.5	9	62	1.50	8	62	0.	0	1
SALIX ALAXENSIS (SEC)	10.	4.5	178.4	9	70	178.44	8	70	-0.00	0	0
ALNUS SINUATA (SEC)	1.	0.4	1.8	9	35	1.78	8	35	-0.00	0	0
MOVE TIME BETWEEN PLOTS (SEC)	260.	129.1	150057.0	9	91	150057.00	8	91	0.	0	1
TOTAL TIME PER PLOT W MOVE	401.	149.2	200246.7	9		200246.70	8		-0.01	0	

TABLE B47 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 10. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	84.	11.2	1245.6	10	8			
BETULA PAPYRIFERA (SEC)	1.	0.4	1.4	10	73			
SALIX PULCHRA (SEC)	36.	8.2	675.1	10	22			
SALIX GLAUCA (SEC)	13.	5.1	259.4	10	67			
SALIX LANATA (SEC)	140. no stems	136.3	185721.8	10	391			
SALIX ALAXENSIS (SEC)	2.	0.7	4.9	10	51			
ALNUS SINUATA (SEC)	2.	0.4	1.8	10	30.			
MOVE TIME BETWEEN PLOTS (SEC)	46.	5.8	341.6	10	7			
TOTAL TIME PER PLOT W MOVE	322.	137.4	188708.2	10				

TABLE B48 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR
SITE 11. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	44.	8.0	638.4	10	14			
BETULA PAPYRIFERA (SEC)	1.	0.7	5.6	10	118			
SALIX PULCHRA (SEC)	5.	0.8	6.8	10	12			
SALIX GLAUCA (SEC)	10.	2.6	68.9	10	31			
SALIX LANATA (SEC)	1.	0.2	0.5	10	12			
SALIX ALAXENSIS (SEC)	1.	0.2	0.2	10	20			
ALNUS SINUATA (SEC)	1.	0.2	0.3	10	17			
MOVE TIME BETWEEN PLOTS (SEC)	114.	6.1	376.9	10	2			
TOTAL TIME PER PLOT W MOVE	177.	7.8	611.8	10				

TABLE 849 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK-WHITE SPRUCE TYPE. N IS NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA (SEC)	64.	8.1	1315.6	20	14	941.98	18	10	8040.05	1	80
BETULA PAPYRIFERA (SEC)	1.	0.4	3.4	20	106	3.52	18	109	1.25	1	39
SALIX PULCHRA (SEC)	20.	5.4	574.2	20	57	340.92	18	34	4774.05	1	473
SALIX GLAUCA (SEC)	11.	2.8	157.9	20	53	164.16	18	55	45.00	1	15
SALIX LANATA (SEC)	70.	68.2	92999.8	20	769	92861.14	18	768	95496.20	1	790
SALIX ALAXENSIS (SEC)	1.	0.4	2.9	20	65	2.56	18	58	8.45	1	190
ALNUS SINUATA (SEC)	1.	0.2	1.1	20	31	1.07	18	29	2.45	1	65
MOVE TIME BETWEEN PLOTS (SEC)	80.	8.8	1560.8	20	11	359.25	18	3	23188.05	1	150
TOTAL TIME PER PLOT W MOVE	250.	69.0	95256.7	20		94660.01	18		105996.80	1	

TABLE B50 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 14. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN WN	WNHAT
BETULA GLANDULOSA (SEC)	92.	7.2	520.8	10	3		
BETULA PAPYRIFERA (SEC)	1.	0.1	0.1	10	6		
SALIX PULCHRA (SEC)	16.	11.8	1388.5	10	234		
SALIX GLAUCA (SEC)	1.	0.3	1.1	10	28		
SALIX LANATA (SEC)	1.	0.7	4.7	10	192		
SALIX ALAXENSIS (SEC)	1.	0.2	0.3	10	31		
ALNUS SINUATA (SEC)	1.	0.3	0.8	10	55		
MOVE TIME BETWEEN PLOTS (SEC)	49.	4.4	193.6	10	4		
TOTAL TIME PER PLOT W MOVE	161.	14.9	2216.5	10			

TABLE B51 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 15. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA (SEC)	85.	5.7	320.1	10	2			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.2	10	20			
SALIX PULCHRA (SEC)	24.	10.6	1129.0	10	80			
SALIX GLAUCA (SEC)	1.	0.2	0.3	10	31			
SALIX LANATA (SEC)	1.	0.2	0.3	10	46			
SALIX ALAXENSIS (SEC)	1.	0.1	0.2	10	12			
ALNUS SINUATA (SEC)	1.	0.2	0.4	10	26			
MOVE TIME BETWEEN PLOTS (SEC)	130.	20.1	4028.1	10	10			
TOTAL TIME PER PLOT W MOVE	243.	22.6	5089.2	10				

TABLE B52 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR
SITE 18. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA (SEC)	57.	3.6	128.2	10	2			
BETULA PAPYRIFERA (SEC)	1.	0.1	0.2	10	12			
SALIX PULCHRA (SEC)	44.	7.9	620.4	10	14			
SALIX GLAUCA (SEC)	6.	2.2	48.3	10	66			
SALIX LANATA (SEC)	17.	7.1	505.9	10	73			
SALIX ALAXENSIS (SEC)	3.	1.6	25.7	10	103			
ALNUS SINUATA (SEC)	1.	0.5	2.9	10	62			
MOVE TIME BETWEEN PLOTS (SEC)	68.	5.5	302.4	10	3			
TOTAL TIME PER PLOT W MOVE	197.	14.5	2101.8	10				

TABLE B53 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 19. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	40.	6.2	381.6	10	10			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.3	10	31			
SALIX PULCHRA (SEC)	15.	3.6	131.3	10	23			
SALIX GLAUCA (SEC)	1.	0.2	0.3	10	31			
SALIX LANATA (SEC)	1.	0.1	0.2	10	12			
SALIX ALAXENSIS (SEC)	0.	0.2	0.3	10	69			
ALNUS SINUATA (SEC)	1.	0.2	0.3	10	31			
MOVE TIME BETWEEN PLOTS (SEC)	130.	29.5	8689.6	10	22			
TOTAL TIME PER PLOT W MOVE	188.	27.3	7428.7	10				

TABLE B54 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK SPRUCE TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 40)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 4	BN	BNHAT
BETULA GLANDULOSA (SEC)	69.	4.4	761.5	40	7	337.67	36	3	5847.63	3	51
BETULA PAPYRIFERA (SEC)	1.	0.1	0.2	40	15	0.19	36	15	0.17	3	13
SALIX PULCHRA (SEC)	25.	4.7	893.9	40	60	817.32	36	55	1813.37	3	122
SALIX GLAUCA (SEC)	2.	0.6	15.8	40	162	12.48	36	128	55.53	3	569
SALIX LANATA (SEC)	5.	2.0	168.0	40	299	127.75	36	228	651.13	3	1158
SALIX ALAXENSIS (SEC)	1.	0.4	7.4	40	195	6.61	36	174	17.17	3	451
ALNUS SINUATA (SEC)	1.	0.2	1.1	40	57	1.11	36	57	1.20	3	61
MOVE TIME BETWEEN PLOTS (SEC)	94.	10.5	4409.3	40	21	3303.42	36	16	17679.22	3	82
TOTAL TIME PER PLOT W MOVE	197.	10.9	4769.7	40		4209.05	36		11497.63	3	

TABLE B55 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 16. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	18.	6.0	365.3	10	46			
BETULA PAPYRIFERA (SEC)	7.	4.0	158.7	10	133			
SALIX PULCHRA (SEC)	8.	4.2	174.7	10	128			
SALIX GLAUCA (SEC)	5.	3.4	114.8	10	196			
SALIX LANATA (SEC)	1.	0.3	0.8	10	26			
SALIX ALAXENSIS (SEC)	1.	0.2	0.6	10	18			
ALNUS SINUATA (SEC)	20.	8.1	651.6	10	69			
MOVE TIME BETWEEN PLOTS (SEC)	119.	38.6	14900.4	10	44			
TOTAL TIME PER PLOT W MOVE	178.	48.8	23789.2	10				

TABLE B56 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 17. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNI
BETULA GLANDULOSA (SEC)	3.	1.1	12.2	10	69			
BETULA PAPYRIFERA (SEC)	7.	2.9	82.4	10	73			
SALIX PULCHRA (SEC)	0.	0.2	0.3	10	69			
SALIX GLAUCA (SEC)	1.	0.2	0.2	10	20			
SALIX LANATA (SEC)	1.	0.2	0.3	10	31			
SALIX ALAXENSIS (SEC)	1.	0.2	0.4	10	26			
ALNUS SINUATA (SEC)	1.	0.2	0.2	10	20			
MOVE TIME BETWEEN PLOTS (SEC)	82.	11.4	1288.4	10	8			
TOTAL TIME PER PLOT W MOVE	95.	12.4	1533.9	10				

TABLE B57 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN MIXED SPRUCE-BIRCH TYPE. N IS NUMBER OF SAMPLING UNITS. ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA (SEC)	10.	3.5	242.1	20	91	188.76	18	71	1201.25	1	451
BETULA PAPYRIFERA (SEC)	7.	2.4	114.2	20	99	120.53	18	104	0.20	1	1
SALIX PULCHRA (SEC)	4.	2.2	96.2	20	253	87.49	18	230	252.05	1	662
SALIX GLAUCA (SEC)	3.	1.7	59.1	20	309	57.50	18	301	88.20	1	461
SALIX LANATA (SEC)	1.	0.2	0.6	20	32	0.52	18	30	1.25	1	71
SALIX ALAXENSIS (SEC)	1.	0.2	0.5	20	22	0.51	18	21	0.80	1	33
ALNUS SINUATA (SEC)	10.	4.5	403.7	20	159	325.90	18	129	1805.00	1	711
MOVE TIME BETWEEN PLOTS (SEC)	101.	20.0	8020.9	20	33	8094.40	18	33	6697.80	1	28
TOTAL TIME PER PLOT W MOVE	137.	26.3	13829.9	20		12661.52	18		34861.25	1	

TABLE B58 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 8. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 11)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	47. no stems	25.3	7054.6	11	133			
BETULA PAPYRIFERA (SEC)	24.	10.0	1092.8	11	77			
SALIX PULCHRA (SEC)	11.	5.2	301.6	11	98			
SALIX GLAUCA (SEC)	1.	0.3	0.7	11	35			
SALIX LANATA (SEC)	2.	1.3	18.2	11	157			
SALIX ALAXENSIS (SEC)	99.	9.8	1055.0	11	5			
ALNUS SINUATA (SEC)	55.	7.1	553.6	11	8			
MOVE TIME BETWEEN PLOTS (SEC)	101.	18.4	3732.9	11	15			
TOTAL TIME PER PLOT W MOVE	341.	45.1	22352.4	11				

TABLE B59 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 9. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA (SEC)	13.	12.1	1317.2	9	309			
BETULA PAPYRIFERA (SEC)	6.	3.6	119.4	9	141			
SALIX PULCHRA (SEC)	35.	6.1	333.0	9	12			
SALIX GLAUCA (SEC)	24.	10.2	944.0	9	65			
SALIX LANATA (SEC)	6.	4.1	153.6	9	169			
SALIX ALAXENSIS (SEC)	27.	6.7	406.9	9	24			
ALNUS SINUATA (SEC)	9.	4.0	142.8	9	66			
MOVE TIME BETWEEN PLOTS (SEC)	158.	30.3	8254.8	9	14			
TOTAL TIME PER PLOT W MOVE	279.	31.0	8654.9	9				

TABLE B60 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR TALL
WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA (SEC)	32. at 5Kms	15.1	4560.0	20	187	4504.65	18	185	5556.81	1	228
BETULA PAPYRIFERA (SEC)	16.	6.0	712.6	20	115	660.14	18	107	1656.42	1	267
SALIX PULCHRA (SEC)	22.	4.7	441.5	20	39	315.57	18	28	2709.02	1	234
SALIX GLAUCA (SEC)	12.	5.2	542.2	20	168	419.95	18	131	2741.87	1	850
SALIX LANATA (SEC)	4.	2.0	78.3	20	206	78.36	18	206	76.42	1	201
SALIX ALAXENSIS (SEC)	67.	10.2	2085.5	20	20	766.98	18	8	25819.44	1	240
ALNUS SINUATA (SEC)	35.	6.7	892.2	20	31	371.01	18	13	10272.78	1	354
MOVE TIME BETWEEN PLOTS (SEC)	127.	17.7	6283.2	20	16	5742.60	18	15	16014.22	1	41
TOTAL TIME PER PLOT W MOVE	313.	28.6	16404.8	20		16264.62	18		18928.72	1	

TABLE B61 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 12. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT
BETULA GLANDULOSA (SEC)	73.	6.9	480.7	10	4
BETULA PAPYRIFERA (SEC)	3.	1.2	15.3	10	80
SALIX PULCHRA (SEC)	38.	7.5	555.3	10	16
SALIX GLAUCA (SEC)	11.	3.3	111.8	10	41
SALIX LANATA (SEC)	27.	6.8	467.0	10	27
SALIX ALAXENSIS (SEC)	4.	1.3	15.8	10	34
ALNUS SINUATA (SEC)	1.	0.4	1.3	10	37
MOVE TIME BETWEEN PLOTS (SEC)	61.	11.1	1240.4	10	14
TOTAL TIME PER PLOT W MOVE	219.	15.1	2280.5	10	

WITHIN WN WN

TABLE B62 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 13. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	46.	7.6	576.7	10	12			
BETULA PAPYRIFERA (SEC)	1.	0.2	0.3	10	17			
SALIX PULCHRA (SEC)	15.	3.8	148.2	10	27			
SALIX GLAUCA (SEC)	8.	2.7	72.1	10	48			
SALIX LANATA (SEC)	2.	0.6	3.8	10	62			
SALIX ALAXENSIS (SEC)	1.	0.2	0.5	10	39			
ALNUS SINUATA (SEC)	1.	0.2	0.3	10	46			
MOVE TIME BETWEEN PLOTS (SEC)	132.	26.4	6956.0	10	17			
TOTAL TIME PER PLOT W MOVE	204.	33.1	10925.3	10				

TABLE B63 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 4. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN WN	WNHAT
BETULA GLANDULOSA (SEC)	79.	6.2	386.8	10	3		
BETULA PAPYRIFERA (SEC)	1.	0.2	0.2	10	6		
SALIX PULCHRA (SEC)	84.	6.3	397.4	10	3		
SALIX GLAUCA (SEC)	46.	20.6	4253.3	10	82		
SALIX LANATA (SEC)	3.	1.1	13.2	10	65		
SALIX ALAXENSIS (SEC)	3.	0.7	5.4	10	33		
ALNUS SINUATA (SEC)	1.	0.3	1.1	10	31		
MOVE TIME BETWEEN PLOTS (SEC)	231.	113.1	127970.9	10	98		
TOTAL TIME PER PLOT W MOVE	448.	124.1	154006.5	10			

TABLE B64 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 5. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	72.	6.9	481.4	10	4			
BETULA PAPYRIFERA (SEC)	2.	0.4	2.0	10	25			
SALIX PULCHRA (SEC)	48.	4.6	213.8	10	4			
SALIX GLAUCA (SEC)	2.	0.3	0.9	10	18			
SALIX LANATA (SEC)	1.	0.2	0.3	10	17			
SALIX ALAXENSIS (SEC)	1.	0.1	0.1	10	6			
ALNUS SINUATA (SEC)	1.	0.1	0.2	10	10			
MOVE TIME BETWEEN PLOTS (SEC)	142.	30.7	9440.4	10	20			
TOTAL TIME PER PLOT W MOVE	268.	27.9	7800.7	10				

TABLE B65 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 6. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA (SEC)	94.	8.5	724.4	10	4			
BETULA PAPYRIFERA (SEC)	1.	0.4	1.3	10	55			
SALIX PULCHRA (SEC)	52.	7.0	487.4	10	8			
SALIX GLAUCA (SEC)	8.	2.7	74.2	10	45			
SALIX LANATA (SEC)	5.	2.4	58.0	10	96			
SALIX ALAXENSIS (SEC)	1.	0.5	2.3	10	48			
ALNUS SINUATA (SEC)	2.	0.5	2.5	10	40			
MOVE TIME BETWEEN PLOTS (SEC)	131.	38.3	14640.1	10	35			
TOTAL TIME PER PLOT W MOVE	294.	39.6	15649.3	10				

TABLE B66 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 7. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA (SEC)	39.	7.2	518.5	10	15			
BETULA PAPYRIFERA (SEC)	1.	0.3	0.7	10	28			
SALIX PULCHRA (SEC)	28.	2.6	68.7	10	4			
SALIX GLAUCA (SEC)	26.	10.6	1128.2	10	68			
SALIX LANATA (SEC)	38.	5.3	280.4	10	8			
SALIX ALAXENSIS (SEC)	1.	0.2	0.6	10	18			
ALNUS SINUATA (SEC)	1.	0.1	0.1	10	6			
MOVE TIME BETWEEN PLOTS (SEC)	251.	80.8	65326.4	10	43			
TOTAL TIME PER PLOT W MOVE	384.	86.1	74190.7	10				

TABLE 867 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW DWARF BIRCH-WILLOW. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 60)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 6	BN	BNHAT
BETULA GLANDULOSA (SEC)	67.	3.8	852.3	60	8	528.08	54	5	4354.35	5	40
BETULA PAPYRIFERA (SEC)	1.	0.2	3.5	60	67	3.30	54	63	5.35	5	102
SALIX PULCHRA (SEC)	44.	3.6	757.4	60	17	311.82	54	7	5569.12	5	118
SALIX GLAUCA (SEC)	17.	4.3	1094.8	60	159	940.10	54	137	2765.20	5	402
SALIX LANATA (SEC)	13.	2.4	339.0	60	89	137.13	54	36	2518.75	5	656
SALIX ALAXENSIS (SEC)	2.	0.3	5.4	60	64	4.11	54	49	19.83	5	234
ALNUS SINUATA (SEC)	1.	0.1	0.9	60	35	0.91	54	33	1.35	5	49
MOVE TIME BETWEEN PLOTS (SEC)	158.	25.4	38647.6	60	64	37595.70	54	62	50008.32	5	82
TOTAL TIME PER PLOT W MOVE	303.	28.3	48165.6	60		44142.17	54		91618.75	5	

TABLE B68 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR
SITE 3. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA (SEC)	13.	11.6	1216.8	9	295			
BETULA PAPYRIFERA (SEC)	8.	6.4	366.5	9	211			
SALIX PULCHRA (SEC)	131.	24.3	5300.5	9	13			
SALIX GLAUCA (SEC)	8.	5.0	224.6	9	148			
SALIX LANATA (SEC)	2.	0.9	7.7	9	64			
SALIX ALAXENSIS (SEC)	5.	3.5	111.3	9	183			
ALNUS SINUATA (SEC)	1.	0.3	0.8	9	31			
MOVE TIME BETWEEN PLOTS (SEC)	251.	105.5	100167.3	9	65			
TOTAL TIME PER PLOT W MOVE	420.	93.3	78267.9	9				

TABLE B69 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (10M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 1	BN	BNHAT
BETULA GLANDULOSA (SEC)	13.	11.6	1216.8	9	295	1216.75	8	295	0.	0	1
BETULA PAPYRIFERA (SEC)	8.	6.4	366.5	9	211	366.53	8	211	0.00	0	1
SALIX PULCHRA (SEC)	131.	24.3	5300.5	9	13	5300.50	8	13	0.	0	1
SALIX GLAUCA (SEC)	8.	5.0	224.6	9	148	224.61	8	148	0.00	0	1
SALIX LANATA (SEC)	2.	0.9	7.7	9	64	7.69	8	64	0.00	0	1
SALIX ALAXENSIS (SEC)	5.	3.5	111.3	9	183	111.25	8	183	0.	0	1
ALNUS SINUATA (SEC)	1.	0.3	0.8	9	31	0.75	8	31	0.	0	1
MOVE TIME BETWEEN PLOTS (SEC)	251.	105.5	100167.3	9	65	100167.25	8	65	0.	0	1
TOTAL TIME PER PLOT W MOVE	420.	93.3	78267.9	9		78267.86	8		-0.00	0	

APPENDIX C

APPENDIX C

DENSITY STATISTICS WITHOUT *Betula glandulosa*

Means, standard errors, variances, and estimated sample sizes for 4-m^2 plot size density estimates for selected shrub species. *Betula glandulosa* has been excluded from the analysis. Density estimates are presented by level IV vegetation type. The within estimated sample size (WHNAT) is the total number of 4-m^2 plots required to sample the density in the vegetation type within 20% of the mean with 67% confidence. These density plot are then evenly allocated to the number of sites sampled in the type.

TABLE C1. MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK-WHITE SPRUCE TYPE. N IS NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA PAPYRIFERA	0.	0.3	1.3	20	501	1.25	18	501	1.25	1	501
SALIX PULCHRA	7.	3.2	209.4	20	120	172.26	18	99	877.81	1	501
SALIX GLAUCA	3.	0.9	15.7	20	52	16.53	18	55	1.25	1	5
TOTAL ALL SPECIES	10.	3.6	252.8	20	69	218.09	18	59	877.81	1	237

TABLE C2 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK SPRUCE TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 40)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 4	BN	BNHAT
SALIX PULCHRA	11.	3.4	474.2	40	102	476.16	36	102	450.16	3	97
SALIX LANATA	10.	3.9	602.3	40	167	.351.67	36	98	3610.00	3	1001
TOTAL ALL SPECIES	20.	5.3	1103.3	40	67	889.84	36	54.	3664.32	3	223

TABLE C3 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN MIXED SPRUCE-BIRCH TYPE. N IS NUMBER OF SAMPLING UNITS. ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA PAPYRIFERA	0.	0.3	1.3	20	501	1.25	18	501	1.25	1	501
SALIX PULCHRA	1.	0.9	15.3	20	501	15.31	18	501	15.31	1	501
ALNUS SINUATA	1.	0.5	5.0	20	501	5.00	18	501	5.00	1	501
TOTAL ALL SPECIES	2.	1.0	19.9	20	189	19.62	18	186	25.31	1	240

TABLE C4 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR TALL WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA PAPYRIFERA	2.	1.0	22.0	20	245	21.46	18	239	31.25	1	348
SALIX PULCHRA	12.	3.4	232.4	20	43	113.92	18	22	2365.31	1	438
SALIX ALAXENSIS	40.	6.6	877.8	20	14	749.48	18	12	3187.81	1	49
ALNUS SINUATA	7.	2.6	130.3	20	72	109.79	18	61	500.00	1	275
TOTAL ALL SPECIES	60.	7.5	1121.6	20	8	1112.85	18	8	1280.00	1	9

TABLE C5 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW DWARF BIRCH-WILLOW. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 61)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 6	BN	BNHAT
BETULA PAPYRIFERA	0.	0.2	3.7	61	1526	3.68	55	1523	3.76	5	1556
SALIX PULCHRA	26.	4.7	1355.3	61	50	1107.66	55	41	4079.80	5	149
SALIX GLAUCA	2.	0.9	47.0	61	208	45.25	55	201	65.82	5	292
SALIX LANATA	11.	3.4	697.9	61	147	484.13	55	102	3049.67	5	642
TOTAL ALL SPECIES	40.	5.3	1682.0	61	27	1401.16	55	23	4771.48	5	176

TABLE C6 MEANS, STANDARD ERRORS, AND VARIANCES FOR STEM COUNTS (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE DENSITY WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 1	BN	BNHAT
SALIX PULCHRA	116.	31.0	8653.3	9	16	8653.30	8	16.	0.00	0	1
SALIX ALAXENSIS	6.	4.5	179.9	9	111	179.86	8	111	-0.00	0	0
TOTAL ALL SPECIES	123.	30.4	8324.1	9	14	8324.13	8	14	0.00	0	1

APPENDIX D

APPENDIX D

TIME TO ESTIMATE DENSITY WITHOUT *Betula glandulosa*

Means, standard errors, and variances for 4-m^2 plot size density time estimates. Time to count stems of each selected shrub species and move time between plots is presented by level IV vegetation type. *Betula glandulosa* has been excluded from the analysis. Estimated sample sizes for times are not used.

TABLE Dt MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK-WHITE SPRUCE TYPE. N IS NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA PAPYRIFERA (SEC)	1.	0.5	4.7	20	56	4.81	18	58	2.45	1	30
SALIX PULCHRA (SEC)	16.	4.4	380.6	20	36	222.50	18	21	3225.80	1	300
SALIX GLAUCA (SEC)	5.	1.7	55.5	20	55	53.94	18	53	84.05	1	83
SALIX LANATA (SEC)	2.	0.6	6.6	20	51	5.84	18	46	20.00	1	155
SALIX ALAXENSIS (SEC)	1.	0.4	2.9	20	43	2.83	18	42	3.20	1	48
ALNUS SINUATA (SEC)	1.	0.1	0.3	20	17	0.34	18	18	-0.00	1	0
MOVE TIME BETWEEN PLOTS (SEC)	102.	18.4	6778.3	20	17	7126.00	18	18	520.20	1	2
TOTAL TIME PER PLOT W MOVE	129.	20.6	8505.5	20	13	8850.79	18	14	2289.80	1	4

TABLE 02 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK SPRUCE TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 40)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 4	BN	BNHAT
BETULA PAPYRIFERA (SEC)	1.	0.2	1.7	40	58	1.73	36	60	0.97	3	34
SALIX PULCHRA (SEC)	13.	2.2	201.6	40	30	168.42	36	25	600.33	3	89
SALIX GLAUCA (SEC)	1.	0.2	1.6	40	27	1.04	36	18	8.49	3	142
SALIX LANATA (SEC)	9.	3.4	466.6	40	141	268.32	36	82	2845.40	3	860
SALIX ALAXENSIS (SEC)	1.	0.3	2.8	40	44	1.94	36	30	13.43	3	207
ALNUS SINUATA (SEC)	1.	0.2	1.2	40	36	1.24	36	37	0.69	3	21
MOVE TIME BETWEEN PLOTS (SEC)	77.	9.0	3216.9	40	14	2360.83	36	10	13490.03	3	57
TOTAL TIME PER PLOT W MOVE	104.	10.3	4216.8	40	10	2890.73	36	7	20129.17	3	47

TABLE D3 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN MIXED SPRUCE-BIRCH TYPE. N IS NUMBER OF SAMPLING UNITS. ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA PAPYRIFERA (SEC)	1.	0.4	2.9	20	55	2.89	18	55	2.45	1	47
SALIX PULCHRA (SEC)	3.	1.4	39.6	20	153	37.16	18	143	84.05	1	324
SALIX GLAUCA (SEC)	1.	0.1	0.4	20	11	0.36	18	11	0.45	1	13
SALIX LANATA (SEC)	1.	0.2	0.6	20	28	0.58	18	26	1.25	1	56
SALIX ALAXENSIS (SEC)	1.	0.2	0.5	20	28	0.56	18	29	0.20	1	11
ALNUS SINUATA (SEC)	2.	1.1	22.9	20	188	22.98	18	188	22.05	1	180
MOVE TIME BETWEEN PLOTS (SEC)	73.	8.9	1578.2	20	8	1665.25	18	8	11.25	1	1
TOTAL TIME PER PLOT W MOVE	81.	8.5	1456.6	20	6	1519.71	18	6	320.00	1	2

TABLE D4 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR TALL WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA PAPYRIFERA (SEC)	5.	2.2	95.7	20	86	80.47	18	72	369.80	1	330
SALIX PULCHRA (SEC)	19.	5.1	512.0	20	38	234.31	18	17	5511.20	1	399
SALIX GLAUCA (SEC)	3.	0.9	16.0	20	45	11.99	18	34	88.20	1	245
SALIX LANATA (SEC)	1.	0.2	0.6	20	10	0.67	18	10	0.20	1	3
SALIX ALAXENSIS (SEC)	65.	12.5	3142.6	20	19	2073.92	18	13	22378.05	1	131
ALNUS SINUATA (SEC)	21.	5.2	539.9	20	31	274.68	18	16	5313.80	1	302
MOVE TIME BETWEEN PLOTS (SEC)	127.	11.2	2521.4	20	4	2406.45	18	4	4590.45	1	8
TOTAL TIME PER PLOT W MOVE	242.	18.5	6856.2	20	3	6788.20	18	3	8080.21	1	4

TABLE D5 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2) OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW DWARF BIRCH-WILLOW. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE TIME WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 61)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 6	BN	BNHAT
BETULA PAPYRIFERA (SEC)	2.	0.5	16.2	61	90	16.27	55	90	15.67	5	87
SALIX PULCHRA (SEC)	34.	3.5	756.0	61	17	577.91	55	13	2715.21	5	58
SALIX GLAUCA (SEC)	8.	1.3	101.4	61	41	92.14	55	37	203.85	5	81
SALIX LANATA (SEC)	10.	2.3	323.6	61	82	176.33	55	45	1944.13	5	468
SALIX ALAXENSIS (SEC)	1.	0.2	2.8	61	53	2.70	55	50	4.39	5	81
ALNUS SINUATA (SEC)	1.	0.1	0.7	61	23	0.72	55	24	0.27	5	9
MOVE TIME BETWEEN PLOTS (SEC)	148.	26.2	41955.5	61	48	43235.92	55	50	27870.67	5	32
TOTAL TIME PER PLOT W MOVE	205.	26.3	42100.5	61	26	43338.22	55	26	28485.35	5	17

TABLE D6 MEANS, STANDARD ERRORS, AND VARIANCES FOR TIMES (4M2)
OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW WILLOW
TYPE. N IS THE NUMBER OF SAMPLING UNITS. THE ESTIMATED SAMPLE
SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE
TIME WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 1	BN	BNHAT
BETULA PAPYRIFERA (SEC)	1.	0.2	0.4	9	8	0.44	8	8	-0.00	0	0
SALIX PULCHRA (SEC)	102.	22.6	4604.6	9	12	4604.61	8	12	0.00	0	1
SALIX GLAUCA (SEC)	22.	17.2	2662.5	9	134	2662.50	8	134	0.	0	1
SALIX LANATA (SEC)	1.	0.4	1.5	9	38	1.50	8	38	0.	0	1
SALIX ALAXENSIS (SEC)	10.	4.5	178.4	9	43	178.44	8	43	-0.00	0	0
ALNUS SINUATA (SEC)	1.	0.4	1.8	9	22	1.78	8	22	-0.00	0	0
MOVE TIME BETWEEN PLOTS (SEC)	260.	129.1	150057.0	9	56	150057.00	8	56	0.	0	1
TOTAL TIME PER PLOT W MOVE	398.	148.3	197896.9	9	32	197896.86	8	32	-0.00	0	0

APPENDIX E

APPENDIX E

DENSITY STATISTICS, $4M^2$ PLOTS, FROM 1982

Means, standard errors, variances, and estimated sample sizes for 4-m^2 plot size density estimates for selected shrub species. Modified from data collected in 1982 by Steigers et al. (1983). Betula glandulosa and other shrubs not sampled in the pilot study are excluded. Density estimates are presented by level IV vegetation type. The within estimated sample size (WNHAT) is the total number of 4-m^2 plots required to sample the density in the vegetation type within 20% of the mean with 67% confidence. These density plots are then evenly allocated to the number of sites sampled in the type.

Table E1

11270 OPEN WHITE SPRUCE

CATEGORY (N = 105)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 7	BN	BNHAT
SALIX PULCHRA STEMS/10 M2	9.	1.4	220.2	105	76	100.47	98	35	2175.24	6	745
SALIX GLAUCA STEMS/10 M2	5.	1.2	159.9	105	184	126.63	98	146	702.64	6	807
SALIX LANATA STEMS/10 M2	5.	1.6	260.5	105	297	202.20	98	230	1213.39	6	1379
ALNUS SINUATA STEMS/10 M2	2.	0.9	79.9	105	456	77.81	98	444	114.70	6	654
TOTAL ALL STEMS/10 M2	20.	2.4	604.0	105	38	452.32	98	29	3080.83	6	193

Table E2

11270 OPEN BLACK SPRUCE

CATEGORY (N = 150)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 10	BN	BNHAT
SALIX PULCHRA STEMS/10 M2	12.	1.6	365.2	150	67	269.10	140	49	1859.83	9	338
SALIX GLAUCA STEMS/10 M2	1.	0.6	63.0	150	843	51.33	140	688	243.96	9	3266
SALIX LANATA STEMS/10 M2	0.	0.3	17.3	150	2702	16.86	140	2634	24.00	9	3751
ALNUS SINUATA STEMS/10 M2	3.	1.0	162.4	150	571	144.57	140	509	439.54	9	1546
TOTAL ALL STEMS/10 M2	16.	2.1	651.5	150	63	447.78	140	43	3820.19	9	366

Table E3

23210 DWARF BIRCH

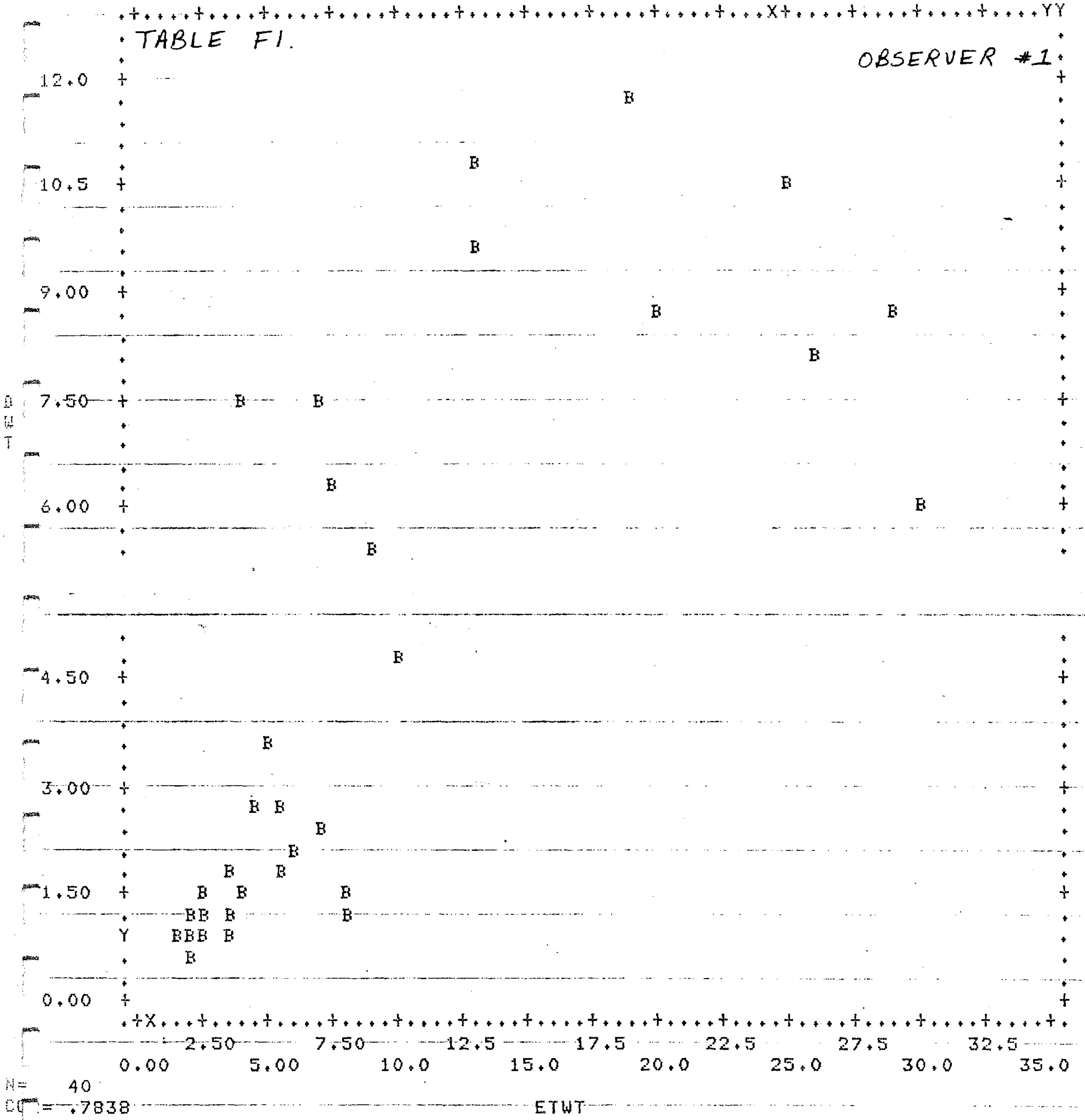
CATEGORY (N = 257)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 18	BN	BNHAT
SALIX PULCHRA STEMS/10 M2	4.	1.0	266.0	257	348	206.62	239	270	1101.10	17	1437
SALIX GLAUCA STEMS/10 M2	1.	0.5	57.6	257	1839	56.29	239	1796	76.56	17	2443
TOTAL ALL STEMS/10 M2	5.	1.2	365.5	257	330	269.91	239	244	1709.86	17	1544

APPENDIX F

APPENDIX F

GRAPHS OF DRY WEIGHT VS OCULAR ESTIMATES

Plots of dry weight against ocular estimates for each observer for each shrub species to determine requirements for mathematical transformations.

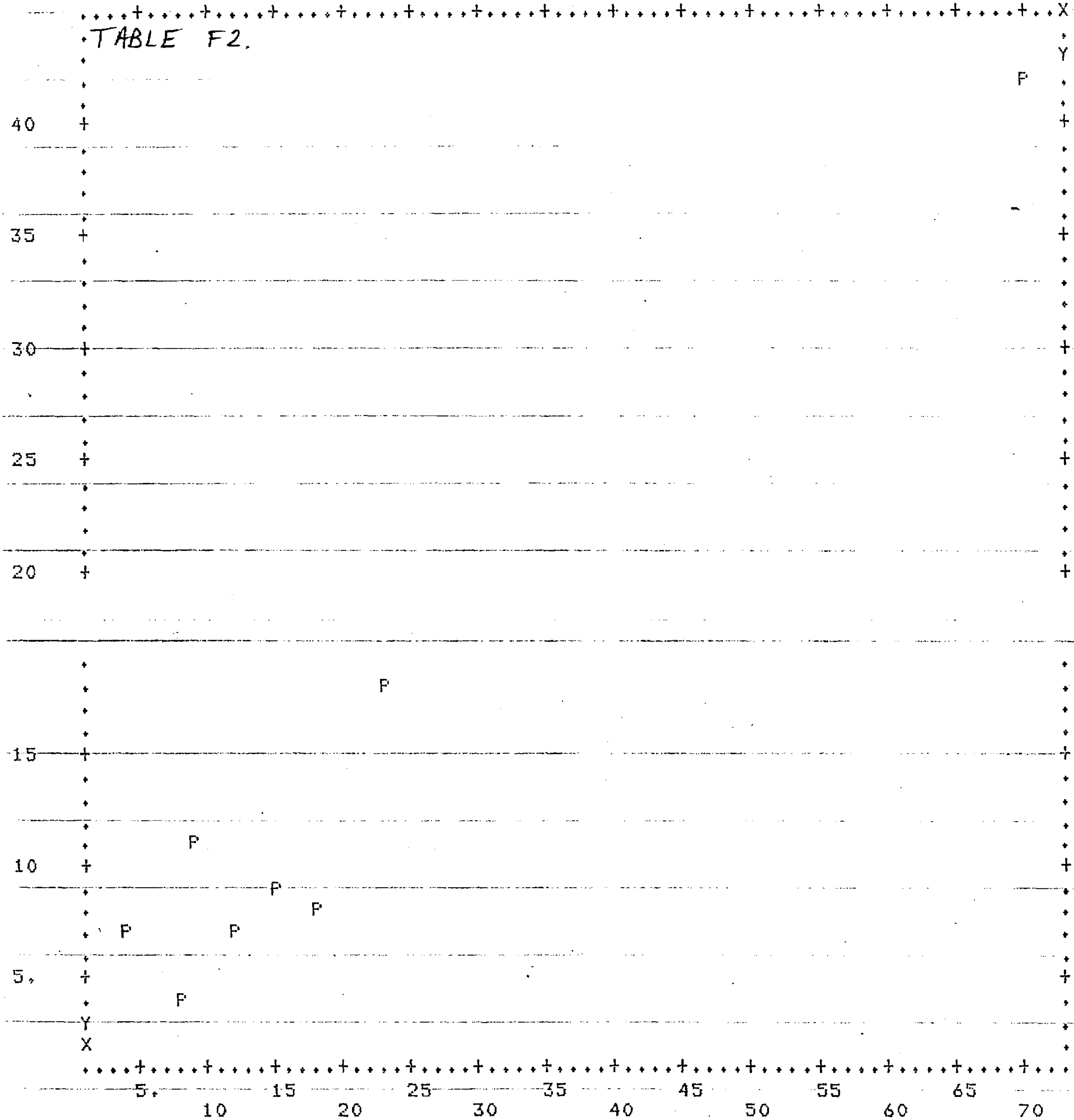


N= 40
CC= .7838

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	7.7350	8.0033	X= 1.8133*Y+ 1.2433	25.349
Y	3.5800	3.4595	Y= .33882*X+ .95921	4.7366

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=BEGL , SYMBOL=B

E 13 BMDP6D OCULAR EST. REGRESSION



N= 8
COR= .9711 ETWT

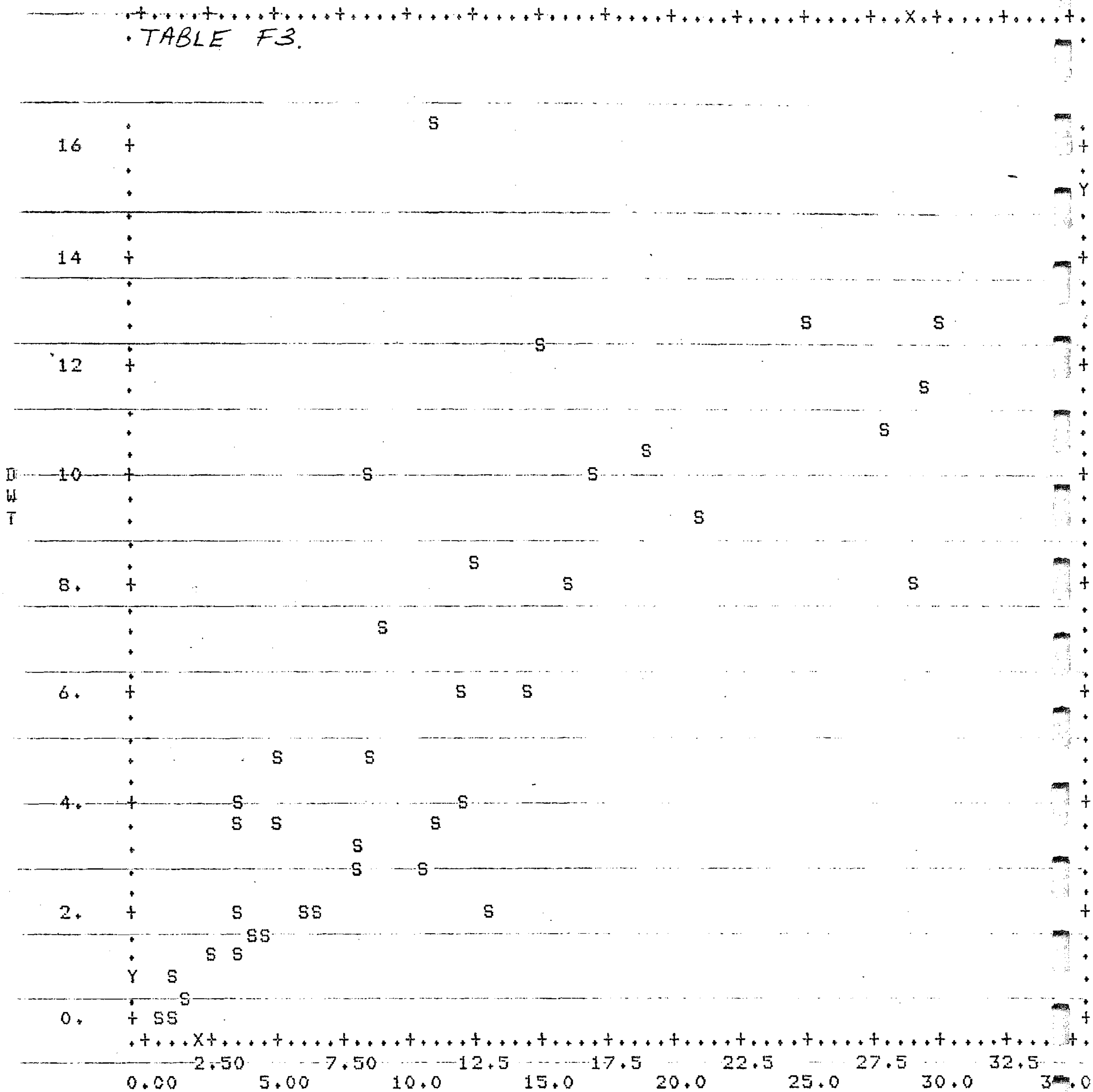
	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	19.687	21.243	X= 1.7045*Y-2.9179	29.969
Y	13.263	12.103	Y= .55330*X+ 2.3694	9.7284

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=BEPA , SYMBOL=P

VARIABLE 11 ETWT VS. VARIABLE 21 WWT GROUP=BEGL , SYMBOL=B

PAGE 7 BMDP6D OCULAR EST. REGRESSION

TABLE F3.

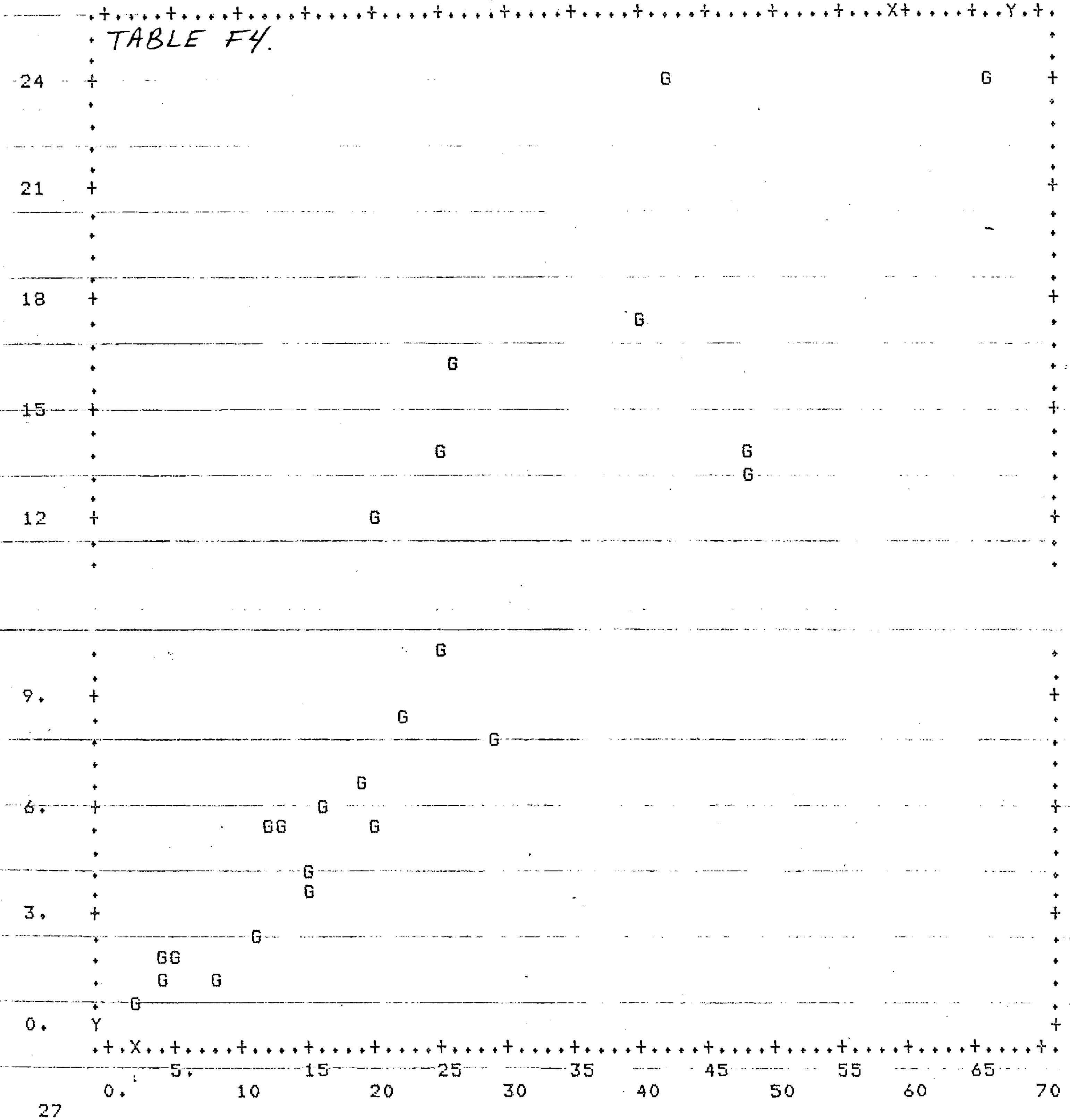


N= 40
COR= .7854

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	10.650	8.5170	X= 1.5422*Y+ 2.3875	28.522
Y	5.3575	4.3375	Y= .40000*X+ 1.0975	7.3976

Sofi

TABLE F4.

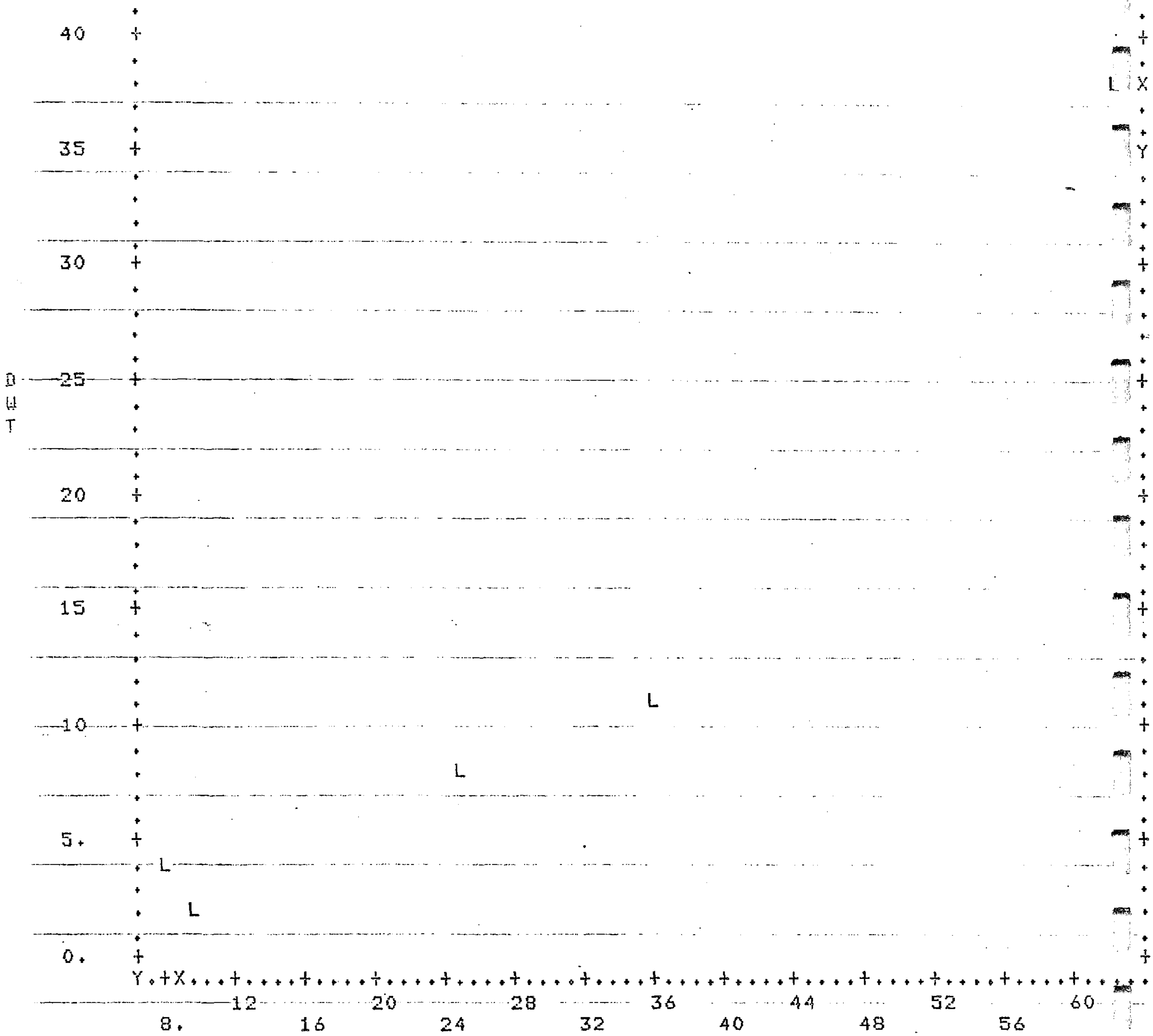


N : 27
COR= .9012 ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	20.933	16.193	X= 2.1642*Y+ 3.5072	51.229
Y	8.0519	6.7430	Y= .37526*X+ .19641	8.8827

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SAGL , SYMBOL=G

TABLE F5.

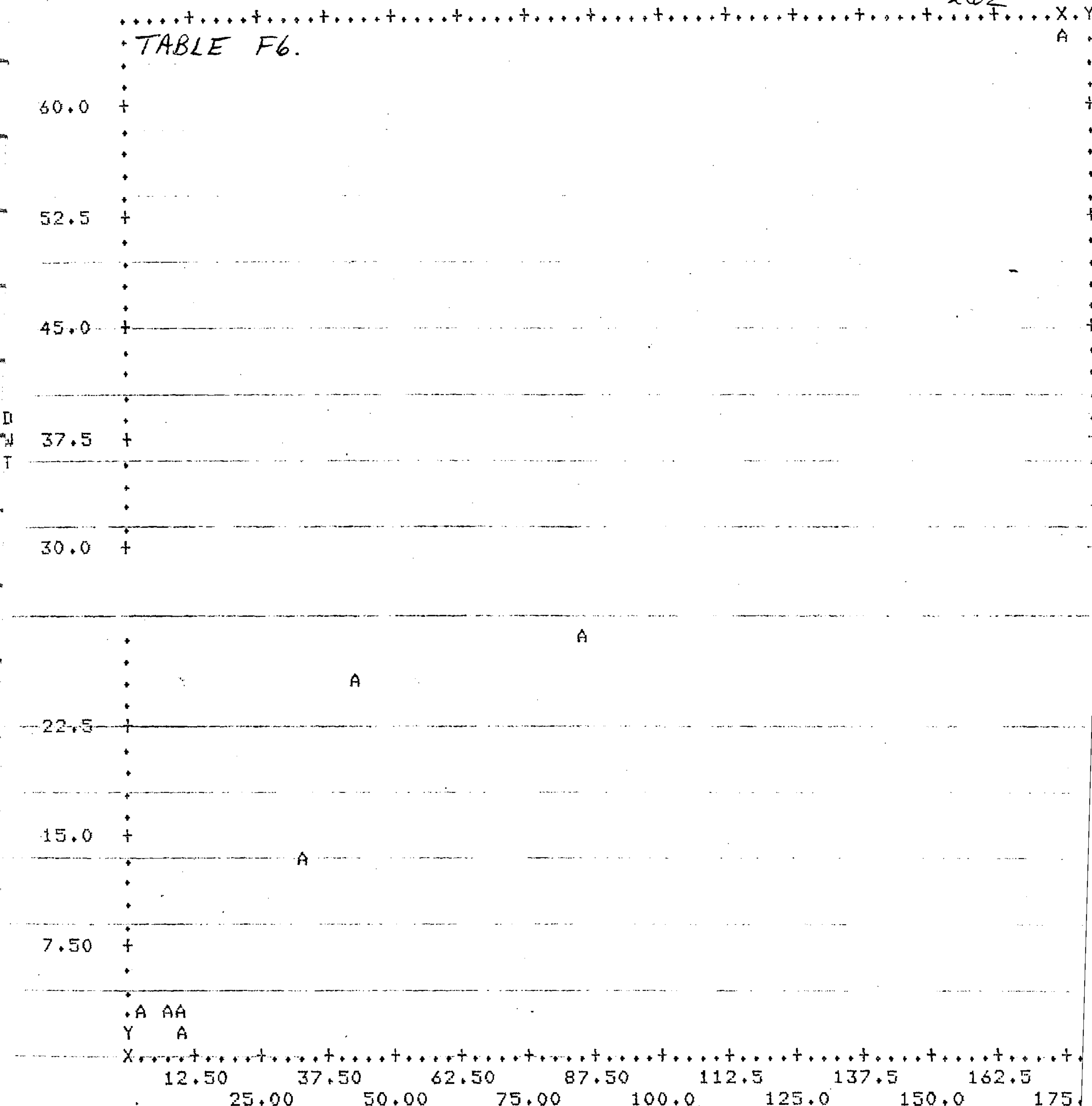


N= 5
COR= .9461 ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	28.200	22.095	X= 1.4135*Y+ 10.446	68.252
Y	12.560	14.789	Y= .63327*X-5.2981	30.577

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SALA , SYMBOL=L

TABLE F6.



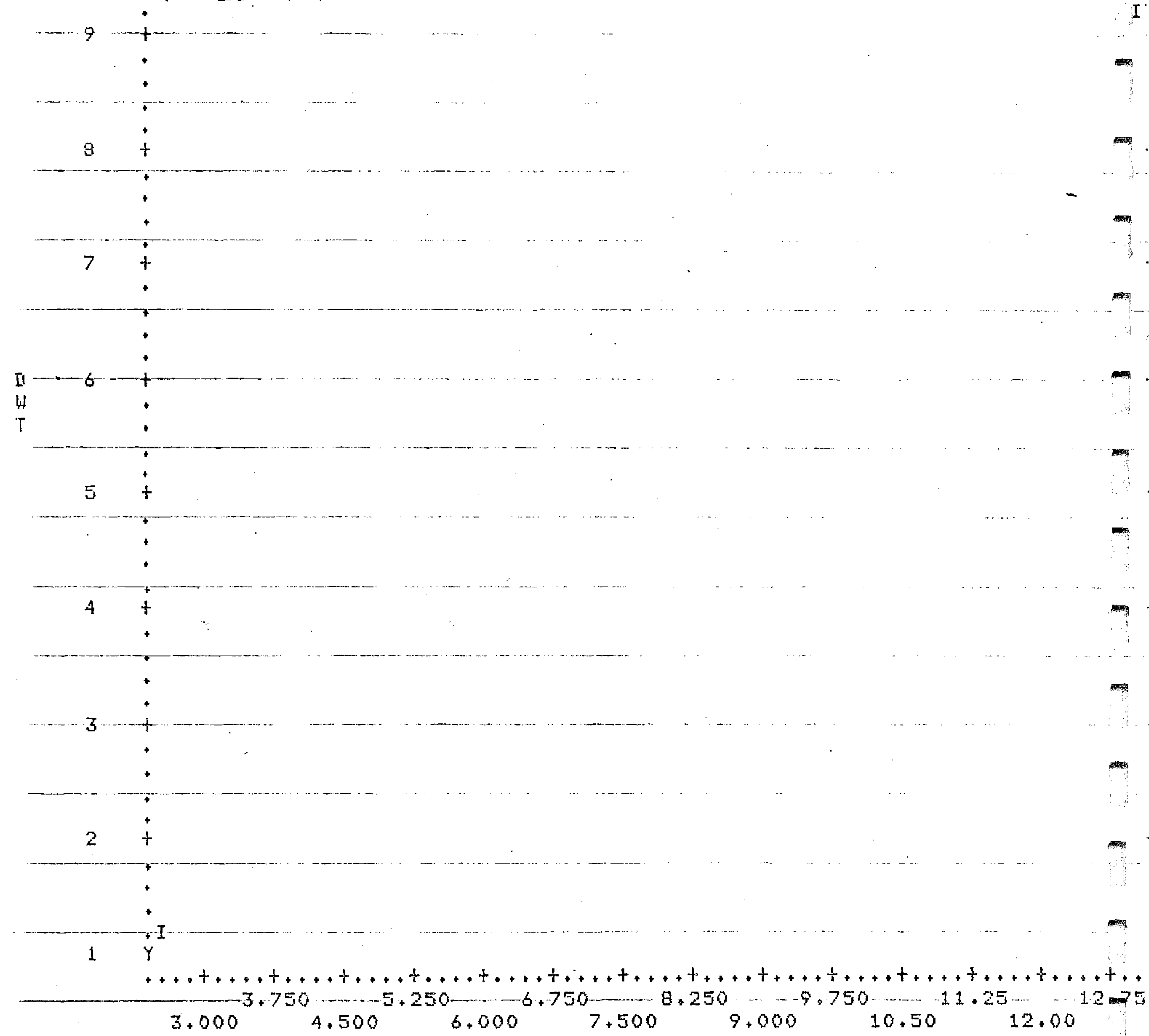
N= 8
COR= .9849

ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	45.688	58.962	X= 2.6782*Y-1.9843	121.52
Y	17.800	21.683	Y= .36220*X+ 1.2520	16.434

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SAAL , SYMBOL=A

TABLE F7.



N= 2
COR= 1.000

ETWT

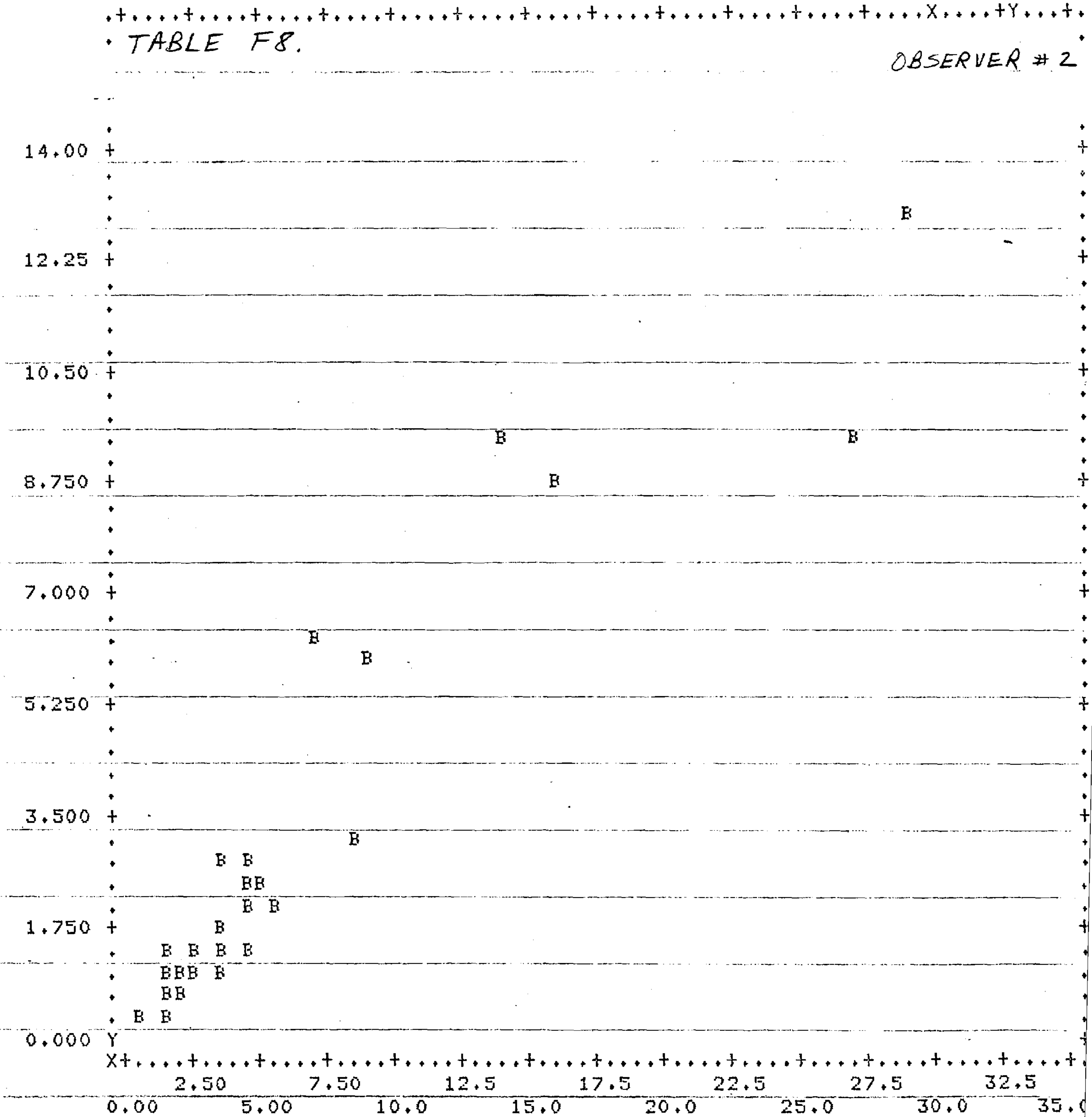
	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	7.7500	7.4246	X= 1.3125*Y+ 1.0562	0.0000
Y	5.1000	5.6569	Y= .76190*X-.80476	0.0000

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=ALSI , SYMBOL=I

264

TABLE F8.

OBSERVER # 2

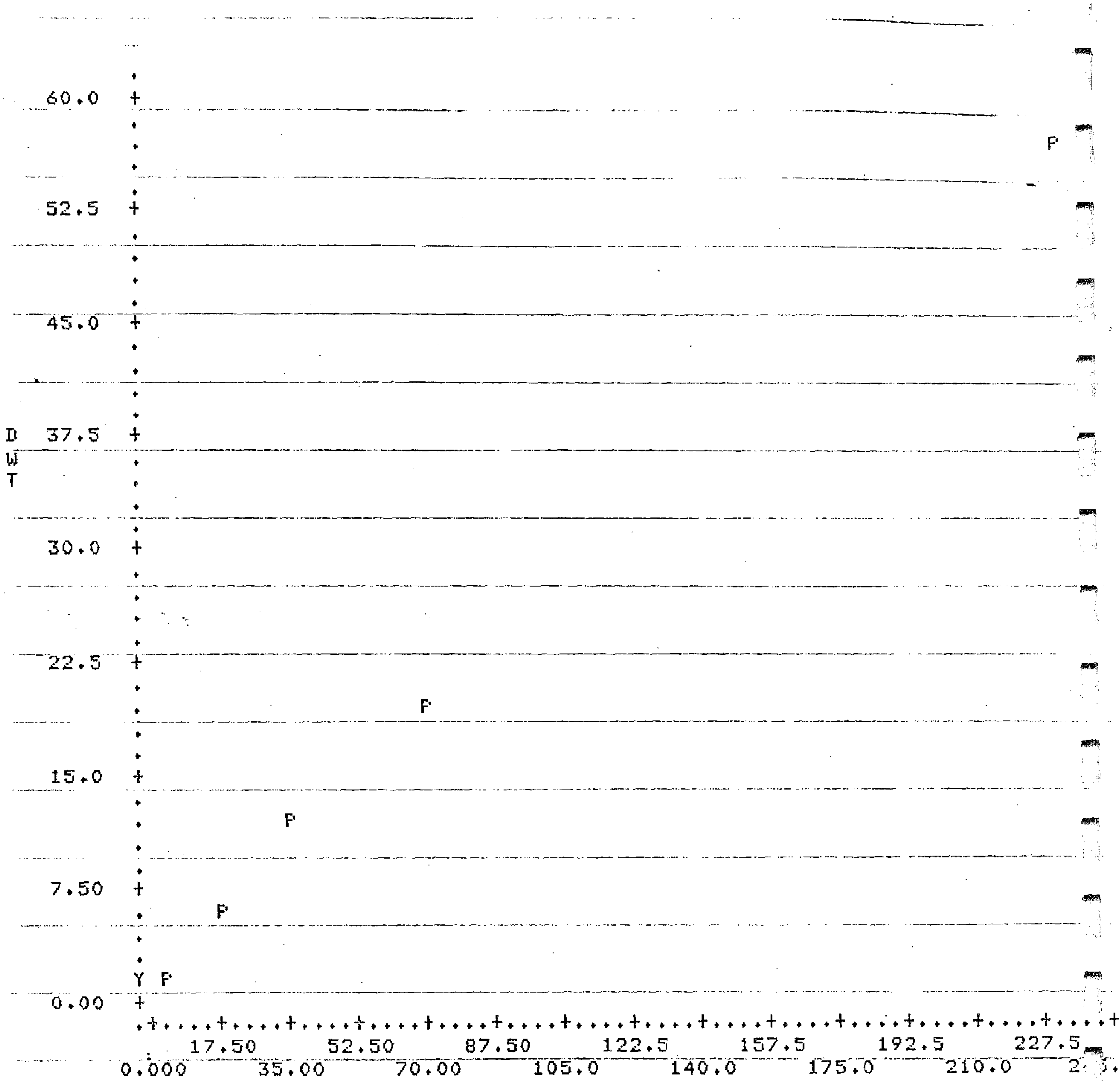


N= 33
COR= .9439

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	5.5758	6.7377	X= 2.0064*Y+ .01856	5.1091
Y	2.7697	3.1697	Y= .44406*X+ .29373	1.1307

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=BEGL , SYMBOL=B

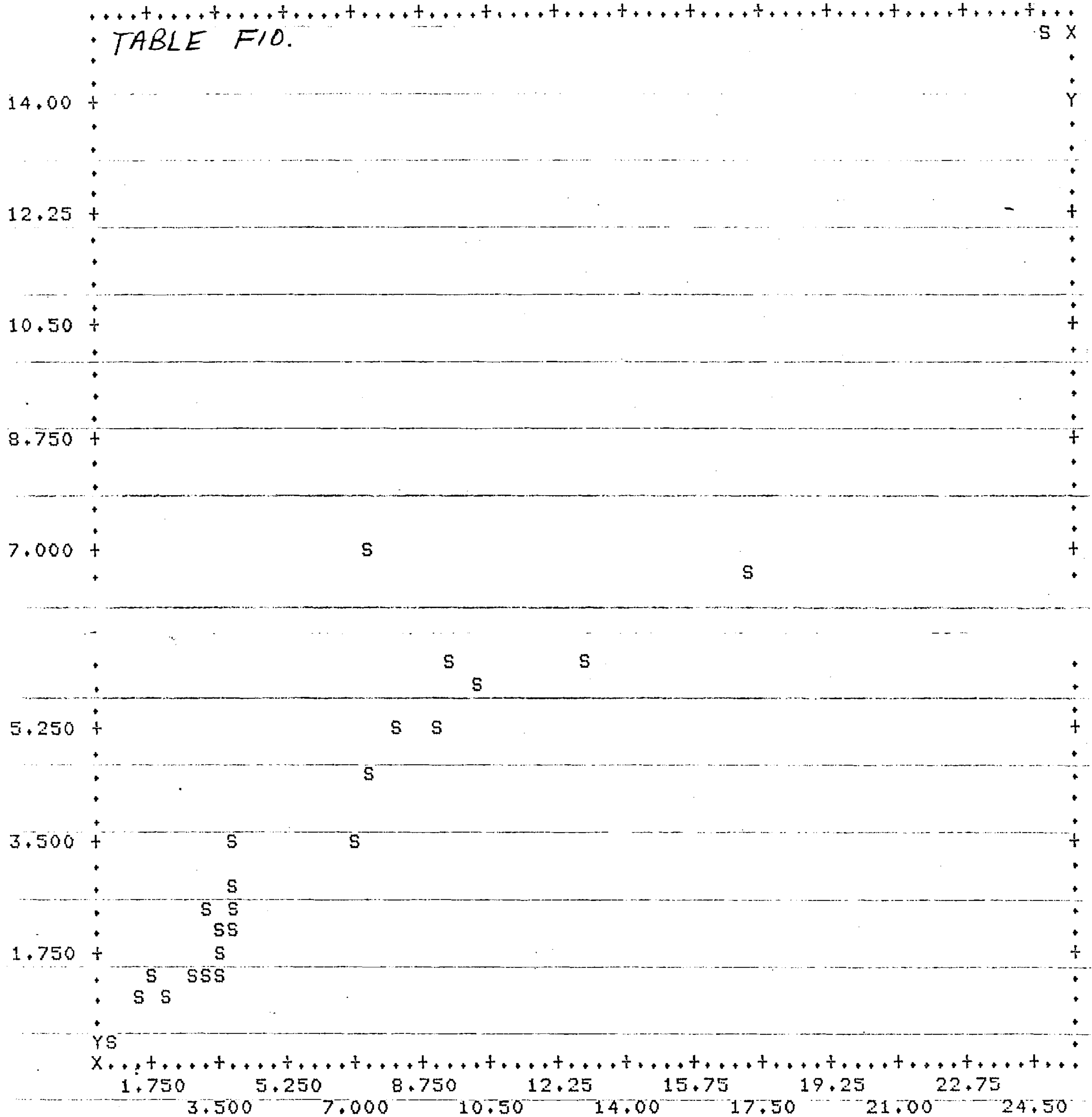
TABLE F9.



N= 5
COR= .9986

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	70.900	92.499	X= 4.1035*Y-7.1487	32.312
Y	19.020	22.509	Y= .24300*X+ 1.7910	1.9135

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=BEPA , SYMBOL=P



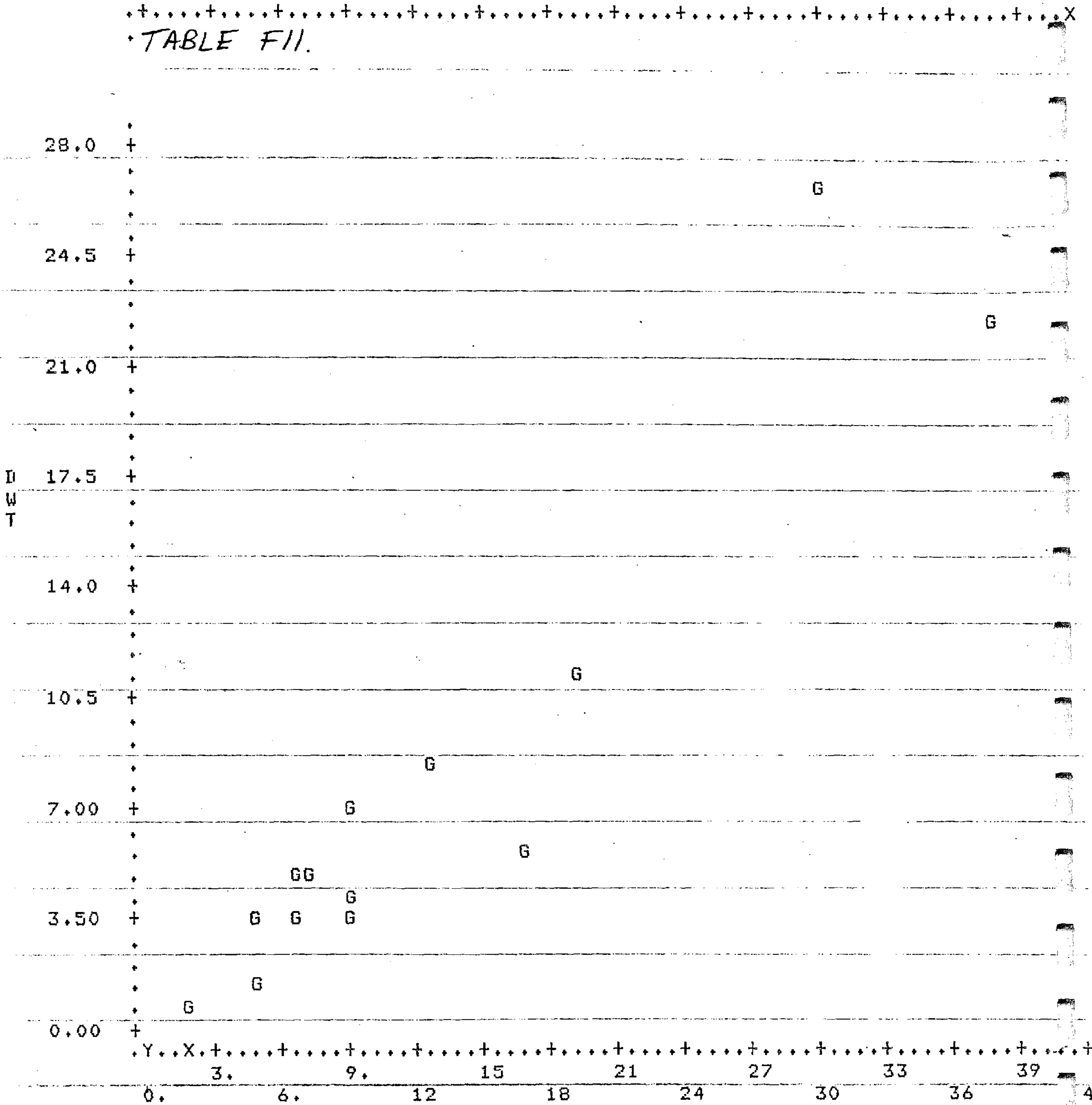
N= 25
CDR= .9540

ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	6.2240	5.5859	X= 1.6861*Y+ .06638	2.9260
Y	3.6520	3.1606	Y= .53979*X+ .29236	.93672

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SAPU , SYMBOL=S

TABLE F11.

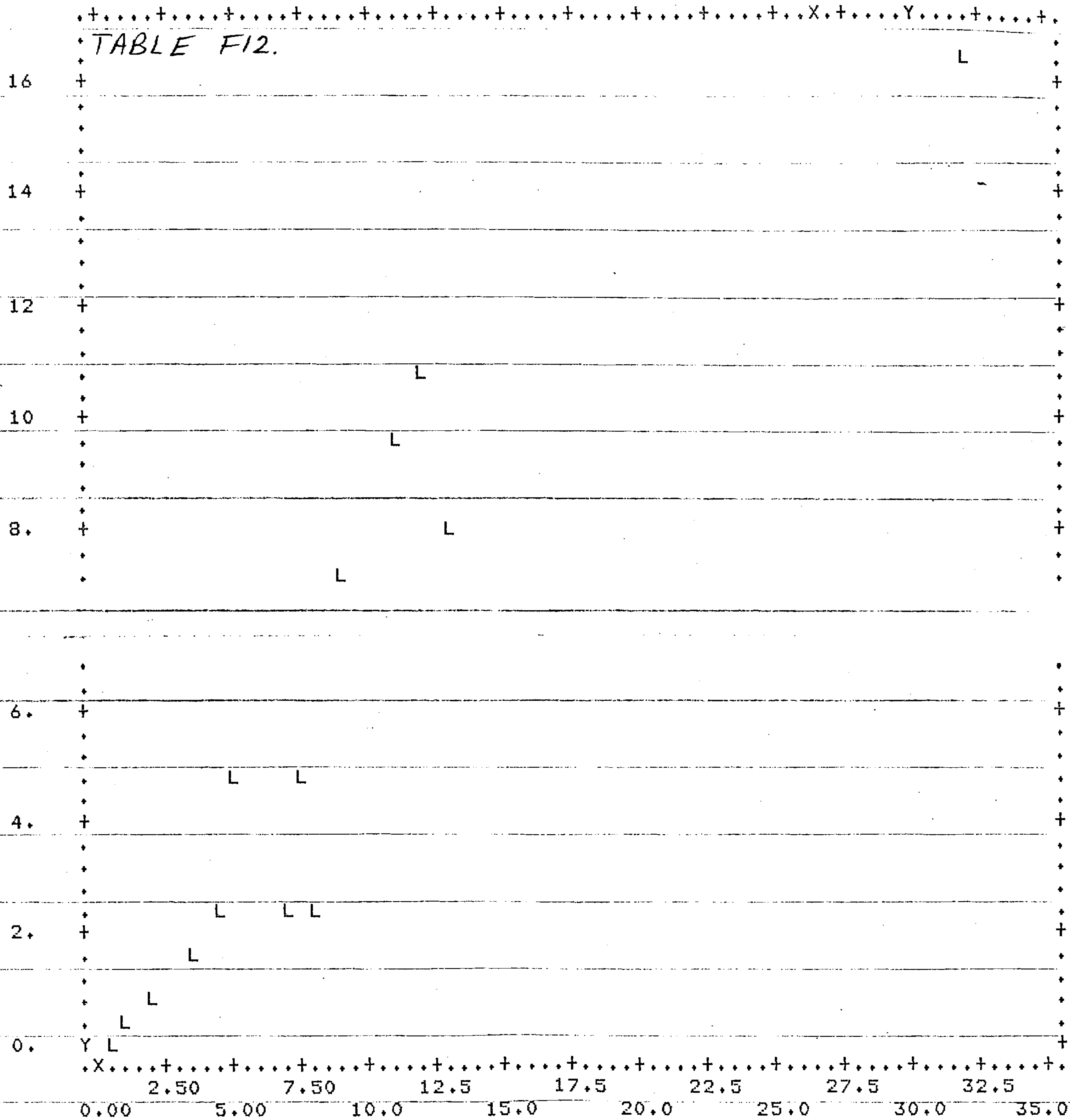


N= 15
COR= .9385

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	11.767	10.356	X= 1.2955*Y+ 2.4301	13.767
Y	7.2067	7.5019	Y= .67987*X-.79309	7.2246

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SAGL , SYMBOL=G

TABLE F12.



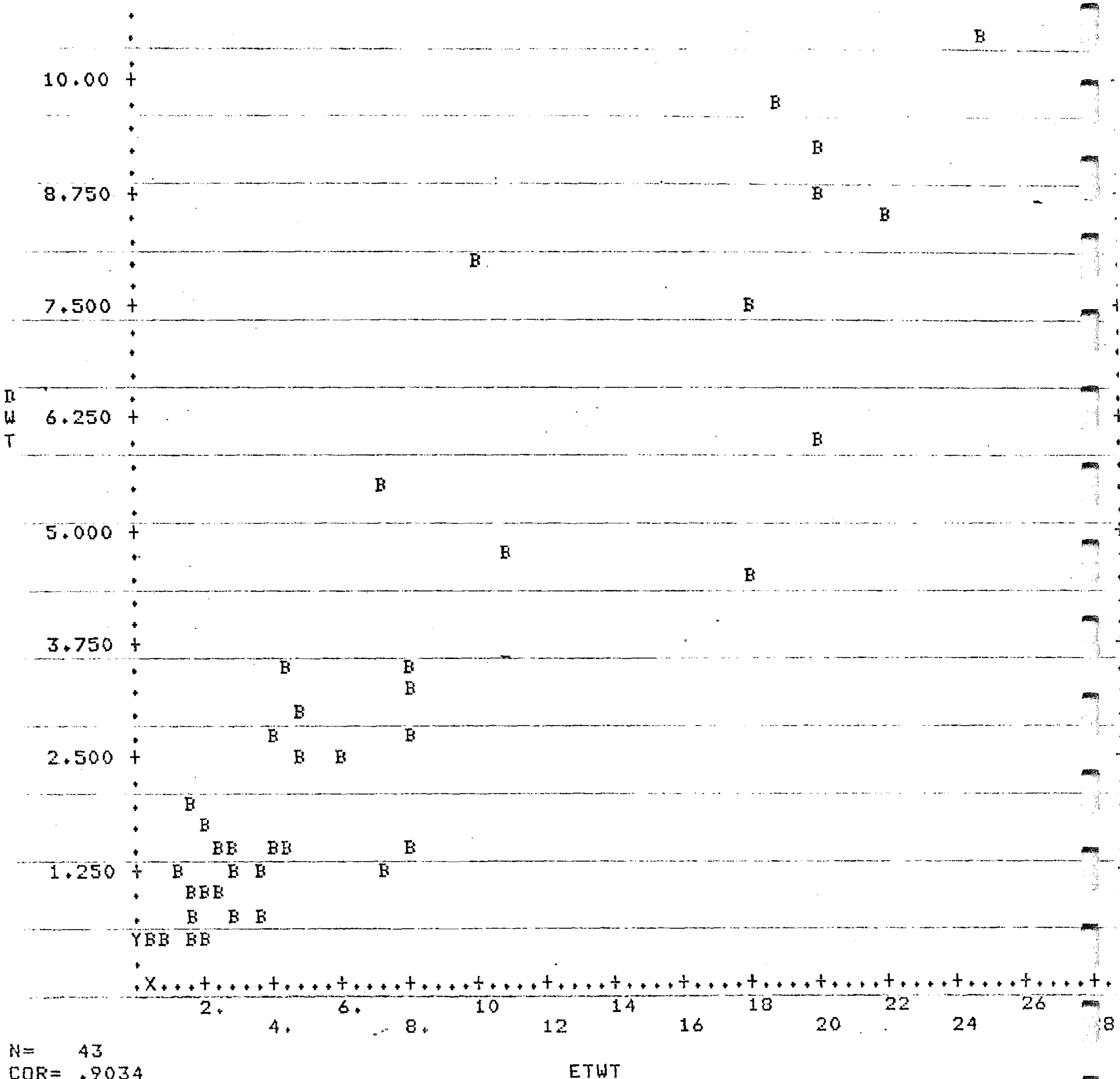
N= 15
DR= .9280

MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
7.8467	7.7953	X= 1.5286*Y+ .42789	9.0794
4.8533	4.7327	Y= .56343*X+ .43227	3.3466

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SALA , SYMBOL=L

TABLE F13

OBSERVER #3

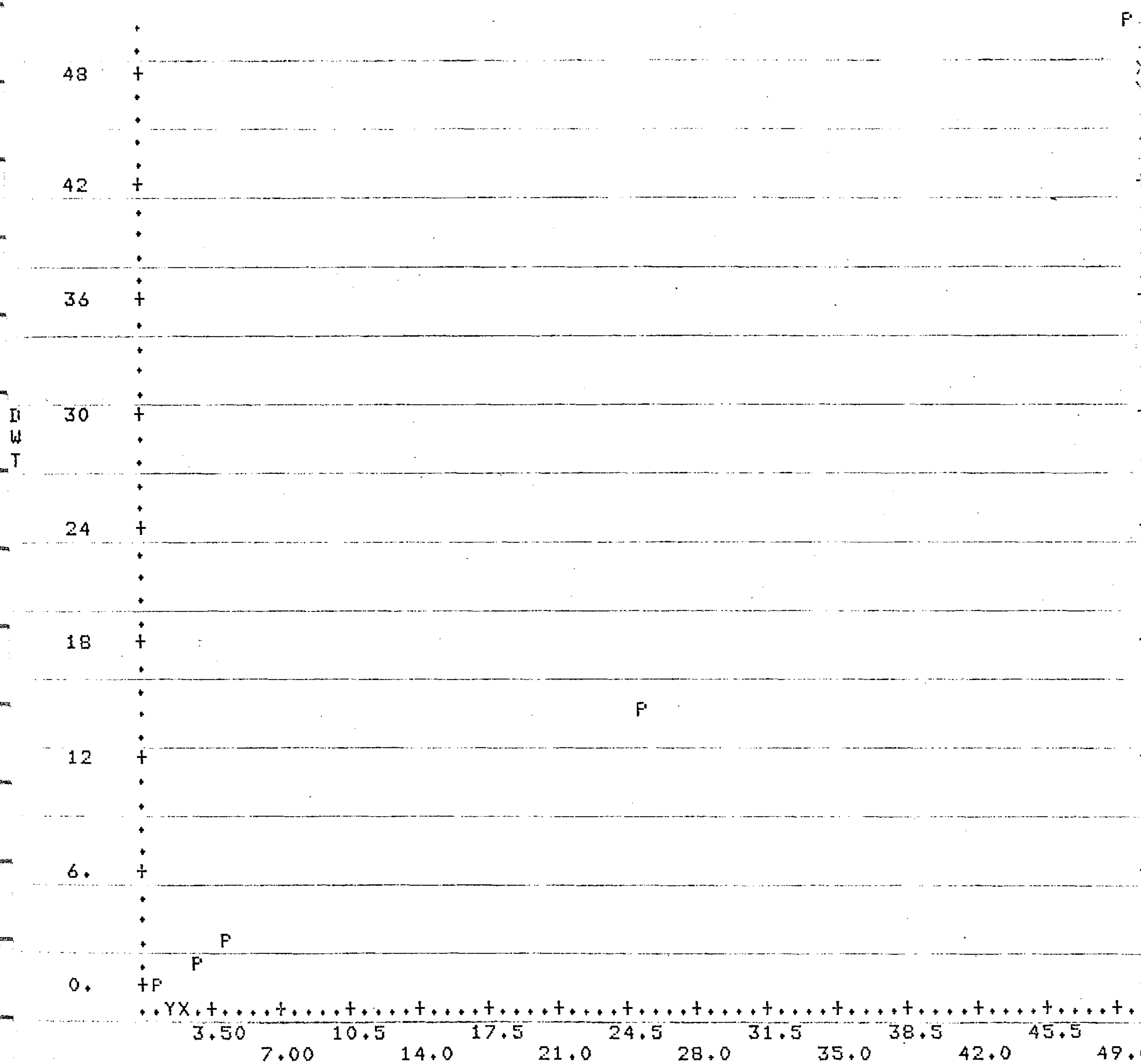


N= 43
COR= .9034

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	7.8884	7.4920	X= 2.1868*Y+ .35672	10.577
Y	3.4442	3.0949	Y= .37318*X+ .50042	1.8049

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=BEGL , SYMBOL=B

TABLE F14.



N= 5
COR= .9781

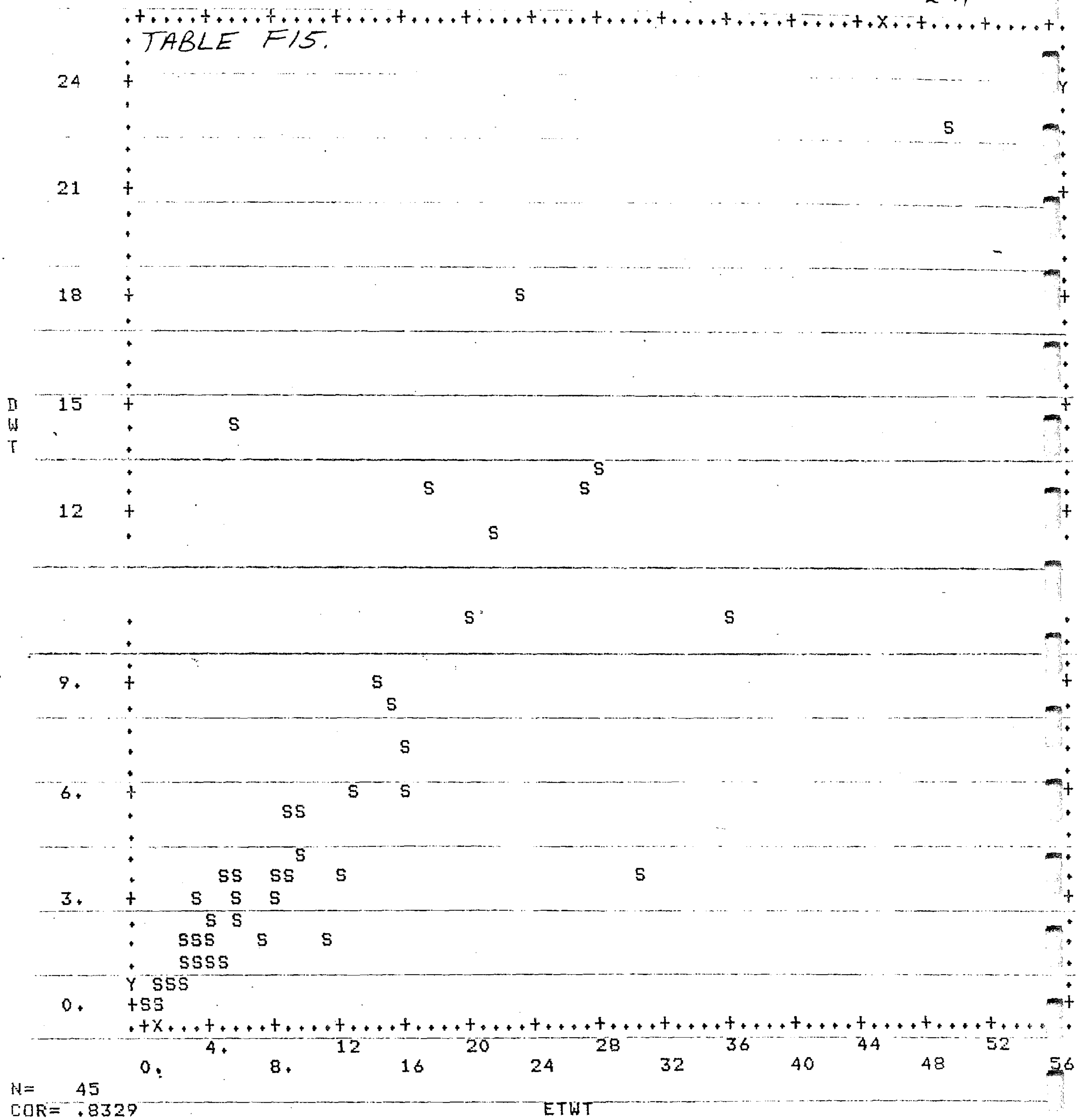
ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	16.560	21.087	X= .98392*Y+ 3.0016	25.631
Y	13.780	20.963	Y= .97241*X-2.3231	25.331

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=BEPA , SYMBOL=P

271

TABLE F15.



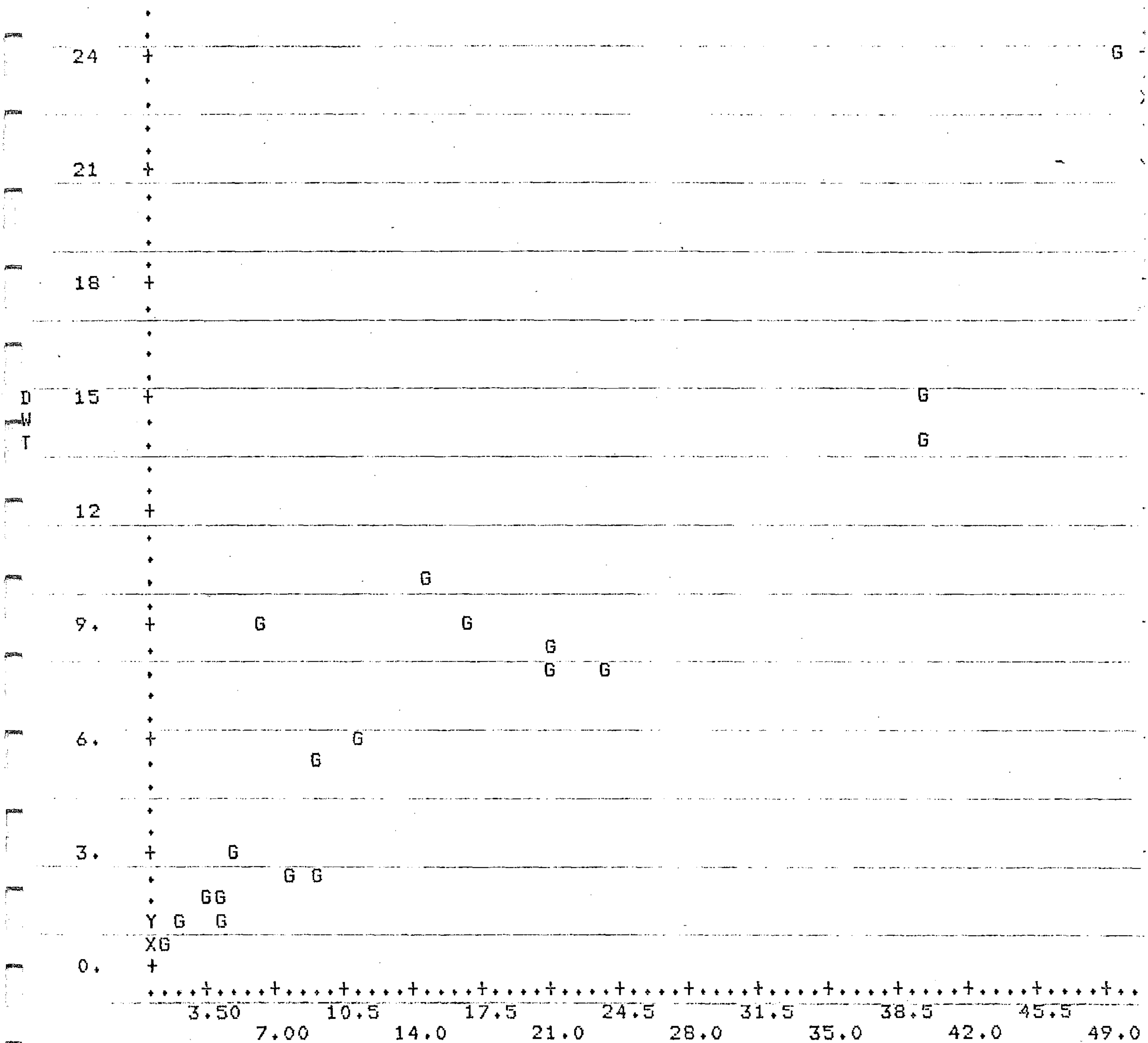
N= 45
COR= .8329

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	10.691	10.657	X= 1.6838*Y+ 2.0888	35.585
Y	5.1089	5.2719	Y= .41205*X+ .70365	8.7082

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SAFU , SYMBOL=S

272

TABLE F16.



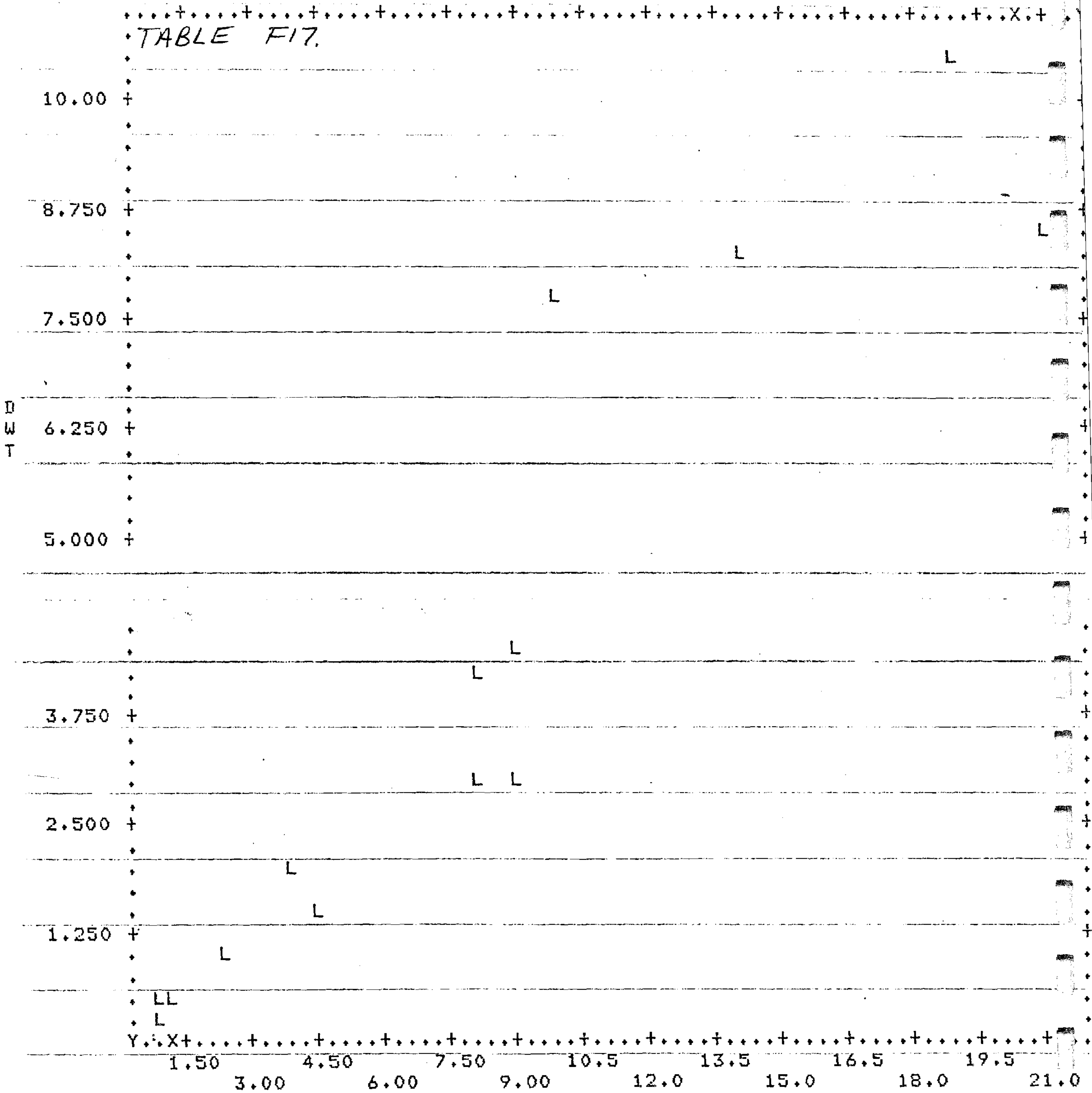
N= 20
COR= .9346

ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	14.640	14.232	X= 2.2349*Y+ .00135	27.038
Y	6.5500	5.9517	Y= .39086*X+ .82783	4.7287

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SAGL , SYMBOL=G

TABLE F17.

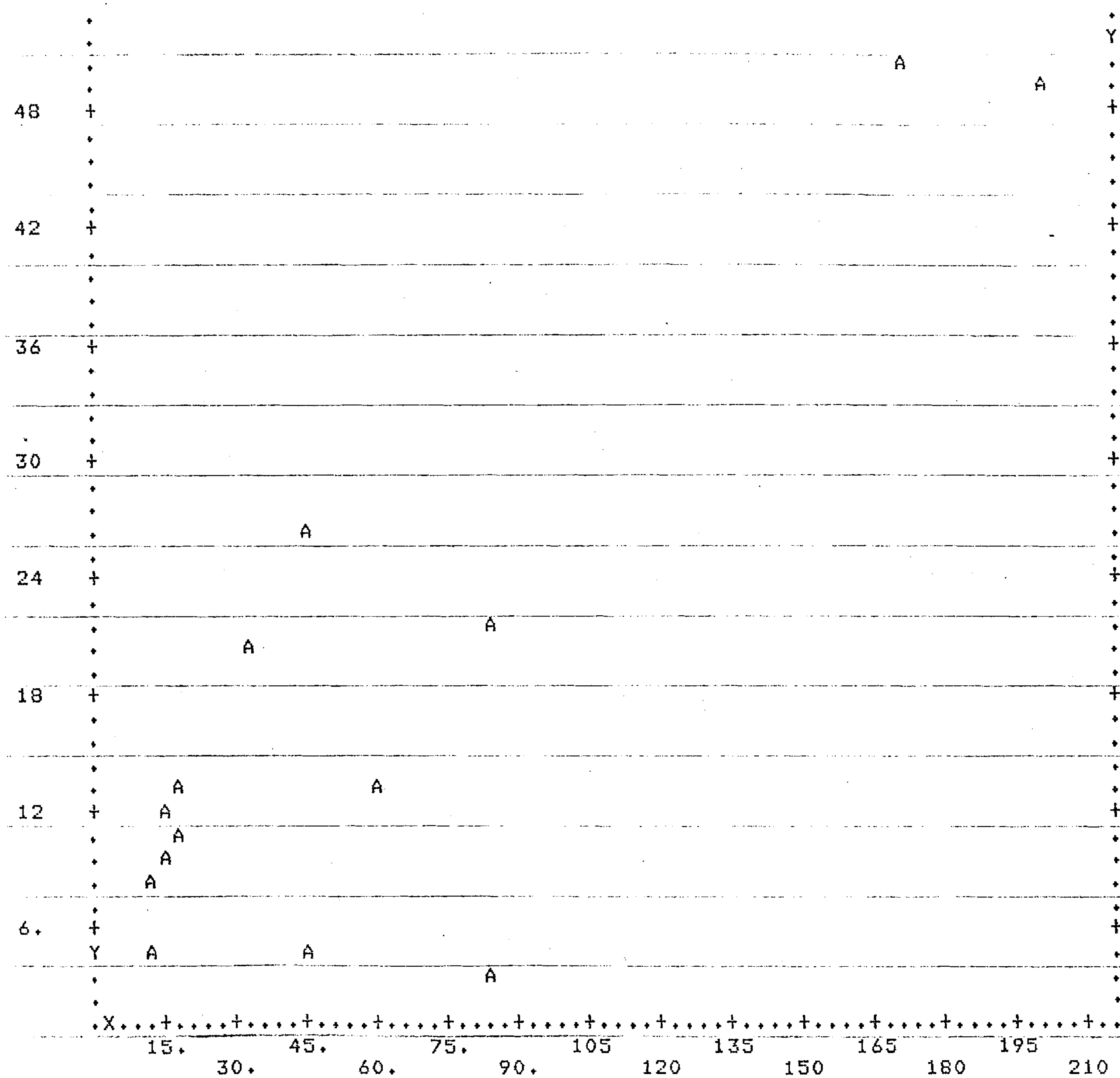


N= 14
COR= .9410

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	8.0143	6.4136	X= 1.7398*Y+ 1.1422	5.1036
Y	3.9500	3.4689	Y= .50896*X-.12895	1.4930

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SALA , SYMBOL=L

TABLE F18.

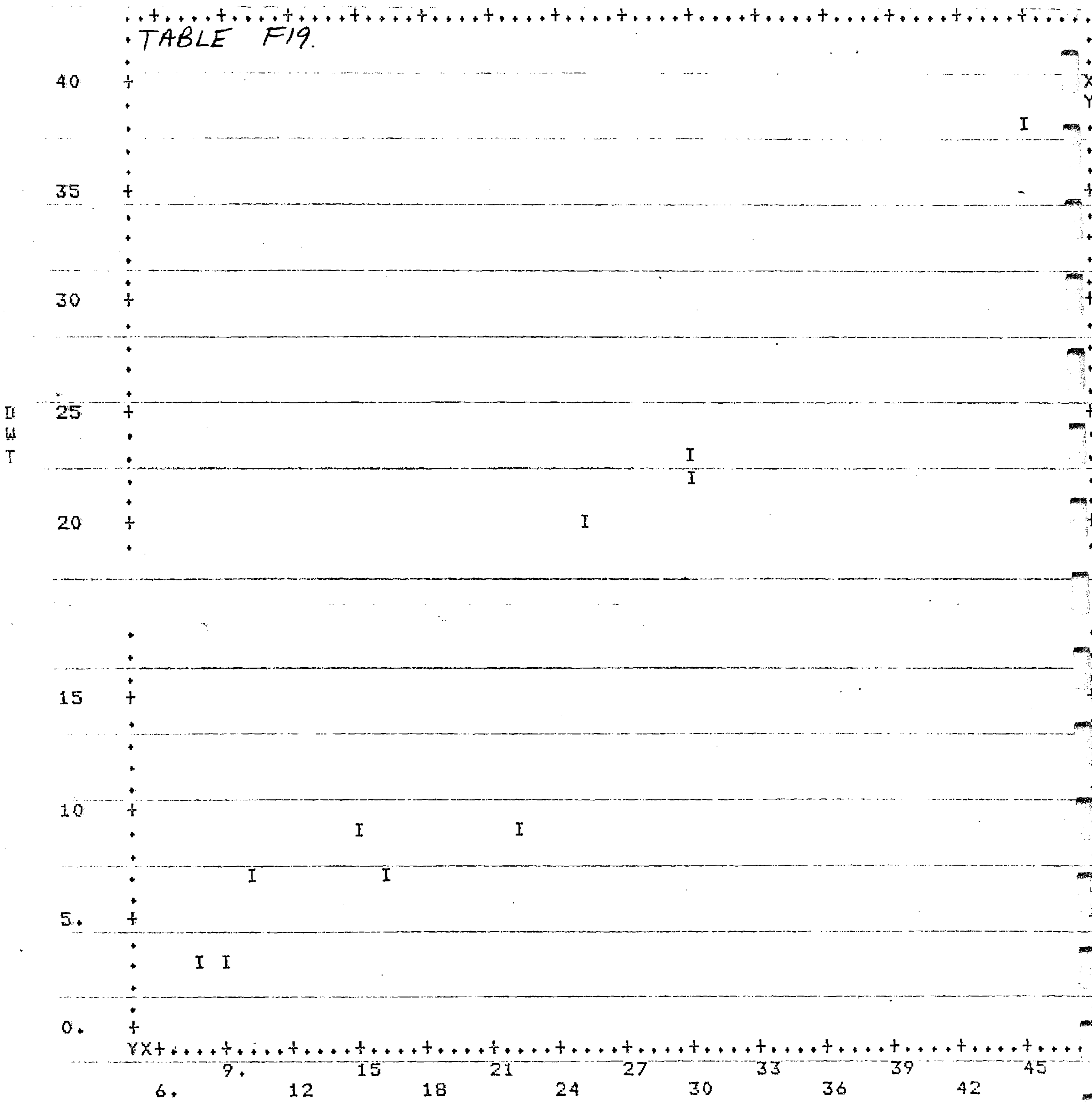


N 14
COR= .8442

ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	58.000	59.681	X= 3.3295*Y-1.2888	1103.9
Y	17.807	15.132	Y= .21403*X+ 5.3935	71.286

RIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SAAL , SYMBOL=A



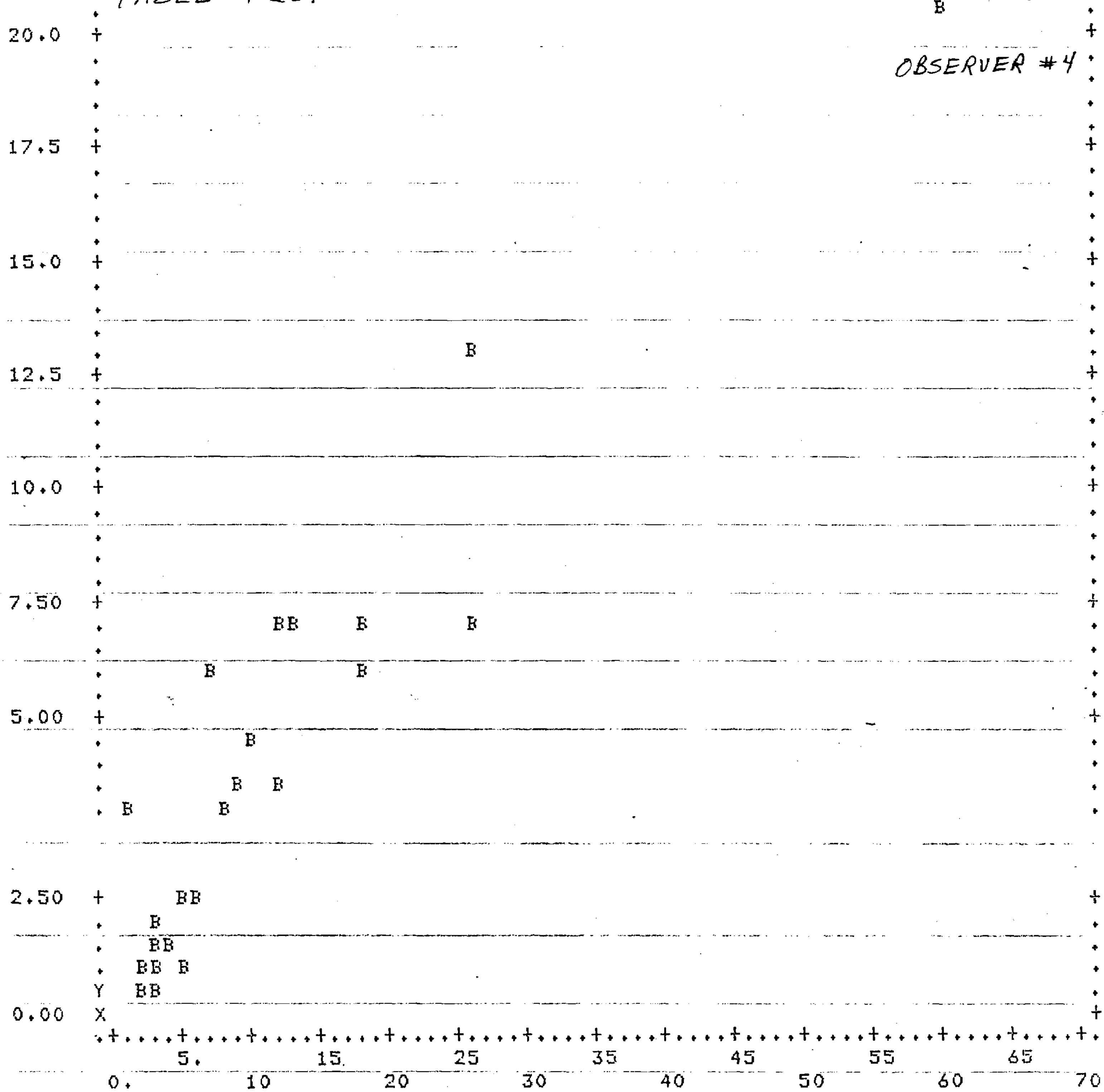
N= 10
COR= .9738

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	21.000	11.785	X= 1.0364*Y+ 6.3250	8.0880
Y	14.160	11.073	Y= .91496*X-5.0542	7.1405

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=ALSI , SYMBOL=I

TABLE F20. 276

OBSERVER #4

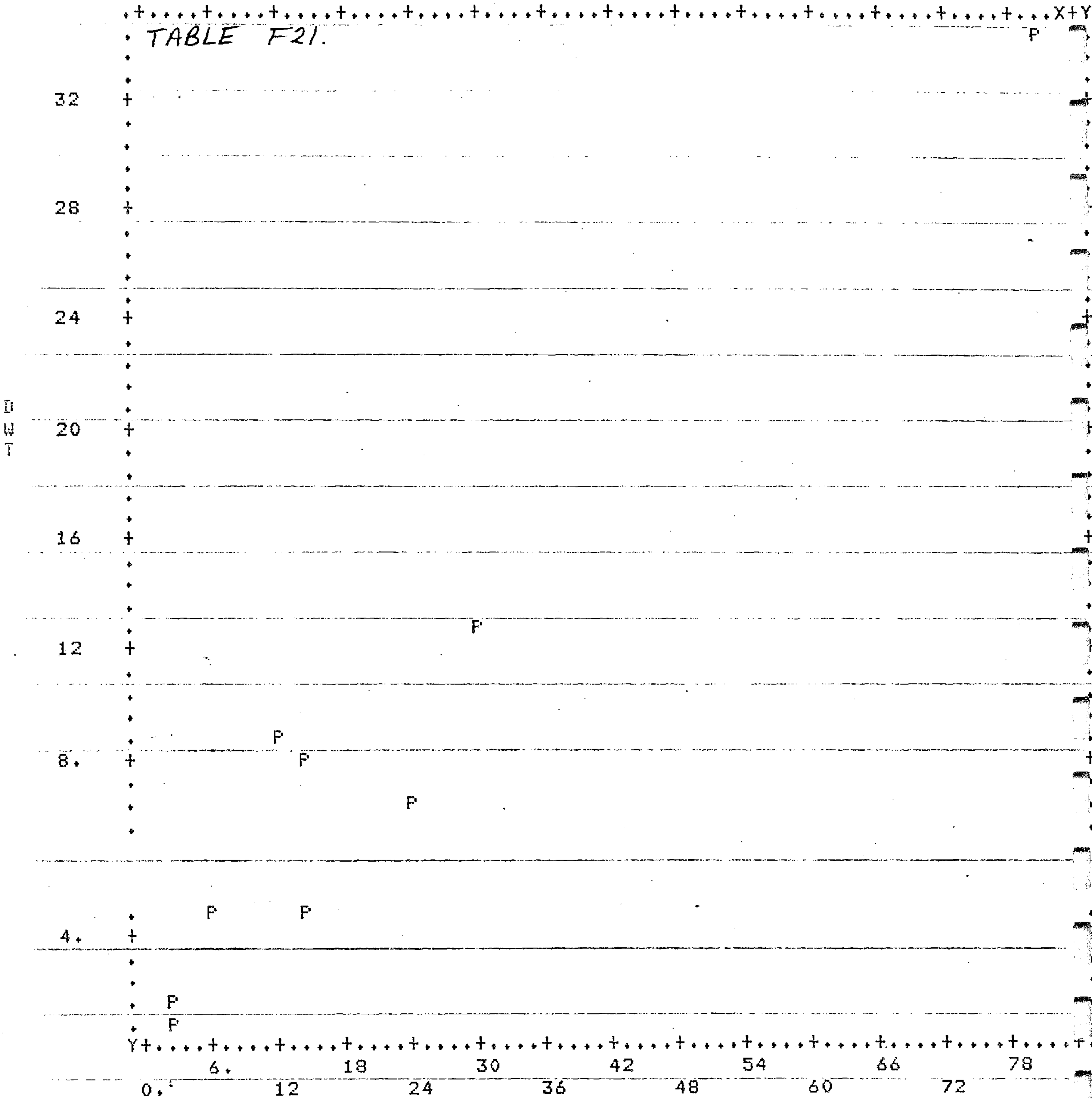


N= 27
COR= .9570

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	9.7037	12.284	X= 2.6512*Y-.91108	13.193
Y	4.0037	4.4342	Y= .34547*X+ .65134	1.7191

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=BEGL , SYMBOL=B

PAGE 6 BMDP6D OCULAR EST. REGRESSION

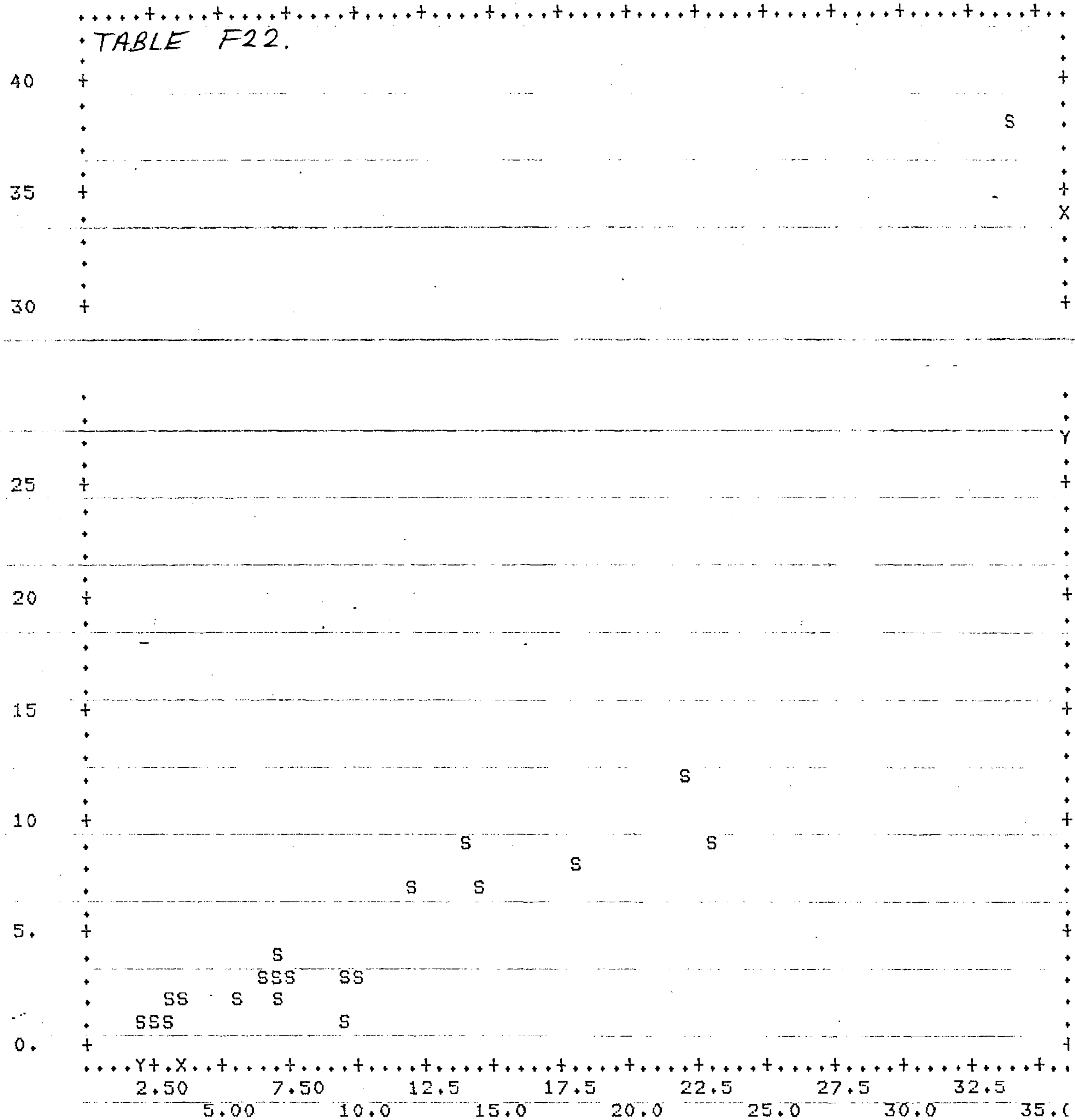


N= 9
COR= .9782 ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	20.589	24.132	X= 2.3610*Y-.81713	28.680
Y	9.0667	9.9986	Y= .40531*X+ .72189	4.9235

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=BEPA , SYMBOL=P

PAGE 7 BMDP6D OCULAR EST. REGRESSION

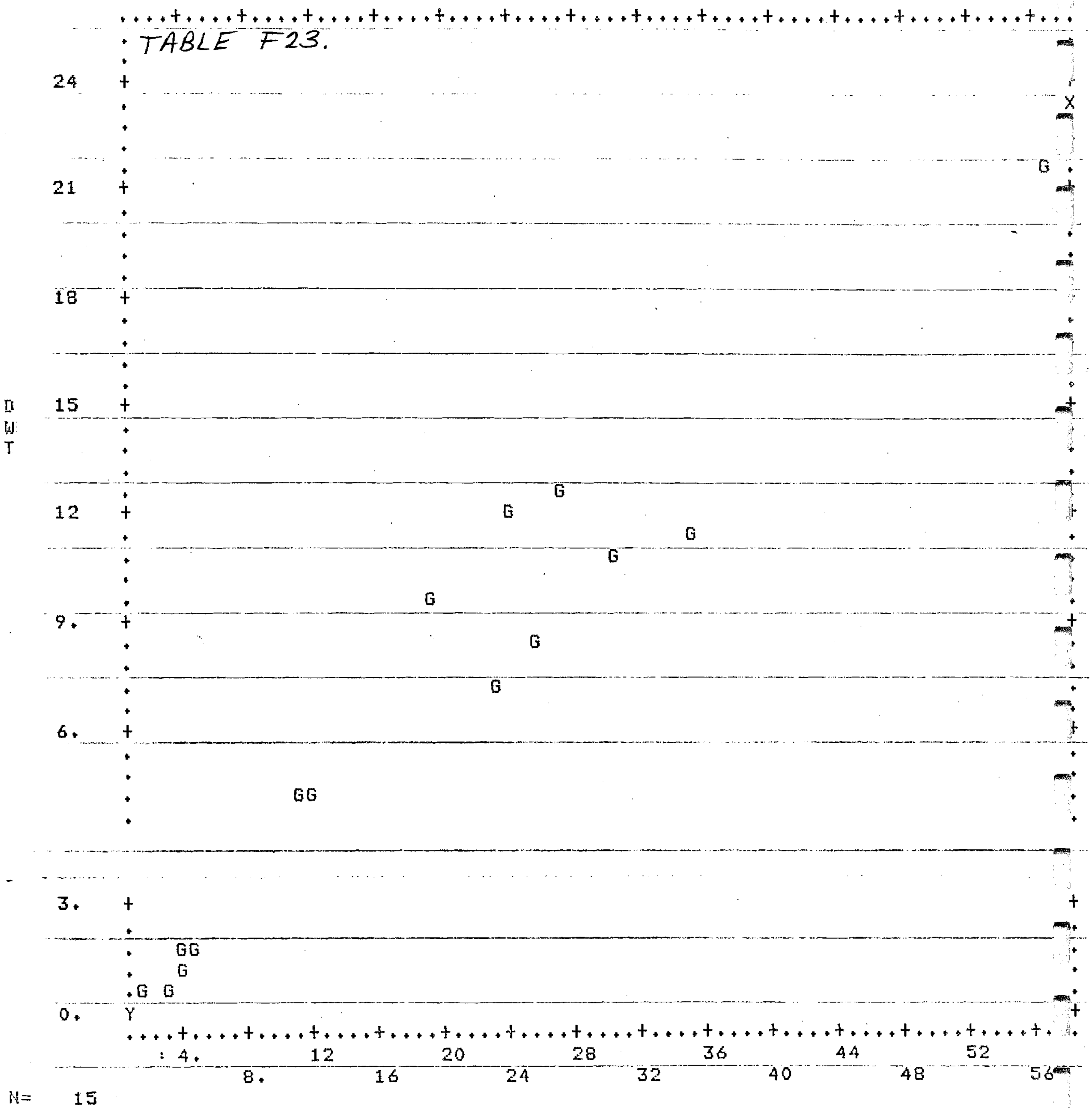


N= 26
COR= .8884

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	9.1308	7.8565	X= .93735*Y+ 4.5738	13.546
Y	4.8615	7.4465	Y= .84208*X-2.8273	12.169

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SAPU , SYMBOL=S

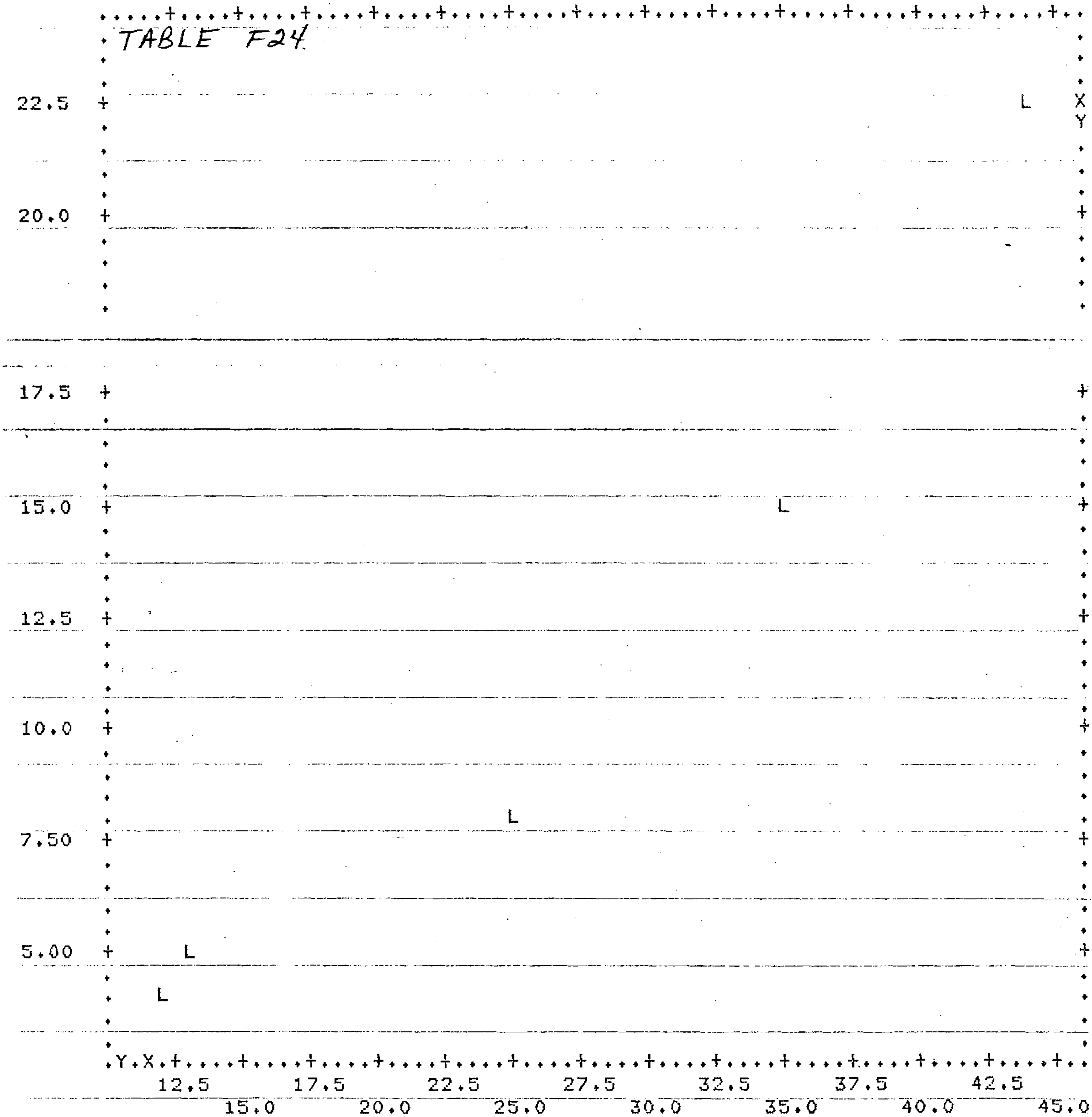
TABLE F23.



N= 15
COR= .9745

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	18.713	15.392	X= 2.4820*Y+ .99162	12.823
Y	7.1400	6.0436	Y= .38265*X-.02061	1.9769

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SAGL , SYMBOL=G



N= 5
COR= .9797

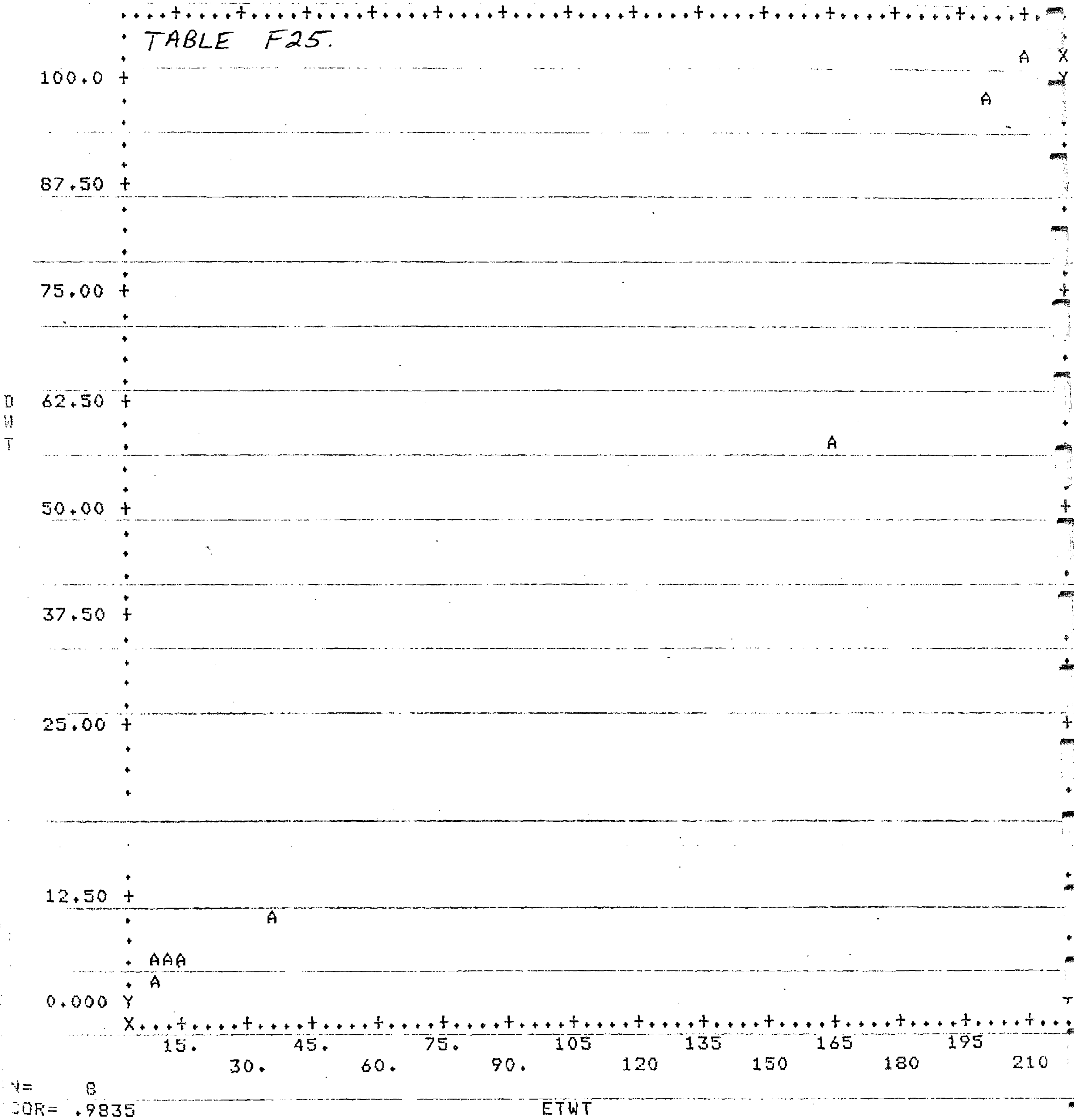
ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	25.800	13.882	X= 1.7428*Y+ 6.9783	10.334
Y	10.800	7.8035	Y= .55073*X-3.4087	3.2655

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SALA , SYMBOL=L

VARIABLE 11 ETWT VS. VARIABLE 21 WWT GROUP=ALSI , SYMBOL=I

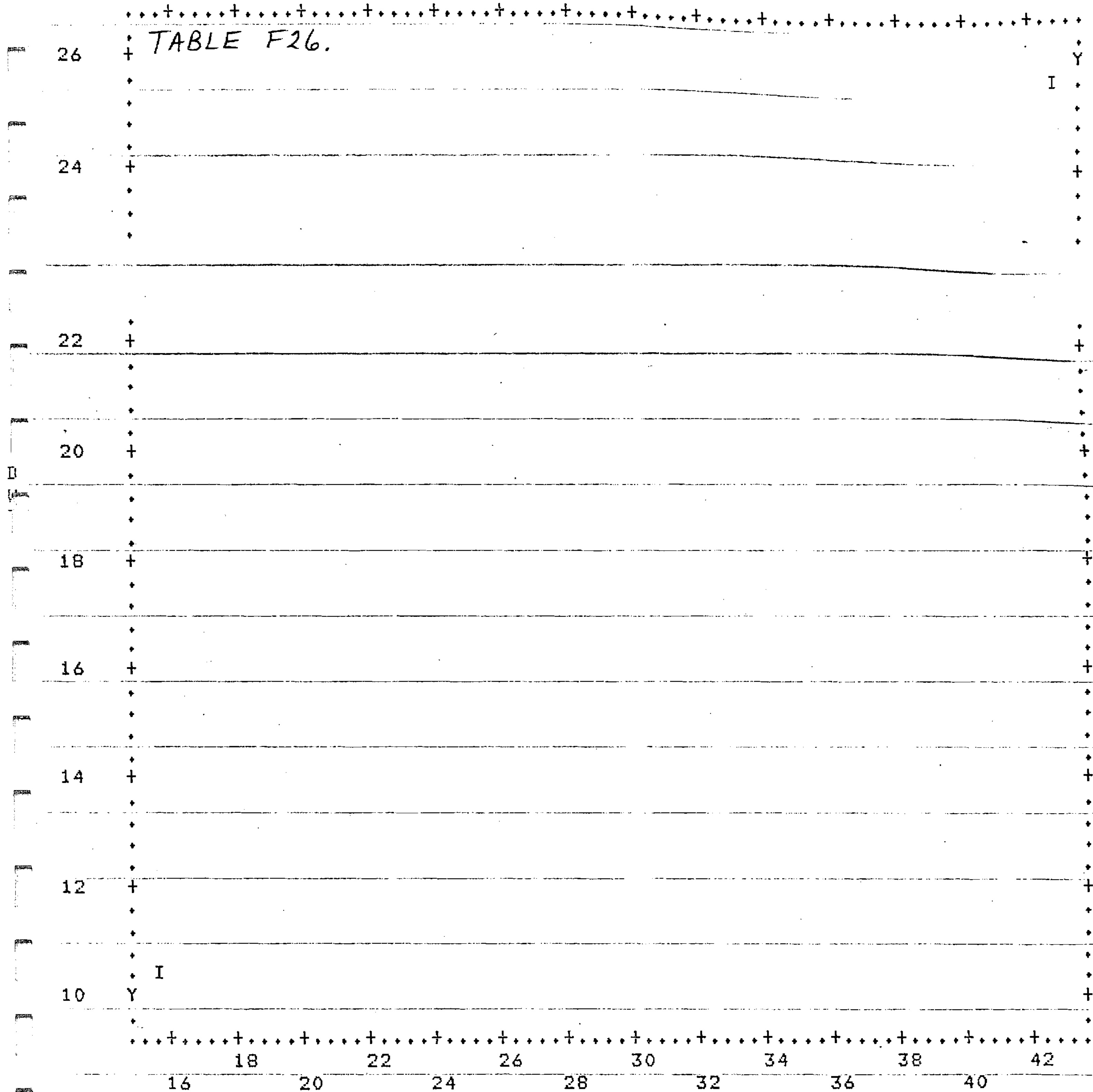
PAGE 17 BMDP6D OCULAR EST. REGRESSION



N= 8
COR= .9835

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	81.713	92.313	X= 2.0858*Y+ 7.5350	324.67
Y	35.563	43.528	Y= .46377*X-2.3331	72.187

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=SAAL , SYMBOL=A



R^2 = 1.000 ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
	29.250	19.445	X= 1.7974*Y-3.1928	0.0000
Y	18.050	10.819	Y= .55636*X+ 1.7764	0.0000

RIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=ALSI , SYMBOL=I

GE 16 BMDP6D OCULAR EST. REGRESSION

APPENDIX G

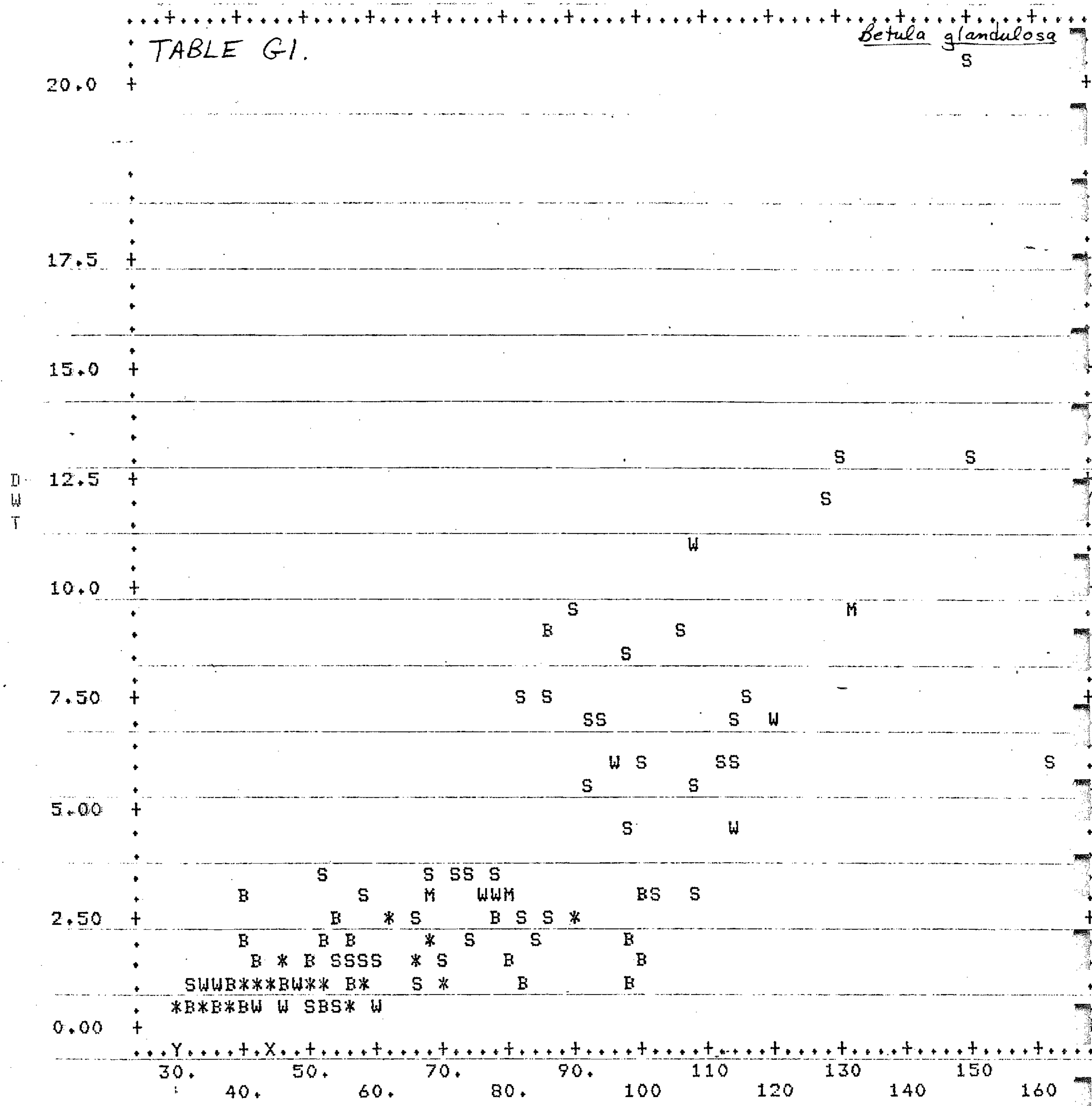
APPENDIX G

GRAPHS OF DRY WEIGHT VS SHRUB DIMENSIONS

Graphs of dry weight against each independent variable for *Betula glandulosa*, *Salix pulchra*, *Salix glauca*, and *Salix lanata* to determine requirements for mathematical transformations.

TABLE G1.

Betula glandulosa



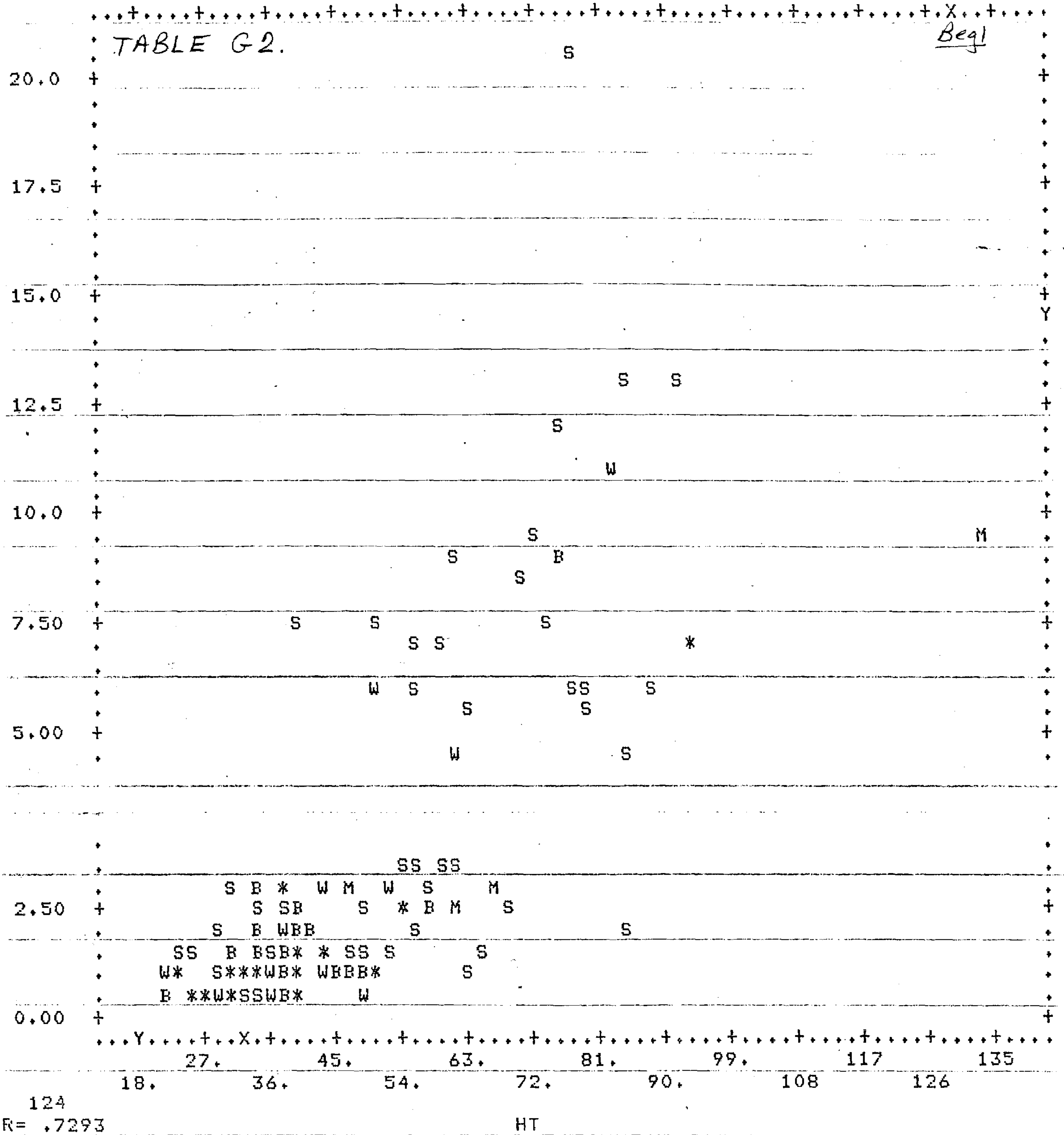
N= 124
COR= .7986

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	68.226	28.880	X= 7.0691*Y+ 47.440	304.58
Y	2.9403	3.2627	Y= .09022*X-3.2152	3.8873

VARIABLE 6 BDIA VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 6 BDIA VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 6 BDIA VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M

TABLE G2.

Begl

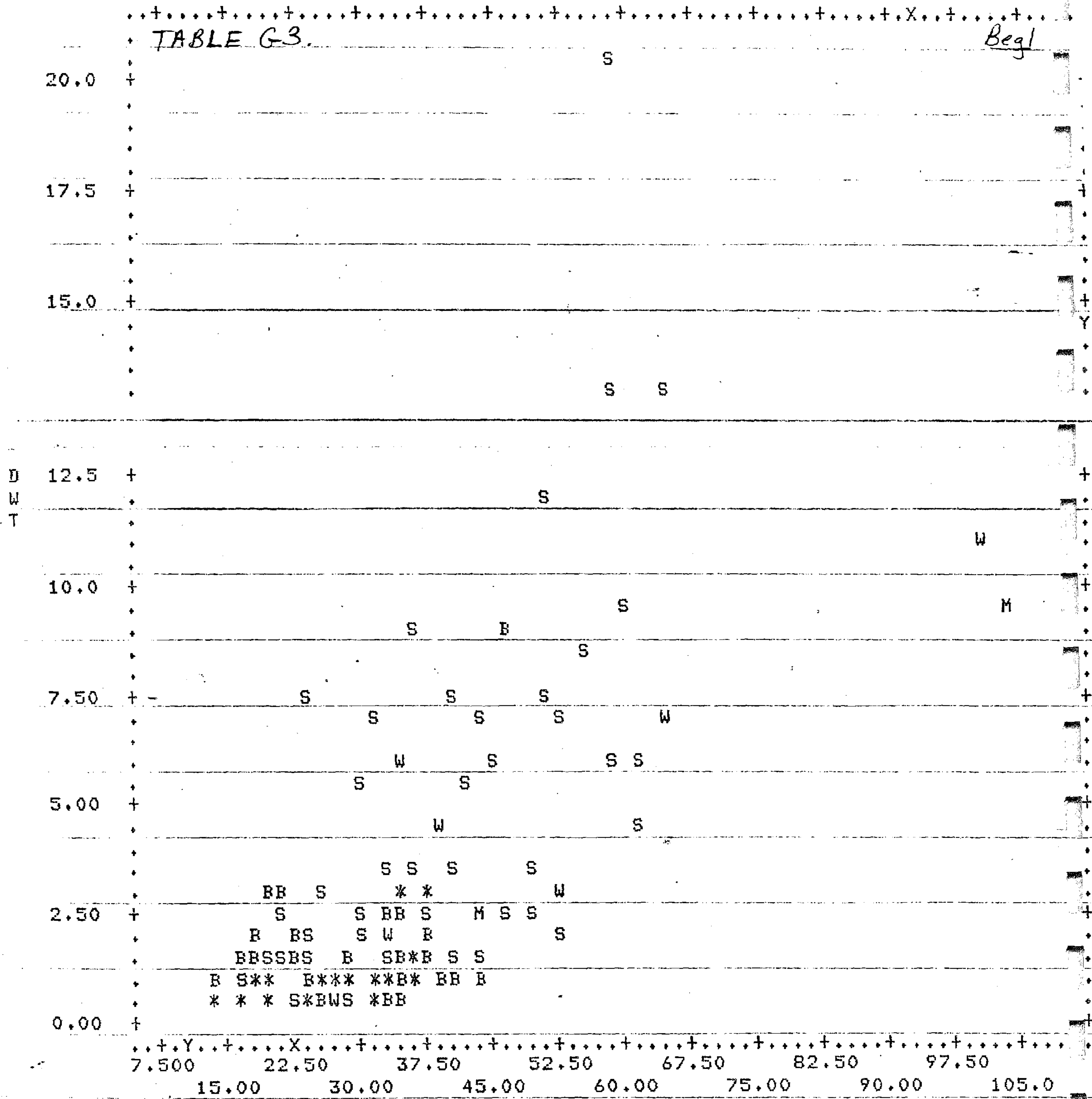


= 124
OR= .7293

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
	46.952	19.790	X= 4.4234*Y+ 33.945	184.87
Y	2.9403	3.2627	Y= .12023*X-2.7045	5.0247

ARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
ARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
ARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
ARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L
VARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=LS , SYMBOL=S

TABLE G3. Begl



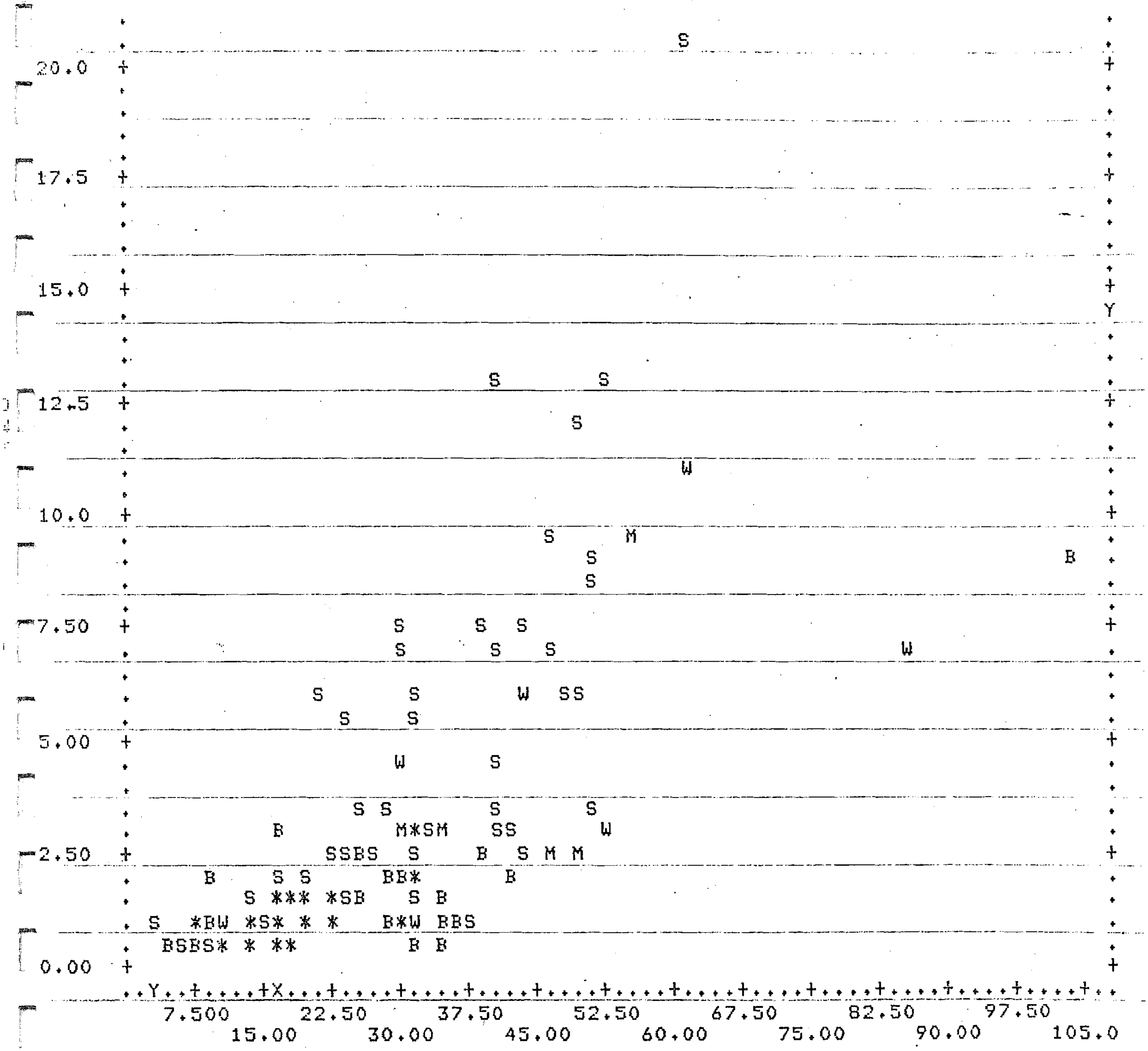
N= 124
COR= .6851

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	33.895	15.319	X= 3.2168*Y+ 24.437	125.53
Y	2.9403	3.2627	Y= .14592*X-2.0058	5.6944

```
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT     GROUP=WWBS    , SYMBOL=W
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT     GROUP=WBS     , SYMBOL=B
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT     GROUP=OM      , SYMBOL=M
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT     GROUP=TW      , SYMBOL=T
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT     GROUP=LW      , SYMBOL=L
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT     GROUP=LS      , SYMBOL=S
```

Begl 287

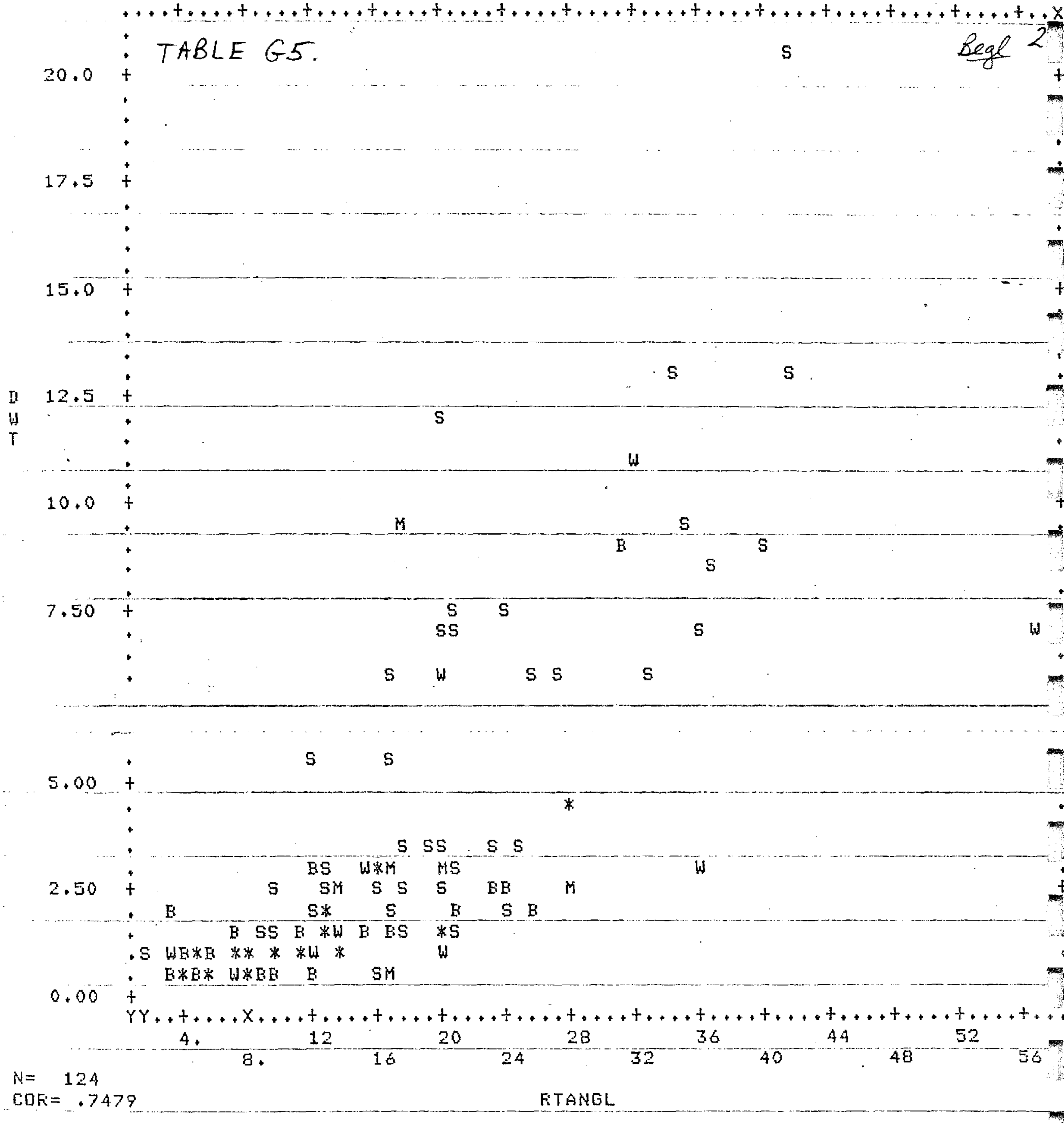
TABLE G4.



N= 124
COR= .6988

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	27.726	15.963	X= 3.4191*Y+ 17.673	131.44
Y	2.9403	3.2627	Y= .14283*X-1.0198	5.4910

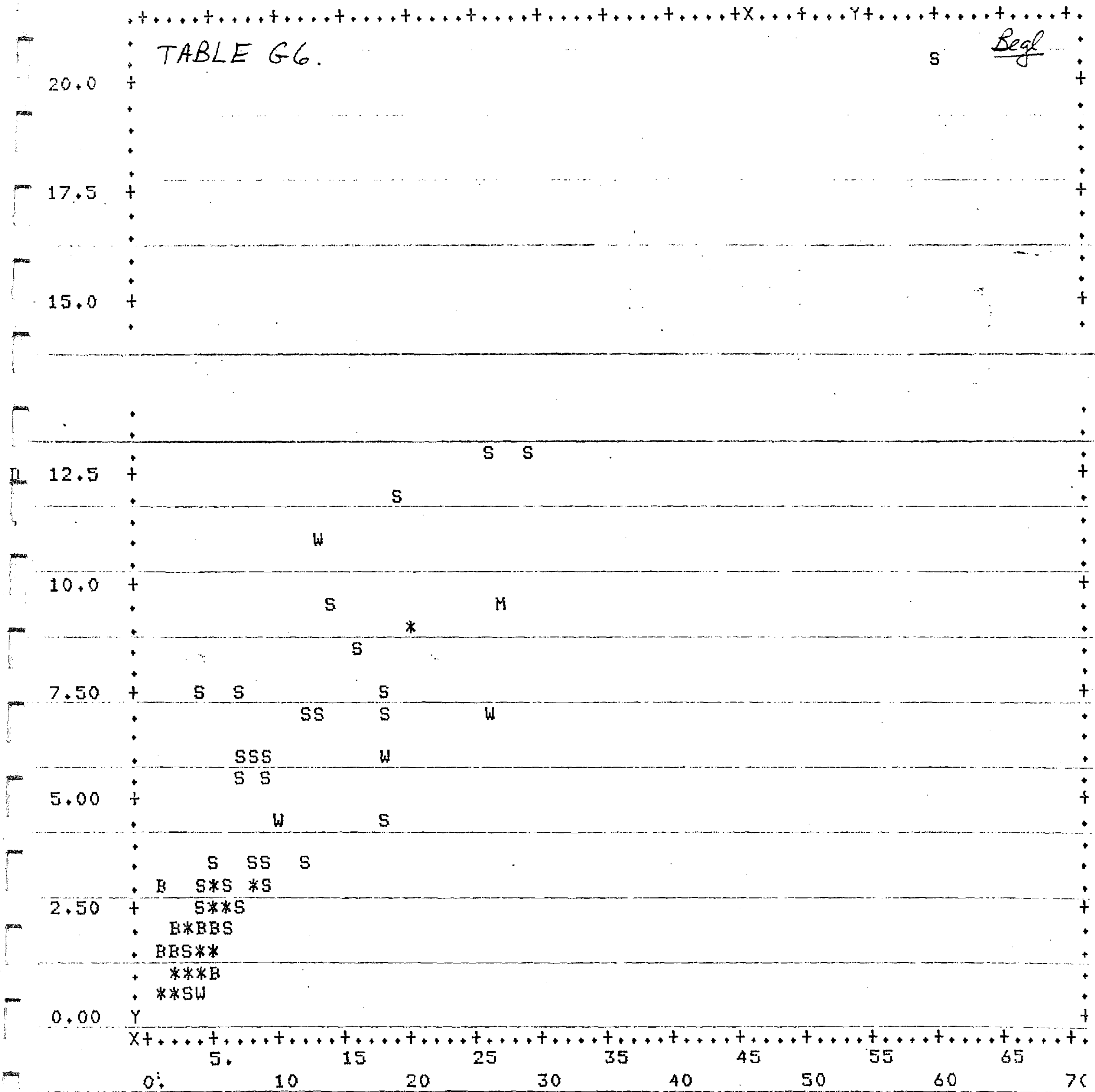
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L



N= 124
COR= .7479

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	15.790	9.9978	X= 2.2917*Y+ 9.0521	44.413
Y	2.9403	3.2627	Y= .24406*X-.91339	4.7298

VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=DM , SYMBOL=M
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=LS , SYMBOL=S



N= 124
COR= .9111

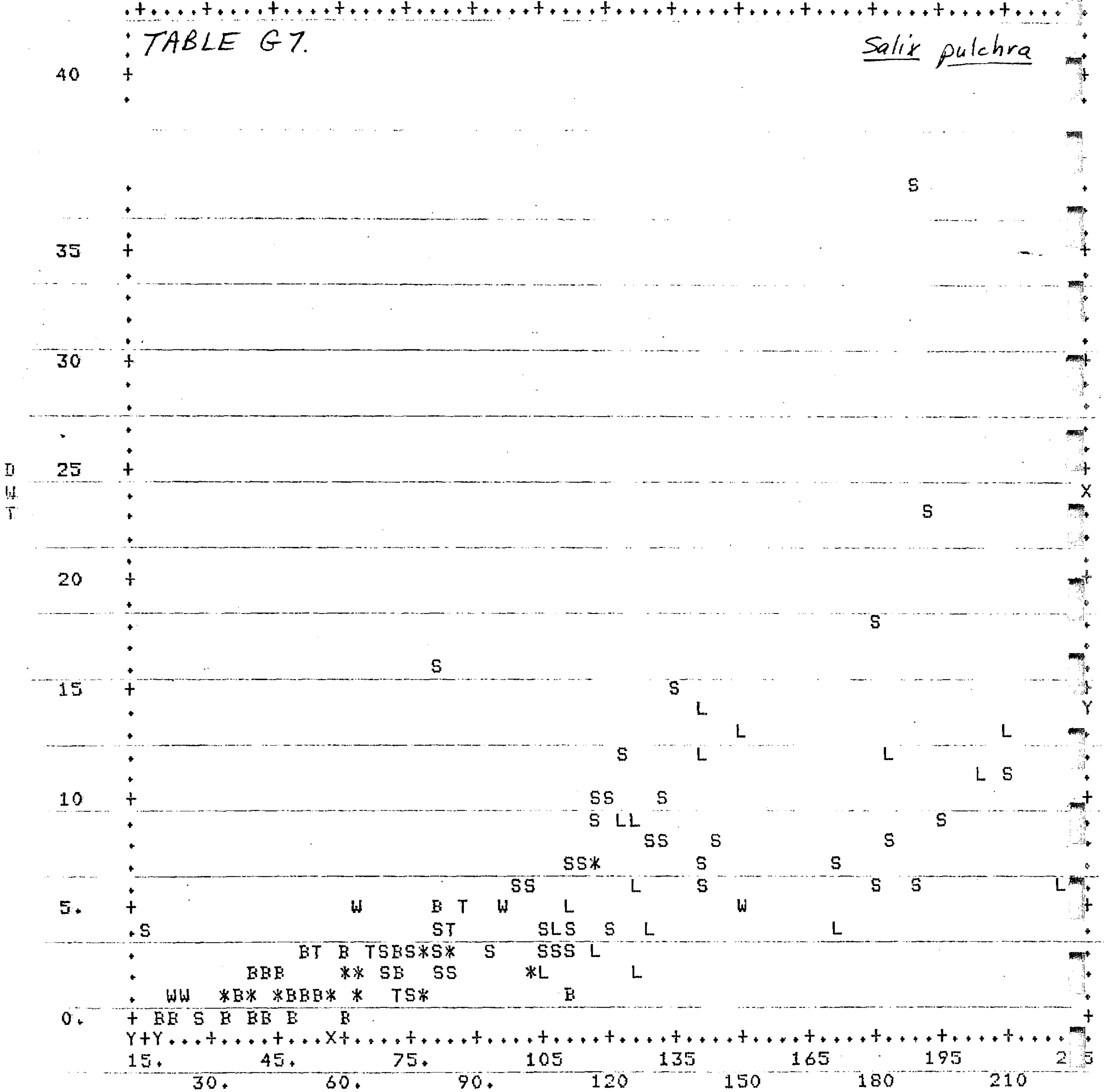
ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	6.1742	7.6587	X= 2.1387*Y-.11424	10.047
Y	2.9403	3.2627	Y= .38814*X+ .54389	1.8234

```
VARIABLE  11 ETWT   VS. VARIABLE  22 DWT   GROUP=WWBS  , SYMBOL=W
VARIABLE  11 ETWT   VS. VARIABLE  22 DWT   GROUP=WBS   , SYMBOL=B
VARIABLE  11 ETWT   VS. VARIABLE  22 DWT   GROUP=OM    , SYMBOL=M
VARIABLE  11 ETWT   VS. VARIABLE  22 DWT   GROUP=TW    , SYMBOL=T
VARIABLE  11 ETWT   VS. VARIABLE  22 DWT   GROUP=LW    , SYMBOL=L
VARIABLE  11 ETWT   VS. VARIABLE  22 DWT   GROUP=LS    , SYMBOL=S
```

TABLE G7.

Salix pulchra



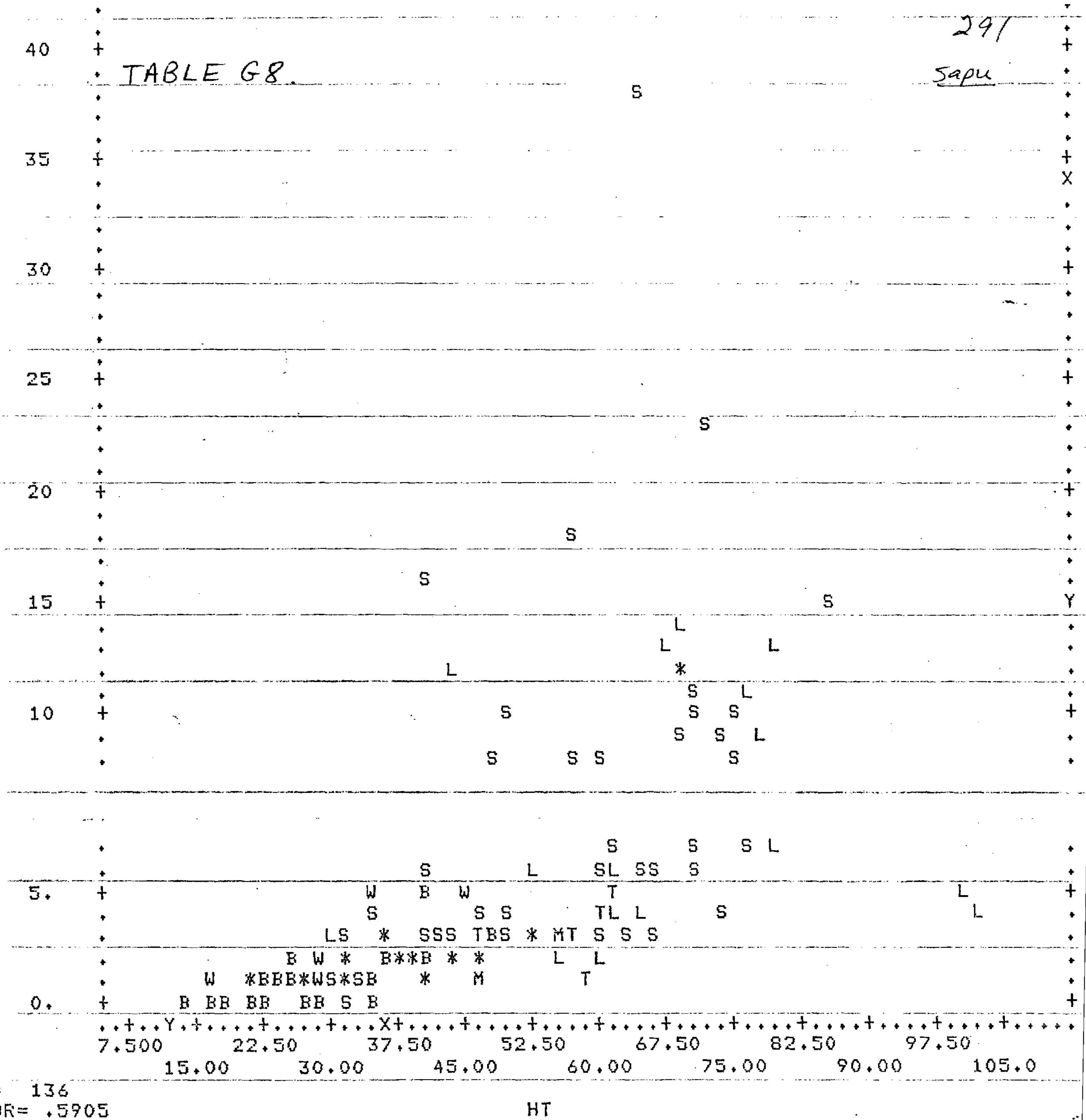
N= 136
COR= .7028

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	98.147	50.731	X= 6.8743*Y+ 64.690	1312.1
Y	4.8669	5.1868	Y= .07186*X-2.1857	13.715

```
VARIABLE   6 BDIA    VS. VARIABLE  22 DWT     GROUP=WWBS    , SYMBOL=W
VARIABLE   6 BDIA    VS. VARIABLE  22 DWT     GROUP=WBS     , SYMBOL=B
VARIABLE   6 BDIA    VS. VARIABLE  22 DWT     GROUP=OM      , SYMBOL=M
```

TABLE G8.

Sapu



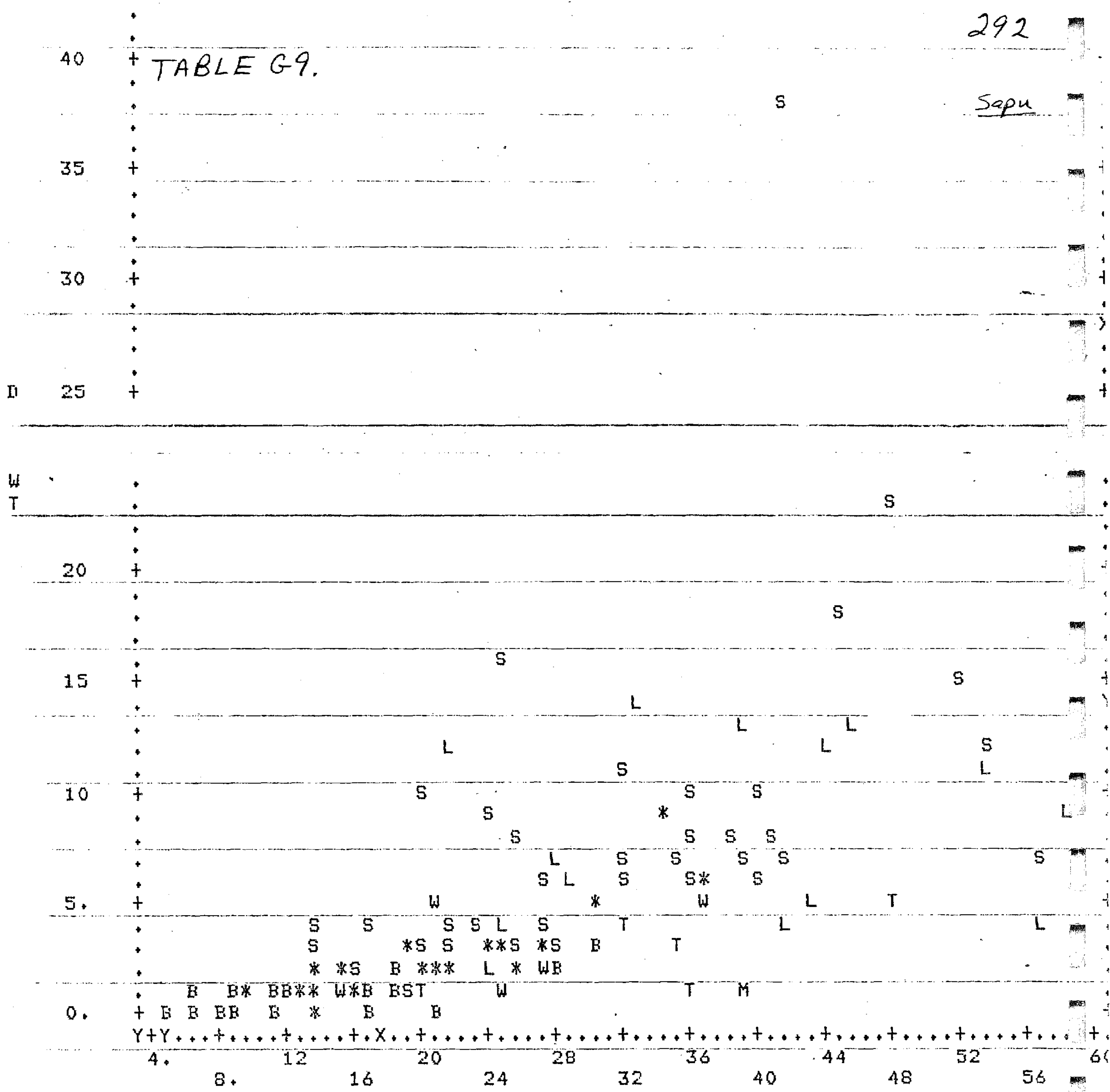
N = 136
CORR= .5905

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	48.294	19.101	X= 2.1745*Y+ 37.711	239.42
Y	4.8669	5.1868	Y= .16034*X-2.8765	17.654

VARIABLE	7 HT	VS. VARIABLE	22 DWT	GROUP=WWBS	, SYMBOL=W
VARIABLE	7 HT	VS. VARIABLE	22 DWT	GROUP=WBS	, SYMBOL=B
VARIABLE	7 HT	VS. VARIABLE	22 DWT	GROUP=OM	, SYMBOL=M
VARIABLE	7 HT	VS. VARIABLE	22 DWT	GROUP=TW	, SYMBOL=T
VARIABLE	7 HT	VS. VARIABLE	22 DWT	GROUP=LW	, SYMBOL=L
VARIABLE	7 HT	VS. VARIABLE	22 DWT	GROUP=LS	, SYMBOL=S

TABLE G9.

Sapu

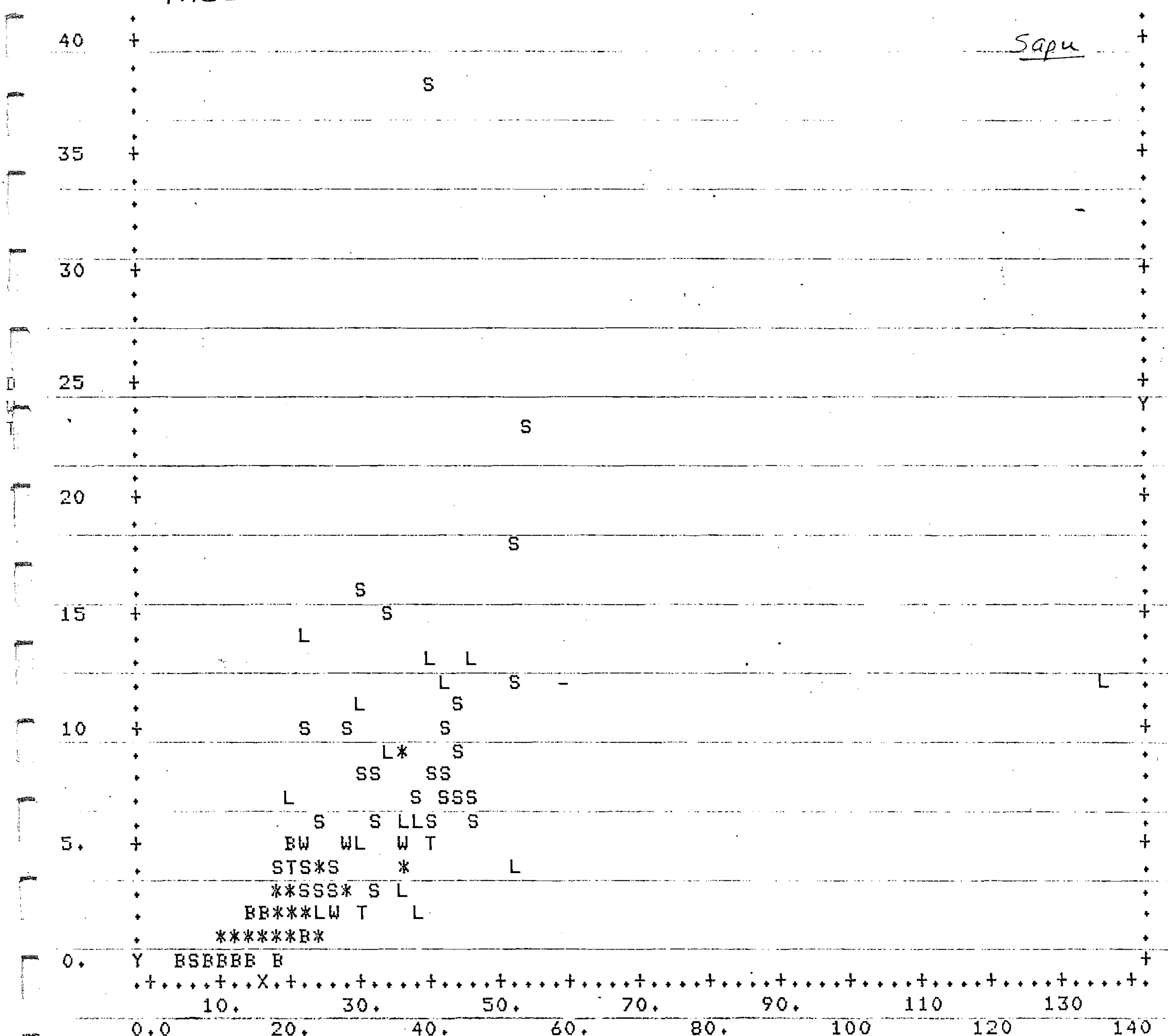


N= 136
COR= .6388 DEPTH

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	26.360	12.277	X= 1.5120*Y+ 19.001	89.897
Y	4.8669	5.1868	Y= .26986*X-2.2466	16.044

VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L
VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=LS , SYMBOL=S

TABLE G10.



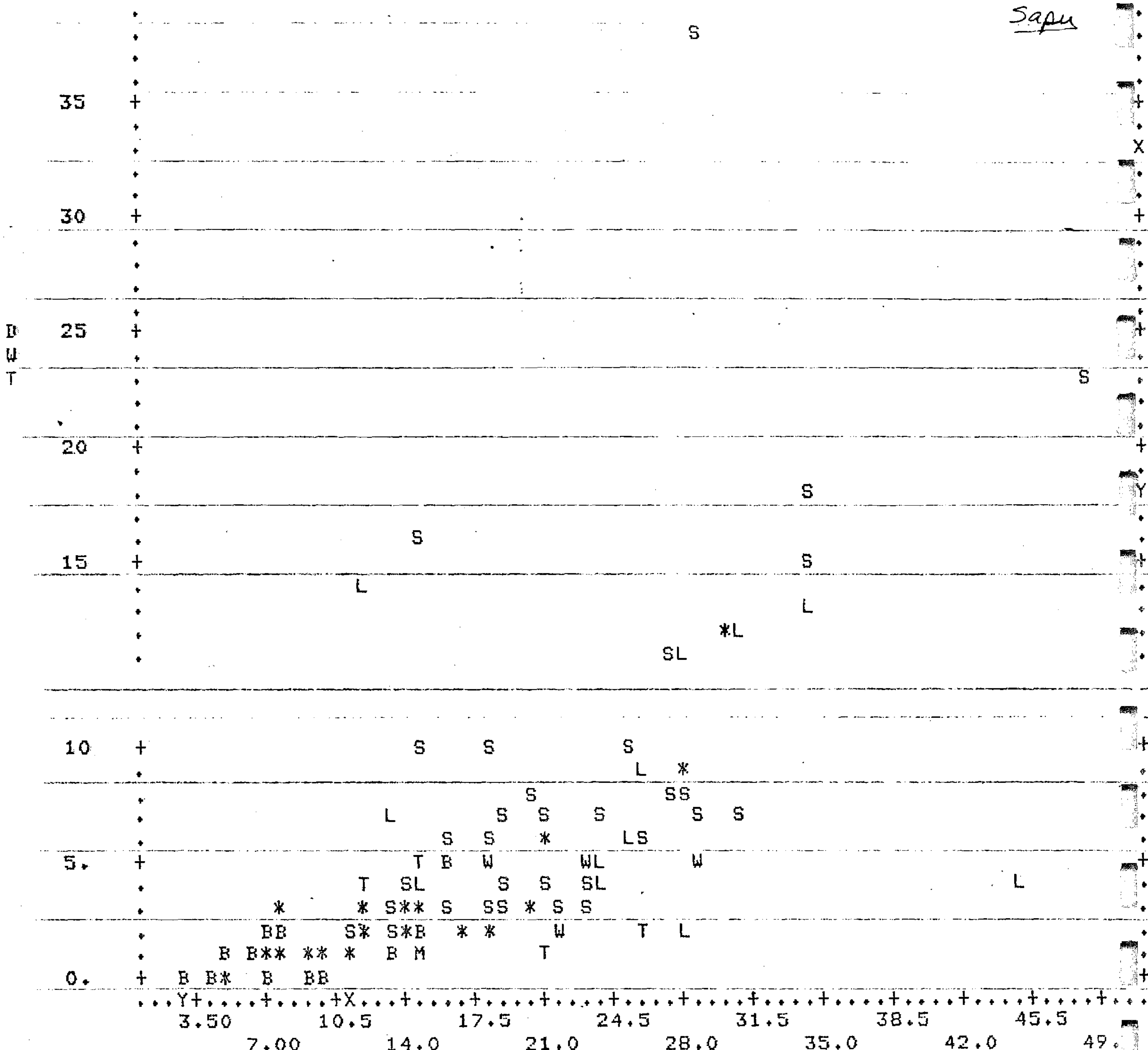
N 136
CLR= .5620

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	27.154	17.419	X= 1.8875*Y+ 17.968	209.12
Y	4.8669	5.1868	Y= .16736*X+ .32244	18.542

VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=LS , SYMBOL=S

TABLE G11.

Sapu

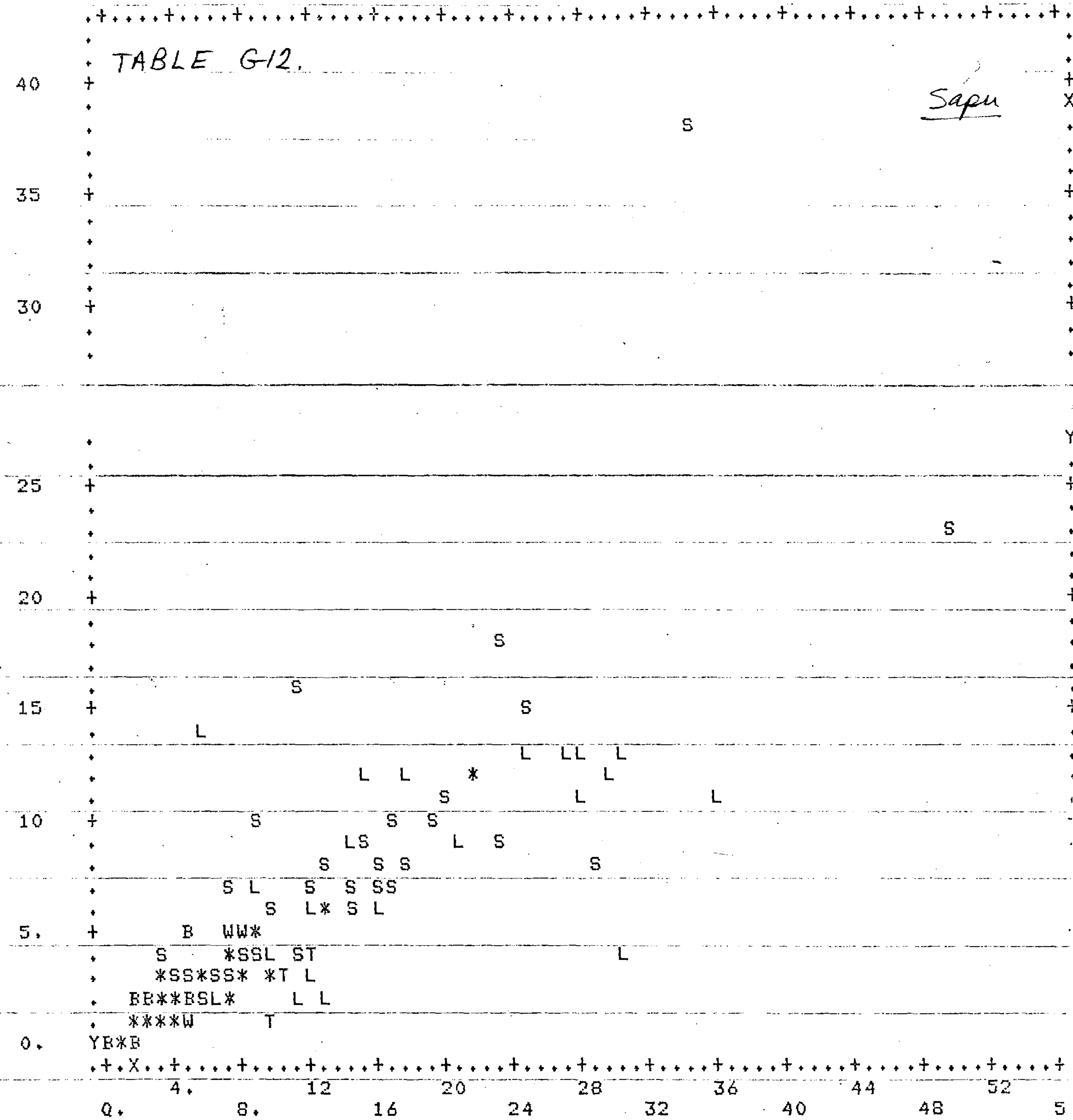


N= 136
COR= .6819

RTANGL

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	17.912	8.9173	X= 1.1724*Y+ 12.206	42.857
Y	4.8669	5.1868	Y= .39665*X-2.2378	14.499

VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=LS , SYMBOL=S



N= 136
COR= .8142

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	9.5596	8.8218	X= 1.3848*Y+ 2.8197	26.429
Y	4.8669	5.1868	Y= .47870*X+ .29071	9.1358

```
VARIABLE  11 ETWT    VS. VARIABLE  22 DWT    GROUP=WWBS   , SYMBOL=W
VARIABLE  11 ETWT    VS. VARIABLE  22 DWT    GROUP=WBS    , SYMBOL=B
VARIABLE  11 ETWT    VS. VARIABLE  22 DWT    GROUP=OM     , SYMBOL=M
VARIABLE  11 ETWT    VS. VARIABLE  22 DWT    GROUP=TW     , SYMBOL=T
VARIABLE  11 ETWT    VS. VARIABLE  22 DWT    GROUP=LW     , SYMBOL=L
VARIABLE  11 ETWT    VS. VARIABLE  22 DWT    GROUP=LS     , SYMBOL=S
```

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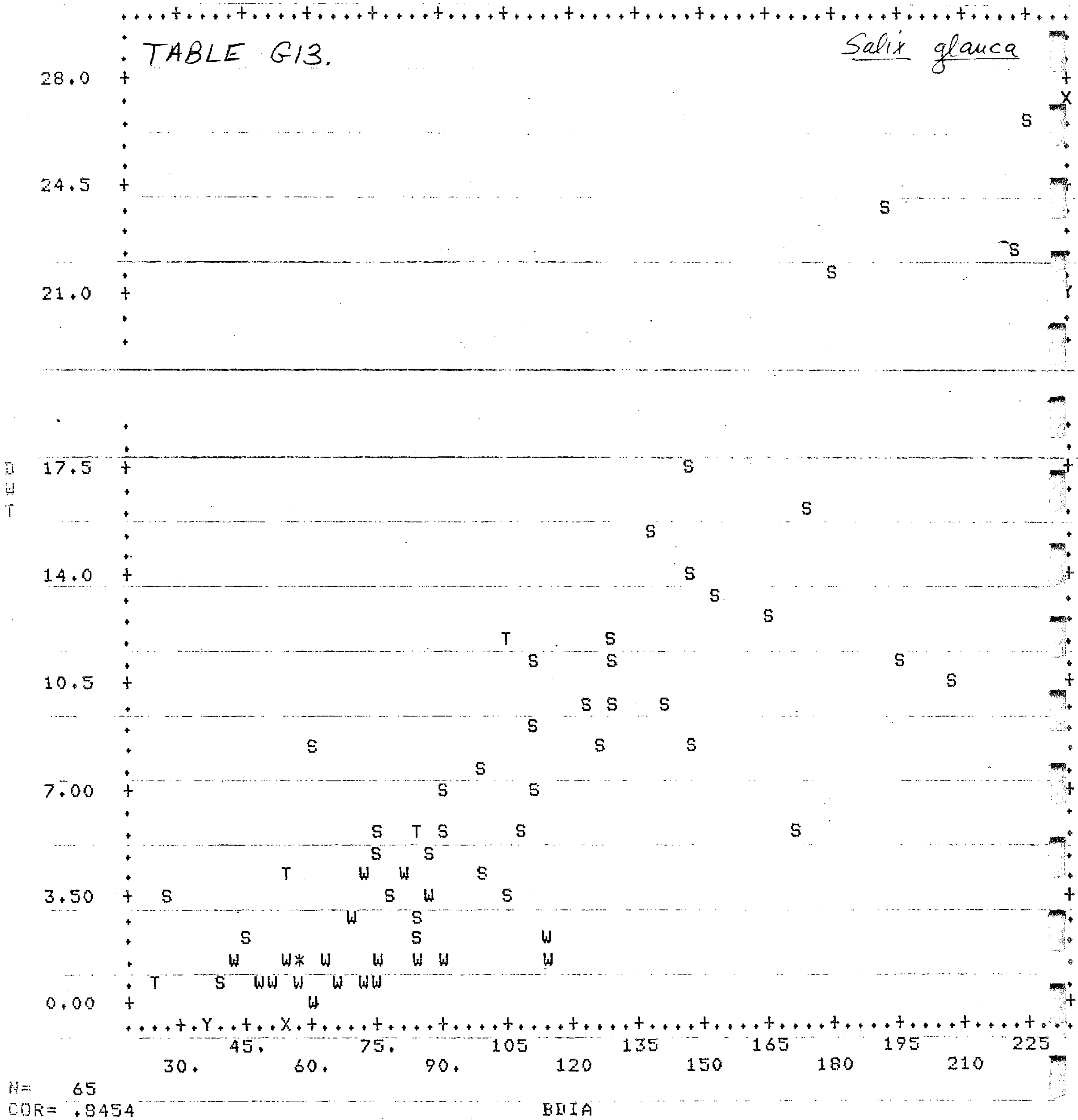
TABLE G13.

Salix glauca



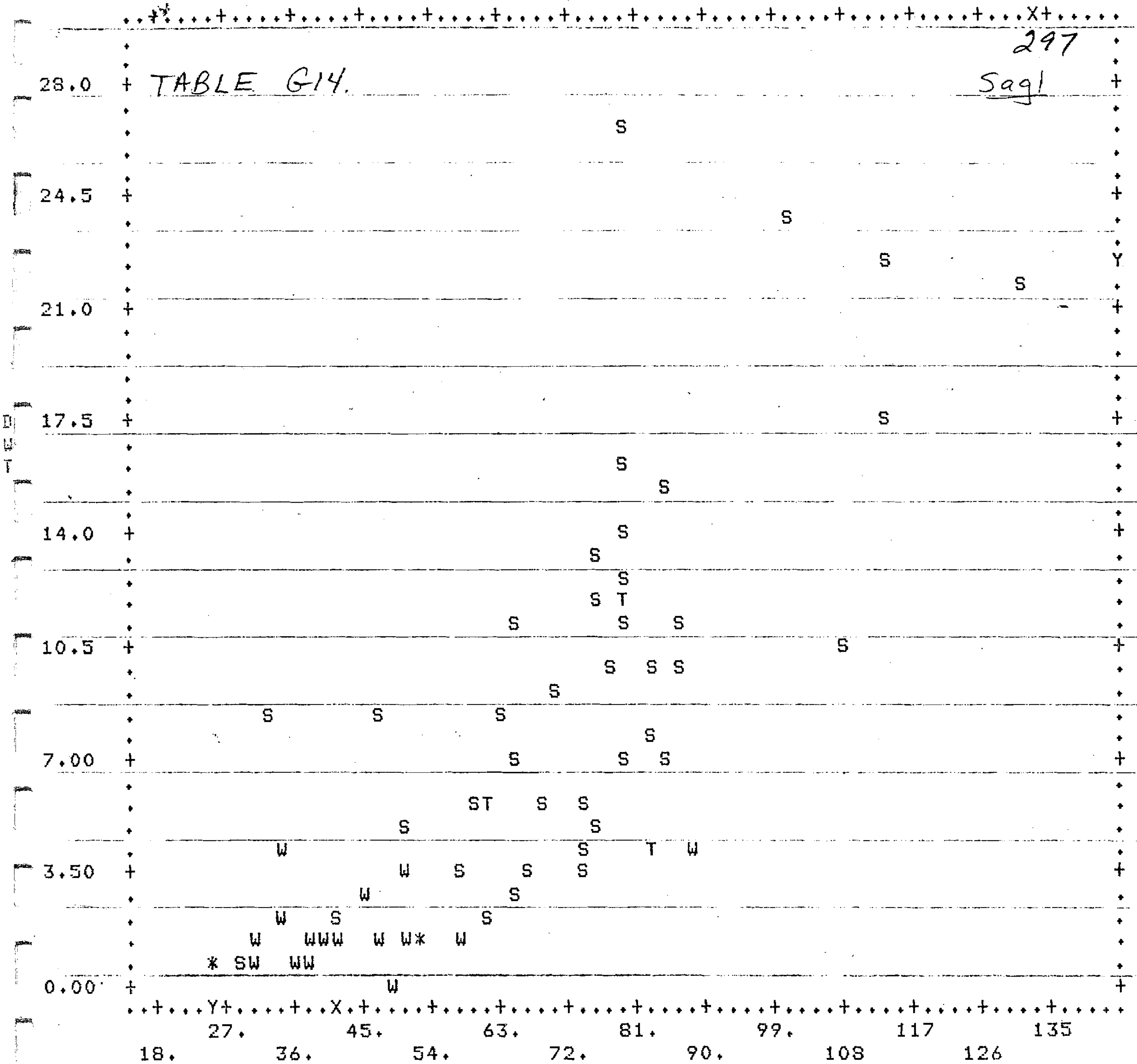
N= 65
COR= .8454

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	102.82	47.898	X= 6.4975*Y+ 58.853	665.07
Y	6.7662	6.2318	Y= .10999*X-4.5422	11.258

```
VARIABLE  6 BDIA   VS. VARIABLE  22 DWT   GROUP=WWBS  , SYMBOL=W
VARIABLE  6 BDIA   VS. VARIABLE  22 DWT   GROUP=WBS   , SYMBOL=B
VARIABLE  6 BDIA   VS. VARIABLE  22 DWT   GROUP=DM    , SYMBOL=M
VARIABLE  6 BDIA   VS. VARIABLE  22 DWT   GROUP=TW    , SYMBOL=T
VARIABLE  6 BDIA   VS. VARIABLE  22 DWT   GROUP=LW    , SYMBOL=L
VARIABLE  6 BDIA   VS. VARIABLE  22 DWT   GROUP=LS    , SYMBOL=S
```

TABLE G14.

Sagl



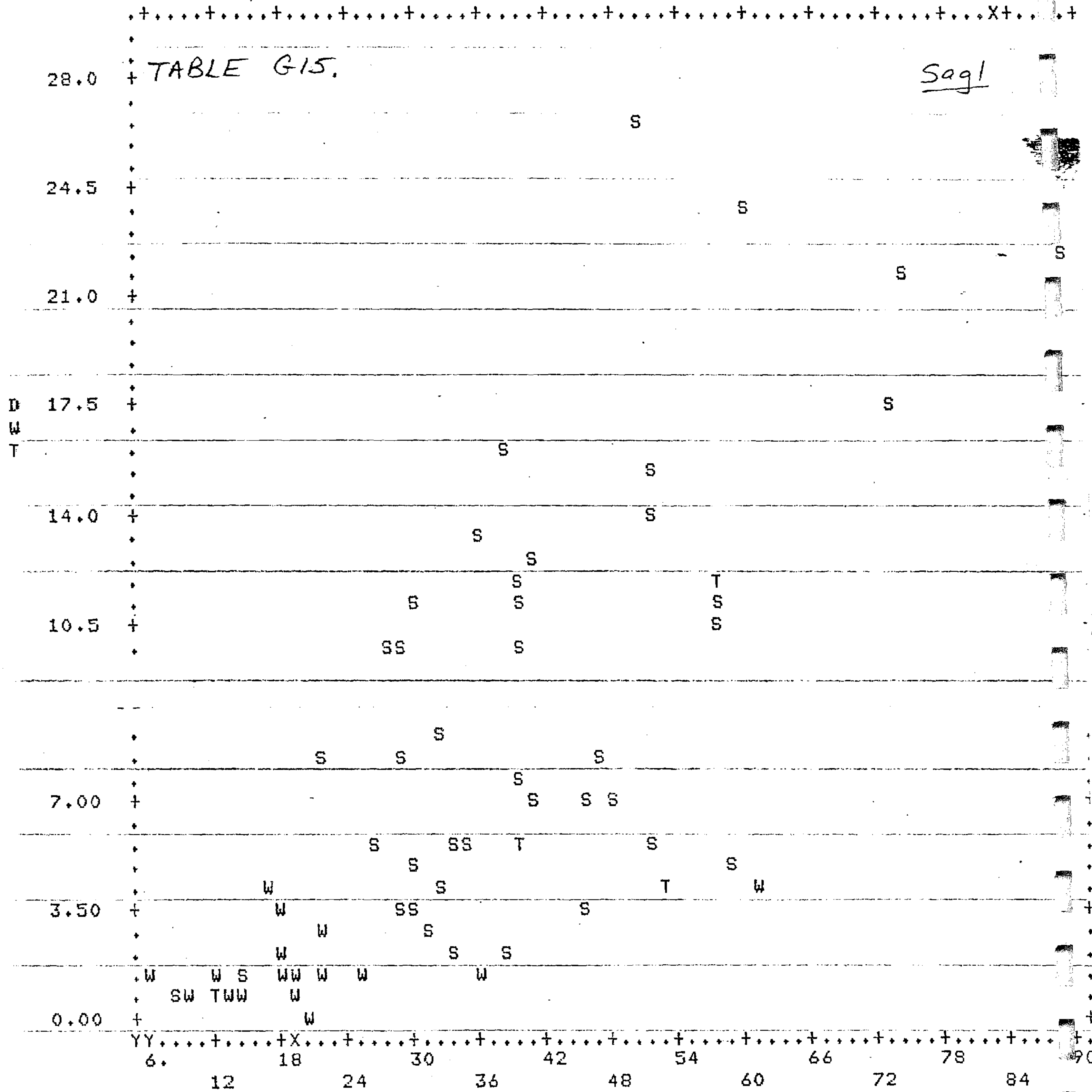
N= 65
COR= .7666 HT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	63.631	24.023	X= 2.9550*Y+ 43.637	241.77
Y	6.7662	6.2318	Y= .19885*X-5.8869	16.270

VARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
VARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L
VARIABLE 7 HT VS. VARIABLE 22 DWT GROUP=LS , SYMBOL=S

TABLE G15.

Sag1



N= 65
COR= .7322

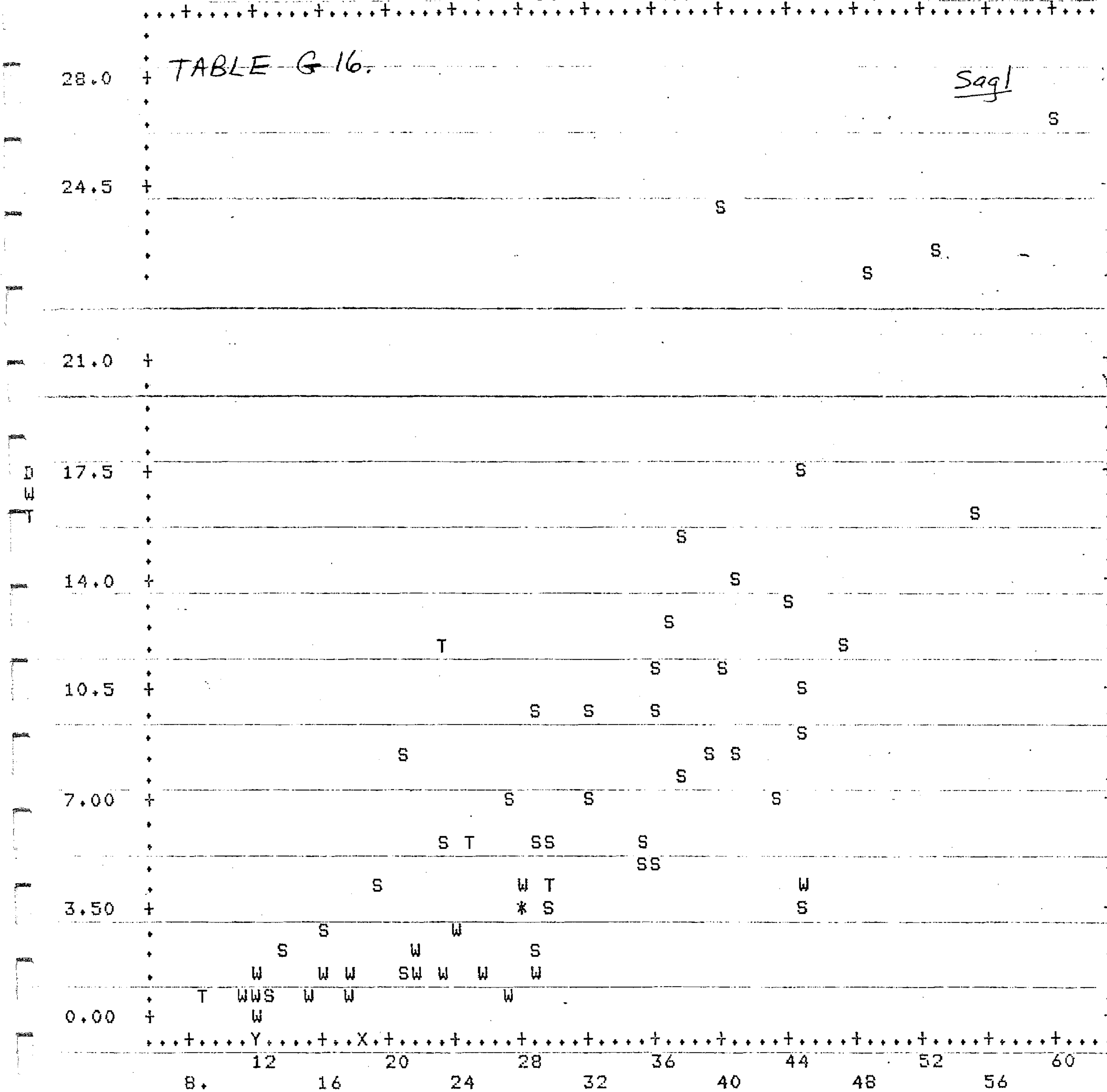
DEPTH

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	34.492	17.770	X= 2.0880*Y+ 20.364	148.80
Y	6.7662	6.2318	Y= .25678*X-2.0909	10.299

VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L
VARIABLE 8 DEPTH VS. VARIABLE 22 DWT GROUP=LS , SYMBOL=S

TABLE G 16.

Sag1



N= 65
COR= .7871

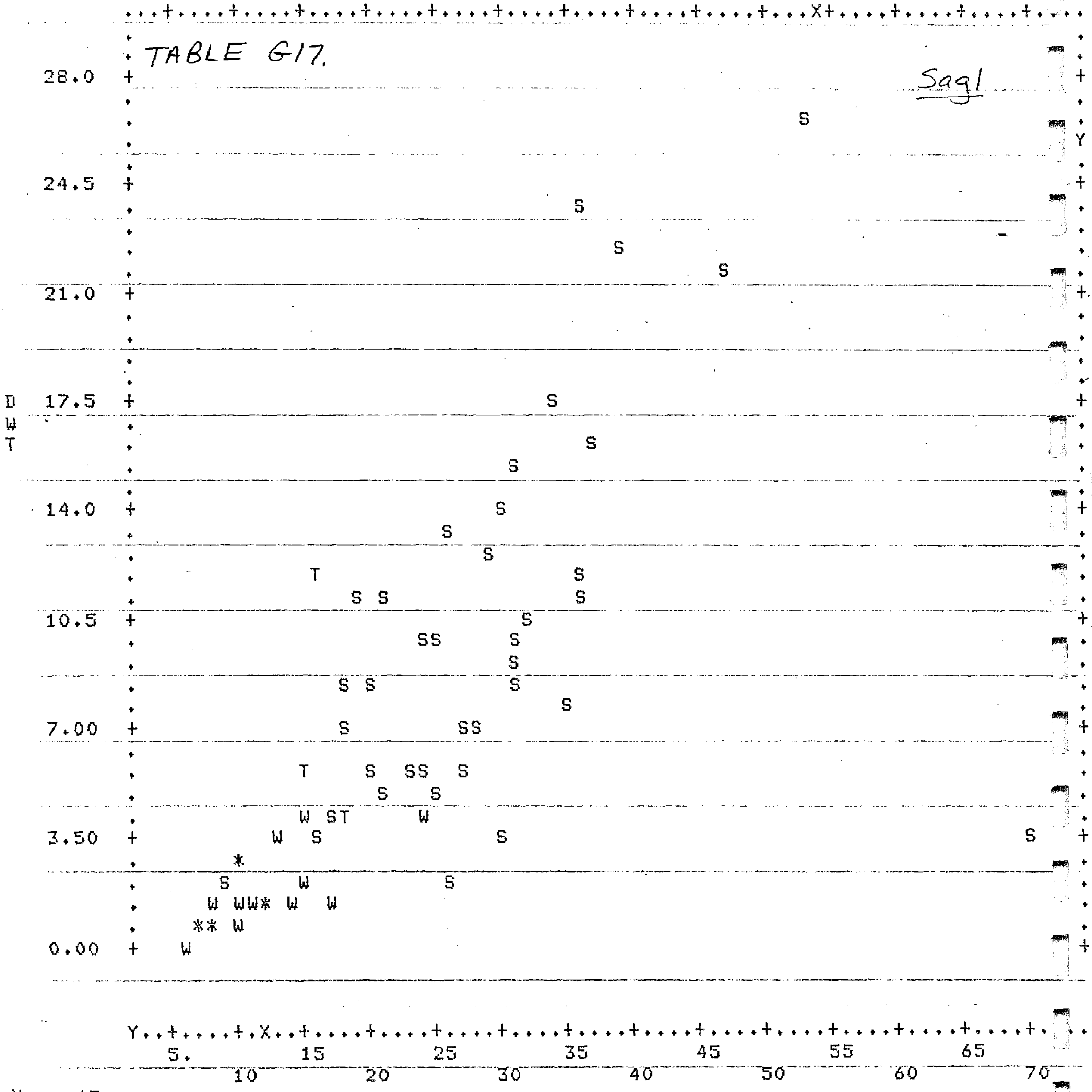
WIDTH

MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
30.231	12.143	X= 1.5338*Y+ 19.853	56.990
6.7662	6.2318	Y= .40394*X-5.4453	15.009

VARIABLE	9 WIDTH	VS.	VARIABLE	22 DWT	GROUP=WWBS	,	SYMBOL=W
VARIABLE	9 WIDTH	VS.	VARIABLE	22 DWT	GROUP=WBS	,	SYMBOL=B
VARIABLE	9 WIDTH	VS.	VARIABLE	22 DWT	GROUP=OM	,	SYMBOL=M
VARIABLE	9 WIDTH	VS.	VARIABLE	22 DWT	GROUP=TW	,	SYMBOL=T
VARIABLE	9 WIDTH	VS.	VARIABLE	22 DWT	GROUP=LW	,	SYMBOL=L
VARIABLE	9 WIDTH	VS.	VARIABLE	22 DWT	GROUP=LS	,	SYMBOL=S

TABLE G17.

Sagl



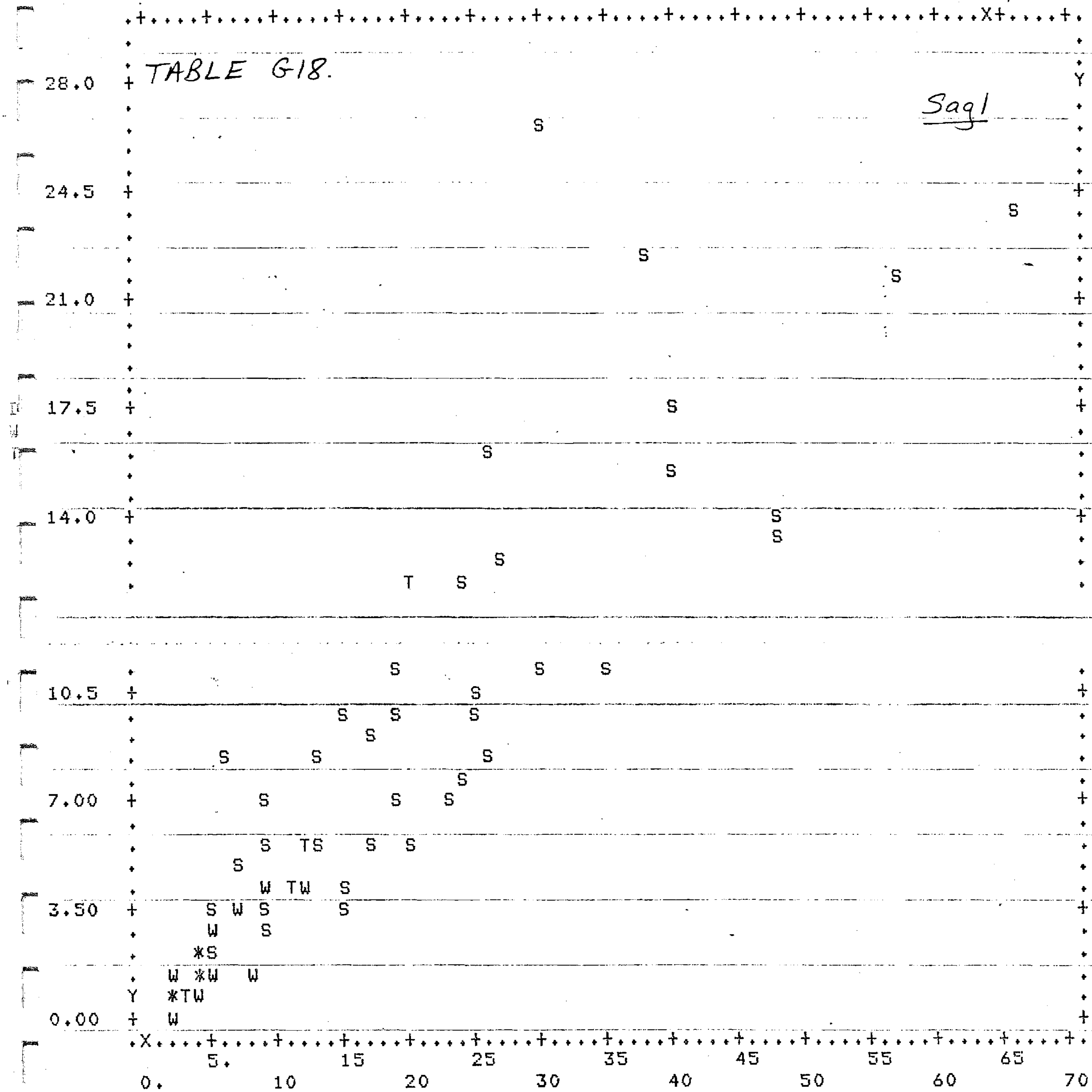
N= 65
COR= .7091

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	21.923	12.186	X= 1.3867*Y+ 12.541	73.006
Y	6.7662	6.2318	Y= .36262*X-1.1835	19.614

VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=LS , SYMBOL=S

TABLE G18.

Saql



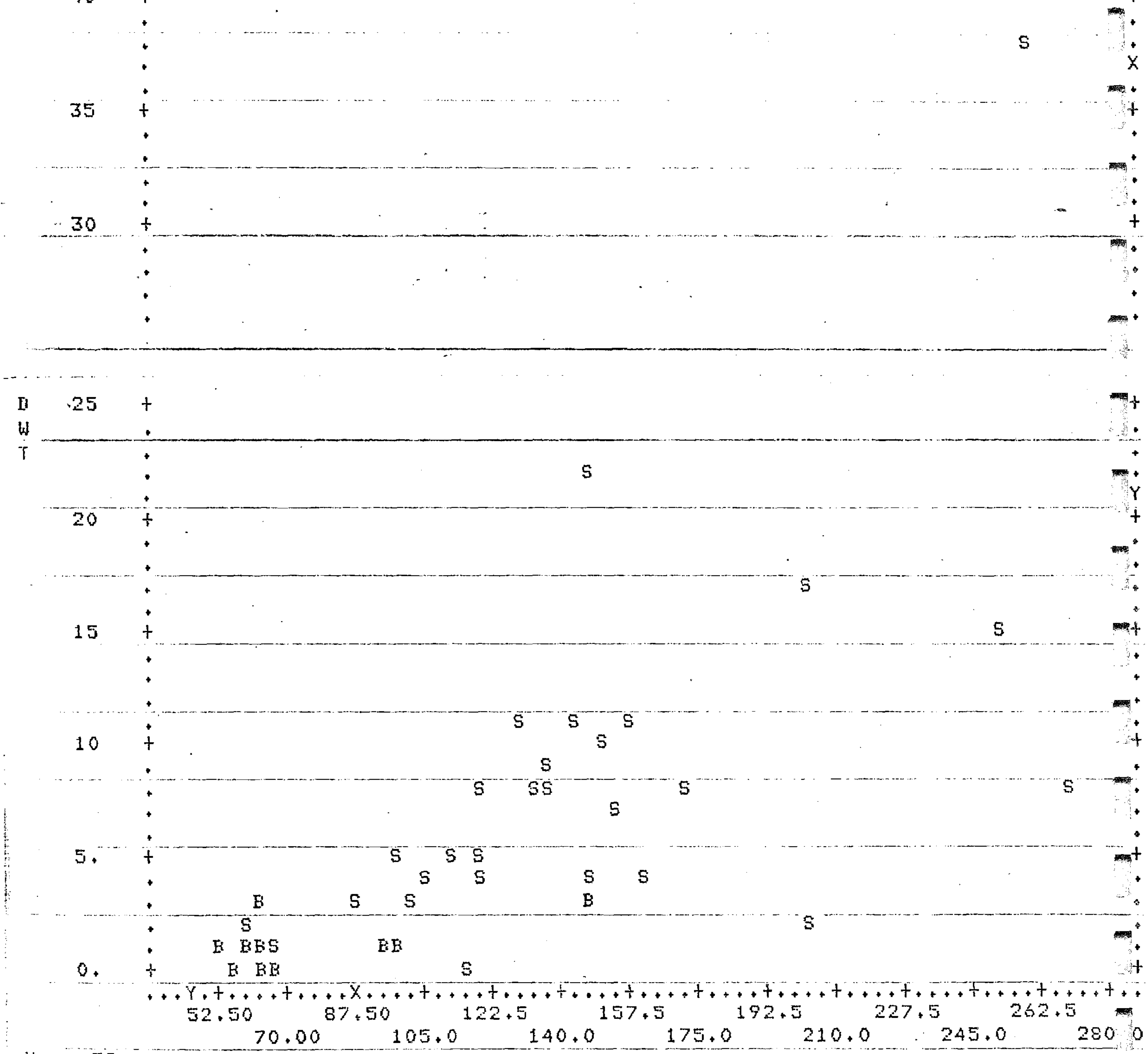
N= 65
R= .8873

ETWT

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	15.680	14.627	X= 2.0826*Y+ 1.5889	46.246
Y	6.7662	6.2318	Y= .37801*X+ .83898	8.3940

VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L
VARIABLE 11 ETWT VS. VARIABLE 22 DWT GROUP=LS , SYMBOL=S

TABLE G19. *Salix lanata*



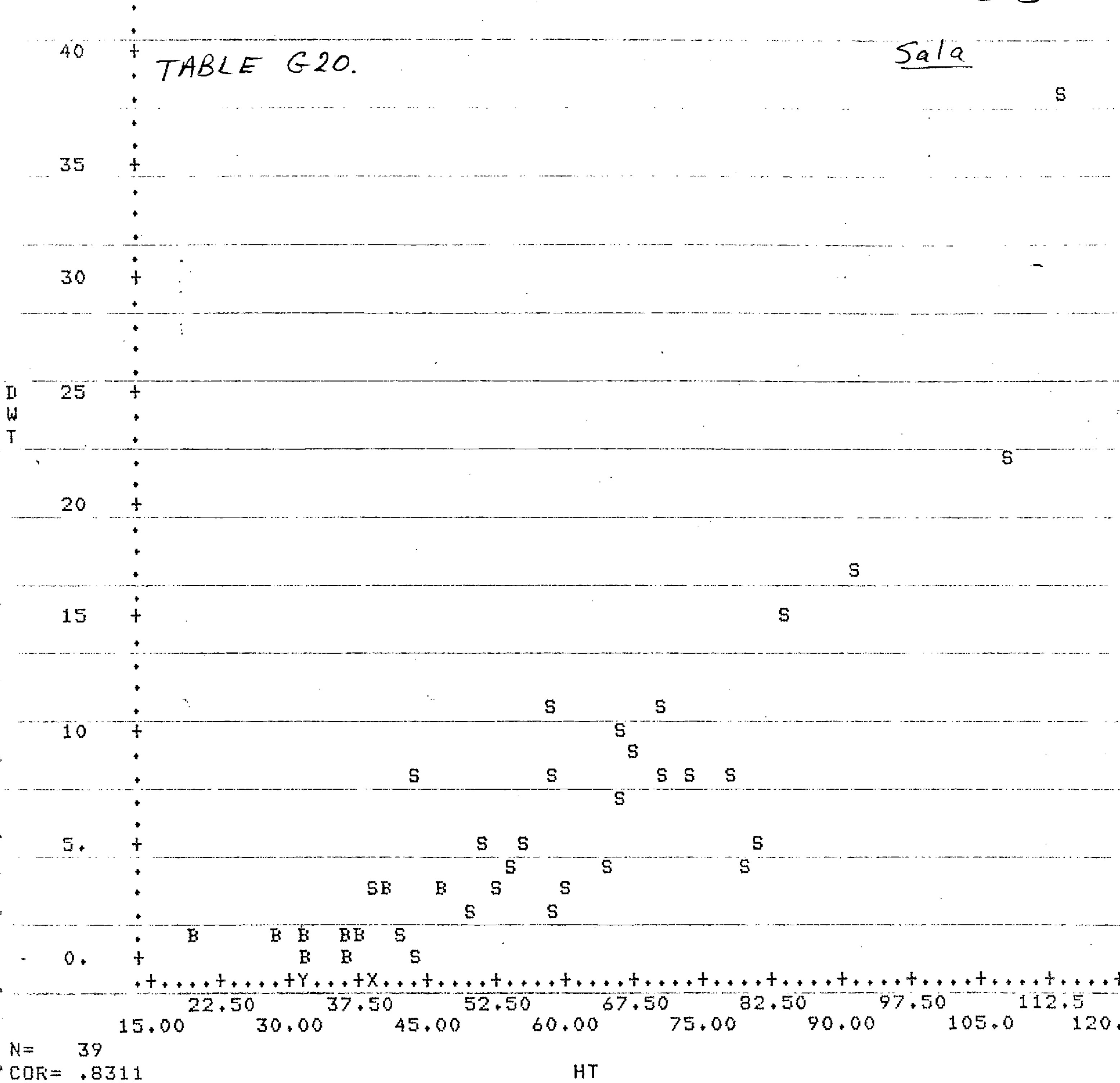
N= 39
COR= .6881

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	125.79	55.606	X= 5.2817*Y+ 92.628	1672.0
Y	6.2795	7.2445	Y= .08965*X-4.9977	28.379

VARIABLE 6 BDIA VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 6 BDIA VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 6 BDIA VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
VARIABLE 6 BDIA VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 6 BDIA VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L
VARIABLE 6 BDIA VS. VARIABLE 22 DWT GROUP=LS , SYMBOL=S

TABLE G20.

Sala



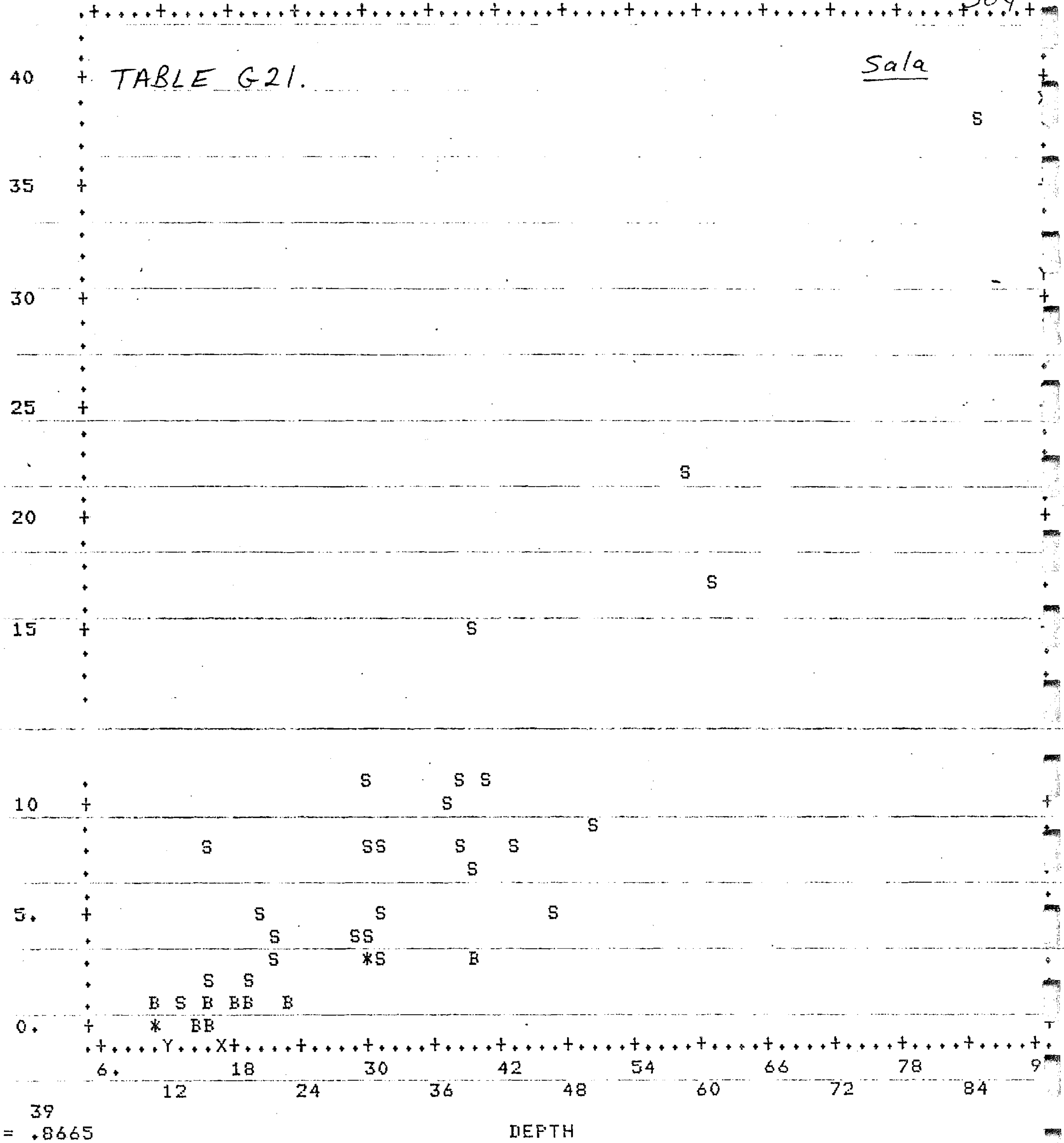
N= 39
COR= .8311

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	57.564	21.406	X= 2.4558*Y+ 42.143	145.51
Y	6.2795	7.2445	Y= .28129*X-9.9125	16.667

```
VARIABLE   7 HT        VS. VARIABLE  22 DWT       GROUP=WWBS    , SYMBOL=W
VARIABLE   7 HT        VS. VARIABLE  22 DWT       GROUP=WBS     , SYMBOL=B
VARIABLE   7 HT        VS. VARIABLE  22 DWT       GROUP=OM      , SYMBOL=M
VARIABLE   7 HT        VS. VARIABLE  22 DWT       GROUP=TW      , SYMBOL=T
VARIABLE   7 HT        VS. VARIABLE  22 DWT       GROUP=LW      , SYMBOL=L
VARIABLE   7 HT        VS. VARIABLE  22 DWT       GROUP=LS      , SYMBOL=S
```

TABLE G21.

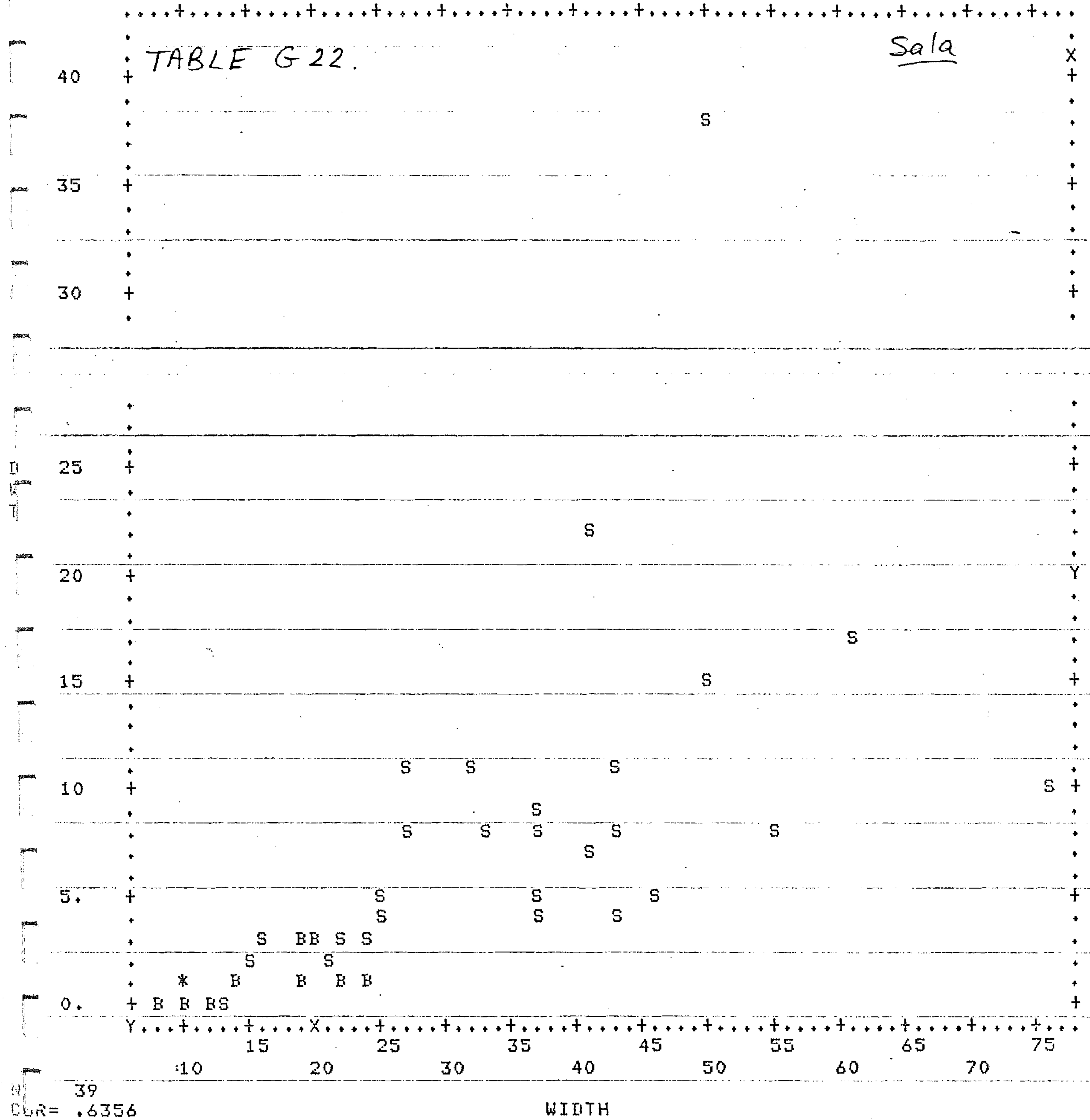
Sala



N= 39
COR= .8665

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	30.359	15.729	X= 1.8813*Y+ 18.545	63.314
Y	6.2795	7.2445	Y= .39910*X-5.8366	13.431

```
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT        GROUP=WWBS     , SYMBOL=W
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT        GROUP=WBS      , SYMBOL=B
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT        GROUP=OM       , SYMBOL=M
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT        GROUP=TW       , SYMBOL=T
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT        GROUP=LW       , SYMBOL=L
VARIABLE   8 DEPTH    VS. VARIABLE   22 DWT        GROUP=LS       , SYMBOL=S
```



N 39
CORR= .6356

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	30.000	15.733	X= 1.3804*Y+ 21.332	151.51
Y	6.2795	7.2445	Y= .29269*X-2.5011	32.123

VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L
VARIABLE 9 WIDTH VS. VARIABLE 22 DWT [illegible]

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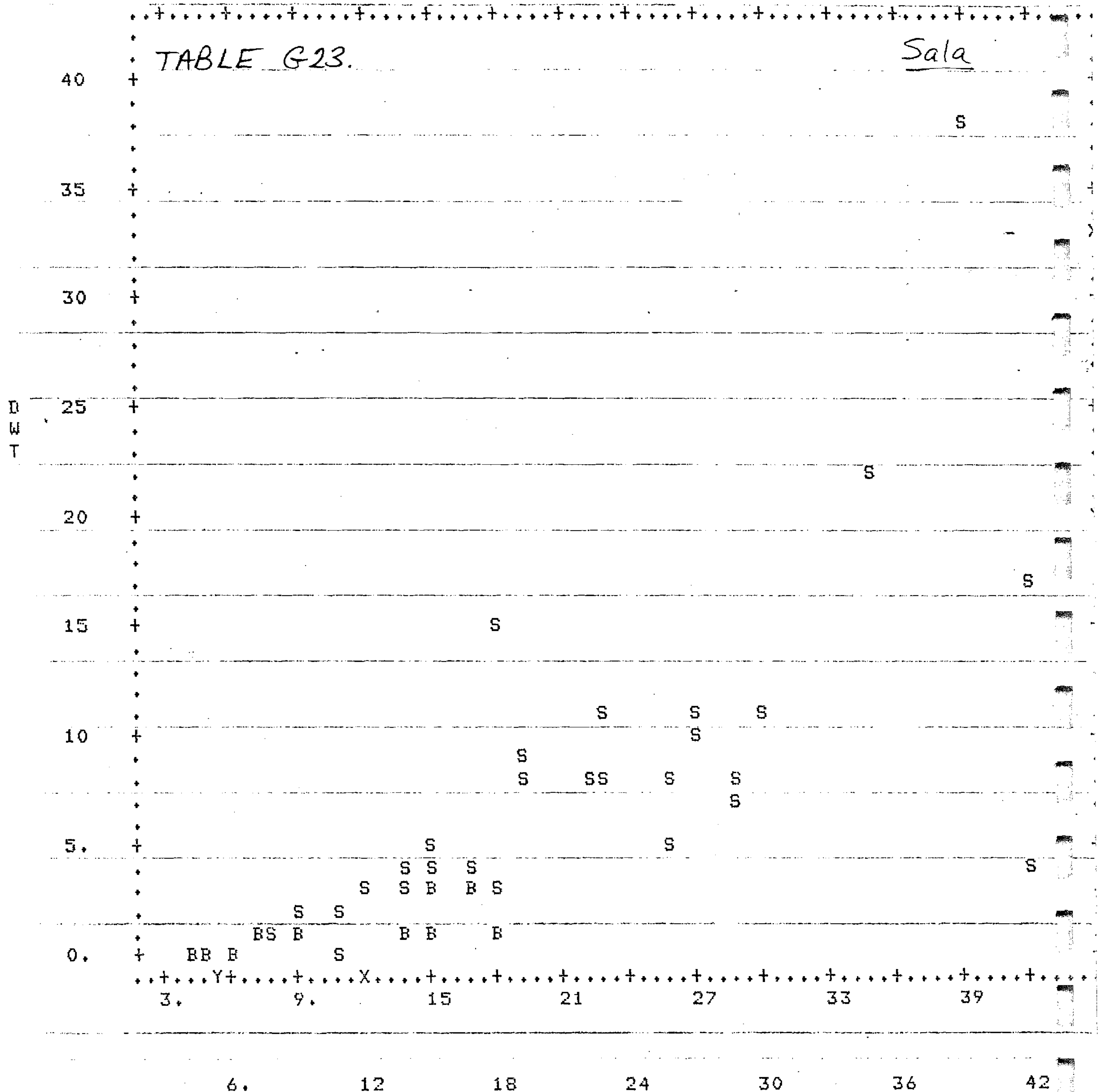
TABLE G23.

Sala



N= 39
COR= .7235

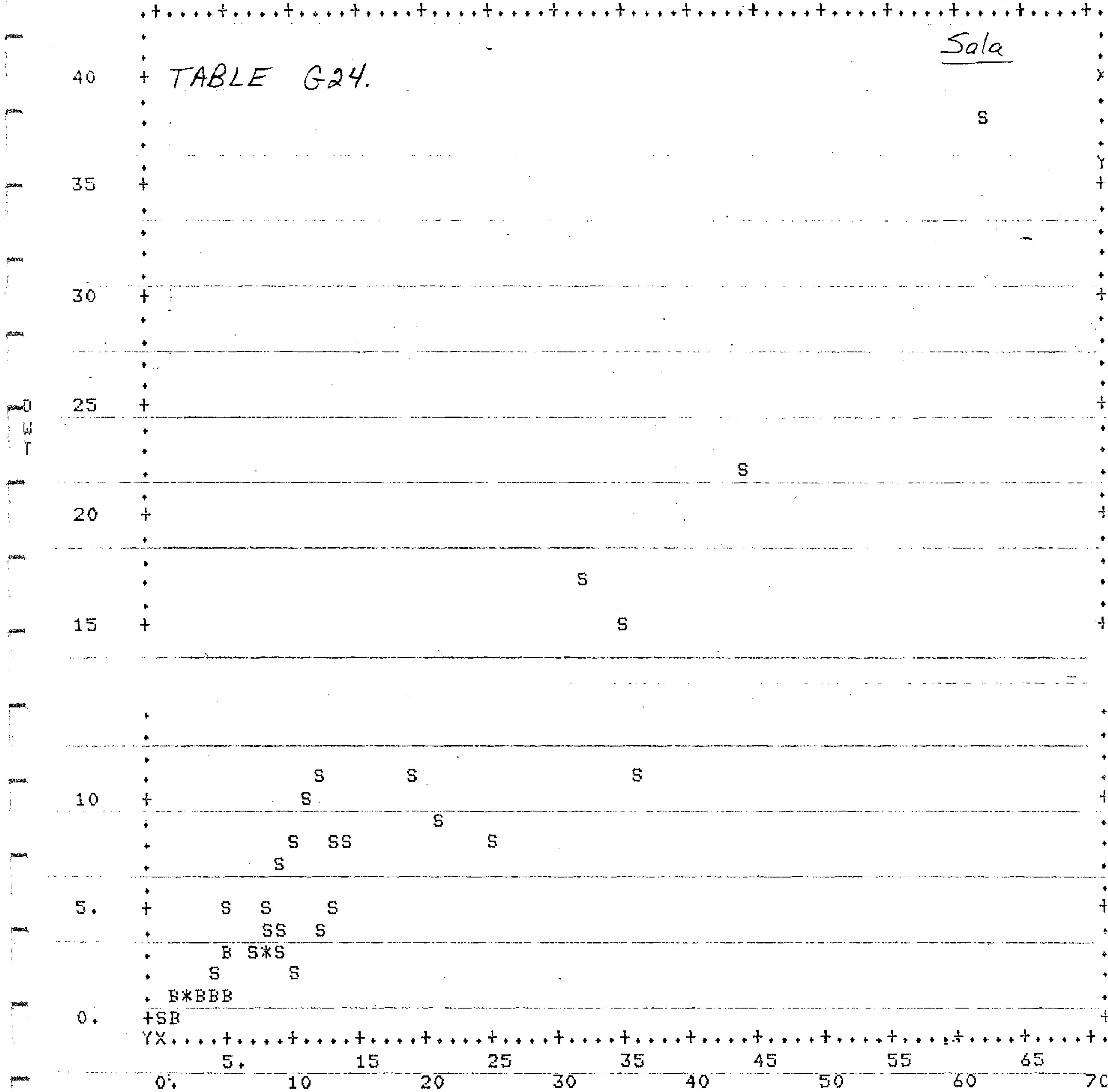
RTANGL

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	19.103	9.8670	X= .98539*Y+ 12.915	47.652
Y	6.2795	7.2445	Y= .53119*X-3.8676	25.688

VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=WWBS , SYMBOL=W
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=WBS , SYMBOL=B
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=OM , SYMBOL=M
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=TW , SYMBOL=T
VARIABLE 10 RTANGL VS. VARIABLE 22 DWT GROUP=LW , SYMBOL=L

TABLE G24.

Sala



N= 39
COR= .9355

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	12.818	13.405	X= 1.7310*Y+ 1.9484	23.056
Y	6.2795	7.2445	Y= .50554*X-.20051	6.7336

VARIABLE	11	ETWT	VS. VARIABLE	22	DWT	GROUP=WWBS	, SYMBOL=W
VARIABLE	11	ETWT	VS. VARIABLE	22	DWT	GROUP=WBS	, SYMBOL=B
VARIABLE	11	ETWT	VS. VARIABLE	22	DWT	GROUP=OM	, SYMBOL=M
VARIABLE	11	ETWT	VS. VARIABLE	22	DWT	GROUP=TW	, SYMBOL=T
VARIABLE	11	ETWT	VS. VARIABLE	22	DWT	GROUP=LW	, SYMBOL=L
VARIABLE	11	ETWT	VS. VARIABLE	22	DWT	GROUP=LS	, SYMBOL=S

APPENDIX H

APPENDIX H

CLIPPED PLOT STATISTICS

Means, standard errors, variances, and estimated sample sizes for dry weight current annual growth of shrub species. Twigs and leaves were clipped from 1-m^2 plots. Dry weight estimates are presented by site, with sites grouped into level IV vegetation types. The within estimated sample size (WNHAT) is the number of 1-m^2 plots required to be clipped in the vegetation type within 20% of the mean with 80% confidence. These clipped plots are then evenly allocated to the number of sites sampled in the type.

TABLE H1 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 10. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

2

CATEGORY (N = 10)	X	$S_{\bar{X}}$	S	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA TWIGS(G/10M2	16.	3.2	101.9	10	17			
BETULA GLANDULOSA LEAVES(G/10M	112.	17.1	2913.5	10	10			
SALIX PULCHRA TWIGS (G/10M2)	2.	1.9	35.3	10	274			
SALIX PULCHRA LEAVES (G/10M2)	6.	5.0	253.2	10	279			
SALIX GLAUCA TWIGS (G/10M2)	1.	0.6	3.6	10	410			
SALIX GLAUCA LEAVES (G/10M2)	2.	1.6	25.6	10	410			
TOTAL TWIGS AND LEAVES (G/10M2	139.	24.9	6189.2	10	14			

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TABLE H2 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 11. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 6)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA TWIGS(G/10M2	31.	11.3	770.4	6	33			
BETULA GLANDULOSA LEAVES(G/10M	233.	69.9	29283.2	6	23			
SALIX GLAUCA TWIGS (G/10M2)	3.	3.3	66.7	6	246			
SALIX GLAUCA LEAVES (G/10M2)	6.	6.0	216.0	6	246			
TOTAL TWIGS AND LEAVES (G/10M2	273.	88.0	46492.3	6	26			

TABLE H3 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS

OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK-WHITE SPRUCE TYPE. N IS NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 16)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA TWIGS(G/10M2	22.	4.8	373.4	16	33	340.64	14	30	832.54	1	73
BETULA GLANDULOSA LEAVES(G/10M	157.	30.8	15181.5	16	26	12331.26	14	21	55085.40	1	92
SALIX PULCHRA TWIGS (G/10M2)	1.	1.2	22.5	16	447	22.72	14	451	19.84	1	394
SALIX PULCHRA LEAVES (G/10M2)	4.	3.2	161.2	16	455	162.78	14	459	139.54	1	394
SALIX GLAUCA TWIGS (G/10M2)	2.	1.3	26.3	16	408	26.12	14	406	28.02	1	435
SALIX GLAUCA LEAVES (G/10M2)	3.	2.4	92.2	16	358	93.60	14	363	72.60	1	282
TOTAL TWIGS AND LEAVES (G/10M2	189.	38.5	23755.9	16	28	20583.13	14	24	68175.11	1	79

TABLE #4. MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 14. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 8)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA TWIGS(G/10M2	41.	14.0	1570.0	8	39			
BETULA GLANDULOSA LEAVES(G/10M	172.	61.2	29919.4	8	42			
SALIX PULCHRA TWIGS (G/10M2)	5.	4.8	180.5	8	328			
SALIX PULCHRA LEAVES (G/10M2)	7.	6.6	351.1	8	328			
TOTAL TWIGS AND LEAVES (G/10M2	224.	78.2	48880.5	8	40			

TABLE H5. MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 15. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN
BETULA GLANDULOSA TWIGS(G/10M2	52.	10.4	971.4	9	15			
BETULA GLANDULOSA LEAVES(G/10M	195.	57.4	29655.0	9	32			
SALIX PULCHRA TWIGS (G/10M2)	34.	15.9	2285.9	9	82			
SALIX PULCHRA LEAVES (G/10M2)	64.	26.4	6265.0	9	64			
TOTAL TWIGS AND LEAVES (G/10M2	345.	59.8	32156.7	9	12			

TABLE H6 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 18. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNI
BETULA GLANDULOSA TWIGS(G/10M2	4.	1.4	18.8	10	46			
BETULA GLANDULOSA LEAVES(G/10M	66.	23.8	5680.9	10	54			
SALIX PULCHRA TWIGS (G/10M2)	2.	0.8	6.8	10	87			
SALIX PULCHRA LEAVES (G/10M2)	10.	4.6	210.5	10	92			
SALIX LANATA TWIGS (G/10M2)	0.	0.2	0.4	10	410			
SALIX LANATA LEAVES (G/10M2)	1.	0.7	5.4	10	113			
TOTAL TWIGS AND LEAVES (G/10M2	83.	26.1	6819.0	10	41			

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TABLE H7 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 19. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA TWIGS(G/10M2	7.	4.0	162.2	10	129			
BETULA GLANDULOSA LEAVES(G/10M	76.	28.9	8340.9	10	60			
SALIX PULCHRA TWIGS (G/10M2)	6.	3.7	133.4	10	181			
SALIX PULCHRA LEAVES (G/10M2)	20.	9.9	989.1	10	102			
TOTAL TWIGS AND LEAVES (G/10M2	108.	36.2	13139.5	10	46			

TABLE 48. MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK SPRUCE TYPE. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 37)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 4	BN	BNHAT
BETULA GLANDULOSA TWIGS(G/10M2	24.	5.2	1008.9	37	70	617.88	33	43	5310.38	3	365
BETULA GLANDULOSA LEAVES(G/10M	123.	22.8	19292.0	37	53	17359.77	33	48	40546.90	3	111
SALIX PULCHRA TWIGS (G/10M2)	11.	4.5	749.6	37	243	630.68	33	205	2058.11	3	667
SALIX PULCHRA LEAVES (G/10M2)	25.	7.9	2281.2	37	151	1920.42	33	127	6249.31	3	412
SALIX LANATA TWIGS (G/10M2)	0.	0.1	0.1	37	1516	0.11	33	1530	0.10	3	1364
SALIX LANATA LEAVES (G/10M2)	0.	0.2	1.7	37	499	1.47	33	420	4.77	3	1364
TOTAL TWIGS AND LEAVES (G/10M2	184.	29.8	32888.8	37	40	23607.38	33	29	134984.67	3	164

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TABLE H2 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 16. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT
BETULA GLANDULOSA TWIGS(G/10M2	5.	2.7	72.8	10	125
BETULA GLANDULOSA LEAVES(G/10M	29.	18.5	3418.9	10	167
ALNUS SINUATA TWIGS (G/10M2)	10.	6.9	476.0	10	184
ALNUS SINUATA LEAVES (G/10M2)	62.	42.7	18273.6	10	193
TOTAL TWIGS AND LEAVES (G/10M2	107.	49.3	24256.0	10	88

WITHIN WN WNI

TABLE H10 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 17. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 10)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WN

TABLE H.1 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN MIXED SPRUCE-BIRCH TYPE. N IS NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA GLANDULOSA TWIGS(G/10M2	2.	1.4	40.8	20	279	36.38	18	249	120.05	1	820
BETULA GLANDULOSA LEAVES(G/10M	15.	9.6	1840.8	20	359	1709.44	18	334	4205.00	1	820
ALNUS SINUATA TWIGS (G/10M2)	5.	3.6	253.4	20	392	238.01	18	368	530.45	1	820
ALNUS SINUATA LEAVES (G/10M2)	31.	22.0	9680.6	20	408	9136.80	18	385	19468.80	1	820
TOTAL TWIGS AND LEAVES (G/10M2	53.	26.9	14480.1	20	209	12128.02	18	175	56817.80	1	820

TABLE H12 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 8. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 7)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA PAPYRIFERA TWIGS (G/10M	10.	7.6	407.3	7	183			
BETULA PAPYRIFERA LEAVES (G/10	26.	20.9	3054.7	7	186			
SALIX ALAXENSIS TWIGS (G/10M2)	690.	165.7	192243.6	7	17			
SALIX ALAXENSIS LEAVES (G/10M2	895.	198.4	275589.0	7	15			
ALNUS SINUATA TWIGS (G/10M2)	136.	62.3	27198.0	7	61			
ALNUS SINUATA LEAVES (G/10M2)	232.	110.3	85111.1	7	65			
TOTAL TWIGS AND LEAVES (G/10M2	1989.	464.1	1508023.8	7	16			

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TABLE H13 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 9. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 6)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
SALIX PULCHRA TWIGS (G/10M2)	7.	6.6	260.2	6	208			
SALIX PULCHRA LEAVES (G/10M2)	21.	17.7	1871.5	6	180			
SALIX ALAXENSIS TWIGS (G/10M2)	46.	27.0	4368.8	6	85			
SALIX ALAXENSIS LEAVES (G/10M2	149.	84.2	42549.1	6	80			
TOTAL TWIGS AND LEAVES (G/10M2	222.	103.8	64697.1	6	54			

TABLE 4.14 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR TALL WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 13)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA PAPYRIFERA TWIGS (G/10M	5.	4.2	228.3	13	353	222.16	11	343	295.98	1	457
BETULA PAPYRIFERA LEAVES (G/10	14.	11.5	1709.3	13	358	1666.18	11	349	2184.00	1	457
SALIX PULCHRA TWIGS (G/10M2)	3.	3.1	122.2	13	458	118.26	11	443	165.94	1	622
SALIX PULCHRA LEAVES (G/10M2)	10.	8.3	894.8	13	403	850.67	11	383	1379.90	1	622
SALIX ALAXENSIS TWIGS (G/10M2)	393.	127.0	209750.5	13		56106845.97	11	29	1341700.33	1	356
SALIX ALAXENSIS LEAVES (G/10M2	550.	153.3	305555.4	13		42169661.78	11	23	1800385.73	1	244
ALNUS SINUATA TWIGS (G/10M2)	73.	37.8	18578.7	13	142	14835.27	11	114	59756.31	1	457
ALNUS SINUATA LEAVES (G/10M2)	125.	66.2	57028.8	13	150	46424.26	11	122	173678.84	1	457
TOTAL TWIGS AND LEAVES (G/10M2	1174.	353.1	1621132.3	13		49851966.20	11	26	**********	1	300

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TABLE H15 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 12. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 4)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA TWIGS(G/10M2	66.	59.5	14140.3	4	132			
BETULA GLANDULOSA LEAVES(G/10M	273.	183.8	135201.0	4	75			
SALIX PULCHRA TWIGS (G/10M2)	18.	4.9	94.9	4	12			
SALIX PULCHRA LEAVES (G/10M2)	93.	32.6	4248.9	4	21			
SALIX GLAUCA TWIGS (G/10M2)	1.	0.5	1.0	4	164			
SALIX GLAUCA LEAVES (G/10M2)	2.	2.3	20.3	4	164			
SALIX LANATA TWIGS (G/10M2)	13.	13.3	702.3	4	164			
SALIX LANATA LEAVES (G/10M2)	37.	37.0	5476.0	4	164			
TOTAL TWIGS AND LEAVES (G/10M2	503.	213.2	181783.6	4	30			

TABLE H46 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 13. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 9)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
BETULA GLANDULOSA TWIGS(G/10M2	33.	10.2	939.7	9	36			
BETULA GLANDULOSA LEAVES(G/10M	207.	48.6	21276.4	9	21			
BETULA PAPYRIFERA TWIGS (G/10M	23.	23.2	4853.4	9	369			
BETULA PAPYRIFERA LEAVES (G/10	35.	35.1	11095.1	9	369			
SALIX PULCHRA TWIGS (G/10M2)	3.	2.2	43.9	9	174			
SALIX PULCHRA LEAVES (G/10M2)	22.	14.7	1956.7	9	163			
SALIX GLAUCA TWIGS (G/10M2)	7.	7.0	441.0	9	369			
SALIX GLAUCA LEAVES (G/10M2)	22.	21.9	4335.8	9	353			
TOTAL TWIGS AND LEAVES (G/10M2	353.	98.8	87933.6	9	29			

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TABLE H47 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 4. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 7)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA TWIGS(G/10M2	24.	7.9	434.9	7	32			
BETULA GLANDULOSA LEAVES(G/10M	95.	25.9	4712.7	7	22			
SALIX PULCHRA TWIGS (G/10M2)	37.	13.8	1335.5	7	41			
SALIX PULCHRA LEAVES (G/10M2)	217.	73.0	37352.1	7	33			
TOTAL TWIGS AND LEAVES (G/10M2	373.	69.6	33926.2	7	11			

TABLE H18 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 5. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 4)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT
BETULA GLANDULOSA TWIGS(G/10M2	17.	8.3	278.3	4	39			
BETULA GLANDULOSA LEAVES(G/10M	189.	87.8	30848.9	4	36			
SALIX PULCHRA TWIGS (G/10M2)	21.	8.8	308.7	4	29			
SALIX PULCHRA LEAVES (G/10M2)	152.	61.9	15351.0	4	28			
TOTAL TWIGS AND LEAVES (G/10M2	379.	79.8	25495.0	4	8			

TABLE H19 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 6. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 3)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNH
BETULA GLANDULOSA TWIGS(G/10M2	55.	39.4	4663.0	3	64			
BETULA GLANDULOSA LEAVES(G/10M	276.	162.8	79521.3	3	43			
SALIX PULCHRA TWIGS (G/10M2)	50.	41.7	5206.3	3	85			
SALIX PULCHRA LEAVES (G/10M2)	35.	18.7	1051.0	3	36			
TOTAL TWIGS AND LEAVES (G/10M2	416.	149.1	66652.0	3	16			

TABLE #20 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW DWARF BIRCH-WILLOW. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 27)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 5	BN	BNHAT
BETULA GLANDULOSA TWIGS(G/10M2	36.	10.0	2692.0	27	87	2850.41	22	92	1820.84	4	59
BETULA GLANDULOSA LEAVES(G/10M	193.	37.2	37326.6	27	42	38894.51	22	43	28703.34	4	32
BETULA PAPYRIFERA TWIGS (G/10M	8.	7.7	1617.8	27	1106	1764.89	22	1207	808.91	4	553
BETULA PAPYRIFERA LEAVES (G/10	12.	11.7	3698.4	27	1106	4034.59	22	1207	1849.19	4	553
SALIX PULCHRA TWIGS (G/10M2)	22.	6.2	1045.2	27	89	908.54	22	77	1796.78	4	152
SALIX PULCHRA LEAVES (G/10M2)	104.	26.0	18239.8	27	70	13666.73	22	52	43391.81	4	165
SALIX GLAUCA TWIGS (G/10M2)	2.	2.3	146.8	27	1038	160.50	22	1135	71.38	4	505
SALIX GLAUCA LEAVES (G/10M2)	8.	7.3	1448.2	27	972	1579.41	22	1060	726.28	4	488
SALIX LANATA TWIGS (G/10M2)	2.	2.0	104.0	27	1106	95.76	22	1018	149.55	4	1590
SALIX LANATA LEAVES (G/10M2)	5.	5.5	811.3	27	1106	746.73	22	1018	1166.19	4	1590
TOTAL TWIGS AND LEAVES (G/10M2	391.	49.6	66551.0	27	18	75553.00	22	21	17040.00	4	5

TABLE #21 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR SITE 3. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 6)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHA
SALIX PULCHRA TWIGS (G/10M2)	217.	56.3	19034.2	6	17			
SALIX PULCHRA LEAVES (G/10M2)	655.	117.6	83025.1	6	8			
TOTAL TWIGS AND LEAVES (G/10M2	872.	170.4	174207.1	6	10			

TABLE #22 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CURRENT ANNUAL GROWTH WITHIN 20% OF THE MEAN WITH 80% CONFIDENCE.

CATEGORY (N = 6)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 1	BN	BNHAT
SALIX PULCHRA TWIGS (G/10M2)	217.	56.3	19034.2	6	17	19034.17	5	17	0.00	0	1
SALIX PULCHRA LEAVES (G/10M2)	655.	117.6	83025.1	6	8	83025.10	5	8	0.	0	1
TOTAL TWIGS AND LEAVES (G/10M2	872.	170.4	174207.1	6	10	174207.07	5	10	0.02	0	1

APPENDIX I

APPENDIX I

CLIPPED PLOT STATISTICS WITHOUT *Betula glandulosa*

Means, standard errors, variances, and estimated sample sizes for dry weight current annual twig growth of selected shrub species. *Betula glandulosa* and leaves of other shrub species have been excluded from the analysis. Twigs were clipped from 1-m^2 plots. Dry weight estimates are presented by level IV vegetation type. The within estimated sample size (WNHAT) is the number of 1-m^2 plots required to be clipped in the vegetation type within 20% of the mean with 67% confidence. These clipped plots are then evenly allocated to the number of sites sampled in the type.

TABLE II. MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK-WHITE SPRUCE TYPE. N IS NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CAG WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 16)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
SALIX PULCHRA TWIGS (G/10M2)	1.	1.2	22.5	16	273	22.72	14	275	19.84	1	241
SALIX GLAUCA TWIGS (G/10M2)	2.	1.3	26.3	16	249	26.12	14	248	28.02	1	266
TOTAL TWIGS ALL SPECIES (G/10M	3.	1.7	46.2	16	124	49.45	14	132	0.70	1	2

TABLE 12. MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR WOODLAND BLACK SPRUCE TYPE. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CAG WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 37)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 4	BN	BNHAT
SALIX PULCHRA TWIGS (G/10M2)	11.	4.5	749.6	37	149	630.68	33	125	2058.11	3	408
SALIX LANATA TWIGS (G/10M2)	0.	0.1	0.1	37	926	0.11	33	934	0.10	3	833
TOTAL TWIGS ALL SPECIES (G/10M	11.	4.5	748.5	37	147	630.57	33	124	2045.61	3	401

TABLE I3 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN MIXED SPRUCE-BIRCH TYPE. N IS NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CAG WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 20)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
ALNUS SINUATA TWIGS (G/10M2)	5.	3.6	253.4	20	239	238.01	18	225	530.45	1	501
TOTAL TWIGS ALL SPECIES (G/10M	5.	3.6	253.4	20	239	238.01	18	225	530.45	1	501

TABLE I4 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR TALL WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CAG WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 13)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 2	BN	BNHAT
BETULA PAPYRIFERA TWIGS (G/10M	5.	4.2	228.3	13	215	222.16	11	210	295.98	1	279
SALIX PULCHRA TWIGS (G/10M2)	3.	3.1	122.2	13	280	118.26	11	271	165.94	1	380
SALIX ALAXENSIS TWIGS (G/10M2)	393.	127.0	209750.5	13	34	106845.97	11	18	1341700.33	1	218
ALNUS SINUATA TWIGS (G/10M2)	73.	37.8	18578.7	13	87	14835.27	11	70	59756.31	1	279
TOTAL TWIGS ALL SPECIES (G/10M	475.	153.5	306264.9	13	34	154115.71	11	18	1979906.03	1	220

TABLE I5 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW DWARF BIRCH-WILLOW. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CAG WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 27)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 5	BN	BNHAT
BETULA PAPYRIFERA TWIGS (G/10M	8.	7.7	1617.8	27	676	1764.89	22	737	808.91	4	338
SALIX PULCHRA TWIGS (G/10M2)	22.	6.2	1045.2	27	54	908.54	22	47	1796.78	4	93
SALIX GLAUCA TWIGS (G/10M2)	2.	2.3	146.8	27	634	160.50	22	693	71.38	4	308
SALIX LANATA TWIGS (G/10M2)	2.	2.0	104.0	27	675	95.76	22	622	149.55	4	971
TOTAL TWIGS ALL SPECIES (G/10M	34.	9.3	2353.6	27	51	2710.99	22	59	387.92	4	9

TABLE I6 MEANS, STANDARD ERRORS, AND VARIANCES FOR DRY WEIGHTS OF SELECTED SHRUB SPECIES INDIVIDUALLY AND COMBINED FOR OPEN LOW WILLOW TYPE. N IS THE NUMBER OF SAMPLING UNITS (1M2). ESTIMATED SAMPLE SIZE (NHAT) IS THE NUMBER OF SAMPLING UNITS REQUIRED TO SAMPLE THE CAG WITHIN 20% OF THE MEAN WITH 67% CONFIDENCE.

CATEGORY (N = 6)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 1	BN	BNHAT
SALIX PULCHRA TWIGS (G/10M2)	217.	56.3	19034.2	6	11	19034.17	5	11	0.00	0	1
TOTAL TWIGS ALL SPECIES (G/10M	217.	56.3	19034.2	6	11	19034.17	5	11	0.00	0	1

APPENDIX J

Table J1

11260 OPEN WHITE SPRUCE

CATEGORY (N = 105)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 7	BN	BNHAT
SALIX PULCHRA TWIG (G/10M2)	9.	2.2	497.2	105	146	237.28	98	70	4741.68	6	1385
SALIX GLAUCA TWIG (G/10M2)	7.	2.7	778.6	105	440	747.34	98	423	1289.73	6	729
SALIX LANATA TWIG (G/10M2)	1.	0.4	18.2	105	1395	17.22	98	1319	34.29	6	2625
ALNUS SINUATA TWIG (G/10M2)	12.	5.2	2877.8	105	470	2538.61	98	415	8418.34	6	1374
BETULA PAPYRIFERA TWIG (G/10M2	1.	1.3	166.0	105	2460	165.34	98	2450	177.19	6	2625
TOTAL ALL SPECIES (G/10M2)	30.	6.3	4205.3	105	116	3733.42	98	103	11912.37	6	328

Table J2

11270 OPEN BLACK SPRUCE

CATEGORY (N = 150)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 10	BN	BNHAT
SALIX PULCHRA TWIG (G/10M2)	11.	2.6	1007.8	150	210	797.06	140	166	4285.82	9	891
SALIX GLAUCA TWIG (G/10M2)	1.	0.8	92.8	150	3751	92.83	140	3751	92.83	9	3751
ALNUS SINUATA TWIG (G/10M2)	7.	4.7	3366.1	150	1516	3148.99	140	1418	6743.63	9	3036
TOTAL ALL SPECIES (G/10M2)	19.	5.3	4279.2	150	290	3812.12	140	259	11544.21	9	783

Table J1

11260 OPEN WHITE SPRUCE

CATEGORY (N = 105)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 7	BN	BNHAT
SALIX PULCHRA TWIG (G/10M2)	9.	2.2	497.2	105	146	237.28	98	70	4741.68	6	1385
SALIX GLAUCA TWIG (G/10M2)	7.	2.7	778.6	105	440	747.34	98	423	1289.73	6	729
SALIX LANATA TWIG (G/10M2)	1.	0.4	18.2	105	1395	17.22	98	1319	34.29	6	2625
ALNUS SINUATA TWIG (G/10M2)	12.	5.2	2877.8	105	470	2538.61	98	415	8418.34	6	1374
BETULA PAPYRIFERA TWIG (G/10M2	1.	1.3	166.0	105	2460	165.34	98	2450	177.19	6	2625
TOTAL ALL SPECIES (G/10M2)	30.	6.3	4205.3	105	116	3733.42	98	103	11912.37	6	328

Table J2

11270 OPEN BLACK SPRUCE

CATEGORY (N = 150)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 10	BN	BNHAT
SALIX PULCHRA TWIG (G/10M2)	11.	2.6	1007.8	150	210	797.06	140	166	4285.82	9	891
SALIX GLAUCA TWIG (G/10M2)	1.	0.8	92.8	150	3751	92.83	140	3751	92.83	9	3751
ALNUS SINUATA TWIG (G/10M2)	7.	4.7	3366.1	150	1516	3148.99	140	1418	6743.63	9	3036
TOTAL ALL SPECIES (G/10M2)	19.	5.3	4279.2	150	290	3812.12	140	259	11544.21	9	783

APPENDIX J

MODIFIED 1982 CLIPPED PLOT STATISTICS

Means, standard errors, variances, and estimated sample sizes for dry weight current annual twig growth of selected shrub species. Modified from data collected in 1982 by Steigers et al. (1983). Betula glandulosa and leaves of shrub species have been excluded from the analysis. Twigs were clipped from 0.5-m^2 plots. Dry weight estimates are presented by level IV vegetation type. The within estimated sample size (WNHAT) is the number of 0.5-m^2 plots required to be clipped in the vegetation type within 20% of the mean with 67% confidence. These clipped plots are then evenly allocated to the number of sites sampled in the type.

Table J3

23210 DWARF BIRCH

CATEGORY (N = 270)	$\bar{X}$	$S_{\bar{X}}$	S^2	N	NHAT	WITHIN	WN	WNHAT	BMS N= 18	BN	BNHAT
SALIX PULCHRA TWIG (G/10M2)	13.	3.6	3564.7	270	512	2811.36	252	404	14731.47	17	2113
SALIX GLAUCA TWIG (G/10M2)	0.	0.1	1.0	270	6751	1.05	252	6751	1.05	17	6751
TOTAL ALL SPECIES (G/10M2)	13.	3.6	3566.1	270	507	2812.27	252	400	14740.86	17	2095