NYU - BOBST
31142 02786 2658
SD97 .I55 S46 1959 Seminar on Forestry held in Te

# Seminar on

# FORESTRY

## Held in Tehran

## Iran

NEW YORK UNIVERSITY
LIBRARIES
DEC 1 9 1968

## July, 1959

CENTO

CENTRAL

SD
97
.I55
S46
1959

NYU

BOBST LIBRARY
OFFSITE

Start Scan Send

NYU - BOBST
31142 02786 2658
SD97 .I55 S46 1959 Seminar on Forestry held in Te

# Seminar on

# FORESTRY

***Held in Tehran***

***Iran***

***July , 1959***

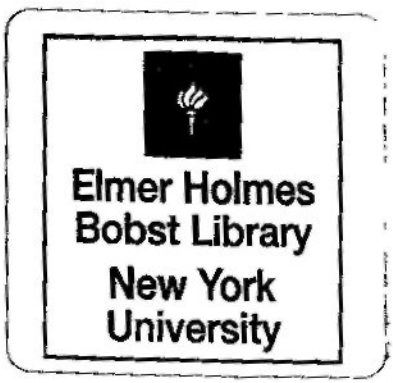
NEW YORK UNIVERSITY
LIBRARIES
DEC 19 1960

CENTO

CENTRAL

SD
97
.I55
S46
1959

NYU
BOBST LIBRARY
OFFSITE


Elmer Holmes
Bobst Library
New York
University

# SEMİNAR ON FORESTRY

Held in Tehran, Iran
July, 1959

CENTRAL TREATY ORGANIZATION
(CENTO)

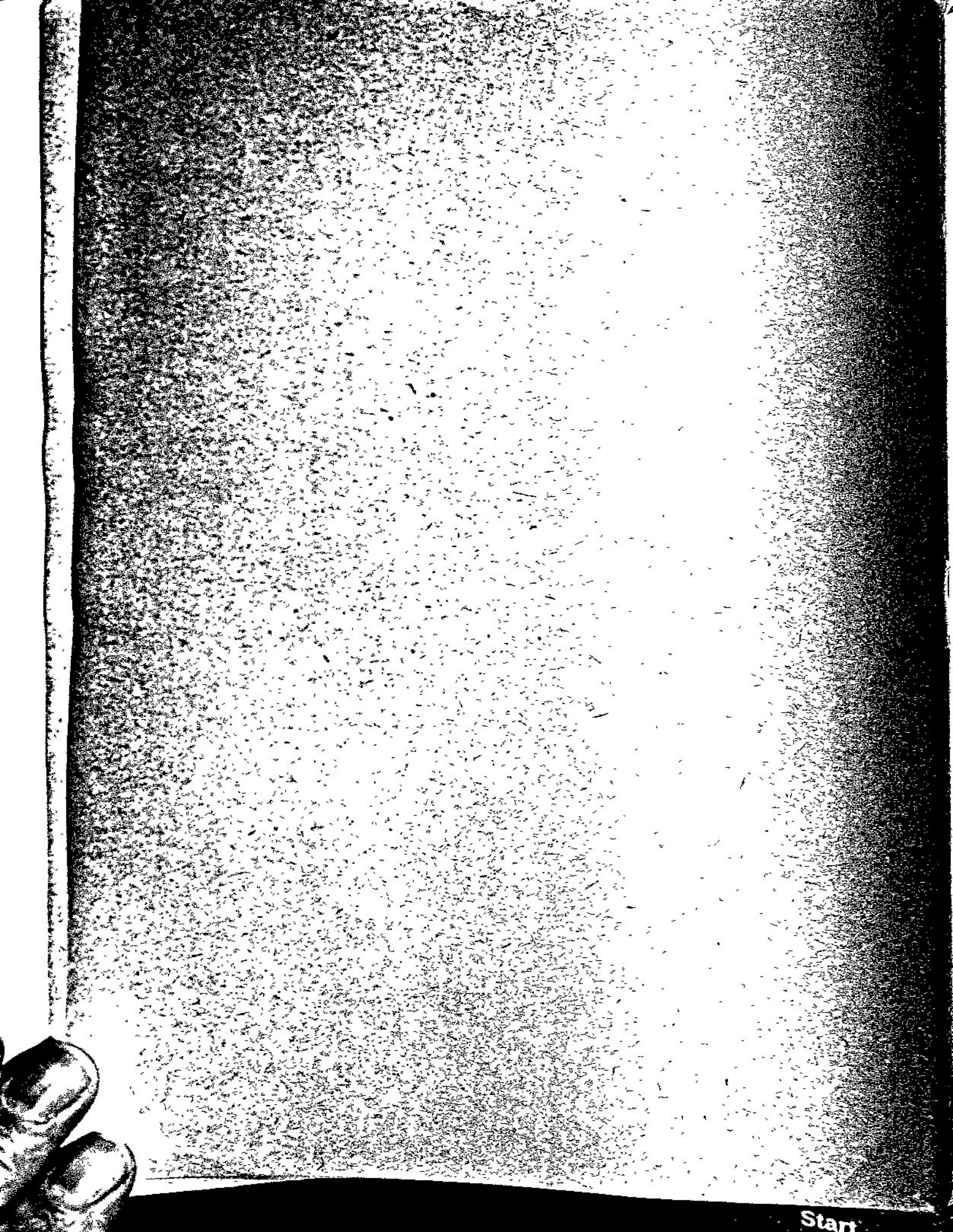
EROĞLU MATBAASI
Ankara—1962

SD
97
.I55
S46
1959

## INDEX



## ANNEX


Start

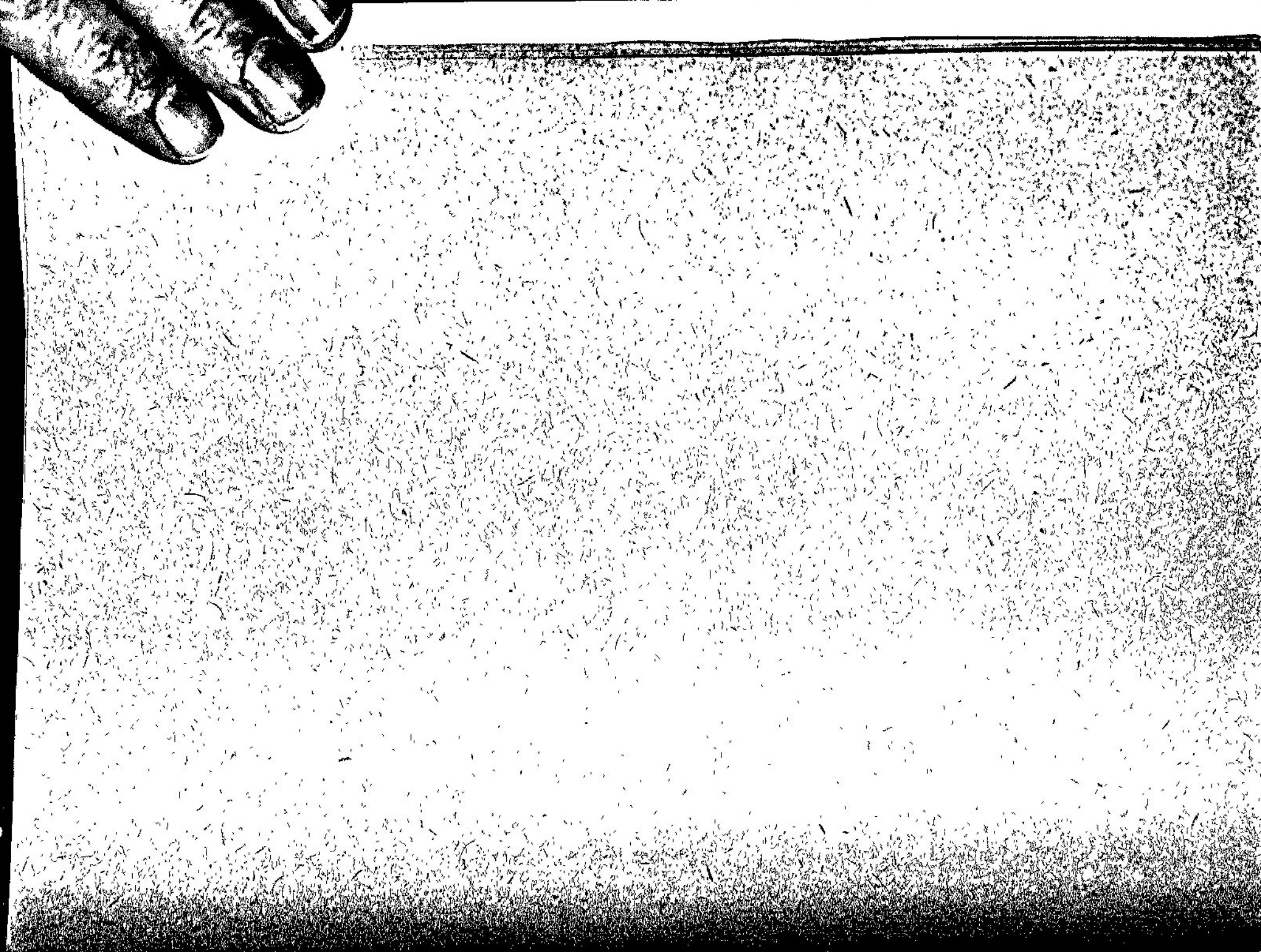
# INTRODUCTION

The First Seminar on Forestry organized under the auspicies of the Central Treaty Organization met for six days, July 21 - 27, 1959, in Tehran, Iran.

The Seminar was opened by His Excellency Mr. Hakimi, Assistant Minister of Agriculture, Government of Iran, under the Chairmanship of Engineer Hossein Mirhaydar of Iran. Papers relating to techniques of forest survey were read and discussed.

During the Seminar a field trip was made to the Caspian forest area in Iran to inspect the techniques in use in the Caspian forest survey, which was at that time being carried out, together with other aspects of forest work which included the production of charcoal.

The material of the Seminar has been put in permanent form in order that the information concerning new techniques of forest survey may be made available to those interested.



# CASPIAN FOREST SURVEY PROGRAMME

## INSTRUCTIONS

BY

EARL J. ROGERS

FOREST SURVEY ADVISER

TO THE IRANIAN FORESTRY SERVICE,

U. S. O. M. / IRAN

I. General Instructions

1 — Triple sample design
2 — Definitions of Terms
3 — Forest Survey Organization
4 — Caspian Forest Survey Area

## FOREST SURVEY DESIGN APPLYING AERIAL PHOTOGRAPHS AND REGRESSION TECHNIQUE FOR THE CASPIAN FOREST OF IRAN

Aerial photo volume tables are not available for the Caspian Forests comprising about 3.5 million hectares. Therefore, photo stand measurements are used which eliminate the need for a photo volume table before ground data is collected. This technique uses Chapman's (3) triple sample design, Worley and Meyer's (4) methods of estimating stand volumes from aerial photos, Bickford's (1), continuous inventory techniques and Chapman's and Schumacker's (2) regression sampling techniques, and Rogers' (6) forest survey design using regression technique.

### Plan in Brief

Basically the plan is a triple sample design. First a large number of photo points 124, 146 are classified as forest and non - forest. Those are cheap and hence many are obtained.

Second a sample of the forest paints (25,410) are interpreted on 0.1 hectare photo plots for two independent variates crown density and average total height of three tallest trees. From these measurements on each plot determines the average crown density and average tree heights are computed.

Third a sample of the photo plots are selected for ground plots (726). The data collected from these ground plots is the same as required for usual forestry survey. The volumes computed from ground plots and the tree heights and crown density from photo plots are constructed into a regression equation for estimating the average net volume per hectare. This average net volume per hectare times the portion of forest area is the mean volume per hectare of gross land area and the confidence of this estimate may be computed.

Formulas

Formulas were developed for volume for sampling error of volume and for number of sample plots.

Figure 1 illustrates the volume formula with the definitions of the symbols. The statistician will recognize the regression formula which is the estimate of mean volume per hectare of forest land. This estimate times the percent of forest land gives the mean volume per hectare of gross land area. The latter is assumed to be free of error. The percent of for forest land (Pf) is determined from sample photo points. Parameters «a» and «b» are the constant regression coefficients computed from the method of least squares using photo plot data and ground plot data. Heights and crown density are measured on forest photo plots.

The variance (Fig. — 2) of this mean volume per hectare of gross land area includes the contribution independent of the regression shown in the first term of the equation, contribution of measurement error of heights and crown density shown in the second term, contribution of forest area measurement shown in the third term and contribution from regression coefficient estimates in the fourth term. The development of this formula is based upon Deming (4), Chapman and Schumacher (2) and Chapman (3). Coding the numerators for the terms shown is done to simplify procedures.

Figure 3 shows the formulas for computing number of ground plots number of photo plots and number of photo points required to meet a given accuracy. For assumed forest area, regression, variances and costs the number of plots are determined the most efficient. These formulas are taken from Chapman's (3) triple sample design.

Figure 4 shows assumed values used in the design.

FIG. I — Volume formula

$$\overline{V}t = P_f \left( a + b_1 \overline{X}_1 + b_2 \overline{X}_2 \right)$$ where:

$\overline{V}t$ = Mean volume per hectare of gross land area.

$P_f$ = Percent of forest land to gross land area interpreted from photo points.

a = Constant, computed by method of least squares.

$b_1$ = Regression coefficient for heights computed by method of least squares.

$b_2$ = Regression coefficient for crown density computed by method of least squares.

$\overline{X}_1$ = Average of the mean total height of 3 tallest trees measured on photo plots.

$\overline{X}_2$ = Average crown density measured on forest photo plots.

Fig. 2 — Variance of mean volume per hectare formula.

$$S^2_{vt} = \frac{P^2_f S^2_{y\,1.2}}{N_g} - \frac{P^2_f \left( b^2_1 S^2_{x1} + b^2_2 S^2_{x2} + 2 b_1 b_2 \text{cov.} x_1 x_2 \right)}{N_p} +$$

$$\frac{\overline{V}^2 f P_f Q}{N} + P^2_f S^2_{y1.2} \left( C_{11} \overline{d}^2_1 + C_{22} \overline{d}^2 + 2 C_{12} \overline{d}^2_1 \overline{d}^2_2 \right)$$

which may be coded as follows:

$$S^2_{yt} = \frac{A}{N_g} + \frac{B}{N_p} + \frac{C}{N} + D$$ where:

$S^2_{yt}$ = Variance of mean volume per hectare of gross area.

$S^2_{y1.2}$ = Variance of independent of regression of mean volume per hectare of forest area estimated by regression.

$S^2_{x1}$ = Variance of average tree height (3 tallest trees) in metres per 0.1 hectare of forest land.

$S^2_{x2}$ = Variance of crown densityy per 0.1 hectare of forest land.

Cov $X_1 X_2$ = Covariance of $X_1$ and $X_2$

$V_f$ = Mean volume per hectare of forest land.

Q = Percent of non - forest land area to gross land area.

$C_{11}, C_{22}, C_{12}$ = C multipliers.

$\bar{d}_1$ = difference between means of tree heights for $N_p$ plots and $N_g$ plats (all measured on photos).

$\bar{d}_2$ = difference between means of crown density for $N_p$ plots and $N_g$ plots, (all measured on photos).

$N_g$ = Number of ground plots.

$N_p$ = Number of photo plots.

N = Number of photo points.

Fig. 3 — Formulae for number of plots.

1. Ground plots

$$N_g = \frac{\sqrt{A}}{S^2_{Yt}\sqrt{C_g}} \left[ \sqrt{AC_g} + \sqrt{BC_p} + \sqrt{CC_f} \right]$$

2. Photo plots

$$N_p = N_g \frac{\sqrt{BC_g}}{\sqrt{AC_p}}$$

3. Photo points

$$N = N_g \sqrt{\frac{CC_g}{AC_f}}$$

WHERE :

$C_g$ = Cost of ground plot

$C_p$ = Cost of photoplot

$C_f$ = Cost of photo point

Fig. 4 — Assumed basic data drawn from experience.

| Item | Symbol | Assume Value |
|---|---|---|
| 1 | $\overline{V}_t$ | 69 cubic metres |
| 2 | $\overline{V}_f$ | 137 cubic metres |
| 3 | $P'_f$ | 50 percent |
| 4 | Q | 50 |
| 5 | a | — 176 |
| 6 | $b_1$ | 6.46 |
| 7 | $b_2$ | 2.84 |
| 8 | $\overline{X}_1$ | 20 metres |
| 9 | $X_2$ | 65 |
| 10 | $S^2_{\overline{vt}}$ | 1 |
| 11 | $S^2_{y\ 1.2}$ | 2564 |
| 12 | $S^2_{x}1$ | 36 |
| 13 | $S^2X_2$ | 770 |
| 14 | $\mathrm{Cov}X_1 X_2$ | 2 |
| 15 | $C_g$ | 3040.00 Rials |
| 16 | $C_p$ | 7.60 Rials |
| 17 | $C_f$ | 0.76 Rials |

The application of the basic data for computing the terms in the error formula are given below.

Computation of terms in variance formula

| Code | Symbol | Values |
|---|---|---|
| A | $P_f^2 S_y^2 1.2$ | 25 (2564) = 641 |
| $B_1$ | $b_1^2 S_{x1}^2$ | $(6.46)^2 36$ = 1502 |
| $B_2$ | $b_2^2 S_{x2}^2$ | $(2.84)^2$ 770 = 6214 |
| $B_3$ | $2b_1 b_2 \text{cov} X_1 X_2$ | 2 (6.46) (2.84) 2 = 73 |
| | $B_1 + B_2 + B_3$ | = 7789 |
| B | $P_f^2(B_1 + B_2 + B_3)$ | .25 (7789) = 1947 |
| C | $\overline{V}_f^2 P_f Q$ | $137^2$(.25) = 4692 |
| D | $P_f^2 S_y^2 1.2(C_{11}d_1^2 + C_{22}^2 d_2^2 + 2C_{12} d_1 d_2) = O$ | |

D is assumed to be zero for design purposes. However, actually D should be included when the error is computed from field data. This assumption is reasonable since the means of $X_1$ for large and small samples are likely to be about the same. The same is true for $X_2$

Computation of ground plots, photo plots and photo points.

1. Ground plots

$$N_g = \frac{\sqrt{641}}{1.0\sqrt{3040}}\left[\sqrt{641(3040)} + \sqrt{1947(7.60)} + \sqrt{4692(.76)}\right] =$$

$$= \frac{25.3}{1.0\,(55)}\left[1396 + 122 + 60\right] = 726$$

2. Photo plots

$$N_p = 726 \sqrt{\frac{1947(3040)}{641\,(7.60)}} = 126\,[35] = 25{,}410$$

3. Photo points

$$N = 726 \sqrt{\frac{4692(3040)}{641\,(.76)}} = 726\,(171) = 124{,}146$$

Estimated costs of photo points, photo plots and ground plots:

| Kind | Number | Cost per plot Rls. | Total |
|---|---|---|---|
| Ground plot | 726 | 3,040.00 | 2,207.040 |
| Photo plot | 25,410 | 7.60 | 193,116 |
| Photo point | 124,146 | 0.76 | 94,351 |
| | Total ..... | | 2.494,507 Rials |

## Bibliography


1. Bickford, C. Allen

   1956, Proposed design for continuous inventory. Eastern Forest Survey Technique Meeting, U.S. Forest Service, Topic 19.

2. Chapman, R. A. and Schumacher, F. X.,
   1954. Sampling methods in forestry and range management. Duke University, School of Forestry, Bulletin 7, Durham, North Carolina.

3. Chapman, R. A.

   1947. Triple sample design for forest surveys, U.S. Forest Service, Washington 25, D. C.

4. Doming, W. E.

   1943 Statistical adjustment of data. John Wiley and Sons, New York.

5. Meyer, M. A. and Worley D. P.

   1957. Volume determinations from aerial stand volume tables and their accuracy, Journal of Forestry. Vol. 55, 368 p.

6. Rogers, Earl J.

   1958. Proposed Forest Survey Applying Aerial Photographs in Regression Technique. Paper given at American Association for Advancement of Science, December 1957.


## DEFINITION OF TERMS

### Forested Lands

Land that is at least 1.0 hectare in size and 40 meters wide with at least 10 percent of the area covered with tree crowns and capable of producing timber or other wood products, or capable of exerting an

nfluence on climate or water, or land that has at least 250 uniformly distributed trees of reproduction size per hectare. Open lands less than 1.0 hestare in size or less than 40 meters wide (except main roads and railroads) which are surrounded by forest are considered as forested land. Orchards, shade trees in cities or agricultural areas, and tree nurseries are not considered forested land.

Non - forested land

Land that is at least 1.0 hectare in size and 40 meters wide with less than 10 percent of the area covered with tree crowns or commercial bamboo, or that less than 250 evenly distributed trees of reproduction size per hectare. Forests less than 1.0 hectare in size or less than 40 meters wide which are surrounded by nonforest are considered as nonforest land.

Commercial Forested Land

Forest lands which include accessible and inaccessible forest lands but do not include non - operable or protection forest lands.

Accessible Forested Land

Forested land where logging and hauling could be done profitably at present with little additional investment in roads, railroads or logging and transportation equipment.

Inaccessible Forested Land

Forested land where logging and hauling may be done profitably but costly access roads or skid trails are needed.

Non - Operable Forested Land

Forested land which is (1) incapable of yielding useable wood products because of poor site conditions or (2) withdrawn from timber management due to excessive steepness of slope or (3) land used for recreation or watershed management etc.

Protection Land

Land on which utilisation of timber is usually prohibited or limited through existing statute, ordinance or administrative order for protection of soil and conservation of water.

National Forest Land

Nationally - owned land now under the jurisdiction of the Iran Forest Administration.

Private Forest Lands

Other forest lands not nationally owned and are not under Iran Forest Administration. These include all land as well as other private forest lands.

## FOREST SURVEY ORGANIZATION

A five - man U. S. Forest Survey team will all be on duty in Iran by about February 1, 1959. This team is responsible for initiating training, guiding and advising forest survey in Iran as a continuing programme, one member will be here 2 years and the other members 1 year.

The Goverment of Iran will furnish qualified personnel to be trained by this U. S. Forest Survey team.

The technical personel and their ultimate qualifications and grades are:

1. Project Leader - One person is required in this category

This person should be a college graduate in Forestry. He must have at least 8 to 10 years experience in forest survey activities with experiences in forest measurement, and compilation, photo interpretation, photogrammetry and field techniques. Such a person must have proven administrative ability and get along well with his fellow employees, which are made up of a wide variety of talents.

The project leader is a Special Account Activities * grade 1 position or its equivalent with an annual salary of 227,496 Rials.

2. Assistant to Project Leader

Four positions are required in this category, (1) photo interpretation specialist, (2) field specialist, (3) statistical specialist, and (4) cartographic engineer. The first three should be college graduates in Forestry while the fourth is a college graduate in Engineering. The photo interpreter should have special training in photogrammetry and have several years experience in interpreting aerial photos for forestry purposes. The field specialist must also have training in photogrammetry but his major experiences must be in the conduct of field work. The statistical specialist should have had special training in statistical procedures and methods that are especially adapted to survey designs, special studies, and compilation of data. The cartographic engineer should be a photogrammetrist with thorough knowledge of mapping

* Special joint fund between the United States and Iran.

methods and procedures. All these positions require at least 3-5 years experience in the fields of speciality. The assistant project leaders are SAA grade 3 positions or its equivalent with an annual salary of 166,248 Rials each.

3. *Leaders*

Fourteen leaders are required. Twelve are crew leaders and must be college or ranger school graduates in Forestry and had at least 1 to 2 years experience in photo interpretation and field surveys.

*Statistical leader* - one is required. This person must be a college graduate in forestry or ranger school and had 1 to 2 years experience in statistical procedures and methods, or, field tecnique or photo techniques. One photogrammetry leader is required. This person must be a college graduate in Engineering and had special training in photogrammetry along with 1 to 2 years experience.

All these positions are SAA grade 5 or its equivalent category with an annual salary of 113,748 Rials.

4. *Aides* - twenty - one aides are required. Twelve are crew aides and must be ranger school graduates or especially talented high school graduates. Two are statistical aides who are graduated from high school and have special interests in mathematics, Seven are engineer aides who are high school graduates and have special interests in mathematics and drafting.

No experiences required for the aides except for the educational requirements mentioned.

These positions are all SAA grade 9 or its equivalent with an annual salary of 56,868 Rials. If positions are filled with persons of more education and training these positions may be filled by SAA grade 7 with an annual salary of 78,744 Rials.

In Summary the technical personnel are:

| *Grade* | *Title* | *No.* | *Annual Salary* |
|---|---|---|---|
| 1 | Project Leader | 1 | 227,496 Rials |
| 3 | Asst. Project Leader | 4 | 664,992 « |
| 5 | Leader | 14 | 1,592,472 « |
| 9 | Aides | 21 | 1,194,228 « |
| | Total | 40 | 3,679,188 Rials |

The non-technical permanent personnel and their qualifications.

*1. Administrative assistant*

One bilingual administrative assistant is required to serve directly under project leader. This person must understand and be responsible for all Government of Iran procedures of personnel management, procurement, finances, property management, and records. This person should have 3 to 5 years experience in this type of work. This person is responsible for these matters and technicians must work with him in these fields. This position is a SAA grade 3 with an annual salary of 166,248 Rials.

*2. Clerk Stenographer*

Two bilingual clerk stenographes are required. These persons should be trained in a Commercial School and have 1 to 3 years experience One should type in Farsi and the other in English. These positions are SAA grade 8 or its equivalent with an annual salary of 65,616 Rials.

*3. Translator*

One translator is required who can freely translate material including highly technical material into English and Farsi. This position is a SAA grade 8 or its equivalent with an annual salary of 65,616 Rials.

*4. Accountant*

One accounting clerk is required. This person should be trained in accounting procedures and have 3 to 5 years experience in this work.

This position is a SAA grade 9 or its equivalent with an annual salary of 56,868.

*5. Chauffeurs*

Fifteen Chauffeurs are required. Three should be bilingual and have at least 3 years experience in driving. Twelve should have at least 1 year experience in driving. The three chauffeurs are grade 11 with an annual salary of 39,372 Rials each. The twelve chauffeurs are SAA grade 12 or its equivalent with an annual salary of 30,624 Rials each. In summary the non - technical personnel are:

| *Grade* | *Title* | *No.* | *Annual Salary* |
|---|---|---|---|
| 6 | Administrative Assistant | 3 | 166,248 Rials |
| 8 | Clerk Stenographer | 2 | 131,232 Rials |
| 8 | Translator | 1 | 65,616 « |
| 1 | Accountant | 1 | 56,868 « |
| 11 | Chauffeurs | 3 | 118,116 « |
| 12 | Chauffeurs | 12 | 367,488 « |
| | Total | 22 | 905,568 Rials |

## CASPIAN FOREST SURVEY AREA

On the maps listed in column 1 of table 1 the Caspian Forest Survey boundaries were marked. The area on each map was obtained from the United States Geographical Survey standard quadrangle area tables, and is shown in column 2. The portion of Caspian Forest Survey Area was determined by dot count and data are shown in column 3, 4 and 5. The Forest Survey Area for each map is shown in column 6. The total Forest Survey Area is estimated as 3,420,487 hectares. This estimate has a sampling error of 5,167 hestares 67 times out of 100.

*Caspian Forest Survey Area*

*Summary of Gross Area, By Map Quadrangles*

| 1. Map Quad. No. | 2. Total area of Quad. (Hectares) | 3. Total dots in Quad. | 4. Dots in Project Area | 5. Ratio project dots to total (4—3) dots | 6. Caspian forest survey area (2x5) (Hectares) |
|---|---|---|---|---|---|
| NJ 39-9 | 1,472,166 | 5854 | 1373 | .2345 | 345,223 |
| 39-10 | « | « | 1223 | .2089 | 307,535 |
| 39-13 | 1,491,218 | 5950 | 224 | .0376 | 56,070 |
| 39-14 | « | « | 1498 | .2518 | 375,489 |
| 39-15 | « | « | 2754 | .4629 | 690,285 |
| 39-16 | « | « | 4197 | .7054 | 1,051,905 |
| NJ 40-9 | 1,720,194 | 6830 | 305 | .0447 | 76,893 |
| 40-10 | 1,472,166 | 5854 | 388 | .0663 | 97,605 |
| 40-13 | 1,491,218 | 5950 | 1574 | .2645 | 394,427 |
| 40-14 | « | « | 21 | .0035 | 5,219 |
| 1-39-E | 1,006,847 | 3933 | 78 | .0198 | 19,936 |
| TOTAL | | | | | 3,420,487 |

*PHOTO INTERPRETATION.*
*OUTLINE BY*

*MR. ELON H. BOMBERGER*
*FORESTRY ADVİSOR, PHOTO INTERPRETATION*
*USOM, IRAN*

I. Basic Interpretation

A. Preparation of photographs

1. Set up filing scheme for project or mission, by flight lines, film (negative) roll numbers, and photo numbers.

2. Prepare an index map of suitable scale, showing location of each print.

3. Mark photo cenire or principal point and its conjugate point.

4. Draw flight lines with yellow ink, connecting principal and conjugate points.

5. Check flying heights (H)

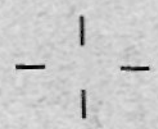
6. Mark boundaries of effective areas on every other (alternate) photos in each flight line (1:50,000 scale).

B. Location of photo points and plots (sampling ynits).

1. Systematic location of photo (plot) points by hand templates.

2. Identification of photo points by consecutive numbers, from right to left and top to bottom on each alternate photo.

3. Reference photo points by four lines, as follows : —

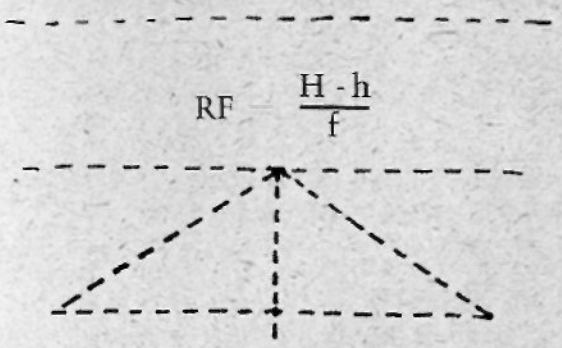


4. Movement of Photo point, when plot area contains both F and NF conditions, toward condition in which photo point falls.

C. Photo Interpretation Techniques.

1. Determination of photo plot scale, using following formula:

$$H - h \quad \frac{F^2 d' R f'}{P_g}$$




Where:

H = Altitude of aircraft above sea level
f = Focal length of lens in M.
d' = Distance on map between photo centres
RF = Is photo scale for a given H-h
RF' = Map scale
h = Elevation of ground in M. at photo plot
Pg = Parallax at ground for photo plot

2. Recognition of basic image features which include following:

a. Shape
b. Size
c. Pattern
d. Tone
e. Texture
f. Shadow cast
g. Site

D. Photo plot measurements

1. Crown diameter — Measured either by simple magnifying scale or micrometer dot wedge and recorded on data form.

2. Crown density or crown closure - 9 classes.

3. Slope of the plot area based upon a distance of 100 metes is measured by a height finder which is used to determine the difference in parallax between the ends of the 100 metre line. The class of slope is read from charts prepared for various parallaxes and recorded on data form. Six classes of slope are recognized.

4. Tree heights — Also measured by parallax method similar to that used for slope measurement. Usually the tree height for a photo plot is based on the three tallest trees on the plot and is recorded in metres.

E. Recording data — All data obtained from photo measurements are entered on a specially prepared Forest Photo Plot Record Form.

II. Type and Stand Class Delineation — Confined to forest lands (min-area varies with different scales).

A. Forest Types — Four types are being considered on this survey and are delineated on basis of growth form and site. The types and symbols by which they are labelled on maps are —

| TYPE | Map Symbol |
|---|---|
| 1. Cypress | C |
| 2. Oak | O |
| 3. Beech | B |
| 4. Mixed hardwood | M |

B. Stand Classes

1. Crown density classes considered are described as follws : —

| Density Class | Description | Map Symbol |
|---|---|---|
| a. 10 — 39 percent | Poorly stocked | — |
| b. 40 — 69 « | Medium « | = |
| c. 70 — 100 « | Well « | ▬ |

2. Height Classes — The tree height classes based on total heights that are recognized are : —

| Height Classes | Description | Map Symbol |
|---|---|---|
| a. 0 — 9 metres | Seedling and sapling | 1 |
| b. 10 — 19 « | Pole | 2 |
| c. 20 — 29 « | Young sawtimber | 3 |
| d. 30 + | Old sawtimber | 4 |

C. Labelling — Each forest type and stand class is carefully labelled according to the symbols already shown. The symbols are lettered on masking tape and placed within delineated class area.

D. Checking — After the delineation on the photos for several 15 minute map (1:50,000) quadrangles are completed; field checking of delineations will be started. It is anticipated that two methods of field checking will be necessary : —

1. Aerial reconnaissance — based on 100 points per map quadrangle.
2. Ground Checks — will be done only if aerial check and photo reexamination indicate the need.

E. Transfer of Data — Upon completion of types and stand class delineation the photo will be assembled by map quadrangles and delivered to the Cartographic Engineer who will transfer the data to the forest map.



Send

# *FIELD INSTRUCTIONS FOR THE FOREST INVENTORY OF CASPIAN FOREST OF IRAN*

*BY*

*ALVA B. WILLIAMS*

*INVENTORY SPECIALIST*

*IN CHARGE OF THE FIELD SURVEY*

## *INTRODUCTION*

These instructions cover the organization, specifications, and procedures for establishing and measuring the ground sample plots for the Forest Survey of the Caspian Region.

Men assigned to collect Forest Survey field data are expected to maintain high standard of accuracy and efficiency in their work. Because a light sampling is used and factors for expanding the data are large, it is important that field measurements and descriptive classification be carefully made. It should be remembered that the measuring of a single plot is equivalent to cruising some 41,957 similar hectares.

The field plots established will be permanent. Future measurements of the forest resource trend of the Caspian Forests will depend upon the accuracy of this field survey.

### *Organization*

The field work will be done under the direction of a forest inventory specialist. Location and measurements of sample points will be done by two-man crews with additional guides, packers, or other local labour where needed. Two-man crews consist of a party chief and a measurer. The party chief directs the work of the crew and is responsib ile for accuracy and efficiency.

Whenever practicable, field crews will work out of the same town or camp. This will permit closer supervision and the establishment of better camps with cooking facilities.

*Equipment*

A jeep with a driver will be furnisted each crew. Each crew will be furnished with the following equipment and supplies.

| | |
|---|---|
| 2 Finnish hand compasses | 1 Kit, First aid |
| 2 Syracuse tree markers | 1 Bark measurer |
| 1 Abney hand level | 2 Hand lens |
| 1 Increment borer | 1 Tent |
| 2 Handaxes, with sheath | 2 Shoes, pairs |
| 2 Pack sacks | 1 - 30 metre tape |
| 2 - 6 inch protractors | 1 - 2 chain tape |
| 2 canteens, 1 qt. | 2 diametre tapes |
| 2 - 3.03 diopter prisms | 1 case, plastic photo |
| 1 tatum holder, letter size | 1 kit, snake bite |
| 1 tape repair kit | 1 stereoscope, pocket |
| 1 Mess outfit, 4 men | 1 Thermos jug |
| 2 scales, photo | 2 sleeping bags |
| 1 Belt, cartridge | 1 Relaskop |

| | |
|---|---|
| Aerial photos | Plot tally sheets |
| Maps | Plot location tags |
| Aluminium nails | Instruction manual |
| Centre stake wire | Coloured rags (as chaining pins) |
| Blank paper | Oil |

After use in damp weather, all steel equipment should be wiped dry and oiled lightly to prevent rusting. All other tools and cases should be well cared for.

*LOCATION OF SAMPLING POINTS IN FIELD*

*Maps and Photos*

The sample points to be located and measured will be selected by the photo interpreter. The exact location of the sample point will be pin-pricked on the large scale photo. The approximate location will be marked on the small scale photo and the map.

*Locating the Sampling Point*

Compasses will be set at zero declination.

The photo interpreters have indicated the starting point, azimuth and distance on the large scale photos.

The crew will proceed as follows:

1. Using the map and small-scale photos, travel by the quickest route to the general area of the sampling point. There the route can be picked up on the large scale photo.

2. Proceed to the starting point (SP).

3. In most cases metal tags should be nailed to a tree at or near the starting point. Nail one well above d.b.h. and one near the ground. Describe this witness tree on the back of the photo. Where the starting point is obvious and permanent, no tags are used. Make complete notes and/or sketches on the reverse of the photo describing the starting point and how to reach it. It will be returned to in future years.

4. Proceed to the sampling point, chaining the distance on the azimuth shown on the photo.

When it is impossible to find the starting point on the ground, the crew will select another starting point evident on both the photo and the ground and compute the azimuth and distance to the sampling point. Make complete notes.

Sampling points will usually be taken as they fall at the end of the chained distance. However, because of inaccurate photo scale or errors in measurement, the location reached may obviously be incorrect when checked with the photo. In such cases the point should be moved to the pin-pricked location; and a note of distance and azimuth of the move should be recorded in the notes.

Sampling points will usually be taken as they fall at the end of the chained distance. However, because of inaccurate photo scale or errors in measurement, the location reached may obviously be incorrect when checked with the photo. In such cases the point should be moved to the pin-pricked location; and a note of distance and azimuth of the move should be recorded in the notes.

*Establishing the Sampling Point*

When the correct location of the sampling point has been reached:

1. Stick a galvanized wire pin about 50 cm long into the ground at sampling point leaving a tight loop about 12 cm. long above ground.

2. Select two witness trees, giving preference to trees that will live, and will not be cut for ten years, and as close to the sampling point as possible.

3. Record the species, d.b.h., azimuth, and distance to each tree.

4. Make two slanting scribe marks just through the cambium and about 10 cm. apart and well above d.b.h. on the sampling point side of each witness tree.

5. Nail two metal tags on each tree facing the sampling point, one well above d.b.h., and the other near the ground. Leave space on the nail for tree growth.

*Secondary Sampling Point*

A secondary sampling point will be located 60 metres north of the primary sampling point unless this would place it on nonforest land. In such event, a new azimuth will be selected, proceeding clockwise at intervals of 10 degrees until a point is obtained which falls well within forest land. Record any changes in the notes.

Establish the secondary point as described above except select only one witness tree.

Both primary and secondary sampling points will be recorded on the same tally form.

*SAMPLING POINT PROCEDURE*

*Plot Slope*

Measure and record slope to nearest degree topographic for each sampling point as follows:

1. Pick the steepest 30 metre diameter across the plot centre (which will not always be the two steepest radii).

2. Measure the slope along this steepest diameter each way from sampling point. Ordinarily one reading is plus and other minus, but a plot on a ridge might have two minus readings and in a drain both might be plus.

3. Disregarding plus and minus signs, add the two readings together and divide by two to get average plot scope.

*Party Chief and Date*

Party chief records his initials and the date.

*Reproduction*

Well established seedlings of desirable species will be counted on a circular 001 hectare plot (1.784 metres radius) centred around each

sample point. Seedlings are at least 30 cm. in height and less than 2.5 cm. in d.b.h.

The first line on the tally sheet is for the primary sampling point; the second line for the secondary point.

In the first space enter the number of good seedlings. Enter O if none. In the second space enter species code of the predominating species.

*Kind of Samples*

A sample of live trees 2.5 cm. d.b.h. and larger and dead trees 13 cm. d.b.h. and larger that died during the past year will be made at each sampling point. Sample trees will be selected by use of a 3.03 diopter wedge prism.

A tally of stumps cut within the last year will be made on 1/10 hectare circular plots centred on each sampling point.

*Use of Prism*

The prism provides a means of selecting or rejecting trees as samples. Selection or rejection is based upon the amount of displacement of the trunk at d.b.h. when viewed through the prism. When displacement is less than d.b.h. the tree is tallied; when the displacement is greater than d.b.h. the tree is not tallied. In borderline cases the distance to the tree in question will always be measured to determine whether or not the tree should be tallied.

*Proper Method of Holding Prism*

The prism should be held directly over the sampling point, or at a distance equal to the distance from the sampling point to the tree if the tree being sighted is hidden by intervening trees or brush. The prism's top edge should be held so as to «cut» the tree at breast height or d.n., the flat side of the wedge should be held as nearly perpendicular as possible to the line of sight to the tree on both axes. Rotating the prism in either a vertical or horizontal direction has the effect of reducing the amount of offset. In cases of doubt, rotate the prism slightly and use the maximum amount of offset.

*Borderline or Obscured Trees*

Sometimes a clear and conclusive prism measurement is impossible, as in the case of borderline trees and trees hidden by brush. In these cases the distance from the sampling point to the centre of the tree will be measured to the nearest tenth of a metre and the d.b.h. of the

tree to the nearest tenth of a centimetre. If the measured distance is at or within the «limiting distance» listed for that d.b.h. in the «limiting distance table» on the tatum code sheet, the tree will be sampled.

*Slope Correction.*

Measure distance to border line trees as if the ground was level. Do not correct for slope; this will be done in the office.

The 1/10 hectare plot for stump count will be corrected for slope; use correction shown on the tatum code sheet for the slope recorded for that sampling point.

*Repeat Tally.*

If a tree is selected by the prism at both sampling points; it will be sampled at each point.

*TREE SAMPLING*

*Forked Trees*

If the base of the fork (not the crotch) is two meters above the stump (30 cm.) sample as one tree, measuring the form class and length of the main or largest stem.

If the fork is below this height, sample each stem selected by the prism as a separate tree. Normal diameter (d.n.) is measured or estimated above the fork. Just the main stem of each fork selected is measured.

*Sprouts*

To the extent that the stems are selected by the prism, sample the 13 cm. d. b.h. and larger sprouts in a clump, but none less than 13 cm. (if selected by the prism), or if there is more than one distinct leader, if selected by the prism), or if there is more than one distinct leader, sample two, but no more than two.

*SAMPLE TREE DEFİNITIONS AND CODES*

*Azimuth.*

The azimuth of each sample tree from the sampling point will be recorded to the nearest 1/2 degree, startling at due north and working clockwise.

*Distance.*

The distance of each sample tree from the sampling point will be estimated and recorded to the nearest tenth of a meter.

*POINT NUMBER*

The primary sampling point will be point No. 1, the secondary point No. 2

*Tree Number.*

Live trees 2.5 cm. d.b.h. and larger and dead trees 13 cm. d.b.h. and larger that died during the past year selected by the prism for sampling will be numbered consecutively, beginning along a line running true north from the sampling point and proceeding clockwise. The first tree sampled on the secondary point will be given the number following that of the last tree sampled on the primary point.

*Species.*

A two number code will indicate species.

| Code | Scientific Name | Iranian Name | English Name |
|---|---|---|---|
| 01 | Quercus sps. | Balout or Mazoo | Oak |
| 02 | Fagus Silvatica | Rash | Beech |
| 03 | Buxus sempervirens | Shemshad | Boxwood |
| 04 | Juglans regia | Gerdoo | Walnut |
| 05 | Acer sps. | Afra | Maple |
| 06 | Zelcova Crenata | Azad | Elm of Siberia |
| 07 | Alnus sps | Tuska | Alder |
| 08 | Ulmus sps. | Narvan | Elm |
| 09 | Fraxinus | Zabban | Ash |
| 10 | Popylus sps. | Palat | Poplar |
| 11 | Carpinus sps. | Mamrads | Blue beech |
| 12 | Parrotia Persica | Anjili | Iron wood |
| 13 | Tilia rubra | Namdar | Linden |
| 14 | Diospyros lotus | Khormandi | Persimmon |
| 15 | Albizzia julibrissin | Shab Khosb | Silk tree |
| 16 | Gleditsia Caspica | Lilaki | Honey locust |
| 17 | Pterocarya fraxinifolia | Lark | False Walnut |
| 18 | Celtis sps. | Daghdaghan | Hackberry |
| 19 | Ficus carica | Anjir | Wild fig |
| 20 | Juniperus polycarps | | Juniper |
| 21 | Taxus baccata | Sorkhdar | Yew |
| 22 | Cupressus sempervirens | Sarve-kuhi | Cyprus |
| 30 | Other Commercial species | | |
| 40 | Other non-commercial species | | |

*D.b.h. or D. n.*

Diameter of trees with normal form will be measured at 1.37 meters above ground, measured on the uphill side on sloping ground. On swell

butted trees, normal diameter (d. n.) will be measured or estimated at 45 cm. above the pronounced swell.

D. b. h. or d. n. is determined by the measure for trees 2 5 cm. and larger and recorded to the nearest one-tenth centimeter if measured or nearest centimeter if estimated.

*Size Class.*

| *Code* | *Size* |
|---|---|
| *1* | *Sawtimber size. At least 30 cm d. b. h. and larger.* |
| *2* | *Poletimber size. At least 13 cm. and less than 30 cm.* |
| *3* | *Sapling size. At least 2.5 cm. and less than 13 cm.* |

*Tree Quality*

*Code*

*1. Select trees*

Sawtimber. At least 30 cm. d. b. h. or larger which contain at least a 4 meter log of grade 3 or better, and is a vigorous tree that shows no sign of risk of mortality. Must have a complete live crown.

Poletimber or Sapling. A live tree 2.5 cm d. b. h. or larger but smaller than sawtimber which has the soundness and form necessary to develop into a select sawlog tree.

*Acceptable Trees*

*Sawtimber.* Trees not acceptable as select trees but which do contain a merchantable butt log at least 2 1/2 meters long of grade 4 or better, or if the butt log is a cull, has at least 50 percent of its gross saw log volume in merchantable sawlogs.

*Poletimber or Sapling.* Live trees 2.5 cm. or larger that will develop into an acceptable, but not a select, sawlog tree.

2 Not a select tree because of natural causes, such as die back in the top, rot, lightning, age, etc.

3. Not a select tree because of man caused damage, such as cutting out top, trimming top, etc.

4. *Sound Cull*

A live tree 2.5 cm. or larger which fails to qualify as accep-

table because of crook, poor form, limbiness, or other sound defect. 50 percent more of the volume is in sound wood.

5. *Rotten Cull*

A live tree 2.5 cm. or larger which fails to qualify as acceptable because of rot. Less than 50 percent of the volume is in sound wood.

6. *Dead.*

All dead trees 13 cm. or larger of commercial species that died during the past year and were at least acceptable trees at time of death.

*Cause of Death.*

The primary cause of death of dead trees tallied will be indicated by code:

| *Code* | *Cause of death* |
|---|---|
| 1 | Insects |
| 2 | Rodents |
| 3 | Suppression |
| 4 | Disease |
| 5 | Girdling or topping by man. |
| 6 | Fire |
| 7 | Other (lightning, wind, etc.) |
| 8 | Unknown |

*Bark Thickness*

Record the single bark thickness in centimeters to tenths on live trees 13 cm. d. b. h. and larger measured at the same height that the diameter was measured and on the side towards plot centre whenever possible. Do not measure bark if the d. b. h. had to be estimated Put an X in the space if the bark cannot be measured.

*Radial Growth.*

Record the radial growth in millimeters on live trees 13 cm. d. b. h. and larger for the last 5 complete growing seasons. Bore at the level that diameter was measured on the side towards the plot centre if possible. X these spaces if this point cannot be rearhed, growth rings cannot be counted, or the d. b. h. was estimated.

*Length.*

*Merchantable Sawlog Trees* : Record length of sawlog portion to the nearest whole meter.Sawlog portion in that section between stump height (30 cm. on the uphill side, or at the point where excessive swell terminates on trees with excessive butt swell) and the point where merc - hantability for sawlogs is limited by defect, branches, defor mity, or minimum diameter (20 cm inside bark).

As a rule the sawlog portion will end due to limbiness when even the diameter of a limb, or the sum of diameters of the limbs originating within a 15 centimeter section, is greater than 1/3 the diameter of the stem at that point, unless there is a merchantable section at least 2 meters in length above that point.

The sawlog portion will not extend above the live portion of the stem.

*Cull Sawlog Trees* : Record lenght of live stem to nearest whole meter between stump height and the point of minimum dia meter of 20 cm. inside bark.

*Pole Trees* : Record length of live stem to nearest whole meter between the stump height and the point of 8 cm. minimum diameter inside bark unless limited by excessive branches or deformity.

*Form Class*

Form class in the ratio of diameter inside bark at the top of the butt sawlog (5 meters above stump) to diameter outside bark at d.b.h., expressed as a percent. Measured checks will need to be made frequently.

Form class of sawtimber size trees, both good trees and culls, will be estimated to the nearest percent.

Form of poletimber size trees, both good trees and culls, will be estimated as falling within one of five form-class groups as follows:

| *Code* | *Form - class group* |
|---|---|
| 1 | Less. than 70 percent |
| 2 | 70 to 74 percent |
| 3 | 75 percent to 79 percent |
| 4 | 80 to 84 percent |
| 5 | 85 percent or more |

If the tree does not contain a full 5 meters between the stump and the merchantable top, extend, the normal taper of the tree to that height.

*Cull*

*Poles :* Cull in select and acceptable pole timber will be estimated as the percentage of the tree volume in the recorded «Length» which would be rejected as sawlogs because of crook, rot, or excessive roughness.

Sawtimber : In select and acceptable trees, the cull volume for each defect within the merchantable length is computed separately and summarized on the back of the tally sheet by tree number. The total for each tree, rounded off to nearest hundredth meter, is then recorded on the front of the sheet. Cull is the volume of decayed or missing wood and the volume of sections of the pole that are too rough to be utilized as sawtimber. It can be computed as follows :

1. Determine length of the section affected. Estimate the percentage of that section that is cull. Estimate the mid point diameter inside bark for the affected section.

2. Record these dimensions as (1) percent loss, (2) length of section, and (3) midpoint diameter inside bark of the section.

3. Look up the section volume on the tatum code sheet and record the percentage of that volume that is cubic meter cull.

*Cull Trees :* (Code 4 and 5 quality) For cull trees 13 cm. and larger, estimate and record the percentage of the tree that would be rejected even for charcoal.

*Grade*

The first or butt log of each merchantable sawlog tree (code 1, 2 and 3 quality) will be graded. The butt log is the first 5 meter log above stump or jump butt unless the tree contains only a shorter log (at least 2 1/2 meters long) in which case the shorter log will be graded.

The poorest of the three best faces of the log will be graded. Specifications for the four grades are given on the tatum code sheet.

Log abnormalities limiting clear cuttings in factory logs (grade 3 or better) include:

Adventitious bud cluster
Bulge, in butt or stem
High bumps
Burl
Butt Scar,
Canker
Conk
Flutes
Holes extending into milling frustum
Limbs
Knots
Knot overgrowths.
Overgrowths following insect damage or bird peck.
Wounds extending into milling frustum.
Seams, if deep

Butt swell, flanges, surface rise, and bird peck of less than four pecks per 30 cm. square area do not limit cuttings.

Decay, seams, or scars whose depth is less than 1/5 the log diameter is not a defect. When the depth exceeds 1/5 the log diameter and extend less than the full length of the log, clear cuttings can be taken over 1/3 of the end tapering out.

Butt logs of merchantable sawlog trees that fail to qualify as factory lumber logs, (first 3 grades)will naturally be grade 4, tie and timber grade. Here straightness, soundness, and effect of defects on the strength of tie or timber are the important factors. The log must be sound internally (no rotten centre), and no single knot or group of knots within a 15 cm. section of the log can exceed 1/3 the log section diameter at that point. Rotten defects or holes on the surface must not extend more than 8 cm. into the tie or timber. Total cull volume in the log cannot exceed 50 percent of the gross volume.

*Upper Stem*

Length : Length of the upper stem of sawtimber trees, both good trees and culls, between the top of the last sawlog and a point where the main stem either reaches a 8 cm. minimum diameter inside bark or breaks up into limbs, will be estimated in number of 1 meter sections. If the upper stem is forked, measure the longest fork, measure only live stem.
Form : Estimate the mid - point diameter of the upper stem inside bark and record to nearest whole centimeter.

*Stumps*

Stumps of trees 13 cm. or larger d.o.b. cut during the past year will be tallied on a 1/10 hectare plot (radius 17.84 meters). Stumps need not be numbered.

*Point Number : Primary No. 1, secondary No. 2*

*Species : By code*

*Tree Quality : At time of cutting, by code*

*Height of Stump : To even centimeter*

*D. O. B. : Diameter outside bark to whole cm.*

PLOT DESCRIPTION

*Photo Number*

Enter number of photo the sampling point is on.

*Point Number*

Sample point numbers will be coded serially from 001. Always enter three numbers. Use primary point only.

*Ostan*

| *Code* | *Ostan* |
|---|---|
| *1* | *Tabriz* |
| 2 | Rasht |
| *3* | *Sari* |

*Province*

| *Code* | *Province* |
|---|---|
| 1 | Ardabil |
| 2 | Astara |
| 3 | Hasht-par |
| 4 | Fuman |
| 5 | Lahijan |
| 6 | Shahsavar |
| 7 | Chalus |
| 8 | Nowshahr |
| 9 | Amol |
| 10 | Babol |
| 11 | Shahi |

| *Code* | *Province* |
|---|---|
| 12 | Sari |
| 13 | Behshahr |
| 14 | Gorgan |
| 15 | Gonbadeghabus |

*District*

Leave blank

*Forest*

Leave blank

*Watershed*

| *Code* | *Watershed* |
|---|---|
| 1 | Nova |
| 2 | Lumur |
| 3 | Shofa |
| 4 | Shevt |
| 5 | Sefid |
| 6 | Puli |
| 7 | Shahvar |
| 8 | Shahsavar |
| 9 | Sardah |
| 10 | Chalus |
| 11 | Kujur |
| 12 | Haraz |
| 13 | Babol |
| 14 | Tolo |
| 15 | Tajan |
| 16 | Nika |
| 17 | Garehsu |
| 18 | Gurgah - Gorgan province |
| 19 | Gurgah - Gonbadeghabus province |

Enter code number for primary point only.

*Ownership*

| *Code* | *Ownership* |
|---|---|
| 0 | Unknown |
| 1 | National Forest |
| 2 | Public domain |
| 3 | Private |

Make an effort to determine correct ownership.

*Forest Type*

| *Code* | *Forest Type* |
|---|---|
| 1 | Beech Forest. Over 50 percent of the stand by volume is beech. |
| 2 | Oak Forest Over 50 percent of the stand by volume is oak |
| 3 | Mixed Forest. Neither of the above species predominates. |

Base the forest type of sawtimber and pole stands on cubic volume; seedling and sapling stands on number of good trees; non - stocked areas on past composition. Base the classification on the area immediately surrounding the primary and secondary sampling points.

Forest types have been mapped on the photos by the photo interpreters. If errors are discovered, make notes on the photos so they can be corrected.

*Stocking*

Stocking is the extent to which growing space is effectively utilized by good trees. Cull trees do not contribute. It will be judged upon the basis of number of good trees and their distribution. Four degrees of stocking will be recognized and coded:

| *Code* | *Degree of Stocking* |
|---|---|
| 1 | Non-stocked, 0-9 percent |
| 2 | Poorly-stocked, 10-39 percent |
| 3 | Moderately-stocked, 40-69 percent |
| 4 | Well stocked to percent or mora. |

Degree of stocking will be based upon the average of both sampling points .

The degree of stocking can usually be readily estimated. When in doubt, the point sample work sheet on the back of the tally sheet may be used as an aid.

The minimum number of growing-stock trees per hectare needed to qualify for each class of stocking is:

| *D.B.H. of Trees-cm.* | *Well Stocked 70%* | *Moderately Stocked 40%* | *Poorly stocked 10 %* |
|---|---|---|---|
| Seedling | 1729 | 988 | 247 |
| 5 | 1383 | 790 | 198 |
| 10 | 1025 | 580 | 146 |
| 15 | 692 | 395 | 99 |
| 20 | 420 | 237 | 59 |
| 25 | 272 | 153 | 40 |
| 30 | 198 | 114 | 27 |
| 35 | 156 | 89 | 22 |
| 40 | 123 | 72 | 17 |
| 45 | 104 | 59 | 15 |
| 50 | 89 | 49 | 12 |

*Status Code*

1. *Non-commercial forest land* (inaccessible) Includes forest lands so physically inaccessible as to be unavailable economically in the forseeable future.

2. *Non-Commercial forest land* (unproductive) Includes forest lands incapable of yielding usable forest products because of adverse site condilitions (such as hingh elevations stocked with noncommercial or small trees).

3. *Non-commercial forest land (reserve)* Includes forest lands withdrawn from timber utilization by law or administrative order.

*Commercial Forest Land*

4. *Primeval.* Forest land that has not been exploited.
5. *Cutover.* Forest land that has been exploited for forest products but still has at least 20 percent stocking of well formed trees.
6. *Unproductive.* Land completely exploited. Generally, so badly mistreated that it will not return to forest naturally.

Base status upon the immediate area surrounding both sampling points unless they have entirely different status. In that case base it upon the primary point only.

*Stand Volume*

Will be computed in the office. It will be classified into three classes:

| *Code* | *Volume per hectare* |
|---|---|
| 1 | 6,000 cubic feet or more |
| 2 | 4,000 to 6,000 cubic feet |
| 3 | Less than 4,000 cubic feet |

*Site*

Broad site quality classes based upon the capability of the land to produce sawlogs will be used. Average the area surrounding both sampling points unless they are entirely different, in which case it will be based upon the area surrounding the primary point.

| *Code* | *Site* |
|---|---|
| *1* | *Poor.* Evidenced by stands of poor growth and scrubby form producing short boled timber, usually one 5-meter log or less. |
| *2.* | *Fair.* Evidenced by stands of average height and form where the trees may be expected to produce an average of two 5-meter logs. |
| 3 | *Good.* Evidenced by stands of the best form and species and capable of producing trees with three 5-meter logs or more. |

*Cutting History*

Report any cutting of trees in recent years (approximately 5 years) on either 1/10 hectare plot surrounding each sampling point. Report no cutting unless at least 10 per cent or more of the original cubic meter volume or number of stems has been cut.

| Code | Cutting History |
|---|---|
| 0 | No cutting |
| 1 | Cutting of only trees of less than 13 cm. stump (or d. b. h.) |

Cutting of trees 13 cm. stump (or d. b. h) and larger

| | |
|---|---|
| 2 | For charcoal only |
| 3 | Sawlogs and/or tie and timber trees only |
| 4 | Cutting of both codes 2 and 3 |
| 5 | Cutting without use of trees |

*Checking sampling point data*

Before leaving the sampling point the measurer will check the tally sheet to assure that no items of data have been omitted. When so assured, he should then initial the sheet as «measurer».

A X should be put in those spaces left blank because it does not apply to that tree, and an X should be put in those spaces left blank because it could not be measured (such as growth data).

## DUTIES OF CREW MEMBERS

The X indicates which crew member is responsible.

| *Job* | *Party Chief* | *Measurer* |
|---|---|---|
| Supervise, crew, plan work | X | |
| Responsible for property | X | |
| Direct way to starting point - use maps, photos, local guide | X | |
| Mark starting point | | X |
| Record starting point notes | X | |
| Work as head chainman and compassman | | X |
| Work as rear chainman, correct for slope | X | |
| Check sample point location with photo | X | |
| Set sample point centre wire pin | | X |
| Select witness trees | X | |
| Obtain witness tree data, scribe and tag trees | | X |
| Record witness tree data, and make notes | X | |
| Count seedlings, .001 hectare plot | | X |
| Record seedlings | X | |
| Stretch tape to measure slope | | X |
| Determine and record slope | X | |
| Determine which are sample trees | X | |
| Measure to borderline trees when necessary | X | X |
| Determine which stumps to tally, 1/10 hectare plot | X | X |
| Measure and record tree azimuth | X | |
| Record approximate tree distances | X | |
| Measure distance to occasional trees | X | X |
| Measure trees and stumps and call tally (species, d.b.h., size class, quality, cause of death, height and d.o.b. of stumps) | | X |

| JOB | Party chief | Measurer |
|---|---|---|
| Record tree and stump tally and repeat call | X | |
| Measure and record tree lengths | X | |
| Measure and record upper stem, length and form | X | |
| Determine and record form class | X | |
| Determine and record cull | X | |
| Do the log grading | X | |
| Measure bark and radial growth | | X |
| Assist in measuring lengths (heights) | | X |
| Compass and measure to secondary sample point and repeat above | X | X |
| Determine and record plot description | X | |
| Edit and initial completed tally sheet | | X |

## POINT SAMPLING LIMITING DISTANCE

Diistance from sampling point

| D.B.H. cm. | Dist. meters. | D.B.H. cm. | Dist. meters. | D.B.H. cm. | Dist. meters. |
|---|---|---|---|---|---|
| 1 | 0.33 | 50 | 16.50 | 125 | 41.26 |
| 2 | 0.66 | 55 | 18.15 | 130 | 42.91 |
| 2.5 | 0.82 | 60 | 19.81 | 135 | 44.56 |
| 3 | 0.99 | 65 | 21.46 | 140 | 46.21 |
| 4 | 1.32 | 70 | 23.11 | 145 | 47.86 |
| 5 | 1.65 | 75 | 24.76 | 150 | 49.51 |
| | | 80 | 26.41 | | |
| 10 | 3.30 | 85 | 28.06 | 0.1 | 0.03 |
| 15 | 4.95 | 90 | 29.71 | 0.2 | 0.07 |
| 20 | 6.60 | 95 | 31.36 | 0.3 | 0.10 |
| 25 | 8.25 | 100 | 33.01 | 0.4 | 0.13 |
| 30 | 9.90 | 105 | 34.66 | 0.5 | 0.16 |
| 35 | 11.55 | 110 | 36.31 | 0.6 | 0.20 |
| 40 | 13.20 | 115 | 37.96 | 0.7 | 0.23 |
| 45 | 14.85 | 120 | 39.61 | 0.8 | 0.26 |
| | | | | 0.9 | 0.30 |

Measure d.b.h. to nearest 1/10 cm.
Measure distance to tree centre to nearest 1/10 meter.
Formulae : distance in meters = c.b.h. in Cm. X 0.3301

## STOCKING PERCENT — good trees

| D.B.H. Class | Growing Stock Count | | | Factor | Count X Factor |
|---|---|---|---|---|---|
| | Pt.1 | Pt.2 | TOTAL | | |
| 5 | | | | 57 | |
| 10 | | | | 19 | |
| 15 | | | | 13 | |
| 20 | | | | 12 | |
| 25 | | | | 12 | |
| 30 | | | | 11 | |
| 35 | | | | 10 | |
| 40 | | | | 10 | |
| 45+ | | | | 9 | |
| 0* | | | | 100 | |

TOTAL
Divided by 2
STOCKING %

* Seedlings. Record a 1 count at each sampling point where there is at least one well established seedling within 1.14 meters of sampling point and not beneath the crown of a larger good tree.

## Cubic Meter Cull

| TREE NO | % - L - M | CUBIC METERS |
|---|---|---|
| | | |
| | | |

FORM CLASS

1. Less than 70%
2. 70 to 74 %
3. 75 to 79 %
4. 80 to 84 %
5. 85 %or more

FOREST TYPE

1. Beech
2. Oak
3. Mixed

SITE

1. Poor
2. Fair
3. Good

OSTAN

1. Tabriz
2. Rasht
3. Sari

PLOT RADIUS
1/10 Hectare
PLOT RADIUS
SLOPE METERS

| | |
|---|---|
| 0 | 17.84 |
| 5 | .85 |
| 10 | .86 |
| 15 | .89 |
| 20 | .92 |
| 25 | .96 |
| 30 | 18.02 |
| 35 | .07 |
| 40 | .14 |
| 45 | .21 |
| 50 | .29 |
| 55 | .38 |
| 60 | .47 |
| 65 | .56 |
| 70 | .66 |
| 75 | .76 |
| 80 | .86 |
| 85 | .97 |
| 90 | 19.07 |
| 95 | .18 |
| 100 | 19.28 |

NUMBER OF TREES FOR 1 % STOCKING ON HECTARE, OR 10% STOCKING ON 1/10 HECTARE

| D.B.H. CLASS | NUMBER |
|---|---|
| Seedlings | 24.7 |
| 5 | 19.8 |
| 10 | 14.8 |
| 15 | 9.9 |
| 20 | 6.2 |
| 25 | 3.7 |
| 30 | 3.0 |
| 35 | 2.2 |
| 40 | 1.7 |
| 45 | 1.5 |
| 50+ | 1.2 |

STOCKING CODE

| | | |
|---|---|---|
| 1. | Non-stocked | 0—9% |
| 2. | Poorly stocked | 10—39 |
| 3. | Medium stocked | 40—69 |
| 4. | Well stocked | 70+ |

CUBIC METER CULL

| TREE NO | % - L - M | CUBIC METERS |
|---|---|---|
| | | |

% — The percentage of defective section that is cull.

L — Length of the defective section in 1/2 meters.

M — Midpoint d.i.b. of defective section

Witness tree : Species ——— D.b.h.——— Azi.——— Dist.———
Species ——— D.b.h.——— Azi.——— Dist.———
Secondary W. T. Species ——— D.b.h.——— Azi.——— Dist.———
Plot slope : 1.——— 2.——— Party chief ——— Date ———

**PLOT TALLY SHEET**

Reproduc'n (1.784 meters)

| | 2.5 Cm & larger | | | | | 13 Cm. & larg Sawtimber | | | | | | | | STUMPS 1/10 hectare | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DISTANCE | POINT NO. | TREE NO. | SPECIES | DBM or DN | SIZE CLASS | QUALITY | CAUSE DEATH | BARK | GROWTH | LENGTH | FORM CLASS | CULL: POLES | CULL: SAWLOGS | GRADE | Upper stem: LENGTH | Upper stem: FORM | POINT NO | SPECIES | QUALITY | HEIGHT | D. O. B. |
| | | | 1 | | | | | | | | | | | | | | | | | | | |
| | | | 2 | | | | | | | | | | | | | | | | | | | |
| | | | 3 | | | | | | | | | | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | | | | | | | | | |
| | | | 5 | | | | | | | | | | | | | | | | | | | |
| | | | 6 | | | | | | | | | | | | | | | | | | | |
| | | | 7 | | | | | | | | | | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | | | | | | | | | |
| | | | 9 | | | | | | | | | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | | | | | | | | | |
| | | | 11 | | | | | | | | | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | | | | | | | | | |
| | | | 13 | | | | | | | | | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | | | | | | | | | |
| | | | 15 | | | | | | | | | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | | | | | | | | | |
| | | | 17 | | | | | | | | | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | | | | | | | | | |
| | | | 19 | | | | | | | | | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | | | | | | | | | |
| | | | 21 | | | | | | | | | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | | | | | | | | | |
| | | | 23 | | | | | | | | | | | | | | | | | | | |
| | | | 24 | | | | | | | | | | | | | | | | | | | |
| | | | 25 | | | | | | | | | | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | | | | | | | | | |
| | | | 27 | | | | | | | | | | | | | | | | | | | |
| | | | 28 | | | | | | | | | | | | | | | | | | | |
| | | | 92 | | | | | | | | | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | | | | | | | | | |
| | | | 31 | | | | | | | | | | | | | | | | | | | |
| | | | 32 | | | | | | | | | | | | | | | | | | | |
| | | | 33 | | | | | | | | | | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | | | | | | | | | |
| | | | 35 | | | | | | | | | | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | | | | | | | | | |
| | | | 37 | | | | | | | | | | | | | | | | | | | |
| | | | 38 | | | | | | | | | | | | | | | | | | | |
| | | | 39 | | | | | | | | | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | | | | | | | | | |

Photo No.
Point No.
Ostan
Province
District
Forest
Watershed
Ownership
Forest type
Stocking
Status
Stand volume
Site
Cutting history

SPECIES CODE

01 Oak
02 Beech
03 Boxwood
04 Walnut
05 Maple
06 Elm of Siberia
07 Alder
08 Elm
09 Ash
10 Poplar
11 Bluebeech
12 Iron wood
13 Linden
14 Persimmon
15 Silk tree
16 Honey locust
17 False walnut
18 Hackberry
19 Wild fig
20 Juniper
21 Yew
22 Cypress
30 Other-commercial
40 Other-Noncomm.

CAUSE OF DEATH

1 Insects
2 Rodents
3 Suppression
4 Disease
5 Man caused
6 Fire
7 Other
8 Unknown

MEASURER

SAME CLASS
Sawtimber 30 +
Poletimber 13 +
Sapling 2.5 +

QUALITY
1 Select
2 Acceptable - naturol
3 Acceptable - man caused
4 Sound cull
5 Rotten cull
6 Dead

OWNERSHIP
0 Unknown
1 national Forest
2 Public domain
3 Private

ANNEX

## LIST OF PATICIPANTS

### İRAN

| | |
|---|---|
| Mr. Hossein Mirhaydar | Head, Forest Management Research Division, Ministry of Agriculture, Tehran. |
| Mr. Ziaedin Roshdieh | Head, Forest Survey Division, Ministry of Agriculture, Tehran. |
| Mr. Sadegh Kiabi | Head of Forest Management, Ministry of Agriculture, Tehran. |

### PAKİSTAN

| | |
|---|---|
| Mr. A. A. Khan | Conservator of Forests, Rawalpindi, PAKİSTAN |
| Mr. Maqsood Khan | Commercial Secretary, Pakistan Embassy, Tehran. |

### TURKEY

| | |
|---|---|
| Mr. Celâl Sanay | Member of Technical Committee, Forest Service, Ministry of Agriculture, Ankara. |
| Mr. Eşref Soysal | Deputy Director, Research and External Relations Division, Forest Service, Ministry of Agriculture, Ankara. |

### UNITED KINGDOM

| | |
|---|---|
| Dr. H. F. Mooney | Forestry Advisor, British Middle East Development Division, Addis Ababa. |

UNITED STATES

| | |
|---|---|
| Mr. George Doverspike | USOM, Iran. |
| Mr. George Brown | USOM, Turkey. |

| *Technical* | *Observers* |
|---|---|
| Mr Earl J. Rogers | USOM Forest Survey Advisor to Iranian Forestry Service. |
| Mr. Elon H. Bomberger | Forestry Advisor (Photo Interpretation), USOM, Iran. |
| Mr. Alva B. Williams | Field Forest Survey Advisor, USOM, Iran. |

BOBST LIBRARY
3 1142 02786 2658

AL TREATY ORGANISATION
ESKI MECLIS, ANKARA, TURKEY

EROĞLU MATBAASI
ANKARA — 1962