FOREST CLASSIFICATION MANUAL

V. VAUGHAN

1957
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## PURPOSE AND SCOPE OF A FOREST AND AREA CLASSIFICATION

### PART I

#### INFORMATION TO BE FILLED IN ON CODE SHEET

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PURPOSE AND SCOPE OF A FOREST AND AREA CLASSIFICATION

A forest and area classification aims at a differentiation between forest stands based on variations in the composition of the forests, and a differentiation between cover types other than forests, for example - meadow, alpine, swamp, etc. Area classification of forest cover is also the initial phase in determining the total volume of a timber stand. It is known that certain species of trees, or associations of species are indigenous to definite ranges, sites, or elevations. Variations in any of these factors are responsible for diversities in forest structure. In order to map these differences or classify the forests, a basis for separation must be derived. Any number of factors may be utilized from a simple mature-immature-non forest breakdown, to a very complex one, depending on the requirements of the survey.

Our initial variants are the structure of the stand, within which ten basic structures are recognized, forest type, that is tree species or group of species, age class, height class, and stocking class (number of stems per acre). Now, having these factors laid down, a forest classifier or coder is able to delineate stands having any of these factors dissimilar. Most of these factors are discernible from air photos, but variations within any one factor can, in many cases, only be determined on the ground. When the extent of the homogeneous stand has been determined it is mapped on the air photo. Thus for our purposes, we have the term forest typing. Once the stand has been separated or typed out on the air photo, using information obtained from ground examination and sample trees, the next step is to describe the forest type.

In order to describe the forest type as systematically and consistently as possible, a method of enumerating characteristics of the stand was devised. Thus the code sheet evolved. It is merely a standard form for recording details of the forest type, and describing the said type, using a code number check off for most of the details. Each detail, or item as it is called on the code sheet, is considered by the coder and the category which most closely describes the stand in question is checked off. All items considered important for an accurate description of the forest type are laid down on the code sheet. To assist the coder, Part I of the Coding Manual defines the items as listed on the code sheet. That is, Part I and the code sheet are the basis for classifying forest stands.

All code sheets must be identified with the area they describe. Therefore, each coder is given a number for the project, and each code sheet is numbered chronologically. The coder's project number and code sheet number appear within the boundary of the type on the air
photo. In the case of non forest cover a code number only appears, since no code sheet is used.

Separation of forest types is usually based on differences within the five variable factors as previously outlined. However, if a more intensive classification is required any of the check-off items may be utilized as a basis for delineation.

Some explanation is required on the use of type lists which appear in Part IV of this manual. All practical combinations of the five basic variables are given, namely type code, age code, height code, and stocking class. The coder first determines the stand structure element, that is, whether the stand is mature, immature, non commercial, etc., based on previously set standards for each allowable stand structure. All species or common combinations of species which occur throughout the province are assembled in a "type list" and given a code number. The coder chooses the most appropriate type number for the stand in question. Age, height, and stocking are divided into classes or groups each having a code number. It should be pointed out that the class range for these last three variables differs with the intensity of the survey. For a reconnaissance survey broad classes are used, while the opposite is true for special surveys.

This system of forest and area classification is designed to provide a uniform method throughout the province, to limit the strata for a workable sampling plan, and furnish a systematic, rapid description of ground cover, particularly forest land, which can be compiled accurately and simply and presented in a tabular form and on maps.

Presentation of data in tabular summaries and on maps must be based on some type of geographical division, due to the extent of the province. Therefore, the province was divided into eighty-eight regions usually based on drainage patterns. Regions were subdivided into smaller units called compartments. Field work, office work, and maps are now indexed or referenced by region and compartment.
PART I INFORMATION TO BE FILLED IN ON CODE SHEET

Part I of the Coding Manual is indexed according to Item Numbers as they appear on the code sheet. See Appendix 1 for sample code sheet.

e.g. On Code Sheet: (2) Elements of Stand Structure.
In Manual: Item 2 - Elements of Stand Structure.

PART I ITEM 1 GENERAL INFORMATION

The following information should be filled in, where applicable, for every code sheet:

(a) Region Number ("R" No.) - The region number applicable is entered here. Each coder will probably work in the same region for the entire season.

(b) Compartment Number - A region is made up of many compartments. Each coder will work in several compartments during the season and the compartment number applicable must be entered on the code sheet.

(c) Project Name - The group of several compartments that the coder works in during the field season may be given a project name.

(d) Special Number (if any) - This refers to special projects such as Timber sales, 20-chain jobs, etc. and will be filled in only when doing these types of survey.

(e) A & B Number - Each coder will be assigned a number at the start of the season. This number will be put in the square in front of the letter 'A' and 'B', as the case may be. Both "A" and "B" code sheets are numbered consecutively from one, and this number is put in the square behind the letter "A" or "B". A "B" number must always be accompanied by an "A" number.

e.g. (i) Coder Number 453 is making out his 32nd. "A" code sheet. Type number will be 453A32.
(ii) Coder 453 has just made out his 85th. "A" code sheet and is about to make out his fourth "B" sheet to date. The type sequence noted from 453A85 by a dotted line line only.
Type number will be 453A85
        453B4
PART I Item 1  GENERAL INFORMATION, contd.

(f) **Photo Roll and Number:** - The photo showing where this code sheet was made out should be recorded. This photo must show the code sheet number pricked through on the reverse side.
   e.g. Record the photo number thusly:  BC622:37

(g) **Coder's Name:** - The coder's name (not number) is to be entered here.

(h) **Date:** - The date that the code sheet was made out should be recorded.
   e.g. 23/8/54

(i) **Type of Survey:**
   1. Inventory
   2. Special

Each code sheet made out should be checked as made either for an inventory or a special type.

(j) **Stereogram Record:** - signify whether or not a stereogram record exists for the type being coded by circling "yes" or "no". Air coders will be able to obtain this information from the air coding party chief, but ground coders may not have access to it, and if so, will leave this check-off blank, to be filled in later in Victoria.
A. **Stand Structure 1: - Main Stand Immature**

A commercial type is classified as main crop immature when it is satisfactorily stocked and:

(i) less than 40 years of age (pure deciduous only).

(ii) less than 80 years of age (pure P1 stands only, i.e. no other species comprising 20% or more of the type.)

(iii) less than 120 years of age, (all stands other than pure P1 or deciduous). (e.g. FS; P1S; SP1; P1SB).

A stand may be called immature when older than these limits if, in the coder's opinion, it is of exceptional development and still growing rapidly.

In types that contain a mixture of deciduous and coniferous, the latter may not be classified as mature until they have reached their maturity age. Thus, a 50 year old spruce-aspen stand could not be called a mature spruce-aspen type, but must be handled in one of the following ways.

(i) Main stand immature spruce-aspen; which is the most logical if the development is fairly good.

(ii) Grown up noncommercial aspen-spruce (4 - AS) or young noncommercial spruce-aspen (3 - SA).
(Map notes only if small minor area).

(iii) Main stand immature spruce plus secondary stand of grown-up noncommercial aspen.

(iv) Main stand immature spruce plus secondary mature of aspen.

(v) Main stand mature aspen plus secondary immature spruce.

(vi) Main stand grown-up noncommercial aspen plus secondary immature spruce.

B. **Stand Structure 2: - Main Stand Mature**

A commercial stand is classified as main crop mature when it is:

(i) over 40 years of age (deciduous only).

(ii) over 80 years of age (pure P1 stands only, no other species 20% or more).

(iii) over 120 years of age.
(all stands other than pure P1 stands and deciduous e.g. FS; P1S; SP1; P1SB.)

Stands should not be classified as mature where their average age falls below the above limits.

- e.g. FS - 110' - 140 yrs. = mature
- P1 - 80' - 95 yrs. = mature
- P1S - 80' - 95 yrs. = immature (because of B (ii) above)
- D - 80' - 47 yrs. = mature
PART I  ITEM 2  ELEMENTS OF STAND STRUCTURE - contd.

C. Stand Structure 3: - Main Stand Non-Commercial Young (Do not use for extensive types (over 100 acres unless instructed.)

Area not covered, or only partly covered, by a commercial forest, but covered by a young non-commercial stand which is occupying the area and excluding or preventing satisfactory restocking. The codes for non-commercial young are identical with those of immature.

For minor areas (100 acres or less) of young non-commercial, a map note on the photograph is sufficient. This map note will consist of stand structure element (3) and species.

e.g.:  (i) Young non-commercial area of alder following slide.

Mark thusly on back of photo: 3-D.

(ii) Non-commercial Pl-Aspen. 3-PlA.

(iii) Non-commercial Brush. 3-Br.

For extensive areas (100 + acres) of young non-commercial, regular code sheets should be made out rather than use map notes (but do not use unless instructed).

e.g. - large burned-over area with young N.C. coming up.

- stagnated stands classed as young N.C.

D. Stand Structure 4: - Main Stand Non-Commercial Grown-up

(Do not use for extensive types (over 100 acres) unless instructed).

Area not covered, or partly covered, by a commercial forest, but covered by an old or grown-up non-commercial stand which is occupying the area and excluding or preventing satisfactory establishment or development of a fully stocked commercial forest.

For minor areas (100 acres or less) of grown-up non-commercial, a map note on the photo is sufficient. This map note will consist of stand structure element (4) and species.

(i) Grown-up non-commercial stand of Pl-Aspen less than 100 acres such as windbreak or isolated strip.

Record thusly on back of photo: - 4 - PlA.

(ii) Grown-up non-commercial Fir, 4-F.

For extensive area (100 + acres) of grown-up non-commercial, regular code sheets should be made out rather than use map notes. The code used is identical to that of the corresponding mature type, (but do not use unless instructed).

PART 2  ITEM 2, contd.

(4)

(1957)
E. **Stand Structure 5: - Secondary Stand Immature**

This classification is to be used only in cases where said secondary stand is making good growth and will, under normal conditions, in time take over and become the main stand.

The most common examples of secondary immature stands are:

(i) secondary immature under interior mature F, Py, and L stands.

(ii) secondary immature under nurse N.C. crop.

(e.g. spruce coming up under nurse aspen or nurse P1 stand.)

Main crop immature plus secondary crop younger immature will not be recognized except in cases where the main stand is acting as a nurse crop. (e.g. young secondary immature spruce under main stand of older P1 immature.)

In the case where there are two distinct immature age classes of almost equal importance in a stand and the younger age group has been selected as the main component, the older immature portion of a stand may be recorded as a map note. This is in addition to showing it in the code key, and will ensure that it goes on the map.

**N.B.** This type of stand does not occur often. This map note should be entered on the code sheet and recorded directly on the photograph.

E.g. Immature stand has two very important age groups with the younger being classified as main.

FL 17 years
L 76 years

Label on photo should be: 1-109
453449
(L-1880)

F. **Stand Structure 6: - Secondary Stand Mature**

**N.B.** To be used on **Block Surveys only**.

The following classifications are permissible:

1. Secondary mature consisting of the advanced growth of an immature stand or stands.

2. Secondary mature consisting of a commercial mature remnant of a deteriorated stand, or a remnant following destruction of a previous mature stand.
PART I  Item 2  ELEMENTS OF STAND STRUCTURE - contd.


3. Combinations of 1 and 2 above.

4. Secondary mature consisting of another age class of a main stand mature.

G. Stand Structure 7: - Secondary Crop Young Non-Commercial

(i) Secondary crop young non-commercial must NOT be checked if main stand is young non-commercial, but is allowable with main crop grown-up non-commercial.

(ii) Secondary crop young non-commercial should NOT be used unless it constitutes an important part of the stand.
(For typical mature stands of SB, HB, HC, etc., where there is always a typical scattered suppressed understorey check off main stand mature only.)

Example of secondary young non-commercial
Young non-commercial Aspen throughout immature Pl stand.

The code used for secondary young non-commercial is identical to that for secondary stand immature.

H. Stand Structure 8: - Secondary Stand Grown-up Non-Commercial

This classification must NOT be checked if main stand is grown-up non-commercial, but is allowable with main crop young non-commercial. Some example of secondary grown-up non-commercial are:

(i) Old F vets or S.T. scattered throughout an immature stand. These may be commercial trees, but are classed as non-commercial as their removal would not warrant disturbing the main crop.

(ii) Old growth alder scattered throughout an immature HC stand.
PART I ITEM 2 ELEMENTS OF STAND STRUCTURE - contd.


In coding this type of stand use the applicable secondary stand mature code for age, height, and stocking.

I. Stand Structure 9: - Main Crop Not Satisfactorily Re-stocked

This classification applies to young stands that are less than 51% stocked. (25% milacre stocking) and usually less than 21 years of age. It also may apply to stands 51% + [see rule (ii) below]. Other exceptions are Py stands and areas denuded over 20 years ago but still not stocked with brush and/or young growth and without sufficient veterans to class as grown-up non-commercial. To aid in determining whether an area is satisfactorily restocked, use the stocking table by age classes on the back of the code sheet (Item 38).

Rules

(i) If more than 21 years of age, check for reclassification as main stand immature or main stand young non-commercial.

(ii) If 51% + stocked, using full stocking by age class basis (Item 38), if the distribution of the stems is good, and if the stems are mainly important species, and if the site is average or better, and if there is a reasonable chance of the stand trending to normal, reclassify as immature.

(iii) Py only - if 21% + stocked, reclassify as immature.

(iv) The code Key (Item 3) need not be filled in if denudation occurred within the last five years. Classify as recent logged or burned, etc., and check off Elements of Stand Structure No. 9.

(v) The history symbol and date of history must be put on the photograph. (Bracket estimated dates.)

These species are present but the area is still N.S.R.

The percent stocking of N.S.R. stands is determined by the quadrat sample (see Sampling Manual Part II, Section 5, pages 56 - 56a). The general rule is to double the percent milacres stocked to obtain percent area stocked. e.g. Quadrat tally shows 17% of milacres stocked (m.a.s.). Therefore (17% X 2) = 34% of area stocked.

PART I Item 2, contd.

(7)

(1957)
I. Stand Structure 9 - Main Stand Not Satisfactorily Re-stocked, contd.

On areas classified as not satisfactorily restocked, history is of the utmost importance, since these N.S.R. areas are later classified by their history rather than by the partial cover that is present. This history means the type of denudation that caused the area to become N.S.R. For instance, the presence of burn signs on stumps does not necessarily mean that the logged and burned classification should be automatically checked off under miscellaneous history. In most cases, in the interior it was the burn that caused the N.S.R. situation. The log-burn classification should be used only if the disturbance could be classed as more or less the one operation of logging and burning, as practiced on the coast and to some extent in the interior. For instance, if an area was selectively logged, and then burned ten years later, it was the burn and not the log-burn that caused the N.S.R.

J. Stand Structure 10 - Main Stand Selectively Logged

N.B. Do not use this classification unless instructed.

The main stand selectively logged classification is used only if:

(i) Area is still satisfactorily stocked.

(ii) Stand was more than 10% disturbed.

(iii) Stand affords no immediate logging show.

(iv) Stand was logged less than 30 years ago.

(v) Stand not classed as main stand non-commercial because of damage done through logging.

(vi) Stand was selectively logged for its main timber values and not for minor products only; (e.g. ties, poles, etc.). Thus, in stands that have been disturbed through the removal of minor products and yet the main portion of the type is still relatively intact, the stand should be classified as main crop immature or main crop mature as the case may be. The logging in this type of stand could be shown as a map note, but under no circumstances should the stand be classed as main stand selectively logged.
PART I  ITEM 2  ELEMENTS OF STAND STRUCTURE - contd.

J. Stand Structure 10 - Main Stand Selectively Logged - contd.

Note: In dealing with stands which appear to be selectively logged this classification should be used as sparingly as possible. That is try and fit the area into other classifications such as, immature with secondary mature or immature with non-commercial remnants of older stand. It is difficult to assess a stand as to its possibilities for a logging show, (iii) above. Therefore, coders attention is drawn to the section below on alternative methods for handling selective logging.

Main stand selectively logged should be used where it is impossible to determine what element of the stand is main.

Alternative Methods of handling Selective Logging

(i) If area is NOT satisfactorily stocked after logging, treat as N.S.R.

(ii) If stand was NOT more than 10% disturbed, treat as any other stand and code out the logging as a disturbance.

(iii) If stand still affords a good "logging show" after the logging, then it should be treated as main stand mature or main stand immature with secondary stand mature.  (Note: Do not treat logged areas in this way unless the loggable portion is quite extensive and can be accurately typed out.)

(iv) If stand was logged 30+ years ago, treat as any other stand and code out logging as a disturbance.

(v) If the damage to the stand after logging is very extensive, it should be classed as main stand non-commercial.
The key is the basis for typing, similar types having similar keys. The key is simply the summary of the more important factors that determine the type. When filling in the key always refer to the type list for correct combination of the components making up the key.

(A) Stand structure element

(B) Forest Type

(C) Age

(D) Height

(E) Stocking class

A. Stand Structure Element

The stand structure elements of recognized types that were checked off are written under this heading. Put main stand first, followed by secondary stands, if any. Only one main stand is allowed. All other components worth mentioning must be classed as secondary stands.

The entire key must be filled out for stand structure elements 1, 2, 3, 4, 5, 6, 9, and 10, while for stand structure elements 7 and 8, age, height, and stocking class may be omitted.

e.g. 2 - F(S) 1(5) - 4 9 - 4

7 - S

B. Forest Type

The forest type is found as follows:

(i) Mature stands - include any species comprising 20% of the volume.

(ii) Immature stands - include any species comprising 20% of the number of trees. In older immature stands, one should begin to take volume into consideration as well as number of trees.
B. Forest Type, contd.

E.g. 80 yr. old immature stand

H - 160 trees/acre; ave. diam. \( \frac{4}{0} \)"

F - 30 " " 12.0"

By strict 20% rule by number of trees, the type would be pure Hemlock. However, the average diameter shows that F should be included in the type. Therefore, the type should be HF.

The above rules should be used in labelling types so that the species are in order of importance; that is, in a B.S. type, the B is the more important of the two species.

(iii) Example of determining a mature forest type on an inventory survey:

(a) Coder establishes his type combination using the 20% rules (e.g., SL).

(b) Coder looks up mature list for an inventory survey and finds that the most applicable type is LCHBS and having code 3031.

(c) Coder enters type in Key as follows:

(SL) 3031 Note that the exact species combination is bracketed, not merely the species covered by the code number.

(iv) In pure Fir mature stands, minor components (species not in type by 20% rule) of the stand will be considered. The following minor elements of pure Fir stands shall be kept separate: Spruce, Yellow Pine, and Larch. The coder shall enter these in the Key as follows:

(a) (F) 1 - main stand Fir with minor amounts of miscellaneous species (coast only).
B. Forest Type, contd.

(b) (F(S))1(5) main stand Fir with minor amounts of Spruce or similar species. (All interior except Py and L areas.)

(c) (F(Py))1(9) main stand Fir with minor amount of Yellow Pine.

(d) (F(L))1(10) main stand Fir with minor amounts of Larch.

All interior pure Fir mature stands MUST fall into one of the last three categories. All coast pure Fir mature stands must go into Category (a).

Note: The above types should not be confused with Fir types in which Spruce, Yellow Pine, and Larch comprise 20% of the stand; e.g.,

(FL) 109 - main stand FL (F and L both 20%)

(LF) 109 - main stand LF

(FPy) 108 - main stand FPy

(FS) 104 - main stand FS

C. Age

Coder must enter the proper age code in the Key. This must be done with the aid of the type list, as the age coding and breakdown are different for each type of survey.

D. Height

Coder must enter the proper height class code in the Key. This must be done with the aid of the type list as the height coding and breakdown are different for each type of survey.

E. Stocking Class

Coder must enter the proper stocking class code in the Key.
PART I  ITEM 3 KEY, contd.

E. Stocking Class, contd.

This must be done with the aid of the type list as the stocking class coding and breakdown are different for each type of survey. Stocking class is based on the number of trees 13"+ for all mature and grown-up non-commercial stands except pure P1 and pure deciduous types, where number of trees 7"+ will be the basis. (Secondary mature and secondary grown-up non-commercial also).

Certain stand structure elements have fixed stocking classes:

Immature (all areas except Block Surveys and
(a) OF, eg. Code 1 and
SOF, eg. Code 2 on a special basis and
(b) OF or SOF and all Py age class 11 on the inventory basis, eg. Code 1) -
stocking class 5 only.

Main young non-commercial
(all areas except understocked and Block Surveys) - stocking class 5 only.
Do not use unless instructed.

Main young non-commercial (understocked) - stocking class 2 only
Do not use unless instructed.

Stocking class 2 for main young non-commercial should be used only in cases where the stand was classified as non-commercial because of the understocking.

Secondary young non-commercial - stocking class 5 only
(Except on Block Surveys where classes 1-5 can be used)

Secondary immature (Special) - stocking class 5 only
(Except on Block Surveys where classes 1-5 can be used)

F. Land Use and Site Group

See Item 40.

G. Date of Establishment

(Entered for inventory and special only.) The date of establishment is the date when the average tree in the stand

PART I. Item 3, contd.

(13)

(1957)
G. Date of Establishment, contd.

became established. This date is found by averaging the ages of the representative sample trees and subtracting the average from the date of survey. Do not confuse the Date of Establishment with the Date of History (Item 29) which is the present date minus the oldest average tree plus the appropriate number of years for establishment after the disturbance.

Example of Date of Establishment
1954 sample tree date: F-43 yrs.
    F-47 yrs.
    C-39 yrs.
    H-35 yrs.

(i) Assume that 85 yr. old H was not representative.

(ii) Average remaining samples (Ave. = 43 yrs.)

(iii) Date of establishment (1954-43 = 1911)

When writing date of establishment on the code sheet the following rules should be observed:

(a) Date of establishment need only be filled out for main stand immature, main stand young non-commercial, and main stand N.S.R.

(b) The ENTIRE date of establishment is written out.

(c) If date of establishment since 1900, call to nearest year; e.g. 1912.

(d) If date of establishment is 1900, write 1901.

(e) If date of establishment 1900 or earlier, take to nearest 10 years.
    e.g. Actual Date 1872, then write 1870
        "  1885  "  "  1880
        "  1886  "  "  1890
        "  1900  "  "  1901
PART I  Item 4  PATHOLOGICAL REMARKS (volume and older immature stands only)

The coder is required to appraise the condition of each species in the main stand on the basis of the eight abnormalities listed under Item 4 on the Code Sheet (F8485). To do this the coder must estimate the percentage of trees of each main species which are Suspect. A Suspect tree is any living tree having one or more of the abnormalities listed (see Part III, pages 3 - 11 of the Sampling Manual for complete descriptions of these abnormalities). In addition, the coder must indicate the approximate frequency of occurrence of each abnormality as light, medium, or heavy.

It must be pointed out that a coder does not necessarily apply a factor to any species by indicating a high percentage of Suspect trees. The primary objective is to provide a measure of the condition of a stand as indicated by the external appearance of its main species. Some species, notably lodgepole pine, show a high percentage of Suspect trees but comparatively little defect. For example, "Pl - scars heavy, fork light, mistletoe medium" on a code sheet conveys more than "Pl looks poor".

A reliable appraisal can best be obtained by actually establishing a plot area (1/8 acre is suggested) in a stand representative of the forest type being coded. Suspect percentages can then be fairly quickly assigned to each main species and the frequency of the various abnormalities noted. Recognition of a representative stand condition also requires that the coder give the stand fairly close scrutiny as he travels through it.

Coders will also get a reliable indication of the relative percentage of Suspect trees in various species from the tallies which they themselves will establish in their compartments.

Examination of some of the decay analysis samples indicates that coder's estimates of Suspect percentages tend to be low. It was noted that for most coniferous species (except Pl), the percentage of Suspect trees varied from 20 to 50 percent depending, in part, upon the age of the stand. Suspect percentages in older immature stands (except Pl) varied from 20 to 40 percent while mature stands varied from 30 to 30 percent. Pl stands showed higher Suspect percentages in older immature stands (up to 60 percent) and even higher percentages in mature stands. While it is recognized that the percentage of Suspect trees in any forest stand may be dependent upon other factors as well as age (for example stand history), the age factor provides a reliable basis for estimation. For example, species occurring as scattered vets in a climax or old growth forest may be 100% Suspect.
A. Code Sheet Checkoff

(i) Code 1 - More or less uniformly spaced and generally even-aged. Previous crop trees absent or unimportant. New forest was established on exposed, open ground;

   e.g. stand coming in after burn, clear logging, etc.

(ii) Code 2 - More or less uniformly spaced and generally even-aged. Previous crop trees absent or not important. New forest was established under cover of an old forest. (Old forest now gone or unimportant.)

   e.g., immature H.B. stand that is now the main stand, having been established under an old F.H. forest. This F.H. forest is no longer important as it has deteriorated and broken up, and exists only as secondary grown-up non-commercial.

(iii) Code 3 - More or less uniformly spaced and generally even-aged. Previous crop trees are absent or not important. New forest (present main stand) was established under cover of immature stand of older age class.

   e.g., twenty-five year old C.H. stand that has taken over as main stand from 80 year old Fir.

(iv) Code 4 - More or less uniformly spaced and generally even-aged. Previous crop trees absent or not important. New forest (present main stand) was established under a nurse crop non-commercial stand.

   e.g., main stand young Spruce coming up under non-commercial Aspen.
PART I  Item 5  MODE OF ESTABLISHMENT OF CLASS MAIN IMMATURE, contd.

A. Code Sheet Checkoff, contd.

(v) Code 5 - True all aged immature forest in which all ages of trees except merchantable are represented.

    e.g. By stand of all ages with some old vets classified as non-commercial, but with NO trees of commercial value as yet.

PART I  Item 6  VIGOUR OF CLASS MAIN MATURE

A. Code Sheet Check off

(i) Code 1. Youthful, regardless of age: i.e., youthful appearance, rapid growth, etc. Stand has attained the minimum rotation age for cutting. Trees of the previous crop are absent or not important.

(ii) Code 2. Mature, ripe; stand has not started to break up. Previous crop trees and secondary crop trees absent or not important.

(iii) Code 3. Over-mature. Stand is beginning to deteriorate and break up. Secondary crop trees present but no appreciable proportion has become merchantable.

(iv) Code 4. Decadent stand. Stand has broken up many years ago but remnants are still in commercial condition and are still the main crop. Secondary crop trees are well advanced, with a few being of a merchantable size.
Code 1. Decadent stand, deteriorated to the point where most of the trees are non-commercial, but still occupying the area and excluding the establishment of a second crop. Second crop trees are still a minor element and have not reached the stage yet where any appreciable proportion are merchantable.

Code 2. Stand disturbed to the point where remaining trees do not provide a commercial logging chance, but which are excluding a normal second crop.

E.g. H.B. stand was high-graded, leaving only damaged and worthless trees which are classified as the non-commercial main stand. These N.C. trees are preventing the satisfactory development of a young stand.

Code 3. Stand has developed into a crop of trees of very poor form, and is preventing the satisfactory development of a normal second crop.

E.g. Branchy non-commercial 160-year old Douglas fir stand that is suitable for fuel wood only.

Code 4. Stand which was originally over-stocked, has now stagnated and become locked. The stand provides no merchantable volume and is preventing the development of a normal second crop.

E.g. Stagnated 100 year old P1 stand which is preventing the development of a secondary immature S stand.

Code 5. Stand normally merchantable but classed non-commercial as an isolated patch.

E.g. (i) Small patch of FC vets in large burn, suitable only for seeding purposes.

(ii) Small patch of F vets in expanse of open range.
Code 1. Doubt if commercial stand will develop.

   e.g. (i) Young F stand, badly damaged as a result of
          logging the old vets.

          (ii) Young N.C. Alder stand. Little chance of
               any commercial species coming in.

Code 2. Stand too sparse, no likelihood of filling in, and no
         chance of trending to normal.

   e.g. Scattered hemlock wolf trees (30 years old)
        growing on an old logged-over area. Not likely to
        fill in because of dense brush, shrubs, debris,
        rock, etc.

Code 3. Dense brushy growth occupying the area and preventing
         the establishment of a commercial stand.

   e.g. Dense aspen coming in after burn, preventing any
        commercial species from becoming established.

Code 4. Stand over-stocked, locked, and likely to become and
         remain stagnant.

   e.g. P1 stand, 20' tall, 75 years old. Stand showing
        negligible diameter and height growth.

Code 5. Stand normally merchantable prospect, but classed
         non-commercial as an isolated patch.

   e.g. (i) Patch of FC immature, left in centre of large
        burn.

         (ii) Patch of F immature in open range.
A. Code Sheet Check off (Block Surveys only)

Code 1. Secondary mature consisting of advanced growth of an immature stand or stands.

Code 2. Secondary mature consisting of a commercial volume remnant of a:

(a) deteriorated stand;

(b) previous mature stand that has been devastated by some catastrophe such as fire, logging, etc.

Code 3. Secondary mature consisting of advanced growth of an immature stand or stands, plus a commercial remnant of a deteriorated stand or a devastated previous mature stand.

Code 4. Other age class and/or height class of mature in a main stand mature.
PART I  Item 10  DEVELOPMENT OF SECONDARY CROP IMMATURE

   Code 1. Poor development.
   Code 2. Fair development.

   This classification is a relative description of the development of secondary immature stands. The height and diameter growth rate will aid in appraising secondary stand development.

PART I  Item 11  CONDITION OF STAND

   Code  Sheet Check-off

   Code 1. Healthy and undamaged - no appreciable sign of damage due to insects or disease.
   Code 4. Infested - slightly disturbed by insect attack.
   Code 5. Diseased - slightly infected recently.
   Code 2. Infested - seriously disturbed by insect attack.
   Code 3. Diseased - seriously infected; infection of long standing; generally prevalent.

   This classification is one of the most important on the code sheet, and requires considerable effort to secure the best obtainable answer.

PART I  Item 10, Item 11

(21)
(1955)
Code 1. Clear Logging with Seed trees System

Logging that more or less denudes the area. Clear logging should leave scattered seed trees throughout the area to assure natural regeneration. This method is used mainly in the coast forests.

Code 2. Patch Logging System

Patch logging is a logging method whereby the area is clear cut in patches (e.g., 100 acres) thereby leaving patches of timber to seed in the logged over portions. These remaining stands will be logged at a later date. The patch logging system is primarily a coast forest method.

Code 3. Selection System

A logging method which aims to cut the growth that has accumulated during the cutting cycle. e.g. Stand is to be logged down to a certain diameter limit every 20 years (cutting cycle). This selection type of logging takes out the loggable portion of the stand, leaving the residual portion to provide another cutting 20 years hence.

Code 4. Shelterwood System

The shelterwood system is a partial logging method which aims at leaving a partial cover to provide seed for the establishment, and "shelter" for the development of a new crop. Once these residual trees have served their purpose and the new stand is firmly established, they will be harvested in one or more operations. The shelterwood system tends to promote the development of a two storied forest and should be used for tolerant species only.
PART I  Item 13  SPECIAL SITE CONSIDERATIONS

Code 1. On area requiring drainage.
   e.g. swampy bottom land.

Code 2. On area subject to excessive temperatures.
   e.g. hot, dry, southern slopes in southern interior.

Code 3. On area subject to excessive erosion.
   e.g. excessively steep side hills, where soil would be
        rapidly washed away if area became denuded, usually
        associated with heavy slide area.

Code 4. On area subject to excessive wind.
   e.g. Unprotected west coast flats such as area
        directly south of Nootka Island.

Code 5. On area subject to excessive flooding.
   e.g. river bottom areas that are completely
        under water for most of the spring months.

The "special site consideration" classification does not
need to be checked for every type, but only for those
types where the above conditions apply.
PART I Item 1

SUGGESTED LOGGING METHOD

This classification describes the logging method most desirable for harvesting a specific stand.

Code 1. Hand Logging

Hand logging is usually feasible for a distance of up to 20 chains from tide water, depending on topography.

Code 2. Horse Logging

Logging with the aid of horses is a common method of logging practiced in the interior. Cat hauling is often used in conjunction with horse logging.

Code 3. Cat Logging

Logging with cats cannot be done in steep or excessively rocky areas. It is used in the open interior fir and yellow-pine stands on moderate slopes, also in interior spruce, balsam, and lodgepole pine.

Code 4. Skidder - Coast only.

Code 5. Hi-Lead

This method is seldom applicable in the interior but is the most common of the logging methods used on the coast.

Code 6. Sky-hook

The sky-hook method of logging is used for the abnormally rough and inaccessible areas.

The suggested logging method means the method of logging and NOT the method used in hauling.

(1955)
PART I  ITEM 15  UNDERSTOREY (Mature and older immature stands only)

Code 1. With

Code 2. Without

Understorey is defined as 200 + potential crop trees per acre established over a fair range of diameters up to 12" D.B.H. class (i.e. up to 13.0"). In other words, the understorey would be the minimum stand left by cutting 14" D.B.H. class and over (i.e. 13.1") and consisting of trees of the following species ONLY:

Northern Interior Spruce - Balsam Region: FS
Interior Dry Belt Region: FPyLS
Interior Wet Belt Region: FCHLSPw
North Coast Region: HESC
Lower Coast Region: FCH

A. Rules

(i) When understorey is present (i.e. Code 1 is checked) the species comprising 20% or more of the understorey should be checked. Do not check off species not making up 20% or more of the understorey.

(ii) When understorey is not present (i.e. Code 2 is checked). It is permissible to check off what species do occur under the general level of the crown cover.

PART I ITEM 16  UTILIZATION VALUE - Mature stands (main or secondary) and older immature.

Code 1. Primarily saw logs and/or pulp.


  e.g. poles, piling, ties, fence posts, cordwood pulp, mine props, fuel wood, shingle bolts, etc.

The "utilization value" is simply the class of product for which the stand could best be used.
PART I ITEM 17 Grazing Value

Code 1. Grazing accessible - can be ridden through easily.

Code 2. Grazing accessible - can be ridden through with some difficulty.

Code 3. Grazing accessible - not possible to ride through; stock can work through.

Code 4. Grazing inaccessible - impossible for stock to work through due to windfalls, dense stocking, etc.

Code 5. No grazing - little or no feed.

PART I ITEM 18 Map Notes in Addition to Key

A. Seed Trees

In the space provided, enter the species of seed trees or vets that are present (if any) in the stand, provided that they warrant a mention on the final map. A map note of this type is of greatest value in N.S.R. stands.

B. Poles

In the space provided, enter the species of poles (if any) that are present. This classification should be checked only if there is considerable values in pole material present, and not just scattered individuals throughout a stand.

C. Ties

In the space provided, enter the species of ties (if any) that are present. This classification should be checked only if there are considerable values in tie material present, and not just scattered individuals throughout a stand.

D. Miscellaneous Map Notes

This space is reserved for any additional notes that warrant mention on the map.

e.g. species and date of establishment of older immature, values in piling, etc. etc.

N.B. Do not use above map notes unless significant values are present.

E. Site

Check off (G) Good, (M) Medium, or (P) Poor, based on curve values (Item 39).
PART I ITEM 19 AVERAGE D.B.H. - 9"+ (Main and secondary stand mature and older immature only).

Code 1 - 10"

Code 2 - 12"

Code 3 - 16"

Code 4 - 22"

Code 5 - 28"

Code 6 - 40" +

PART I ITEM 20 LOGGING CHANCE

Code 1 - Good Logging Chance: good ground for logging, not too rough.

Code 2 - Fair logging chance: ground quite rocky, rough, steep, etc.

Code 3 - Poor logging chance: ground excessively rough, rocky, etc.

Logging chance means the physical or topographic logging chance only and should NOT take into consideration the type of timber on the area. Thus, a flat, accessible, area should be termed a good logging chance, whether the stand present is mature timber or ten-year old immature.

Any further elaboration on the logging chance of an area can be made in the type and area description, Item 43.
The following rules should be adhered to in taking sample trees:

(i) Pick trees in upper height range (not average height); i.e. heights of dominants and co-dominants.

(ii) Pick trees in upper diameter range (not average diameters).

(iii) Bore trees close to ground level where feasible (1-2 ft).

(iv) Take diameter at breast height (4 1/2 ft. above the ground – D.B.H.)

(v) Record the boring age, record the boring height, refer to the stump age-total age correction factor table to obtain the appropriate correction; then record the total age. (Refer to the pocket manual for stump age-total age correction factor table.)

(vi) If possible, get ages from stumps in cut-over portions of the type, keeping in mind the date of logging so that the total age can be determined.

Definitions

(i) Dominant Trees: Trees with crowns extending above the general level of the crown cover, larger than the average trees in the stand and with crowns well developed but possibly somewhat crowded on the sides.

(ii) Co-dominant Trees: Trees with crowns forming the general level of the crown cover, usually with medium-sized crowns more or less crowded on the sides.

(iii) Intermediate Trees: Trees shorter than those in the two preceding classes, with crowns extending into the crown cover formed by co-dominant and dominant trees, usually with small crowns considerably crowded on the sides.

(iv) Over-topped trees: Trees with crowns entirely below the general level of the crown cover.

The number of sample trees which should be measured by the coder depends upon the variation in the stand. For example, a typical well-stocked, even-aged P1 stand may require but one sample tree, whereas a less uniform stand of P1 will require many heights and ages.

Rule: Take enough sample trees to firmly establish the height and age classification into which the various stand elements should be put; also so that a representative site index can be determined for each species in the type.
PART I  ITEM 22  ASPECT

Code 1. Flat
Code 2. North
Code 3. North-east
Code 4. East
Code 5. South-east
Code 6. South
Code 7. South-west
Code 8. West
Code 9. North-west

Aspect is the general direction of slope.

PART II  ITEM 23  AVERAGE SLOPES

Code 1. Flat or moderate (0 - 20 topographic abney reading)
Code 2. Medium (20 - 40 topographic abney reading)
Code 3. Steep generally (40-60 topographic abney reading)
Code 4. Excessive (60 + topographic abney reading)

PART II  ITEM 24  ACCESSIBILITY

Accessibility is a measure of permanent topographic feasibility of logging an area. This classification does not concern itself with timber values, but rather with topographic features; e.g. rock bluffs, canyons, etc., and other such features which cut the minor areas off from normal access.
PART I ITEM 25 ELEVATIONS

Code 1. 0 - 2000 feet
Code 2. 2000 - 4000 feet
Code 3. 4000 - 6000 feet
Code 4. 6000 - 8000 feet
Code 5. 8000 + feet.

PART I ITEM 26 BASIC CLASS NUMBERS

Code 1. Icefield, Snowfield
Type out only large areas of snow or ice that are permanent types. Patches of snow that would undoubtedly be absent on any photograph taken later in the summer should be left as alpine.

Code 2. Alpine, treeless, rocky, blueberry, heather, alpine meadows, etc.

Code 3. Rock outcrops only. Do not type small areas of rock out of alpine or scrub.

Code 4. Rockslide, talus. This type should be accompanied by a slide symbol showing the direction of the slide.

Code 5. Quarry.


Code 7. Sand (land area).

Code 8. Tailings.


Code 10. Upland forest on non-productive site - Scattered scrubby trees of no potential use in upland areas.

Code 11. "N.P." Disturbed - non-productive areas that are normally classified as "10" when trees are present. Show symbol for disturbance: e.g. □ burn symbol.
Code 12. Lowland forest on non-productive site - Minor lowland non-productive areas (100 acres or less) can be labelled with basic class number "12" accompanied by the species present. e.g. 12 (FC).

Code 13.

Code 14.

Code 15. Lakes.

Code 16. Lake mud flats.

Code 17. Lake sand flats.

Code 18. Lake gravel bars.


Code 20. Lake rocks at or near the surface.


Code 22.

Code 23.

Code 24.


Code 27. River sand flats.


Code 32. River slough.

Code 33.

Code 34.

Code 35. Swamp.


Code 37.

Code 38.

Code 39.

Code 40. Cultivated farm fields.

Code 41. Fallow fields — formerly under cultivation; at present not in crop.

Code 42. Clearings — cleared of cover and debris, but not tilled.

Code 43.

Code 44.

Code 45. Orchard.

Code 46.

Code 47.

Code 48.

Code 49.

Code 50. Roads, railroads, power-lines, rights of way (cleared), flumes, pipelines.


Code 52. Urban — district municipality.


Code 55. Airport.

Code 56. Isolated summer resort.

Code 57. Isolated industrial plan. (When using state whether sawmill, cannery, etc. on back of photo.)

Code 58. Power or irrigation development, dam, power plant.

Code 59.

Code 60. Artificial hay field.

Code 61. Overgrazed forest or stump pasture.

Code 62. Natural hay field - may or may not be harvested.

Code 63. Open lowland range with no forest cover.

Code 64. Open upland range.

Solid type lines are required between any classification between groups (e.g. 42 and 63).

Dotted type lines are required between any classification within groups.

Groups: - (1-9, 11); (10, 12); (15-21); (25-31); (35-36); (40-42); (45); (50-57); (60-64).

e.g. Solid type line between 10 and 2.
Dotted type line between 60 and 63.
The percentage composition, diameter range, average diameter, height range, and A.M.H. of the various species making up the individual stands are recorded in the stand description table. All species comprising 10% or more of the main stand or of a secondary stand should be mentioned, although the recording of lesser elements is encouraged. These details should apply to individual stands only, that is main only or secondary only.

For example, under secondary stand, Douglas fir was recorded as comprising 40% of the stand with a diameter range of from 10 - 36 inches and an average diameter of 26 inches, a height range of 60 - 100 feet and an A.M.H. of 110 feet. This means that the diameter and height average measurements and limits apply to the Douglas fir in the secondary stand only and not the type as a whole.

When estimating diameter range in older immature and in mature stands, ignore the 0 - 8 inch diameter classes. Thus the lower limit of any diameter range may be as low as 9 inches.

In the case of height range, ignore the lowest storeys in older immature and mature stands. That is, generally speaking, trees less than 40 to 50 feet high, or those with diameters less than 9 inches.

When estimating diameter range and height range in younger immature stands, both height and diameter may range from zero.

Rules:

(i) Calculate percentages using number of trees for younger immature, and volume for older immature and mature.

(ii) Consider only potential crop trees in main stand immature.

(iii) Mention all species comprising at least 10% of the stand.
PART I Item 28 MISCELLANEOUS HISTORY

A. Code Sheet Check off.

Code 1. Unknown; use this classification only if no sign of the disturbance can be found.

3. Windthrow; stand damaged or completely blown down by wind.

4. Slides; mud slides, snow slides, etc., where area remains classed as productive.

5. Floods.

6. Defoliating insects; insects which attack the needles or leaves of the tree, eg. hemlock looper. Watch for dead and dying foliage, needle tunnels, etc.

7. Cambium insects; insects which attack the trunk of the tree. Watch for wood-pecker holes, tiny sawdust piles at the base of the tree, insect tunnels, etc.

8. Fumes; fumes from industrial plants that kill trees (e.g. smelters).

9. Disease; watch for conks, witches broom, etc. If infection is heavy windthrow damage is usually high.

10. Ice storm damage; stand broken by snow and ice. (Usually closely knitted immature stands.)

11. Land clearing; once cleared by man, now reverting to forest.

12. Older field cultivation; former cultivated field now reverted to forest.

13. Filling in swamp; forest gradually reclaiming swamp land.

14. Recent alluvial deposits; deposits of silt by rivers.

15. Ice and glacier retreat; forest reclamation land once covered by glaciers.

16. Burning.

17. Burning; re-burning.

18. Logging and Burning; e.g. slash burn after logging or escape fire after cutting.

19. Logging; burning, re-burning.

20. Windthrow; burning.

21. Defoliating insects; burning.

22. Cambium insects; burning.

23. Fumes; burning.

24. Disease; burning.

25. Ice storm; burning.
A. Code Sheet Check off - contd.

Code 26. Land clearing; burning.

27. Logging; windthrow.

28. Part-hewn ties only; partially logged for ties only.

29. Part-cedar poles only; partially logged for cedar poles only.

30. Part-piling only; partially logged for piling only.

31. Part-cedar poles and ties only; partially logged for cedar poles and ties only.

32. Part-ties and piling only; partially logged for ties and piling only.

33. Part-poles and piling only; partially logged for poles and piling only.

34. Part-ties, poles, piling, and other minor products.

35. Pre-logging small timber; logging which takes out all merchantable small timber in advance of the main logging show. This logging method removes trees which would normally be damaged during the course of main logging operations.

36. Hand logging; logging by hand using no power whatsoever, i.e., no machinery or engines, horses, etc.

37. Salvage logging; logging of timber (standing or down) which has been left by a catastrophe such as logging, burning, insect attack, disease, etc. This timber is salvaged as it would normally become worthless within a few years if not taken out.

38. Clear logged; logging which more or less denudes the area, viz. coast logging.

39. Selectively logged-merchantable; partial logging that takes out merchantable material. This is to distinguish it from areas managed on short cutting cycles by careful marking of trees to be cut (40 - below), and minor product cutting (e.g. poles, piles, ties, etc.).

40. Selectively logged-marked; partial logging of stand that has been marked.

B. Rules on Disturbances for Miscellaneous History

(1) Coder will write R.D., E.D., E.E.D., and D.R. where applicable in the square under main stand. If a disturbance affected a secondary stand only, then R.D., E.D., and E.E.D., where applicable, is put in the second square.
B. Rules on Disturbances for Miscellaneous History - contd.

(ii) R.D., E.D., and E.E.D. are used for disturbances that affect a stand, while D.R. is used only for the disturbance responsible for establishing a stand.

(iii) In combinations of two or more histories (e.g. logging; windthrow), the disturbances can be in any order of occurrence. Combinations should not be checked, however, unless the disturbances occurred in the same general period.

For definitions of R.D., E.D., E.E.D., and D.R. see Item 29.
PART I  Item 29  DATES OF HISTORY

A.  Rules for Disturbances

(1)  Fill in actual dates of disturbances (single or periodic).
    e.g.  R.D. = 1926  (single)
         R.D. = 1926 - 1935  (periodic)

(2)  For dates 1900 or earlier take to nearest ten, while
     for dates later than 1900, take to nearest year.
     e.g.  RD = 1884, then write 1880

(3)  Bracket all estimated dates of history (single or
     periodic).
     e.g.  Exact date of burn unknown.  Coder estimates date
          to be 1912.  Therefore, date must be bracketed,
          (1912).  However, if the date of burn was definitely
          known to be in 1912, then the date is entered direct
          with no brackets.

B.  Aids in estimating the disturbance dates

(1)  Total age of sample trees.  Take oldest representative sample
     tree age found and add an estimated number of years for
     the stand to become established after the disturbance.
     Subtract the total from the date of survey, which gives
     the date of the disturbance.

     In extensive types, there is always the possibility of
     finding some trees which survived the disturbance, as
     residuals, and therefore, the sample trees used must
     be those which became established as a result of the
     disturbance in question.
     e.g.  Sample tree ages 24, 29, 27, 22, 25
          Estimated time for stand to become established
          = 5 years.
          Date of survey:  1954
          Estimated date of disturbance =
          1954 - (29 + 5) = (1920)

(2)  Release counts:  Another way of estimating dates of history
     is by estimating the number of years since release of the
     former second stories.  This method is especially useful
     where the disturbance was relatively slight, (selective
     logging, insect attack, etc.).
e.g. Area with old selective logging history. Sample tree = 65 years (total age). Width of rings showed that a distinct increase in growth rate occurred 11 years previously. Date of Survey: 1954 (N.B. allow 2 years for tree to respond to release.) Estimated date of logging = 1954 - (11 + 2) = (1941)

In cases of disease, insect attack, etc., this estimated figure shows when the previous crop tree died. Therefore, the exact date of disturbance would probably be somewhat earlier than the above date. e.g. Estimated date of insect attack = (1938 - 1940)

C. Definitions of Disturbances

(1) R.D. (Recent Disturbance)

R.D. may be defined as the most recent or latest disturbance in a stand.

(a) Most recent disturbance in mature timber stand. e.g. Main stand mature that was logged selectively for cedar poles in 1935 - 1937:

<table>
<thead>
<tr>
<th>R.D.</th>
<th>E.D.</th>
<th>E.E. D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 1935 - 1937</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

(b) Most recent disturbance that disturbed an immature stand which was established by some previous disturbance.

<table>
<thead>
<tr>
<th>R.D.</th>
<th>D.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1948</td>
<td>1890  (taken to nearest 10)</td>
</tr>
</tbody>
</table>
(c) Most recent disturbance disturbing the immature which was established by a previous disturbance (D.R.) and disturbed later (E.D.).
    e.g. Spruce-Balsam stand established from the result of an old insect attack in 1890-1901.
    The area was logged in 1935 for the old vets, and attacked again by insects in 1942 - 1944:
    R. D. = 1942 - 1944
    E. D. = 1935
    D. R. = 1890 - 1901

(d) Most recent disturbance disturbing the immature which was disturbed on two previous occasions (E.D. and E.E.D.) in addition to the disturbance that established the stand.
    e.g. Fir-Cedar stand established by a burn in 1860 and subjected to partial logging in 1926 - 1931, and insect attack in 1939 - 1944, and a further logging in 1949 - 1953.
    R. D. = 1949 - 1953
    E. D. = 1939 - 1944
    E. E. D. = 1926 - 1931
    D. R. = 1860

(2) E.D. (Earlier Disturbance)

An earlier disturbance (if present) is the disturbance that precedes the recent disturbance.

(3) E.E.D. (Earlier Early Disturbance)

An earlier early disturbance (if present) is the disturbance that preceded both the R.D. and E.D. In most cases, the E.E.D. classification may be omitted. It should be used only in important stands that warrant such an intensive description.

(4) D.R. (Disturbance Responsible)

N.B.

The D.R. (disturbance responsible) classification is used to describe the disturbance that established a stand (immature or mature). In mature stands, D.R. may be omitted unless the stand warrants such an intensive classification.
e.g.'s Immature stand showing various disturbances:

1907
\[ \xrightarrow{1931 - 37 \text{ Insects}} \] D.R. = 1907

1907
\[ \xrightarrow{1931 - 37} \] R.D. = 1931 - 1937

In types with more complicated histories, it is advisable to make a diagram similar to the one above. This makes for a much clearer picture of the history.
PART I  ITEM 30  DEGREE OF DISTURBANCE

The degree of disturbance of the stand in percent according to:
- R.D. - Recent disturbance
- E.D. - Earlier disturbance
- E.E.D. - Earlier early disturbance
- D.R. - Disturbance responsible (do not use unless instructed).

Code 1.  0 - 25% disturbed
   2.  26 - 50% "
   3.  51 - 75% "
   4.  76 - 100% "

These disturbance degrees do NOT refer to percentage volume disturbance, but rather to an area disturbance of the whole stand (main plus secondary).

Examples
(1) 26 - 50% of the area of an immature plus mature stand may be disturbed when the secondary mature stand is logged.

(2) Selective logging may occur throughout a stand but only 0 - 25% of the total stand area may be disturbed.

PART I  ITEM 31  SEED TREE OCCURRENCE (N.S.R. and Main stand young non-commercial only)

Code 1. Marginal available - seed source is available to N.S.R. area from surrounding timber.

2. Groups sparse - seed source is available from scattered seed tree groups found throughout the non-stocked area.

3. Groups plentiful - seed source is available from numerous seed tree groups found throughout the N.S.R. area.

4. Not available - seed source not available. Insufficient seed trees, and marginal timber too distant to satisfactorily seed in the entire area.
PART I ITEM 32 PERCENT STOCKING

(N.S.R. only)

A. Code Sheet Check-off

Code 1 = 0 - 10% stocked (special)
2 = 11 - 20% "
3 = 21 - 40% "
4 = 41 - 50% "

Code 1 = 0 - 20% stocked (inventory)
3 = 21 - 50% "

51% + stocked - reclassify as immature (see Item 2, \( \geq 2 \) rule (ii))
21% + stocked - (Py only) reclassify as immature

Check-off if either Uniform or Patchy stocking is significant in deciding on immature or N.S.R. classification.

B. Examples (Using 100% Stocking Table - Item 38 on back of code sheet.)

(i) HC stand; \( 1\frac{1}{4} \) years of age; 200 trees/acre

\[
\text{\% stocking} = \left( \frac{200 \times 100}{750} \right) = 27\% \text{ stocked}
\]

(ii) F stand; 3 years of age; 450 trees/acre

\[
\text{\% stocking} = \left( \frac{450 \times 100}{1000} \right) = 45\% \text{ stocked}
\]

(iii) 25 chain quadrat sample shows 13 of the 80 mil-acres stocked.

Total species tallied were: Pl = 9 trees;
S = 5 trees; B = 2 trees. Age = 9 years
% of mil-acres stocked (m.a.s.) = \( \left( \frac{13 \times 100}{80} \right) \% = 16\% \)

% of area stocked = \( \left( \frac{16\% \times 2}{1} \right) = 32\% \)

100% stocking for 9 year old stand = 1000 trees/acre

32% " " " " " " " " = \( \left( \frac{32 \times 1000}{100} \right) \)

= 320 trees/acre

Therefore Pl has \( \left( \frac{9}{16} \times 320 \right) = 180 \text{ trees/acre} \)

S has \( \left( \frac{5}{16} \times 320 \right) = 100 \text{ trees/acre} \)

B has \( \left( \frac{2}{16} \times 320 \right) = 40 \text{ trees/acre} \)

PART I ITEM 32

(1957)
(N.S.R. and Maine stand non-commercial only.)

Code 1. Not plantable due to classification as non-commercial.

2. Not plantable due to dense debris, slash, snags.

3. Not plantable due to rough, steep, or rocky ground.

4. Not plantable due to isolation, small area.

5. Not recommended for planting - will restock naturally.

6. Plantable - good ground.

7. Plantable - sparse, brushy, deciduous.

8. Plantable - considerable debris, slash, snags.

9. Recent logging or burning (1 - 5 years) -
areas recommended for future examination.
PART I ITEM 34 GROUND DEBRIS

(N.S.R., Main stand young non-commercial, and 0 – 20 year old immature only)

Code 1. Negligible: - 0 – 10% of surface area covered by debris.

2. Moderate: - 11 – 50% of surface area covered by debris.

3. Heavy: - 51% + of surface area covered by debris.

PART I ITEM 35 NUMBER OF SNAGS PER ACRE

(N.S.R., Main stand young non-commercial, and 0 – 20 year immature only.)

Code 1. Negligible

2. 0 – 10

3. 11 – 30

4. 31 +

A snag is defined as any dead standing tree 4" dbh or over and 10' tall or over.

PART I ITEM 36 AVERAGE D.B.H. OF SNAGS

(N.S.R., Main stand young non-commercial, and 0 – 20 year immature only.)

Code 1. Average d.b.h. - 10"

2. Average d.b.h. - 16"

3. Average d.b.h. - 22"

4. Average d.b.h. - 28"

5. Average d.b.h. - 40"

6. Average d.b.h. - 52" +

PART I Item 34, 35, 36

(45)

(1957)
PART I  ITEM 37  HAZARD RATE

Code 1. Extreme danger.


A. Factors Affecting Hazard

(a) Proximity to cause (roads, trails, railroads, etc.)
    i.e. closer to highway, etc., the greater the danger
    from fire.

(ii) Type of stand:
    (a) more danger of fire in coniferous than in
        deciduous stand.
    (b) Generally, more danger of fire in immature
        than in mature.
    (c) presence of slash, debris, and snags increases
        fire hazard.
    (d) more danger of fire in dry, exposed sites than
        in wet, swamp areas.

(iii) Regional climate:
    (a) negligible danger in high summer rainfall areas:
        e.g. North coast.
    (b) extreme danger in areas abnormally dry during
        the summer; e.g. east coast of Vancouver Island.

PART I  ITEM 38  100% STOCKING TABLE

<table>
<thead>
<tr>
<th>Age</th>
<th>No./Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>1000</td>
</tr>
<tr>
<td>11-20</td>
<td>750</td>
</tr>
<tr>
<td>21-40</td>
<td>500</td>
</tr>
<tr>
<td>41-60</td>
<td>300</td>
</tr>
<tr>
<td>61-80</td>
<td>200</td>
</tr>
<tr>
<td>81-100</td>
<td>150</td>
</tr>
<tr>
<td>101+</td>
<td>100</td>
</tr>
</tbody>
</table>

PART I  Item 37, 38
(1957)
PART I Item 39 SITE INDEX

The coder will determine the site index of each main species in a type by applying the sample trees measured in Item 21 to the site index curves found in his pocket manual. The procedure should be:

(1) Average the dominant and codominant sample trees of each species obtaining an average age and average height for each species separately.

(2) Apply this "average tree" to the site index curve for the species in question to obtain the site index for that species in that particular type.
   e.g. A pure Douglas fir type on the coast; 3 sample trees were measured.
       F - 30.0" - 175 years - 185'
       F - 40.0" - 185 years - 180'
       F - 35.0" - 180 years - 175'

       Average age - 180 years
       A.M.H. - 180'

Using the site index table for coast Douglas fir plot height over age. Trace the coordinate point back to 100 years using the curves as a guide and the site index is seen to be approximately 150.

(3) When recording site index on the code sheet list the species in order of importance, according to the Stand Description, Item 27.

When recording the site index in the IBM check-off, Item 44, columns 56 and 57, use the site index value for the most important species in the type.

Note:

In young non-commercial (0-20 year), young immature (0-20 year), and N.S.R. stands, use previous crop remnants or surrounding timber to estimate site index.

Note:

Use the Fieldman's pocket manual to classify all stands into Forest productive (Good and Medium sites) and Forest low site (Poor sites from curves). See Item 18 on code sheet for check off.
PART I Item 40 LAND USE AND SITE GROUP

The following are the Land Use and Site Group classification of which only the first four are to be used unless otherwise instructed.

Code 1 - Forest Productive Site
Code 2 - Forest Low Site
Code 3 - Forest Non-Productive Site
Code 4 - Range Productive Site
Code 5 - Range Low Site
Code 6 - Range Non-Productive Site
Code 7 - Agricultural Productive Site
Code 8 - Agricultural Low Site
Code 9 - Agricultural Non-Productive Site

A. Forest Productive Site (Code 1) (greater than poor from curves, Item 39)

A forest productive site will grow a second crop in a normal rotation and the classification should be reserved for productive areas which are mainly suited for the growing of forests.

B. Forest Low Site (Code 2) (falling into poor from curves, Item 39)

Forest Low Site: will grow second crop in long rotation.

This classification will be used to describe the poorer sites that are approaching the non-productive classification.

C. Forest Non-Productive Site (Code 3) (Item 39)

A forest non-productive site will not grow a second crop except on an extreme rotation.

This classification will not be used to describe stocked forest.

For non-productive areas code sheets are not warranted and map notes will be used. These map notes are:

"10" - Basic class number "10" is used to describe small areas of unsatisfactorily stocked forest cover growing on upland non-productive areas.

"N.P." - A map note "N.P.", followed by a burn symbol should be used on all areas that have been denuded so completely by burning that erosion has stripped the land of much of its soil, leaving the area non-productive.
C. Forest Non-Productive Site (Code 3) - contd.

3 - Br. - Never type out such areas adjacent to or in alpine or "10". Classifying as 3-Br. (YNC - Brush) should signify an area has a productive site. Thus ignore such types near or in non-productive areas to avoid ambiguity and also to simplify typing in these unimportant areas.

"12" - Basic class number "12" used to describe unsatisfactorily stocked forest cover growing on all lowland non-productive areas. All map notes in lowland non-productive areas should be accompanied by the species present.

  e.g. 12(F)  ) On exposed areas near sea level.
  12(PIL)  )

D. Range Productive Site (4000 series) - "OR"

The coder shall only use this classification if:
the stand is very open and the area is adjacent to ranch or settlement and is definitely used, and should be used for grazing purposes only.

RULE: Use the primarily range classification sparingly. Think of these low stocked forest areas as Open or Semi-Open Forest rather than as range.

PART I ITEM 41 TREE SPACING TABLE

<table>
<thead>
<tr>
<th>FEET</th>
<th>TREES/ACRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x 2</td>
<td>10,890</td>
</tr>
<tr>
<td>3 x 3</td>
<td>4,840</td>
</tr>
<tr>
<td>4 x 4</td>
<td>2,722</td>
</tr>
<tr>
<td>5 x 5</td>
<td>1,742</td>
</tr>
<tr>
<td>6 x 6</td>
<td>1,210</td>
</tr>
<tr>
<td>7 x 7</td>
<td>889</td>
</tr>
</tbody>
</table>

PART I Item 40 - contd. Item 41

(49)

(1957)
PART I  ITEM 41  TREE SPACING TABLE - contd.

<table>
<thead>
<tr>
<th>FEET</th>
<th>TREES/ACRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 X 8</td>
<td>681</td>
</tr>
<tr>
<td>9 X 9</td>
<td>538</td>
</tr>
<tr>
<td>10 X 10</td>
<td>436</td>
</tr>
<tr>
<td>12 X 12</td>
<td>302</td>
</tr>
<tr>
<td>14 X 14</td>
<td>222</td>
</tr>
<tr>
<td>16 X 16</td>
<td>170</td>
</tr>
<tr>
<td>18 X 18</td>
<td>134</td>
</tr>
<tr>
<td>20 X 20</td>
<td>109</td>
</tr>
</tbody>
</table>

PART I  ITEM 42  TOTAL STOCKING CLASS

A. Mature and Grown-up Non-Commercial

Number of trees 13" + (all species except P1 and deciduous)
Number of trees 7" + (P1 and deciduous only)

1. Inventory
   Code 1. 0 - 10 trees (reserved for Open Forest with Grazing Under Cover - main stands only)
   2. 11 - 30 trees (including Semi-Open Forest with Grazing Under Cover and also all Py Selection)
   3. 31 + trees.

2. Special
   Code 1. 0 - 10 trees (reserved for Open Forest with Grazing Under Cover - main stands only)
   2. 11 - 30 trees (including Semi-Open Forest with Grazing Under Cover and also all Py Selection)
   3. 31 - 60 trees.
   4. 61 - 90 trees.
   5. 91 + trees (use on block surveys only unless instructed otherwise).

B. Immature and Young non-commercial

1. Inventory
   Use stocking class 5 always except in the following two cases.

   (a) All Open or Semi-Open Forest with Grazing Under Cover plus all Py age Class 11.
PART II ITEM 42 TOTAL STOCKING CLASS - contd.

(b) Areas classed as main young non-commercial because of understocking, use stocking class 2 only

2. Special (block surveys only unless instructed otherwise).
   Code 1. 0 - 25% stocked (of full stocking for age class - Item 38).
   2. 26 - 50% "   "
   3. 51 - 75% "   "
   4. 76 - 100% "   "
   5. 101% + "   "

Exception: in grazing country when special coding or other than block surveys, use:
   (1) All Open Forest with Grazing Under Cover
       eg. 0 - 25% stocked.
   (2) All Semi-Open Forest with Grazing Under Cover
       eg. 26 - 50% stocked.
   (5) All other types.

PART I ITEM 43 TYPE AND AREA DESCRIPTION

A written description must be made for every stand that is coded, and any worthwhile information pertaining to the stand or to the area should be recorded. Forms FS486 (forest description sheets Appendix 2) will be used for this purpose. These sheets will be labelled with the original code sheet number and must be attached to same.

Code sheet type descriptions should be as complete and detailed as possible. A number of guides for the use in type description write-ups appear on the code sheet, but the following is a more complete outline, and should be followed as closely as possible.

A. Mature Forest Types

1. General Description

Give a general description of the type and sub-types emphasizing the occurrence of the various species, and the age and stocking distribution throughout the type.

Under species occurrence describe the local distribution of individual species,
PART II  ITEM 43  TYPE AND AREA DESCRIPTION - contd.

A. Mature Forest Types - contd.

   e.g.  (i) A fir-yellow pine type has fir evenly distributed
       on all aspects and slopes whereas the yellow
       pine occurs only on south and west exposures.

       (ii) In a hemlock-balsam type, hemlock is common
           at all elevations whereas the balsam occurs
           throughout but chiefly at the upper levels.

Under age, note whether the stand is even aged or uneven
aged, and if the latter is the case, describe the age
class distribution.

i.e. An extensive lodgepole pine type originating after
a burn may be found to be very even aged in nature,
whereas a dry belt fir-yellow pine stand will most
likely have all age classes represented.

Note whether the area is sparsely or densely stocked and
discuss the nature of the stocking in terms of patchiness,
uniformity, etc. Mention any unusual conditions important
for management purposes.

   e.g. (i) "Dense groups of 100 year old Douglas fir
           requiring thinning in an uneven-aged yellow
           pine-fir type."

Sub type descriptions should include minor variations in the
stand whether typed out or not. For example, in an overmature
hemlock forest type, it may be desirable to describe the small
patches (sub-types) of various aged immature hemlock which
are scattered throughout the main type, since their presence
may influence the manner in which the stand should be logged.

A truly comprehensive general description should also include
sufficient detail concerning all species in the lower storeys
of a stand.

2. Growth, Mortality, and Condition by Species

A short description should be made describing the rate of growth
and vigour, abnormal mortality, and general condition of each
species in turn (main and secondary stands). Abnormal mortality
may include details such as the number of dead trees by age
and diameter groups and emphasis should be placed on recording
information concerning the mortality estimated to have occurred
within the last ten years.
PART I  ITEM 43  TYPE AND AREA DESCRIPTION - contd.

A. Mature Forest Types - contd.
Describe the general condition of each species as indicated by the presence of one or more of the eight suspect characters (Item 4 - code sheet) and other factors which may have influenced the health and vigour of the stand.

3. Merchantability

Discuss the suitability of each species for the various products, sawlogs, pulp and minor products. Indicate the quality of sawlog material present in coastal types by recording the estimated quantities of #1 and #2 material present for each species. In certain types the timber may be suitable for pulp only and in others, minor products only. It is sufficient to note that a certain species in a certain type is suitable for pulp only, but more details are required where minor products are concerned.

Examples: (i) In a fir-cedar-hemlock stand of the south coast considerable sawlog values are present in fir and cedar but the hemlock is suitable for pulp only.
Fir runs - 5% #1, and 45% #2 sawlogs.
Cedar runs - 10% #1, and 30% #2 sawlogs.

(ii) A 150 year old lodgepole pine-spruce-balsam stand of the central interior contains excellent tie values in pine, fair sawlog values in spruce, and the balsam is suitable for pulp only.

Lodgepole pine runs - 4 to 5 ties per average tie tree.

4. Regeneration Conditions

(a) Describe the present regeneration in the type, by species present, average age, height and condition.

PART I  ITEM 43, contd.

(53)

(1957)
A. Mature Forest Types - contd.

eg. "Small dense groups of spruce, 25 years, 3 to 20 feet in height frequent under openings in the main crop canopy, especially on the poorer sites. Condition is healthy".

Note any obviously preferred seed bed conditions and any preferred light and moisture conditions for regeneration.

(b) Describe the ground vegetation as it relates to the regeneration problem in the type.

eg. "On good sites and especially where the crown cover is light, dense devil's club and salmonberry appear to hinder the regeneration of spruce".

(c) Describe the depth and condition of organic material (debris and humus).

eg. "About 3 inches of undecayed organic litter (branches, needles, etc.) above 6 inches of raw humus. Seedlings appear to dry out and die a few months after establishment."

(d) Soil type - describe the soil texture which may be clay, clay loam, silt loam, loam, sandy loam, or sand. Discuss in greater detail if the coder has the knowledge and experience to do so.

(e) Condition of crop trees as seed bearers. The average crown length as a percentage of total height is a useful fact. Mention any relevant factors.

eg. The presence of good tree types which could be favoured as seed bearers in a logging plan.

Items (a) to (e) may all be considered as important factors in any logging-forestry plan where natural regeneration is being sought.

PART II ITEM 43, contd.

(54)

(1957)
5. **Fire Hazard**

Describe the fuels in the forest type briefly under:

(a) Ground fuels - windfalls, slash, humus, ground vegetation type, as hazard factors.

(b) Tree fuels - Crown depth, density of stand, presence of snags, as hazard factors.

(c) Human factors - note to what degree the type is being directly or indirectly affected by human use.

(d) Climatic factors - note the effect of the local climate on the hazard within the type.

eg. Hazard is generally negligible in rain belt areas, but high or extreme in dry belt areas particularly those where the lightning storm incidence is high.

(e) Describe any factors of aspect and soil characteristics of the forest type relevant to fire hazard condition.

6. **Biological and Physical Disturbance**

Stand histories should be noted as to stand origin and subsequent history. Mention the effects of past insect, disease, or animal disturbances that have significantly affected one or more species in the stand. Discuss the effects of past flood, slide, windthrow, fire, logging, snow and ice disturbances, etc., if any have occurred.

7. **Access and Road Building Possibilities**

**Access**

Describe the present access routes mentioning any trails, roads, navigable rivers and lakes that pass through the type. For types with no existing or nearby roads, trails, etc., discuss the access possibilities pointing out feasible routes.
PART II ITEM 43 TYPE AND AREA DESCRIPTION - contd.
A. Mature Forest Types - contd.

Road Building

Describe the possibilities within the type mentioning the presence of serious obstacles to road construction such as steep, rough, topography, the prevalence of rock outcrops, and swampy ground. Mention the presence of any known gravel deposits within or adjacent to the type.

8. Site and Drainage

Describe the average site within the type as either good, medium, or poor. Base your conclusions on a combination of the observed forest stand (A.M.H. - Age - Site Index, Items 18, 21, 27 and 39). Although conclusions will be governed chiefly by the curves in the pocket manual, values obtained in this way may appear too high or too low according to the observed ground vegetation, soil conditions, growth rate and stand age. Significant discrepancies should be noted. The coder should also compare the actual site index of the type with that of neighbouring types. In this way, it is possible to obtain a fairly comprehensive picture of the distribution of site values throughout a watershed.

Discuss briefly the drainage features in a type in terms of good, fair, or poor. On steep and medium slopes the drainage is invariably good, but often on gradual slopes and flat land, it is quite poor, occasionally with an adverse effect on the productivity of the site.

9. Silvicultural Problems

On the basis of the observed forest condition, rate the type, or even certain elements in the type, for priority of cutting. If the coder feels qualified, on the basis of his knowledge of stand condition, regeneration conditions, and topography, he may point out evidence of silvicultural problems. Avoid making specific recommendations (regarding silvicultural treatments). Naturally, he may discuss various priority cuttings which are necessitated by factors such as decadence (static or negative growth) in a certain
A. Mature Forest Types - contd.

percentage of the type. "In the uneven aged Py stands, immediate cutting of poor risk veterans scattered throughout the type is advisable."

In some types, stand conditions may necessitate a high cutting priority on fairly large blocks of timber, rather than on certain elements in the type.

Coders may wish to refer to the Cutting Priority Rating Legend listed below for information concerning the various types of stands considered during cutting priority studies.

For complete details reference should be made to the Office Manual, Chapter III, Section 5.

**Cutting Priority Rating Legend**

<table>
<thead>
<tr>
<th>Stand Condition</th>
<th>Cutting Priority Rating Code</th>
<th>Map Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immature, N.S.R., non-productive, grown-up non-commercial deciduous, and young non-commercial coniferous and deciduous</td>
<td>0</td>
<td>not coloured</td>
</tr>
<tr>
<td>Immature selection (selectively logged)</td>
<td>1</td>
<td>light green border only</td>
</tr>
<tr>
<td>Immature plus volume in thinnings or thrifty overstorey</td>
<td>2</td>
<td>light green centre (no dark green border)</td>
</tr>
<tr>
<td>Thrifty mature</td>
<td>3</td>
<td>dark green centre</td>
</tr>
<tr>
<td>Mature (in balance)</td>
<td>4</td>
<td>yellow centre (dark green border)</td>
</tr>
<tr>
<td>Overmature (losing volume slowly)</td>
<td>5</td>
<td>orange centre (dark green border)</td>
</tr>
<tr>
<td>Decadent (losing volume rapidly)</td>
<td>6</td>
<td>Red centre (dark green border)</td>
</tr>
<tr>
<td>Grown-up non-commercial coniferous</td>
<td>7</td>
<td>dark blue centre (dark green border)</td>
</tr>
<tr>
<td>Immature and/or young non-commercial plus overmature overstorey (ie. secondary mature stand)</td>
<td>8</td>
<td>light green centre (dark green border)</td>
</tr>
</tbody>
</table>
B. Immature Forest Types

1. General Description

Describe the type and sub types as to species occurrence, and age and stocking distribution. Mention the average age in even aged types and the age range in uneven aged types. Stocking is a very important factor in immature types and a good word picture of stocking conditions is necessary.

2. Growth, Mortality, and Condition

Describe the type and sub types as to form, vigour, competition, mortality, and condition.

Growth - drain data will be calculated in Victoria from sample plot data, but any general information on this subject gained from field observation should be stated.

Report on the condition of the type as revealed by mortality, suspect characters, increment borings, and general appearance.

3. Merchantability

Where applicable describe the suitability of each species in the type for sawlogs, pulp, and/or one or more of the various minor products. This applies chiefly to older immature of exceptional development, particularly where such stands are readily accessible.

4. Regeneration Conditions

See Item 4 under mature types (Particularly important in older immature types.)
PART I  ITEM 43. TYPE AND AREA DESCRIPTION - contd.
   B. Immature Forest Types - contd.
      5. Fire Hazard

      See Item 5 under mature types.

      6. Biological and Physical Disturbance

      See Item 6 under mature types.

      7. Access and Road Building Possibilities

      See Item 7 under mature types.

      8. Site and Drainage

      See Item 8 under mature types.

      NB. In young immature, if necessary use previous crop
      remnants or surrounding timber to obtain a
      representative age-height relationship for site
      index determination.

      9. Silvicultural Problems

      If the coder feels qualified on the basis of his knowledge
      of stand condition, regeneration conditions, topography,
      climate, etc., he may point out silvicultural problems.
      Avoid making specific recommendations (regarding silvicultur-
      al treatments).
      For stand containing significant values in small sawlogs,
      ties, piling, etc., the coder may indicate thinning is
      desirable for stand improvement and utilization purposes.

      Avoid suggesting thinning for every immature stand that
      appears to be overstocked. On the other hand mention any
      conditions of stagnancy where future values are seriously
      prejudiced and discuss thinning if the site value and
      accessibility justify it.

   C. N.S.R. Types

      1. General Description

      Discuss species occurrence, age, and stocking distribution,
      emphasizing the following:
PART I  ITEM 43  TYPE AND AREA DESCRIPTION - contd.

C. N.S.R. Types - contd.

(i) Percent stocking by species, and distribution of the stocking (i.e. in groups or sparsely scattered.)

2. Growth, Mortality, and Condition

Report briefly any relevant information, e.g. high mortality rate in new regeneration due to exposure on southern aspects.

3. Merchantability

Not applicable.

4. Regeneration Conditions

Discuss the nature of the present regeneration then elaborate on the chances of satisfactory stocking in the future, considering the factors of seed source, seedbed conditions, ground vegetation, humus, soil, debris, nurse species, aspect, slope, etc., of the area.

5. Hazard

State the present fire hazard condition based on the factors (a - e) listed and described under Item 5, mature types.

6. Biological and Physical Disturbance

See Item 6, mature types, outlining particularly the disturbance responsible for the N.S.R. condition, and its general effect on the area.

7. Access and Road Building Possibilities

Discuss briefly, see Item 7, mature types.

8. Site and Drainage

Site - use previous crop remnants or surrounding timber to estimate site index. See Item 8, mature types, record briefly any relevant information on site and drainage.
C. N.S.R. Types - contd.

9. Silvicultural Problem

State the feasibility of planting according to the above factors (present stocking, seed source, regeneration conditions, site value, access, etc.)

D. Non-Commercial Types

Where non-commercial cover is present on good sites, where the site has high potentiality for supporting commercial tree species and where access is good, give a brief description of the type, the site, and its location.

NB: Use the regular type description outline (Item 43) but discuss only those points of the nine listed that are applicable to the type in question.

E.g. Under general description, a paragraph may read: "N.C. Br. consisting of dense bushy alder and vine maple on a good Douglas fir site, adjacent to old logging grades."
Such a type is very significant for management purposes.

PART I ITEM 43, contd.

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(1957)
This section is designed to facilitate mechanical identification of all coded types. All information recorded here becomes the net description of the type on the map. It must be remembered that this is strictly a numeric description, and no letters are to be used. Any alphabetical references must be converted to numbers, i.e. - A - 1, B - 2, etc.

Each pertinent item on the code sheet is represented by a field of 1, 2, or more columns and each field used must be filled out in full. i.e., in the Basis, 4 columns are provided in the Coder Identity field. Coder 955 would enter 0955 in this space.

Basis

3. Zone - The province is divided into 9 zones - enter the appropriate number. Each coder will probably work in the same zone all season. The Party Chief will provide appropriate zone numbers.

5, 5, 6. Sub-zone or Special Projects - use Sub-zone No. for Inventory, Special No. for special projects.

7 to 14. Coder - Copy from Item 1 - Code Sheet Number. Convert A and B to 1 and 2 respectively, i.e.

952A67 reads 09521067
1065B5 reads 10652005

Card XI Details

15 to 26 Percent Suspect - Copy from Item 4, i.e. F 30%, A 40%, S 50% would read 013154055. Enter only major species.

Note: Cols. 17, 20, 23, and 26, for 100% suspect use 2.

Card XI Details

15 to 21 Recent or Responsible Disturbance (Victoria Office only). Recent disturbance can be RD, ED, or RED, so long as this is the most recent major disturbance to the area. Record Responsible Disturbances for young stands only. Miscellaneous History - Item 28

Date of History - Item 29

(If periodic - record mean date)
Card X2 Details, contd.

% Distrubed - Item 30
History Date Class - Item

22 to 27 NSR Classifications - Copy from Items 31 to 37.

Card X1, X2 Details

28, 29, 30 Classification of Type - Refer to Item 3 for Element combinations and record the following: N.B. where terms young commercial, or grown up commercial appear this refers to immature and mature respectively.

100 Series - Young Commercial Stands.

A. Less than 80 years of age
101. Young commercial.
102. Young commercial with secondary young non commercial.
103. Young commercial with secondary grown up non commercial.
104. Young commercial with secondary young commercial of older age class (less than 80 years).
105. Young commercial with secondary young commercial of older age class (over 80 years).
106. Young commercial with secondary grown up commercial.

B. Over 80 years of age
107. Young commercial.
108. Young commercial with secondary young non commercial.
109. Young commercial with secondary grown up non commercial.
110. Young commercial with secondary young commercial of younger age class (less than 80 yrs.).
111. Young commercial with secondary young commercial of older age class (over 80 yrs.).
112. Young commercial with secondary grown up commercial.

PART II ITEM 44, contd.

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(1957)
PART I ITEM 44 I.B.M. CHECK-OFF - contd.
Card X1, X2 Details - contd.

C. All age stand

115. Young commercial (selection - selectively logged).

200 Series - Grown Up Commercial Stands

201. Grown up Commercial.
202. Grown up commercial with secondary young non commercial.
203. Grown up commercial with secondary grown up non commercial.
204. Grown up commercial with secondary young commercial (less than 80 yrs.).
205. Grown up commercial with secondary young commercial (over 80 yrs.).

300 Series - Young Non Commercial Stands

A. Coniferous

301. Young non commercial.
302. Young non commercial with secondary grown up non commercial.
303. Young non commercial with secondary young commercial (less than 80 yrs.).
304. Young non commercial with secondary young commercial (over 80 yrs.).
305. Young non commercial with secondary grown up commercial.

B. Deciduous

311. Young non commercial.
312. Young non commercial with secondary grown up non commercial.
313. Young non commercial with secondary young commercial (less than 80 yrs.).
314. Young non commercial with secondary young commercial (over 80 yrs.).
315. Young non commercial with secondary grown up commercial.

C. Mixed - Deciduous Coniferous

321. Young non commercial.
322. Young non commercial with secondary grown up non commercial.

PART I ITEM 44, contd.

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(1957)
Card X1, X2 Details – contd.

323. Young non commercial with secondary young commercial (less than 80 yrs.).
324. Young non commercial with secondary young commercial (over 80 yrs.).
325. Young non commercial with secondary grown up commercial.

400 Series – Grown Up Non Commercial Stands

A. Coniferous
401. Grown up non commercial.
402. Grown up non commercial with secondary young non commercial.
403. Grown up non commercial with secondary young commercial (less than 80 yrs.).
404. Grown up non commercial with secondary young commercial (over 80 yrs.).
405. Grown up non commercial with secondary grown up commercial.

B. Deciduous
411. Grown up non commercial.
412. Grown up non commercial with secondary young non commercial.
413. Grown up non commercial with secondary young commercial (less than 80 yrs.).
414. Grown up non commercial with secondary young commercial (over 80 yrs.).
415. Grown up non commercial with secondary grown up commercial.

C. Mixed Deciduous and Coniferous
421. Grown up non commercial.
422. Grown up non commercial with secondary young non commercial.
423. Grown up non commercial with secondary young commercial (less than 80 yrs.).
424. Grown up non commercial with secondary young commercial (over 80 yrs.).
425. Grown up non commercial with secondary grown up commercial.
900 Series - Not Satisfactorily Restocked with Commercial or Non Commercial Stands.
901. Not satisfactorily restocked, recent disturbance (1 - 5 yrs.).
902. Not satisfactorily restocked with partial stand of young non commercial.
903. Not satisfactorily restocked with partial stand of grown up non commercial.
904. Not satisfactorily restocked with partial stand of young commercial.
905. Not satisfactorily restocked with no partial stand.

32. Land Use and Site Group - Item 3 or 40.
33. Cover Class - 0 Non Forest (or not suitable for)
   1 Forest
   2 Open Forest with G.U.C.
   3 Semi-Open Forest with G.U.C.

36 to 55. Main and Secondary Stand Keys - Item 3.
56, 57. Site Index - Item 39.
58 to 71. Stand details - Items 5, 6, 8, 7, 11, 10, 9, 20, 12, 13, 14, 15, 16.
72 to 73. Year of Survey (Example: 1954 - enter 54).

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PART II MISCELLANEOUS INFORMATION

SECTION I GENERAL RULES ON TYPING

A. Forest type are determined using those factors appearing in the Key. Large forest productive areas are divided into forest types by typing out the recognized factors in the following order:

1. Mature Stands (a) type
   (b) height
   (c) age and stocking class

2. Immature Stands (a) age
   (b) type
   (c) height

3. N.S.R. Stands (a) stocking class
   (b) type
   (c) age

This does not mean that factor number one must be typed out before factor number two in every case. If there is no appreciable difference between factors number one, then the first type line should be made separating factors number two, and so on down the line until the desired degree of intensity has been obtained.

B. The following minimum areas should be used as a guide when typing on 40 chain photographs. (One square inch at this scale equals approximately 160 acres, and on 20 chain photos approximately 40 acres.)

<table>
<thead>
<tr>
<th></th>
<th>Non Productive</th>
<th>Forest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventory</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Special</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>

E.g. In special typing, no forest type should be typed out from another if the area of the type is less than 20 acres.

(1957)
PART II  SECTION 1  GENERAL RULES ON TYPING - contd.

C. The coder must prick the code number through to the back of the photograph. This should be done liberally throughout the type.

D. The following information should be recorded on the FACE of the photograph in the field:
1. type lines.
2. roads, trails, railroads, flumes, power lines, etc. etc.
3. rivers, creeks, etc. (if necessary).

E. The following information should be recorded on the BACK of the photograph in the field:
1. code sheet numbers.
2. all sample tree data.
3. sawmills, schools, post-offices, look-outs, etc.
4. barometer information where applicable - barometer number, reading, date, and time.
5. miscellaneous information.

All labels that are put on the back of the photograph in the field are to be transferred to the face of the photograph when checking and inking type lines.

F. When typing timber from denuded areas (e.g. burns, clear logging, open range, etc.) tend to be conservative with the timber type line. That is, it is better to throw a few trees in with the burn than to throw burned-over area in with the timber.

G. Type only the central or "effective" area of each photograph. The "effective" area is that area on the photograph bounded by wing points and by adjacent photo centres. By typing in this central area, it should be possible to confine typing to every second photograph. Where duplicate sets of photographs are available, always type on the mapping copy.

H. Make sure all types lines are tied in between photographs and flights.

I. Type out definite types and NOT transition types.
e.g. FH type grades into HB type.
Type out FH and HB, but not FHB, provided that it is a narrow transition type, and not a genuine stand.

PART II, SECTION 1, contd.

(2)

(1957)
PART II SECTION 1 GENERAL RULES ON TYPING, contd.

J. Record all sample tree data on the back of the photograph indicating the position where the data was obtained.

K. It has been found that many attempt to type out non-productive areas far too intensively. Only a small proportion of a person's time should be spent typing in these areas above timber-line.

The following are specific points to remember in typing:

1. **DO NOT** type out small areas of rock, snow, etc., in the upland non-productive areas, but rather throw it all in with the alpine type (code 2).

2. **DO NOT** label slides on a non-productive area as 3-Br. but rather extend the N.P. or alpine line down to include these slides. A type can only be classed as a non-commercial type if it is growing on low site or productive area.

3. **DO NOT** type out snow fields separately from alpines, unless these snow fields are of glacier size.

4. **DO NOT** give type lines that "ragged" appearance unnecessarily, but rather keep the type lines reasonably smooth.

5. **DO NOT** take out rock areas in alpine or N.P. unless they constitute a large acreage. However, it is important to type out "rock outcrops" in forest types.

6. **DO NOT** type out very tiny immature or mature types separately from other forest types. Remember that a full description has to be draughted into the type.

7. **DO NOT** put final compartment lines on photographs where boundary follows lot lines. A general location is sufficient, as the final boundary will be obtained from the map without the use of the photographs.

8. **DO NOT** hand in sloppy work. Neatness and legibility are essential for photo labels. Having to decipher sloppy, inaccurate work causes a bottle neck in Kail plotting, tracing, and summarizing.
Type lines are merely the lines used on the photograph and the map to segregate forest types. Two types of lines are used, the solid type line and the dotted type line.

A. Solid Type Line

A solid type line is used to separate:

1. Main stands that have substantial differences in the key structure.

2. Secondary mature stands that have a substantial difference in the key structure.

3. Basic class numbers not in the same series (eg. solid type line between 63 and 40.)

B. Dotted Type Line

A dotted type line is used to separate:

1. Secondary stands (except secondary mature) that have a substantial difference in the key structure.

2. Basic class numbers in the same series (eg. dotted type line between 63 and 62.)

3. Stands having any worthwhile differences other than those affecting the Key factors. (eg. dotted type lines between stands having substantial differences in history, etc.)

Note: Solid type lines are always associated with "A" code sheet types.
Dotted type lines are always associated with "B" code sheet types.
PART II  SECTION 3 "A" AND "B" NUMBERS

A coder must make out a new code sheet for every major type that he encounters. These code sheets are numbered consecutively from one and are termed "A" code sheets. In addition to these "A" sheets, the coder may find it necessary to complete a limited number of "B" code sheets. A "B" code sheet is made out for a sub type that differs from the main type by some minor difference such as history, presence of certain secondary stands. For example, if two adjacent types should be separated even though their main stands and their secondary mature stand (if any) are similar, and the differences are not significant enough to warrant two "A" types, then one should be classed as a sub type of the other and a "B" code sheet used for it.

The following rules govern the use of "A" and "B" code sheets:

1. "B" code sheets must always be related to an "A" sheet.

2. Both "A" and "B" number must be put on photo.

3. "B" number is separated from its related "A" number by a dotted line.

4. Keep number of "B" sheets for summer to an absolute minimum, using instead a new "A" number and solid type line where possible.

5. "B" code sheets should be numbered consecutively from one for the season regardless of what "A" type the "B" type occurs in.

Example of "B" types.

Large immature Douglas fir type with the main portion established through logging and burning (453A94) and the remainder established through burning only (453A94-453B3) and logging only (453A94-453B4).
The following steps should be taken in coding, typing, tying in, and completing a given area.

1. Coder should size up entire area and determine the approximate time that should be spent on each compartment. Once this is done, this schedule must be kept, not only in field work but in all phases including the sending of completed material to Victoria.

2. Coder draws type line on photograph around stand that should be separated. This type line is found with the aid of ground observation and photo interpretation and when established, is ground checked as thoroughly as circumstances permit.

3. Coder establishes type and locates same on appropriate type list.

4. Coder fills in Key using the applicable stand structure element code, age code, height code, and stocking code.

5. Under forest type (Key), coder enters type found by 20% rule, brackets the type, and enters the code number obtained from type list. The species found and the species included in the code number do not necessarily agree. eg. (LC) 3031.

6. Coder fills out remainder of code sheet, and pricks through code sheet number to the back of photograph.

7. Coder will complete and check all type lines and code sheets for the general area being worked in. Care should be taken to see that all type lines are complete and all types labelled with the appropriate code number. Coder should keep a record of every "A" and "B" code sheet made out in a pocket size notebook.

8. Do not group code sheets indiscriminately. Established code sheets should only be applied to similar types where the stands are identical in all respects as well as those factors in the Key. Too often, if a code sheet is applied too extensively, all the information secured, except that in the Key, is no longer applicable and is thereby quite worthless.
9. The coding party chief is responsible for seeing that compartments are complete; ie. type lines and labels inked, type lines tied across flights and compartments, types correctly labelled, and code sheets filled in properly.

10. Completed photographs should be sent to Victoria compartment-wise, but do NOT keep a finished compartment back just because another compartment needs to be tied in to it. Rather keep out the border photographs needed for the tying in, and send in the remaining ones for the compartment. Try and send in blocks of completed work as soon as possible whether all the border photographs for the compartment are there or not.

Similarly, it is advisable to send completed code sheets to Victoria at regular intervals so as to minimize any loss through catastrophes such as fire, etc.

11. All areas must be completely typed and all photographs sent to Victoria by the first week in September.
Compartment revisions constitute a different problem than typing and coding an area for the first time. For revising an area, a coder will be supplied with the original typed photographs, a complete set of blank photographs, a compartment work map showing original type lines and a copy of the original code sheet keys.

The following points should be used as a guide in revising compartments:

1. Sum up which portions of the area to be done warrant and need the most time and effort, and plan your work schedule accordingly.

2. Do not have more than two compartments "on the fire" at one time. That is, the first compartment should be typed, tied in, and completely finished before starting the third compartment, and so on down the line. This policy should be followed, where logical, so as to keep the work flowing in a parallel pattern.

3. Using a 2B pencil, put new types and labels on the original typed photos, at the same time crossing out old type lines and labels found to be in error.

4. All new type lines and labels are to be carefully sketched (not intersected) on the compartment work map with a red pencil. Eliminate all unwanted type lines and labels on the map by crossing out with a red pencil. Care MUST be taken with the work map as a properly kept record is absolutely necessary in interpreting your revised work.

5. New code sheets must be made out for all types. Restrict the application of code sheets to IDENTICAL types (those similar in all respects as well as key factors) in the same locality.

"A" & "B"

6. Coder should keep a record of every code sheet made out in a pocket-size note book. This record should include the key structure, date of establishment of immature and N.S.R., condition of volume stand, photo number, and adequate space for brief remarks. In order that this record can be kept up to date, new code sheets should be entered as they are made out.
7. It is recommended that coding strips be used where there are exceptional timber values or in areas where type delineation would be extremely difficult without exceptionally good ground coverage.

8. A comprehensive type description must be made on form FS-486 in the field for every stand coded, in addition to the compartment description write-up for each compartment concerned. It is essential that this information be gathered in the field, so as to avoid any office estimations.

9. Before leaving a compartment, a complete check MUST be made so as to check for hanging type lines, unlabelled types, wrongly labelled types, proper "tie-ins", etc., etc. Ink in the new type lines and labels and erase all of the original work found to be in error before mailing the photos to Victoria.

10. All completed compartments must be sent to Victoria as soon as possible and should include all typed photographs, code sheets, type and area descriptions, and the compartment work map.
PART II SECTION 6  STRIP CODING

Strip coding is merely the typing and coding of an area while running a strip. The advantages of strip coding are most apparent where:

(i) types are difficult to discern on the photographs.
(ii) timber values warrant a more intensive typing procedure.
(iii) difficulty is found in pin pointing oneself on the photograph due to lack of definite topographic detail.

The party chief should weigh the foregoing points for each compartment or portion of a compartment, and thus determine the number of coding strips necessary to achieve the required intensity of type mapping. In addition, the party chief should indicate where these coding strips should be run for the best results. In certain cases, he might find it necessary to actually do all the preliminary planning himself; although in most cases, the person who is to run the strip should be taught how to plan his work most efficiently.

A great deal of care should be taken in "laying out" these strips. Make sure that the strip goes through the type in question so as to get a representative answer. Too often, strips laid out haphazardly go through edges of types, thus hitting transition areas rather than the main type. In some cases, it may be found necessary to change the direction of a portion of the strip. If you find that you are not getting into a representative section of the type.

The interval between coding strips on any area that is to be done by this method should average eighty chains. This interval may be increased or reduced depending upon the individual area.

All coding strips must be plotted on the map and photograph. Coding strips are to be numbered consecutively from one for each compartment and are numbered independently from the tally strips.

The coder should take sample trees at intervals along the strip. This sample tree data should be written on the compass sheet at the appropriate chainage. In addition, the coder should record the type "Key" at intervals of 5 chains. (This interval may be extended in large types.) It is not necessary to take sample trees automatically each time the "Key" is recorded; take them as required. eg. 20 chs. 2 - FC-\(\frac{4}{2}\)-9-\(\frac{1}{2}\)
25 chs. 2 - FC-\(\frac{4}{2}\)-9-3
30 chs. 1 - F-6-35-5 etc.

PART II. SECTION 6
(13)

(1957)
This information should be recorded in addition to the procedure of making out code sheets for established types. The actual method of running the strip is identical with that for sampling (unless otherwise directed) and reference should be made to the Sampling Manual, Part II, Section 4, pages 26, 27 and Part II, Section 7, pages 62 - 71, for these instructions. Although the proper use of the abney is essential for slope allowance in strip coding, contours need not be drawn except in special cases. It is important that barometer readings are taken and recorded correctly on the photo at good pinpoints for control (slides, swamps, etc.).

Experience has shown that emphasis must be placed on the training of compassmen during the early weeks of the field season. There is a definite knack in running compass rapidly and accurately. No crew can operate efficiently without a good compassman. Three-man crews work the most efficiently using the strip-coding system, a compassman, a rear chairman, and a coder. The coder will be able to supervise all aspects of the work, but will be free to examine the timber types thoroughly. On two man crews, the coder must act as rear chairman in addition to his other duties.

Coders should attempt to type the photographs as intensively as possible while they are running the strip. They should not limit the extent of their mapping to the obvious lines that are easily discernible, but should also take out types that are found by ground observation but are difficult to see on the photograph. Coders should avoid deviating from proposed lines in order to examine small types or sub-types missed by strips.

However, they should make the best use of their time in walking to the start or from the end of a strip. Do not retrace the exact line of a strip on the way home unless it is necessary. It is more efficient to deviate somewhat from this line, so as to examine new types or substantiate recognized types.

In conclusion, it has been found time and time again that coders have missed a type although they passed it many times going to and from work. Keep your eyes open at all times, and don't be afraid to prick notes onto the back of the photograph for any type, even though it may be that you won't be working in that particular area for some time. Any worthwhile information such as type, species present, ages, heights, insect or disease attack, barometer readings, etc., should be recorded this way.
PART II  SECTION 7  COMPARTMENT DESCRIPTION

After the coder has finished typing a compartment and describing the forest types on forms FS486 for this compartment, he will write up a general description for each compartment or groups of very similar compartments. Each compartment will be described under the headings of AREA and SPECIES on forms FS486 provided for the purpose. This description will be based on the coder's knowledge of the compartment which he has coded and typed. The code sheets, compass sheets, type and area descriptions, air photographs, base maps, and personal recollection of ground and forest conditions throughout the compartment must be correlated and written into a clear report or description of the compartment. It is very advisable to collect field notes in a small note book while coding a compartment, to fill out the details required under A and B below. The compartment description must be adequate to provide an individual, who has never been in the compartment, with a good overall picture of the area.

A. Description of Area

1. Topography

Under this heading describe briefly the topographic features of the Compartment, the general drainage system, soil types (see 4, Item 43), the approximate range of elevations, slopes (be sure to place the word topographic in brackets behind any figure stated) and aspects, mentioning the most common conditions. Indicate any adjacent topographical features of importance to the compartment area.

e.g. "The compartment consists of a series of ridges and valleys running roughly North and South, with elevations ranging from 2000 to 4000 feet. Slopes vary between 10 and 30 (topographic) and average about 20 in the timbered area. The most common aspects are East and West. The valleys are generally wide bottomed and benches frequently occur above the lower slopes. The soil types are largely clay or muck in the valley bottoms with patches of silt or sand in the river bends. On most slopes the soils are shallow sandy loam overlying weathered granite parent material. Clayey loams occur on the lower slopes. The benches are mostly gravelly and bear shallow soils low in organic material. The upper slopes have little or no soil except in the gullies, where coarse textured sandy soil occurs."

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The drainage system appears to be old, with a south flowing meandering river being fed by numerous small lakes and creeks. There are no canyons on the river but river driving possibilities are poor owing to numerous "S" bends.

The compartment is sheltered on the West by the Caribou Mountains.

2. Climate

Describe briefly any local factors of climate which are significant for management purposes. (Regional rainfall etc. need not be mentioned).

Excessive snow fall causing noticeable stand damage (frequently seen in immature stand), prevailing wind and the direction of winds known to be particularly damaging to stands (this may frequently be ascertained from local residents, and also by observation of blow down areas). Mention any conditions of severe drought or extreme temperatures (e.g. extremely high ground temperatures on some steep south slopes), extreme rain storms causing flash floods and consequent erosion, frequent lightning occurrence and any other significant local climatic factors.

3. Access

Under this heading describe briefly:

(a) Existing roads, public or private (indicate if seasonal or year round) Railways, trails.

(b) Potential aircraft landing areas (suitable sized lakes or straight stretches of river). Possible water transportation routes.

(c) Road building possibilities.
Tentative recommendation for suitable road location, having in mind topography, timber value and road building material. Briefly mention serious obstacles to road building, as swamps, rock slides, canyons, adverse grade. Also keep

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in mind that the feasibility of an access road is dependent on the timber values which will be hauled over it, (e.g. low timber value and excessive access road cost may render road building impossible).

4. Logging Blocks

For our purposes a logging block is considered to be an area of merchantable sized timber (this could be older immature in some areas), composed of one or more adjacent forest types which, by virtue of their extent, relatively uniform stand conditions (e.g. an area of mostly overmature timber with light blowdown and insect attack throughout, or an area of mostly thrifty mature timber), and access (e.g. a side valley which can be logged by one system of logging roads tributary to the main access road), should be considered as one unit for management planning and prescription. Potential logging blocks in a compartment will be described briefly, and priority rating for cutting, based on the factors of stand conditions, access problems and timber value, should be recommended. Relevant utilization factors should be brought out, for example, an area of decadent low value hemlock-cedar may be made economically loggable by the presence of scattered cedar poles and occasional large sound white pine trees.

There may be only one potential logging block in a whole compartment, as in the case of a compartment which has a group of mature types in a side valley, but is otherwise mostly young immature, or where a compartment is accessible throughout and completely timbered with merchantable sized stands of generally similar condition.

5. Protection

A general statement of protection factors in the compartment is required. The overall hazard and areas of particularly high hazard should be briefly described, keeping in mind the predominant features of climate, topography, and vegetation cover (tree and ground). Further data on hazard by forest types is given in the remarks section of the code sheets. Include a brief statement on past fires, and logging history (particularly slash and snag condition).
Describe any factors of present and expected high fire hazard due to insect infestation, disease occurrence, and blowdown. Strips or patches of deciduous species are worthy of mention, in their capacity as natural fire breaks.

Describe the degree of human use of the area, existing roads, trails, and possible transportation routes (water and land). Potential look-out points and their coverage, coverage by existing look-outs, and the location and availability of water, particularly during the fire season, are other important factors.

6. Present Industries
Describe briefly under:

(a) Forest industry - Logging operations, and mills
    (give cutting capacity if known).
(b) Other industry - grazing, mining, etc.
(c) Proximate towns or villages.

7. Agriculture and agricultural possibilities
Briefly state present degree of agricultural use of the area, and/or any obvious and clear cut agricultural possibilities.

B. Description of Species
Describe briefly each species in the compartment, in order of predominance, under the following headings:
i.e. 1. White Spruce
   (a) Occurrence
   (b) Merchantability
   (c) Silvicultural Problems
2. Douglas fir
   (a) Occurrence
   (b) Merchantability
   (c) Silvicultural Problems

(a) Occurrence by topographic location and associated species.
  e.g. "White spruce occurs in mixture with balsam and minor amount of lodgepole pine on plateaus above about 3000 feet and in sheltered moist valleys at lower elevations. It occurs pure
in immature stands, established by burning, but is seldom found as an understorey except in the more open spruce-balsam stands on poor sites.

(b) Merchantability, disease, and insect infestation, vigour and any other factors of importance.
   e.g. The white spruce is mostly of excellent form and vigour on the medium and average sites. In the mature stands a very high percentage of the stems are merchantable and should give first class lumber. On the wetter sites, and particularly in the overmature stands, butt rot seriously reduces the merchantable values, and scattered windfall and occasional patches of complete blowdown have occurred. In the blowdown patches spruce bark beetles are present in small numbers, and have not yet attacked the adjacent standing timber.

(c) Local silvicultural problems, connected with the establishment and development of the species.

   Observed factors of suitable seed bed, ground cover conditions, competition with other species, nurse species, etc.
   e.g. Spruce has regenerated well after hot burns and heavy logging where the soil was exposed, and where seed source was not further than about 5 chains. In some areas aspen is acting as a nurse crop to spruce which appears to be filling in year by year even where seed source is distant. Under a forest canopy spruce appears to have difficulty in competing with the more dense understorey of balsam, even where the canopy is quite open.

Base any prescriptions on adequate observation and keep them concise. Avoid vague generalities. Description at this stage is more valuable than prescription.

It is only natural that the most important species in the compartment should warrant the most intensive write-up. Thus, species that occur in very minor amounts do not need such an intensive description as has been outlined.
C. N.S.R. and N.C. Types

Describe generally for the whole compartment.

1. N.S.R. Types.

2. N.C. Types.
PART II  SECTION 8  LOCATION OF SURVEY POSTS

The accurate location of a few corner posts on each timber sale is required in order that existing surveys may be plotted accurately on each timber sale map, and in order that management officials will have a known point or points located on the ground for starting points for the location on the ground of the boundary of the timber sale. Normally, the coder or coding party chief will be responsible for ground locating corner posts, but other crews may also be required to locate posts. The party chief concerned will be provided with a lot plan showing location of all corner posts and a description of the bearing trees.

A. Types of Posts

1. (Wo.P.) Standard Wooden Post - This is a squared wooden post usually 3 feet high and 4 inches to a side. The log corners are scribed on the squared sides of the post, e.g. NWL509, which means north west corner of lot 509. This type of post is the common type found and is usually placed in a stone mound, with bearing trees (see heading - Bearing Trees).

2. (I.P.) Iron Post or Pin - This is a squared cast iron pin about 6 inches to 1 foot high, and 1/2 inch to a side. The lot corners are scribed in Roman Numerals on the sides of the pin. This type of post is used in old Dominion Surveys as a section or 1/4 section post. It may be found in a mound with or without bearing trees and pits.

3. (S.P.) Standard B.C. Land Survey Post - This is a 1 inch round iron pin with a brass cap about 2 inches in diameter. The intersection of the survey lines is scribed on the top of the cap and the lot or section numbers are shown in their respective quadrants. This type of post is found beside a stone mound and may or may not have bearing trees and/or pits.

4. (Wit.P.) Witness Post - This may be any of the above types and is used where it is not possible to put a post at the exact corner, e.g. where the corner may fall in the middle of a stream, in a lake, etc. On the post is described the distance and direction from the post to the corner in question. It may or may not have bearing trees, pits and/or a mound.
B. Corner Post Location Aids

1. Bearing Trees (B.T.) - A bearing tree is usually a prominent tree within about a chain or less from the post which has been blazed on the side facing the post and scribed on the blaze. The inscription being the distance (in links) and direction of the tree from the post. There are usually 2 to 4 bearing trees at each post. If the post has been damaged or removed it is possible to locate its position by intersection from the bearing trees. On the survey map will be shown the species and diameter of the B.T.'s (when the survey was made) and the bearings and distances to them from the posts. A bearing tree blaze differs from other blazes mainly in two ways: (a) It is cut deeper. (b) The bottom of the blaze is cut square and horizontal. Even after the blaze has healed over it is still recognizable by the square bottom.

![Diagram](image)

Ordinary Blaze | Bearing Tree Blaze | Ordinary Blaze | Bearing Tree Blaze

Remember the diameter of the tree will be greater than the diameter shown in the survey notes. The change in diameter varying with the age of the survey.

2. Mounds - Survey posts are usually placed in a stone mound. This mound may vary from a few rocks placed in a circle around the base of a post to a small cairn built around the post. In the case of S.P.'s, the mound is often a cairn built alongside the post. The best plan is to look for a minimum sized mound as this is the most common.

3. Pits - Pits are not very common, but if they are present they are very useful in locating a post. They vary in size, but an average sized pit would be 2 feet wide by 3 feet long by 2 feet deep. There may be any number from 1 to 4 pits around a post and they are usually placed about 10 feet in cardinal directions from the post.
4. Survey Lines - The prominence of a lot line depends upon the age of the survey. A new lot line is much easier to see than an old one. Look for a line of blazes and brushing out along a cardinal direction. With an old survey, the brushing does not show well, but the blazes even if they are healed over are quite easy to find and to follow. Do not confuse a lot line with other blazed lines such as a trap line or other trails. The lot lines, except in special cases, always follow the cardinal directions. Trees are blazed on both sides of a lot line and on both sides of each tree so that you can follow the line either east or west or north or south as the case may be. Other clues are corners of fences, clearings or even logging boundaries.

C. Locating Corner Posts

Locate only those posts which you can pinpoint accurately on a photo or those which can easily be tied to a point which you can pinpoint.

Upon reaching your timber sale, find one post as soon as you possibly can. If there is a farmer or logger in the area, ask him if he knows the location of any posts. These men often do know the location of one or two posts and that is all you need to start your work. After finding your first post, "flag it" (see flagging and pinpoint it on your picture).

Once you pinpoint one post on your picture, you have a basis for locating any other posts on the area. The procedure to follow in locating other posts is as follows:

1. Intersect position of first posts from the pictures onto the photo laydown map.

2. Scale off on the laydown, using the information shown on the original survey map, the positions of the remaining posts that are to be located.

3. Intersect these post locations back onto the photos.

4. Go to those points on the ground corresponding to the photo locations and start looking.

Concentrate on posts which are within a few chains of roads,
creeks or other prominent features. To aid you in choosing posts to locate, the original survey map will have marked on it the posts which should be easy to find.

D. Flagging

Flagging a post is the placing of a flag (form F.S. 226) in a prominent place, by nailing to a tree etc., on a road, trail, or creek, etc.

The form should be completed by filling in the blanks, drawing a sketch in the space provided and making the map scale.

e.g. Post SE Lot 457 is located. A line is run 15 ch. E. and 5 ch. S. to the road where the flag is to be posted. The following diagram shows the completed F.S. 226.

![Diagram](image-url)

**BOUNDARY**

This notice marks the SE corner of Lot 457 (Lot T.S., T.L., H.L.L., Etc.)

The location of this notice is indicated on sketch below.

Lot 457

Scale: One Square = 5 ch.

Forest Service (Surveys)

Form F.S. 226
PART IX  SECTION 9  STANDARDS OF FOREST CLASSIFICATION AND SPECIAL CRUISE TECHNIQUES

A. Provincial Inventory Standard

This standard will produce a forest cover map with forest typing which is fairly generalized in accordance with the "inventory" standard of permissible forest types by species combination, age class, height class, and stocking class. Broad access breakdown is in order for this standard of survey. Sampling intensity will be such as to provide cubic foot volume estimates for each forest zone with an accuracy of plus or minus 10 percent. The area and volume summary will be broken down into two access classes, accessible and inaccessible.

Map scale will be 40 chains to 1 inch, and the standard B.C. photos at a scale of approximately 40 chains to 1 inch will be used. This standard of survey is submitted as being acceptable only for use in general planning and direction of policy.

B. Unit Survey Standard

This standard of survey is in order for any project request which requires mapping detail, and area and volume estimates for a large management unit as, for example, a whole Public Working Circle. This class of survey will aim at providing detail of forest cover types, topography, and area and volume estimates suitable for preliminary management planning and reconnaissance for main access road location.

This class of survey is in order to meet requests such as those of District Foresters, Engineering Services or Working Plans Division for unit surveys of Cottonwood P.W.C., Narcosli P.W.C., Upper Koootenay P.W.C. and others.

1. Air photography, planimetric and topographic mapping

The standard 40 ch: 1 inch B.C. vertical air photographs will be adequate for any topographic mapping required in this intensity of survey. When required, 100 foot contours will be plotted to the air photographs and base maps at a scale of 40 ch: 1 inch using a machine of the calibre of the grid parallax contouring machine. Ground control will be based on barometer elevations taken at preselected points, in conjunction with the work of forest typing and sample establishment.

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However, such ground control will not be suitable for a reliable contouring job adequate for preliminary road reconnaissance, but will only provide a general picture of the relative topographic variation in the unit. If it is known that an accurate contouring job will be required in the future for a certain part of the unit, special provision will be made for field crews to secure adequate ground control for such areas under the directional planning of the Air Surveys or Topographic Division. Air photographs at a scale of 1:40 chains: 1 inch will be adequate for forest type delineation and interpretation purposes unless photo volume techniques are anticipated when better quality photographs at a scale of 20 chains: 1 inch will be required. The minimum acceptable standard in this regard will be a contact scale of 1:15840 with a resolution of 5 feet or better.

2. Forest cover typing and other forestry detail

(a) Forest cover types

Forest cover types will be delineated according to the permissible detail of species combination, age, class, height class, and stocking class listed under the "special" standard of typing in the Forest Surveys Division Coding Manual, with the exception that in immature types, 30 feet rather than 15 feet height classes and only stocking classes one, two, (SWC only) and five will be recognized. That is, the special type list standard of stocking classes will be applied in immature stands. Note: inventory standards of height classes are to be used. Air photographs at a scale of 40 chains: 1 inch will be adequate for forest cover type delineation on this standard of survey. On this scale, the smallest forest type which can be accurately and consistently delineated is 20 acres in area. Where delineation of smaller forest types and/or special interpretation techniques, as photo volume is required, a higher order of photography will be necessitated. For this higher order, the minimum acceptable standard will be a contact scale of 1:15840 with a resolution of 5 feet or better.

Forest cover typing in the field will be accomplished by a system of ground examination and accompanying photo interpretation. Ground coverage will be achieved according to the type variation inherent in a unit using standard photo-ground navigation techniques.
Forest cover detail will be transferred from the air photographs to base maps at a scale of 40 chains: 1 inch.

Descriptive data on factors of forest protection will be collected on the field sheets within each forest type recognized and this data (hazard, tree and ground fuels, etc.) will be available, in conjunction with the forest cover maps and compartment reports, for protection planning.

(b) Site Classification

Site classification will be on a very broad basis in this class of survey, and will be considered only within the boundaries of the forest types recognized. Sampling and forest type field sheets will supply a relatively small amount of sample tree data for site classification, for the large area which is generally implied in a unit survey. No map representation of site class will be attempted in this standard of survey, except for map notes, good, medium, or poor.

(c) Access Classification

Based on field examination and air photo interpretation, the inaccessible areas in a unit will be delineated and the statement of area and volumes in the unit summary will be broken down into inaccessible and accessible. The aim in delineating the inaccessible areas, if any, in a unit will be to class as inaccessible those areas which should not be considered as supporting growing stock or being forest productive land for the purposes of calculating the expected unit allowable cut and for long term management planning. The limiting factors in deciding the location of the access boundaries will be the more obvious topographic features and/or the location of areas supporting extremely low timber values. Generally, topography will be given more weight than timber values in this regard.

3. Sampling

Note: For sampling procedures see the Sampling Manual, Part II, Section 8.

4. Report

The unit survey report will consist of a foreword, a text, and an appendix.
PART II SECTION 9 STANDARDS OF FOREST CLASSIFICATION AND SPECIAL CRUISE TECHNIQUES - contd.

The foreword will describe briefly in general terms the important features of the area in question, with a condensed summary of timber values involved.

The text will elaborate on the points highlighted in the foreword; area, access, protection, industry, timber values, etc.

The appendix will contain tabular statements of area and volume for each compartment within the unit with a total summary for the unit itself, compartment descriptions, miscellaneous photographs, and forest cover maps.

Any additional data requested by an interested agency for a particular unit survey will be included in the report.

C. Special Cruise Survey Standard

This standard of survey is in order for project requests which require mapping detail and area and volume estimates for a part of a larger unit, as for example the Kuskax Creek Special Cruise which consists of two compartments within the Nakusp P.W.C. This class of survey will aim at providing detail of forest cover types, topography, and area and volume estimates suitable for advanced management planning, including an assessment of general cutting priority, and for an accurate analysis of main access road location and costs. This type of survey will be such as to permit an approximate breakdown of the project area into branch road logging blocks, and/or priority cutting blocks, but will not provide adequately accurate estimates of volume within each block.

1. Air photography, planimetric and topographic mapping

The standard 1:50,000 B.C. vertical air photographs will be adequate for topographic mapping in this intensity of survey. 50 foot contours will be plotted on to base maps at a scale of 1:20,000 maps using a multiplex plotting machine. Ground control will be based on barometer elevations taken at preselected identifiable photo and ground pinpoints, using a 2 or 3 barometer set up. Such ground control must be adequate for use in plotting a contour interval smaller than that indicated above if a more intensive resurvey of the project area becomes necessary (for example for branch road location purposes). The plan of ground control will be laid out under the direction of an appropriate qualified agency (suggest Air Surveys Division or Topographic Division) and carried out in the field by either (1) Forest Surveys Division under direction of qualified supervision or (2) Topographic Division.
On this standard of survey, the aim will be to produce a contouring job in which accuracy will be measured in terms of precision of contour interval. However, absolute accuracy will also be a long term aim, commensurate with the value and needs of the project area.

Air photographs at a scale of 20 chains: 1 inch or larger, and of suitable quality, will be required for forest type delineation and special forestry interpretative uses. The minimum acceptable standard in this regard will be a contact scale of 1:15840 with a resolution of 5 feet or better. Forest cover and topographic detail will be transferred from the appropriate air photographs to base maps at a scale of 20 chains: 1 inch. The Kail plotter will be the accepted planimetric plotter and the Multiplex machine the accepted topographic plotter.

2. Forest cover typing and other forestry detail

(a) Forest cover types

Forest cover types will be delineated according to the permissible detail of species combination, age class, height class, and stocking class listed under the "special" standard of typing in the Forest Surveys Division Coding Manual, with the exception that in immature types, 30 feet rather than 15 feet height classes and only stocking class one, two, (GUC only) and five will be recognized. That is, the special type list standard of stocking classes will be applied in immature stands. Note: Inventory standards of height classes are to be used.

Air photographs at a contact scale of approximately 20 chains: 1 inch will be required for forestry interpretation purposes on this standard of survey. On this scale of photographs, the smallest forest type which will be delineated is 10 acres in area of air photograph for this class of survey.

The following scale and quality is recommended as the minimum acceptable standard. Contact scale of 1:15840 with a resolution of 5 feet or better. Descriptive data on factors
of forest protection will be collected on the field sheets within each forest type recognized and this data (hazard, tree and ground fuels, etc.) will be available, in conjunction with the forest cover maps and compartment reports, for protection planning. Forest cover typing in the field will be accomplished by a system of ground examination and accompanying photo interpretation. Ground coverage may be arranged in a systematic strip system or by photo-ground navigation means other than stripping depending on the problems inherent in the particular project. Forest cover detail will be transferred from the air photographs to base maps at a scale of 20 chains: 1 inch.

(b) Site Classification

In this standard of survey site classification will only be considered for areas coincident with forest types. No site type lines, other than those which are also forest type lines will be recognized.

Within each forest type delineated on the forest cover map the site classification will be based on the sample tree data shown on the sampling and forest type field sheets and air photographs. Site class labels will not be shown on the forest cover map since the site class may vary with the species in the forest type and a single site class estimate for a forest type may misrepresent the situation, except for map notes, Good, Medium, or Poor.

Where site information is particularly important in part of the unit, provision may be made for additional collection of sample tree data on a systematic basis within forest types in the area concerned. This will, of course, increase the cost of survey.

(c) Access classification

In this standard of survey the aim will be to indicate those areas which are easily accessible (Access I) under present logging methods and which will provide the main contribution toward the cost of the main access road in the project area. The aim will also be to separate the inaccessible areas (Access IX) from those which are at present of difficult access (Access II) but must be considered as producing or capable of producing growing stock which will become available for logging under present logging methods when the branch road system develops and/or close utilization is achieved. The access classification
will be based on field examination, air photo interpretation, and familiarity with local and regional logging methods. The inaccessible or Access III delineation will be dictated largely by topography in conjunction with the location of stands of extremely low commercial value. Stands within this delineation are extremely unlikely to be loggable within the first or second rotation.

The easily accessible or Access I delineation will generally be limited to valley bottom and lower slope areas generally supporting the high value stands, easily loggable under present logging methods. Almost certainly the location of the main access road into the project area will be contained within the boundaries of Access I.

Areas classed as presently difficult access, or Access II will usually lie between Access I and III, that is on the middle slopes. However, some lower slope or even valley bottom areas may be classed as Access II because they are at the extreme upper end of a long valley beyond the expected limit of the main access road and supporting forest stands which are patchy or of mediocre value.

In places of sudden steep topography above a lower slope or valley bottom, Access III areas may abut Access I.

3. Sampling

Note: For sampling procedures see the Sampling Manual, Part II, Section 8.

4. Report

The report for a special cruise will be to the standard of the reports made for White Swan, Kuskanax, Naver, and Stone in 1953. Any additional data requested by an interested agency for a particular special cruise will be included in the report. For example, area and volume summaries may be required in finer detail or to different breakdowns than those normally presented in a special cruise report.
D. Block Survey Standard

1. Purpose

This class of survey will aim at providing details of forest cover, site, topography, and area and volume estimates suitable for advanced management planning within selected parts of a unit, as for example branch road analysis, in the blocks delineated by the Engineering Services Division in part of the Willow P.W.C. Map and summary details will be adequate for timber sale planning within a block but will not be sufficient to serve as a basis for the sale of timber.

2. Air Photography, planimetric and topographic mapping

The standard 40 ch: 1 inch B.C. vertical air photographs will be adequate for topographic mapping in this intensity of survey. Contours of suitable interval (50 foot or less) will be plotted on to base maps at a scale of 20 chains: 1 inch using a multiplex plotting machine. Ground control will be based on a plan laid out under the direction of an appropriate qualified agency (suggest Air Surveys or Topographic Division) and carried out in the field by either:

(a) Forest Surveys Division under direction of qualified supervision.
(b) Topographic Division.

Ground control will consist of a network of barometer elevations taken at preselected identifiable photo and ground pinpoints using a 2 or 3 barometer set up.

For this standard of survey, the aim will be to produce a contouring job in which the absolute accuracy of the whole topographic model as well as the relative accuracy of contour interval is of a high degree.

For forest type delineation and special forestry interpretative uses air photographs at a scale of 20 chains or larger and of suitable quality, will be required. The minimum acceptable standard in this regard will be a contact scale of 1:15000 with a resolution of at least 5 feet.
The Kail plotter will be the accepted planimetric plotter and the Multiplex machine the accepted topographic plotter.

3. Forest cover typing and other forestry detail

(a) Forest cover types and Coding Procedure

Forest cover types will be delineated according to the permissible detail of age class, height class, and stocking class listed under the "special" standard of typing in the Forest Surveys Division "Coding" Manual with the following departures.

(i) Special standards are used for age, height, and stocking in the immature as well as mature for both main and secondary stands.

eg. An immature Douglas fir-larch stand, 45 years old, 50 feet AMH, and with 220 trees per acre would be coded:

Special: (FL)109, 1 - 5 - 3½ - 5
Block Survey: (FL)109, 1 - 5 - 5 - 3

(Stocking class 3 derived from the standards set in tables, Item 38 and Item 42).

(ii) Where secondary mature and grown-up non-commercial stands are coded, use the main stand mature-grown up non-commercial standard. Similarly when secondary immature or young non-commercial stands exist use the main stand immature - young non-commercial standard.

eg. (a) An immature spruce-balsam stand, 65 years old, 65 feet AMH, with 180 trees per acre, containing a secondary mature remnant of spruce 220 years old, 110 feet high, with 26 trees per acre, would be coded:

Special: (SB)140, 1 - 6 - 35 - 5
(S) 5, 6 - 5½ - 9 - 2
Block Survey: (SB)140, 1 - 6 - 6 - 4
(S) 5, 6 - 4 - 9 - 2

PART II SECTION 9, contd.

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(b) A mature Douglas fir stand, 180 years old, 140 feet AMH, 50 trees per acre, with a secondary immature cedar-hemlock stand, 30 years old, 35 feet high, with 200 trees per acre, would be coded:

Special: \( \text{(F) 1, 2} \frac{1}{4} \text{ - 11 - 3} \)
\( \text{(CH) 115, 5} \frac{23}{4} - 3 \frac{1}{4} - 5 \)

Block Survey: \( \text{(F) 1, 2} \frac{1}{4} - 11 - 3 \)
\( \text{(CH) 115, 5} \frac{23}{4} - 4 - 2 \)

(iii) Any combination of age, height, and stocking is permissible.

eg. (a) Mature lodgepole pine, \( \frac{1}{4} - 9 - 3 \) is not permissible according to the special standards in the type lists (Pocket Manual), but does occur and will be permitted on a block survey.

(b) Mature Douglas fir, \( \frac{1}{4} - 17 - 3 \) is not permissible according to the special standards shown in the type lists but may occur and will be permitted on a block survey.

Permissible species and species combinations recognized in forest types will be limited only by the 20% composition rule. Any species 20% or more by volume in mature stands and 20% or more by number of trees in an immature stand will be included in the forest type name, with the species listed in order of predominance. For example, balsam-spruce, will be separated from spruce-balsam types where the difference in composition is significant enough to be recognized and mapped on the ground using a strip examination system, and delineated on the air photograph.

Forest typing will be accomplished in the field by a system of preplanned strip coverage, tied to one or more base lines in each block, with mapping and descriptive data being collected on map sheets, description sheets, and code sheets along the strips. Block areas will be systematically stripped using an interval of approximately 10 chains. Coding strips
should be run according to procedures laid down in the Coding Manual, Part II, Section 6. Coders should run at least 10 chains into a new type before filling in a code sheet and a description sheet. However, all type changes should be recorded on the map sheet immediately they are identified. Similarly, the type code key should be recorded at least every five chains. In this regard, it should not be necessary to take sample trees for this purpose, these only being required when a code sheet is being completed. Coders may be able to use one code sheet for several separate portions of a similar type on one strip. These portions must not only be similar in regard to age, height, stocking, and species content but also in respect to condition, quality, and utilization value. In other words, coders must guard against "carrying" code sheets. It may be possible on one strip but rarely from strip to strip.

Consequently, the coder will find that the typing problem involves a correlation of map sheet types, photo types, code sheets and release and growth plot samples for individual strips and between adjacent strips, except that in the latter instance, it will often be necessary to combine certain code sheets. In this case the most suitable code sheet would be used. Before destroying the "less desirable" sheets, transfer all sample trees from them to the selected code sheet, and write a composite description for the type, using all the code sheets.

Photo interpretation in each block will extend and complete the forest types indicated by the ground examinations, and will, in some cases, disclose additional significant small types, which may have to be visited and coded if there is any doubt about them being patches of known types. Solid type lines will be used to separate all types. Do not use dotted type lines or fill in B code sheets unless given special instruction.

Descriptive data on factors of forest protection will be collected on the field sheets within each forest type recognized and this (hazard, tree and ground fuels, etc.) will be available, in conjunction with the forest cover maps for protection planning.
Any additional detail requested for a particular block survey will be collected, as long as its collection can be integrated with the over-all plan of ground strip examination and the increased cost of survey is not out of proportion to the value of the information.

Air photographs at a contact scale of 20 chains: 1 inch or larger will be necessary for forest type delineation and other forestry interpretative purposes in this class of survey. The following scale and quality is recommended as the minimum acceptable standard for such purposes: a contact scale of 1:15,840 with a resolution of 5 feet or better.

The smallest forest type which will be recognized on this standard of survey is 10 acres.

Forest cover details will be transferred from the air photographs to base maps at a scale of 20 chains: 1 inch.

Areas of logging, N.S.R., and Non-commercial, will be delineated on air photographs and maps, and will be described on field sheets according to the instructions of Forest Surveys Division "Coding" Manual.

(b) Site Classification

The aim will be to provide a reliable estimate of site class for the main species in each forest type delineated on the air photographs. Sample trees measured during the normal course of forest typing on strips and those measured on sample plots will be the basis of the site classification. Additional sample trees will be measured as necessary throughout the block and their age and height written on the back of the appropriate air photographs beside the pinpricked location of the trees. This additional data will be collected at carefully selected ground points designated by the survey party chief and with the object of providing adequate sample tree data in each forest type recognized.

No map representation of site class will be made but the sample tree data collected will allow for such a procedure if it is
desired at a later date in the form of an overlay.

(c) **Access Classification**

In a block survey it must be assumed that the area within each block is for the most part accessible and contains merchantable timber values which can profitably be removed along one or more branch roads the location of which have not yet been fixed.

The block survey will aim at producing maps adequate in detail of forest and ground cover, topography, and area and volume estimates for a detailed branch road analysis in each block.

Since it is expected that all or most of each block will consist of Access I and/or II, and that such distinction can best be made after the forest and topographic maps are available, the only field work that is required in regard to access is the delineation of Access III areas which due to topography and/or very low commercial forest values are considered inaccessible for at least one rotation. Such inaccessible areas will normally be limited to the fringes of blocks in the higher elevations.

4. **Fieldman's Duties**

(a) **Compassman**

Act as a head chainman and compassman-topographer taking and recording all abney readings. Filling in a compass (map) sheet for each strip. (Refer to Sampling Manual - Part II, Section 7.)

(b) **Party Chief (coder)**

The Party Chief will be responsible for producing the type map on the 20 chain low level photos. He will make a detailed map sheet on every strip showing type changes and important topographic features. He will also complete code sheets and type and area descriptions for each forest type. (Following the required procedures as laid down in the Coding Manual, Part I, Items 1 to 44.) He will act as rear chainman while on strip.
5. Report

A brief survey report, based on the outline of the "compartment description" in the Forest Surveys Division "Coding" Manual will be compiled for each block within a project area. Only those features of the "compartment description" outline which apply to the description of a fairly localized area (in this case a block, which is generally only a part of a compartment) will be covered in the block report.

After the survey is completed, the block reports will be brought together in one comprehensive report for the whole project area. In this report area and volume summaries will be presented for the whole project area, for individual blocks, and for any special breakdowns requested within blocks. An appreciation of special problems in the project area and correlation of important factors between the blocks which constitute the whole project will be presented at the start of the project report. In a block survey project it is felt that a highly detailed report is unnecessary in view of the complexity of information presented on forest cover and topographic maps, and on the code sheets, type description sheets, and sample records.

However, special efforts will be made to report on all requested details of protection, silviculture, logging, or other factors based on the considerable ground coverage which will be achieved in the course of the survey.

6. Sampling

Note: For Sampling procedures see Sampling Manual Part II, Section 8.

E. Taxation Cruising General

1. Purpose

Field work will be done to produce an estimate of timber volume on a given tract of land (usually timber lease or licence) by establishing enough samples in the timber to give a cruise of 5% of the timber area or a volume estimate with a standard error of ± 10% with a 95% probability.
2. Field Procedure

(a) Establish the boundaries of the area on the appropriate air photo, using standard intersection techniques.

(b) Locate surveyed lot corners and lines of the area in the field. Attention is drawn to Part II, Section 8 of the Coding Manual as a guide in locating surveyed lots or corners. Contrary to this section, however, flags need not be posted in this work. All corners that are found must be pin pointed on the photo if possible: If a pin point location is not possible, then the corner must be carefully tied to some prominent feature on the air photo. Notes on the back of the photo to show this location are given in Part II, Section 8, page 25 of the Coding Manual. Further, a plot of lot lines made up from corner post locations established on the air photograph and intersected to the map may not always agree with lot lines already on the map. In such instances, the cruiser will assume his plot from corners established in the field is the correct one.

The cruiser must take all possible care that his samples are established within the boundaries of the area to the cruised, therefore, he should know the ground location of the lines and corners only where they are in "volume" timber. That is, it is not necessary to locate on the ground, lines and corners which bound "non-volume" areas such as N.S.R., or younger immature, except where these lines and corners are to be used as tie points for cruise strips, or as an aid in finding other lines and corners. Note: for description of "volume" see next, page 2(c), (i) - (iv), Part II, Section 9.

It is most possible that any evidence of lines and corners established by old surveys may be obscure or even non-existent. In such cases, it is suggested that no more than one day on small areas of 160 acres or less, or two days on large areas greater than 160 acres, be spent in attempting to establish the ground location of lot lines and corners. When a complete search for lines and corners has been made, and the cruiser is certain that they no longer exist, he may take the plot of the lines and corners as the air photo (transferred from the map) as the best definition of the area.
(c) Describe the "volume" portions of the forest cover of the area according to the methods laid down for special coding in the Coding Manual.

Requirements of this cruising are that we sample only types with "volume", that is:

(i) mature
(ii) older immature
(iii) older immature with secondary mature
(iv) younger immature with secondary older immature or mature, and only these types will require special coding.

On many of these cruise areas, there are scattered small patches of timber. Only those which are 10 acres or greater need be coded. Also, these small patches need not be sampled unless they occur frequently on the area, that is, unless their total combined acreage is 40 acres or more.

Time spent on describing other forest types, that is the "non-volume" ones, should be kept to a minimum. No more time should be taken than to prove that the type is "non-volume"; which would consist of taking one or two sample trees and filling in a code sheet with code key only on it.

(d) Description of Logging Chance

Forms TX178B will be sent out with each special cruise file and the cruiser will be required to fill in the section entitled Logging Characteristics.

Average conditions for the special cruise area shall be described opposite the various headings. Fill in all spaces except "Average volume per acre", which will be filled in at the Victoria office. To facilitate photostating use a 2B pencil and print neatly.
PART II  SECTION 9  STANDARDS OF FOREST CLASSIFICATION AND SPECIAL CRUISE TECHNIQUES - contd.

Be sure to enter the Special Cruise Number on the sheet. Enter this number under Description of Property at the top of the sheet.

3. Field Office Procedures

(a) Before mailing to Victoria, party chiefs will check all field sheets for completeness.

(b) Each party chief will type the photos involved, plotting the strips and plots on the photos (where the size of the area on the photo permits) and then transfer all types, strips and plots, and essential topographic detail to a map on Form TX 3 by sketching, scale 20 Ch: 1 inch. Where only typed photos are available do not erase old types but outline the special cruise areas and show new type lines and labels in pencil only. However, complete the map on form TX 3 as above, showing all the special cruise information. If a "sample" sketch map is not at hand request one from Victoria.

(c) Finally, each party chief will write a brief but pertinent report for each special cruise, outlining the important details in regard to topography, merchantability, etc. Use the compartment description outline and forest description sheet forms. Write neatly using a ball point or 2B pencil.

(d) On completion of (a) - (c) mail to Victoria for filing and final processing.

(e) All records of labour distribution, mileage or hours of mechanical units, costs, etc., are to be kept separate for each of these cruises by Special Cruise numbers.

4. Sampling

Note: For sampling procedures see the Sampling Manual, Part II, Section 8.

PART II  SECTION 9, contd.

(42)

(1957)
F. Examination Procedures for Crown Granted Lands

1. Purpose

These properties are Crown Granted Lands which will require additional field work to that outlined in the instructions on Taxation Cruising. Extra data is required for evaluation of site quality on immature and logged-over lands (i.e. "non-volume" areas). This information will be taken in the following manner.

(a) Immature Areas

These areas will be handled with special coding procedure as given in the Coding Manual. However, there is one important difference to note. For taxation purposes, immature types must be coded in 5 year age classes in stands up to 50 years old: 10 year class from 51 - 60, and from this age our own special coding age classes will apply. Therefore, age codes to use will be:

<table>
<thead>
<tr>
<th>Age Class</th>
<th>Code</th>
<th>Age Class</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5</td>
<td>1</td>
<td>31 - 35</td>
<td>4C</td>
</tr>
<tr>
<td>6 - 10</td>
<td>2</td>
<td>36 - 40</td>
<td>4D</td>
</tr>
<tr>
<td>11 - 15</td>
<td>3A</td>
<td>41 - 45</td>
<td>5A</td>
</tr>
<tr>
<td>16 - 20</td>
<td>3B</td>
<td>46 - 50</td>
<td>5B</td>
</tr>
<tr>
<td>21 - 25</td>
<td>4A</td>
<td>51 - 60</td>
<td>5C</td>
</tr>
<tr>
<td>26 - 30</td>
<td>4B</td>
<td>61 - 80</td>
<td>6</td>
</tr>
</tbody>
</table>

Smallest immature type to be sampled will be 5 acres. Areas less than 5 acres will be evaluated solely on sample trees on the code sheet.

Further, do not break up any large immature type into portions less than 10 acres, unless a type line is clearly recognizable on the photo.
The cruiser must also indicate on his code sheet, his estimation of whether the site supporting the type is of good, medium, or poor quality for that region.

(b) Logged Over Areas

These lands must also be assessed for site quality. In effect a general site map must be made up for the logged-over areas, defining areas that are of good, medium, or poor quality for the region. Logged over lands will be those areas which have been logged in the last five years (i.e., 1951 - 1955).

The cruiser will inspect the logged over lands and draw type lines that, in his estimation, separate areas of broad site quality groups. Estimations of site quality will be substantiated by taking stump counts in each area of uniform site quality in the following manner. Lay out a strip which will run across the contours through the widest part of the logged area. At every 10 chains along the strip take a sample of stumps as described below.

Choose three stumps (adjacent to each 10 chain point) of the dominant species on the area not greater than one acre in size. Choose stumps that are of "dominant" size but avoid abnormally large stumps or stumps whose growth rings are abnormally eccentric. Along a line of average radius on each stump count off the first 100 annual rings and measure the distance from the pith to the 100th ring, to ascertain the radius at 100 years. Average the three radial measurements and convert the average radius to diameter by multiplying it by 2. The following table will indicate the site quality based on diameter at 100 years.

<table>
<thead>
<tr>
<th>Site quality</th>
<th>Diameter at 100 years (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>poor</td>
<td>$&lt;10.3$</td>
</tr>
<tr>
<td>medium</td>
<td>$10.4 - 17.8$</td>
</tr>
<tr>
<td>good</td>
<td>$17.9+$</td>
</tr>
</tbody>
</table>

Stump count data: species, stump diameter, height of stump, radius at 100 years and calculations of average
PART II SECTION 9  STANDARDS OF FOREST CLASSIFICATION AND SPECIAL CRUISE TECHNIQUES - contd.

diameter at 100 years must be entered in the Calculations section of the code sheet. Each site quality typed out in a block of logged-over land must be covered by a code sheet.

G. 20 Chain Inventory

1. General

These areas are distinguished by virtue of 20 chain scale, 8 inch focal length photography used to establish a net of photo volume double samples to be used in a scheme to improve the error of the volume estimate by application of stand photo volume tables.

The application of these photos and photo volume plots will be in conjunction with the maximum use of other aids, eg. air coding, ground coding checks, air sampling with a minimum of stereograms being built up to cover the major types, and relascope double samples.

The ground sampling work will also be integrated with volume table, loss, and other merchantability factor requirements, to correlate the locality with regional data on hand.

2. Forest Classification

(a) Two sets of photos are available, "A" and "B". Photo volume samples will be completed on the "B" set of photos and the results in the form of a map showing the location of the samples with a table of the stand heights and stand densities will be provided to the air coding party before any air coding work is commenced.

(b) Air coding to the special standard laid down in the coding manual will be completed on the "A" set of photos and the results sent to the Victoria office for typing and extensive application of stereograms. As soon as the type map has been completed a copy will be forwarded to the ground party.
(c) The air coding crew will air sample important photo volume sample areas to obtain primarily an estimate of volume by species.

(d) Air samples in major types will be accompanied by a stereogram record at the discretion of the air coding party chief. Similarly he will designate the location of other stereogram record areas on the appropriate photos.

(e) No extensive ground coding program is to be planned. Ground crews will fill in code sheets and type description sheets for any areas visited on the ground during ground sampling and relascope sampling. The field or air coding party chiefs also may find it necessary to designate ground coding in specified areas other than the above depending on mapping requirements.

(f) The Victoria region staff will correlate air coding notes, ground code sheets and type descriptions, and final type maps, to provide the compartment descriptions and unit report pending further compilation.

3. Stereograms

(a) Definition — a stereoscopic pair of photographs or drawings correctly oriented and mounted for stereoscopic viewing. For our work — a pictorial representation of a stand from aerial photos.

(b) Use — as an aid in forest type mapping. This technique of forest classification will be confined to the Victoria office phase of mapping, except that the actual stereogram areas must be delineated on the photos in the field by the air or ground party chief, or some other qualified mapper. Approximate 2" X 2" stereoscopic mate areas should be clearly delineated on a stereoscopic pair of photos for each stereogram.

(c) Delineation

(i) only that part of a photo contained within the wing points (control points) can be considered as suitable, i.e. the "effective" area of any photo.

(ii) use the pair of photos closest to whose baseline the type is located.
(iii) any one stereogram may show several types but the description in the stereogram file will only apply to one of the types shown. Therefore, types will have to be clearly delineated and labelled before the stereograms are constructed.

N.B. Keep labels small and neat and outside the 2" X 2" areas so as not to hinder the usefulness of the stereogram.

(iv) minor types (100 acres or less depending on local type variation) will not warrant stereogram records. These, plus patches of NCBr, swamps, etc. will be classified either by code sheets alone or by map notes. Photo interpretation techniques will undoubtedly apply here.
PART III  PHOTOGRAMMETRY

SECTION 1 AERIAL PHOTOGRAPHS

A. Introduction

The uses of aerial photographs in forest inventory are increasingly important. Their utility can be expected to increase as additional techniques (e.g., determining timber volumes from photographs) are developed and adapted to local conditions.

The use of aerial photographs, however, should not be regarded as a complete substitute for ground work. It seems that we will never dispense with the need for ground observation. This is especially true in B.C., because of complex cover types and rough topography.

B. Characteristics of Aerial Photographs

In forest survey work, we are concerned entirely with vertical aerial photographs. The other kinds of aerial photographs, namely obliques and composites, are of academic interest only to forest survey workers in B.C. Obliques are obtained from exposures made with the axis of the lens at an angle to the vertical. Composites are made with multilens cameras. The axis of one lens is vertical and the others are oblique (i.e., at an angle to the vertical).

1. Vertical aerial photographs

In securing this type of photograph, the aircraft is flown back and forth over the area in question along straight and level flight lines. The flight lines are spaced as nearly parallel to one another as possible, so as to give complete photographic coverage in strips of pictures. The distance between photo centres, and the width of strips results in pictures which overlap the subject area both along flights (side lap) and between pictures of given flight (end lap). The amount of overlap is generally 30% side lap and 60% end lap.

2. Types of vertical aerial photographs used

The Forest Surveys Division makes use of aerial photographs secured from two agencies. As far as possible, the aerial photographs used are flown by the Air Surveys Division of the Surveys and Mapping Service. These photographs may be identified by the letters "B.C." preceding the flight number on the individual photograph (e.g., B.C. 1250 - 20). The camera used has a lens with a focal length of 3.25 inches, and the negative size is 5 X 5 inches. The prints are enlargements of these negatives, being 9 X 9 inches in size. Making enlargements of the negatives produces a photograph having a larger scale than would result from contact prints. In effect the focal length of the lens is increased from 3.25 inches to 5.85 inches (3.25 X 2).
2. Types of vertical aerial photographs used, contd.

Thus in determining photo scale for "B.C." photos by method (b) shown in C below, a focal length of 5.85" must be used. It should be noted, however, that for some purposes, the blowup may be greater, up to several diameters, and the effective focal length varied accordingly.

Where "B.C." photographs are not available, R.C.A.F. flying may be used. The R.C.A.F. photographs may be identified by the letter "A" preceding the flight number on the individual photograph (e.g., A 1203-8-95). Generally speaking, the Air Force photographs are taken from 20,000 feet above sea level, using a camera with a 6 inch focal length lens. However, as much of the Air Force photography was carried out in connection with training programs during the past war, the flying was not always consistent with these specifications. Thus in determining photo scale for R.C.A.F. photographs it is probably advisable to use method (a) shown in C below.

C. Some Elementary Mathematical Characteristics of Vertical Aerial Photographs

Some basic fundamentals are essential to understanding the nature of aerial photographs. These will be discussed under: I. Scale; II. Scale Change Due to Relief; III. Effect of Tilt.

1. Scale

The scale of an aerial photograph is expressed in terms of a representative fraction or a ratio (e.g., 1/35,000, i.e., 1 inch = 35,000 inches). There are two methods of determining the scale of an aerial photograph.

\[
\text{Scale} = \frac{P}{G}
\]

(a)

- **P** = the distance between two points on a photograph.
- **G** = the distance between the same points on the ground.

(See section on Navigation for method of transferring points from photo to map).
PART III PHOTOGRAMMETRY

C. Some Elementary Mathematical Characteristics of Vertical Aerial Photographs

Note: \( P \) and \( G \) must be expressed in the same units of measure in the formula.

Example - Two points are 2.6 inches apart on the aerial photo. The same two points are 2.6 inches apart on the map. The map has a scale of 1 inch = 40 chains. Thus the two points are \((40)(2.6)\) or \(104\) chains apart on the ground.

\[
\text{Scale} = \frac{2.6}{(104)(66)(12)} = \frac{2.6}{82368} = \frac{1}{31,680}
\]

(b) If a map is not available, the scale of an aerial photograph may be determined by considering the focal length of lens and the flying height of the aircraft, as follows:

From (a) above, Scale = \( \frac{P}{G} \)

then by similar triangles \( \frac{P}{G} = \frac{F}{H} \)

Therefore: Scale = \( \frac{F}{H} \), where

\( F = \) focal length of lens
\( H = \) height of aircraft above ground (not height above sea level)

Note: \( F \) and \( H \) must be expressed in the same units of measure in the formula.

Example - Flying height of aircraft is 15,500 feet above ground level. Focal length of lens is 5.65 inches.

PART III, SECTION 1, contd. (SANSMANUAL PART V) (1955)
PART III PHOTOGRAMMETRY

C. Some Elementary Mathematical Characteristics of Vertical Aerial Photographs

Therefore \( \text{Scale} = \frac{5.85}{15,500 \times 12} = \frac{5.85}{186,000} = \frac{1}{31,795} \)

(B.C. Photos used on 40 chain laydowns generally from 17,500 M.S.L.)

2. Scale Change Due to Relief

The foregoing section on scale assumes conditions of level terrain. When topographic relief is present, there results an apparent displacement of photographed images. On the resulting photograph, those objects higher than the datum will be displaced outward and those lower will be displaced inward. Thus, where there is relief, the scale of a given aerial photograph is variable. The fundamental rule is - the scale is constant along the contour.

Scale = \( \frac{F}{H-h} \) where

- \( F \) = Focal length of lens
- \( H \) = height of aircraft above sea level
- \( h \) = height of ground above sea level

Example: if ht. of aircraft above sea level = 17,500',
ht. of point (a) above sea level = 2,000',
ht. of point (b) above sea level = 1,000',
focal length of lens = 5.85''

then scale for point (a) = \( \frac{F}{H-h} = \frac{5.85}{(17,500-2,000)12} = \frac{5.85}{186,000} \)

= \( \frac{1}{31,795} \) (i.e. 1" = 40 chains)

PART III, SECTION 1, contd. (SAMPLING MANUAL)

(1955)
2. Scale Change Due to Relief, contd.

\[
\text{scale for point (b)} = \frac{F}{H-h}
\]

\[
= \frac{5.85}{(17,500-1000)12} = \frac{5.85}{198,000}
\]

\[
= \frac{1}{33,846} \quad (\text{i.e. } 1'' = 43 \text{ chains})
\]

It should be noted that, in the above example, while the difference in elevation between point (a) and point (b) is 1000 feet the difference in scale is only 3 chains per inch. Thus a fairly general approximation of ground elevation will permit the calculation of scale which is accurate enough for most purposes.

3. Effect of Tilt

Tilt in aerial photographs results from exposures made when the aircraft and the camera are not in truly horizontal position. Tilt can result when the aircraft is ascending, descending or when one wing is high. The area covered by such exposures is not a true square, since less area is included by the low side of the film and more by the high side. The subject area included in the photograph is then really a trapezoid and hence the images are displaced and distorted in shape and scale.

It is not important to know the mathematics involved in tilted photography, aside from knowing in general the effects. Since the photographs in use have tilt limited to about one degree, it will be undetected by fieldmen and so will be of no consequence. Therefore, for the purposes of forest surveying the fundamental rule to be applied is: - angles about the (central) principal point of the photograph are true and can be measured by a protractor between rays radiating out from the centre (principal point) to any point on the photo, regardless of elevation, and transferred directly to the map from the principal point traverse (base line) provided that the origin of the protractor is placed on the mapped centre of the photograph used, and provided the angle is plotted from the base line on the map which was used on the photograph.
PART III PHOTOGRAMMETRY

SECTION 2 USE OF STEREOSCOPE

A. Introduction

The principles of binocular vision can be applied to the study of aerial photographs to produce a three-dimensional image. If the same area is photographed from two different points, each photograph records the image that would have been seen by a human eye had it been in the position of the camera lens. As mentioned previously, the aerial photographs in use have an end overlap of 90% and a side overlap of 30%. An overlapping pair of aerial photographs are, in effect, views of an image from two eye positions. If these two photographs are viewed (with the pictures in the correct sequence) so that one eye sees one picture and the other eye sees the other picture, the two pictures will be fused by the brain into a single three-dimensional image.

The stereoscope (either the large mirror type or the small pocket size lens type) is simply a mechanical means of keeping left and right images separated for presentation to the left and right eyes respectively.

Since vertical aerial photographs are normally taken many feet apart, the illusion of depth created when a pair of overlapping aerial photographs is viewed through the stereoscope is similar to that seen by the naked eye but a few feet from the ground. As a result the third dimension is exaggerated in the stereoscopic image, objects appearing higher and slopes steeper than they actually are.

B. Orientation of Photographs for Stereoscopic Study

Any two adjacent photographs in a flight can be used for stereoscopic study. The area which can be viewed stereoscopically on each pair is that portion common to both photographs.

A short time devoted to properly orienting photographs will greatly increase the ease and efficiency of stereoscopic study. Many people undergo unnecessary eye strain because of their lack of appreciation of the need for proper orientation of the aerial photographs.

The method outlined below for orienting photographs should be followed in stereoscopic study.
PART III PHOTOGRAMMETRY

B. Orientation of Photographs for Stereoscopic Study, contd.

1. Select two adjacent photographs in a flight. If the left and right hand photos are in the correct order, the area common to both will be in the centre (as indicated in above diagram).

2. Locate and mark the principal point (centre) of each photograph. This point is indicated by a cross (X) in the centre of the photo.

3. Transfer the principal point of each photograph to the position where it appears on the adjacent print. The position of the transferred principal point is known as the conjugate principal point.

4. Keeping the area common to both photos in the centre, place the photos so that any shadows in them fall as nearly as possible toward the observer. To accomplish this it may be necessary to rotate the two photos through 180°. There is a strong tendency for the observer to see relief in reverse, if the shadows fall away from him.

5. Using a straight edge, line up the photos so that a straight line will pass from the left hand principal point through the left hand conjugate principal point, the right hand conjugate principal point and the right hand principal point. Remove the straight edge.

6. Place the stereoscope over the photographs, with an imaginary line through the centres of the lenses or mirrors directly above the line of flight on the photographs, i.e. line up the stereoscope, do not shift the photos.

7. Study the photographs through the stereoscope. Keeping the alignment as described in 5 above, either increase or decrease the distance between the photographs until the principal point on the left photo and the conjugate principal point on the right photo appear to merge. You should now see a single three-dimensional image.

If the adjacent photos viewed are not in the correct order (i.e. with the area common to both not in the centre), it is still possible to see a three-dimensional image. However, what the observer will see is a pseudoscopic image. A pseudoscopic image is one in which the natural ground relief is reversed. That is, all the valleys will appear to be standing up, and the high points will appear as depressions. The pseudoscopic image is particularly noticeable if a body of water is being viewed. In this case the surface of the water will appear to be higher than the surrounding land.
PART III  PHOTOGRAMMETRY

SECTION 3  PHOTO INTERPRETATION

A. Introduction

Photo-interpreting ability depends upon the accuracy with which the observer can recognize, under the stereoscope, objects with which he is familiar on the ground. It is the utmost importance that photo-interpreters develop the ability to correlate forest and other features on the ground and the photograph. Familiarity with local conditions will do more than anything else to improve the quality of photo-interpretation.

B. Pictorial Qualities of Photographic Images

Objects are recognized on aerial photographs because of pictorial elements of which shape, dimension, tone, and texture are important.

1. Shape and Dimension

Many images may be recognized by their two-dimensional shape. These include railroads, roads, rivers, and lakes. When viewed in the third dimension other shapes may be recognized. These include hills, valleys, cliffs, buildings, trees and shrubs.

2. Tone

Most photographic tones are gray. Objects which reflect considerable light will photograph light in tone, while objects which absorb light will photograph dark.

While tone is valuable in photo-interpretation, it should not form the sole basis of judgement. A uniform stand of timber, for instance, may register in a variety of tones, depending upon the location of the sun and the topography. The stand will appear lightest on the side of the photograph away from the sun, because the camera will catch the greatest amount of sunlight shining on the tree crowns. Also trees growing on a hillside sloping away from the sun will photograph darker in tone than similar trees growing on a hillside sloping toward the sun. Furthermore, most aerial cameras admit more light through the centre of the lens than around the margins. Thus tones around the margin of the photograph will be darker than in the centre.

3. Texture

As with tone, texture may vary from one part of a homogeneous stand to another because of the relative locations of the sun and camera. Also a timber stand viewed from directly above will appear finer in texture than the same stand, viewed from an angle.

Furthermore, a stand growing on a hillside facing the photo centre will have a more coarse texture than the same stand growing on a hillside sloping away from the photo centre.

An important aid to photo interpretation which is not a pictorial quality, is the relation of an object to topography. Tree species occupy characteristic topographic sites, and would normally be looked for on these sites.
PART III PHOTOGRAMMETRY

SECTION 4 "WOODS" NAVIGATION

A. Introduction

It will be necessary for field crews, particularly those engaged in sample plot work, to do considerable navigation of a "dead reckoning" nature in the woods. As mentioned in Section 5 on "Aerial Photo Volume Tables", sample plots will be located on the ground by running a compass line from a reference point such as a swamp, bend in a creek, road junction, etc.

The position of this (or any other) point on the map cannot be determined directly from the photograph since, when topographic relief is present, the photo location of a point will be displaced in a radial direction from the photo centre, and the scale of the photograph will be variable. The direction can be determined as one ray from the centre of each photo in which the point appears, but it is necessary to fix the location of the reference point (road junction etc.) from the photograph to the map by plotting the intersection of at least two rays.

B. Transferring a point from Photograph to Map
PART III PHOTOGRAMMETRY

B. Transferring a point from Photograph to Map, contd.

In the above example, point (a) on photo BC 1427:99 is to be transferred to the map. The procedure is as follows:

1. Mark the location of point (a) on photo BC 1427:100 (point (a') in the illustration). This should be done by stereoscopic study of the two photographs, unless the exact point is unmistakable in both photos.

2. On photo 99 draw a line from point (a) to the photo centre. Similarly on photo 100, draw a line from point (a') to the photo centre.

3. On Photo 99 place a protractor along the flight line. The line through 180 degrees on the protractor should be placed exactly over the common flight line between the two photos being used and the intersection of the lines through 180 degrees and 90 degrees on the protractor should be exactly over the photo centre.

Now read off the acute angle between the flight line and the line from the photo centre to point (a) (55° in the example).

4. Mark off a similar angle on the map and draw a line through photo centre 99.

5. Repeat step 3 on photo 100, and read off the acute angle between the flight line and the line from the photo centre to point (a') (48° in the example).

6. Mark off a similar angle on the map and draw a line through photo centre 100.

7. The intersection of the two lines on the map will be the location of point (a).

8. It is possible for a point to show in six photographs, three on one flight and three on the adjacent flight. To be as accurate as possible, plot as many rays as possible and spot the middle of any "triangle of error", or take the point where most of the rays intersect.

C. Transferring a point from Map to Photograph

This job will be necessary on various occasions, e.g. transferring the map location of a sample plot to the photograph. It should be understood that this is only an example.
PART III  PHOTOGRAMMETRY

C.  Transferring a point from map to photograph, contd.

If the sample plot can be "pin-pointed" exactly on the photograph by reference to an identifiable point it is not necessary to plot the location on the map then transfer it to the photo. It is necessary, however, to be absolutely certain that you have identified the exact position of the plot centre on the photograph, and this can only be done if there is some unusual feature at the plot location, such as a tall snag in the middle of a small opening.

The procedure can in general be applied anytime you wish to know where you are on the photograph when you are running a line on the map.

The procedure for transferring a point from map to photo is as follows:
PART III  PHOTOGRAMMETRY

C. Transferring a point from Map to Photograph, contd.

1. Point (a) on the map is to be transferred to photo B.C. 142799. On the map draw a line from point (a) to the centre of photo 99.

2. Place a protractor on the map, with the line through 180° on the protractor exactly over the flight line between photo centre 99 and 100. Place the protractor so that the intersection of the lines through 180 degrees and 90 degrees falls directly over photo centre 99 on the map.

Now read off the acute angle between the flight line and the line from point (a) to photo centre 99 (52° in the example).

3. Mark off a similar angle on photo 99, and draw a line from the photo centre.

4. On the map draw a line from point (a) to the centre of photo 100.

5. Repeat step 2 for photo centre 100 on the map. Now read off the acute angle between the flight line and the line from point (a) to photo centre 100 (56° in the example).

6. Mark off a similar angle on photo 100, and draw a line from the photo centre.

7. Study photos 99 and 100 stereoscopically. The line on photo 99 and the line on photo 100 will now appear to cross. Thus the position of point (a) on photo 99 is fixed by the apparent intersection of the lines on photo 99 and photo 100.

D. Navigating entirely from Photographs

The aerial photographs in themselves provide the best available map of the country and full use should be made of them. It is essential that field men be able to relate their progress over the ground to all corresponding identifiable positions on the aerial photographs.

In many areas the forest is broken up by the occurrence of numerous lakes, swamps or other natural openings (e.g. areas of open range) which can be readily identified on the aerial photographs. In this type of country, knowing your starting point, it is possible to navigate entirely from the aerial photographs by proceeding, in short jumps, from one swamp etc. to another. This procedure will be particularly valuable to "coders" once proficiency is acquired.
PART III  PHOTOGRAMMETRY

SECTION 5  AERIAL PHOTO VOLUME TABLES

A. Types of Aerial Photo Volume Tables

1. Stand volume table

This type of volume table allows direct estimation of volumes per acre by measures of average stand conditions on photo plots in appropriate forest types. Corrected total volume estimates for any desired unit of area may be obtained by a suitable amount of double sampling (i.e. ground checking).

2. Individual tree volume table

This type of volume table allows the direct estimation of individual tree volumes by individual tree measurements on a photo plot. Volume per acre is calculated by the summation of individual tree volumes brought to a per acre basis.

The stand volume table is the type of photo volume table which we will construct, and during the field season data will be collected on both volume/decay samples and inventory samples for this purpose.

B. Method of Construction

1. Ground sample-photo sample relation

The construction of aerial photo stand volume tables depends upon the establishment of any existing correlation between photo (and/or ground) measured variables and ground sample volumes. If such a correlation does exist in a forest type, it will only be established by considering the variables and the volumes from coincident sample areas. This follows from the established fact that variation in stand volume increases from a point. Hence photo measured variables should be taken from photo samples exactly coincident with the ground samples.

It follows, then, that there is need for extreme accuracy in locating both volume/decay and inventory samples on the ground and on the aerial photos. If the centre of a sample falls on a point which is recognizable on the aerial photo, the location will be "pin pricked" directly on the photo.

If, however, the sample centre falls in a densely timbered area it will be necessary to transfer this location from the map to the photo by the method outlined in Section 4 on "Woods" Navigation and "pin-prick" the location on the photo. Thus in running a compass line to a sample, extreme care must be exercised to ensure that the compass bearing given for the line is followed exactly on the ground and that the correct distance is run.
PART III  PHOTOGRAMMETRY

B. Method of Construction, contd.

In this connection, it is valuable to "pin-prick" any position on the compass line which is identifiable on the photo.

Example

"Pin-prick" and circle with pencil on back of photo - write on back of photo: edge of swamp 20 chains from start of strip No.----

An instrument will be used for "pin-pricking" locations on aerial photos. Make this instrument by pushing a common pin through half an eraser, and use the other half to "cap" the point when not in use. This instrument should be used (rather than a pencil point or other blunt instrument) as it is important to keep the size of the hole made in the photograph as small as possible. Each "pin-prick" should be circled on the back of the photo.

2. Variables to be measured on ground plots

(a) Height

The measurements will be entered in the column titled "Tot. Ht." of the Tree Heights section under Tree Measurements on the back of the sample plot sheet.

Five height measurements of the tallest trees (dominants and/or co-dominants) in each 1/8 acre plot are required, to establish a reliable average maximum height for the plot. This does not necessitate any additional field work, since the sample crews are instructed (in the Section on Tree Heights in the Sampling Manual) to take the height of five dominant and/or co-dominant trees, along with heights for lower D.B.H. classes to establish a diameter-height curve for the plot. The calculation of site index also depends upon adequate height measurements. Thus with these several compilations based on tree height, the need for accurate measurements is apparent.

(b) Crown-closure

Where the sampling crew is equipped with a "Moosehorn" instrument, 20 crown-closure readings per 1/8 acre plot will be taken. The procedure for taking "Moosehorn" reading will be as follows:

PART III, SECTION 5, contd.  (SAMPLING MANUAL)

(16)  (PART Y)

(1955)
PART III PHOTOGRAMMETRY

B. Method of Construction, contd.

(i) The readings will be taken along two lines through the centre of each 1/8 acre plot at right angles and in the direction of the lines run to the plot from the sample centre and at right angles.

(ii) Five readings will be taken on each side of the centre of all four plots at 6 foot intervals.

Enlargement of Plots

The "Moosehorn" operator sights into the eyepiece with the instrument vertical and calls out the number of dots which fall in open spaces in the upper crown cover (not shrubbery or suppressed trees as this foliage is not visible on the air photographs and could not figure in an estimate of density made from them). If a dot falls in a clear opening between foliage, i.e. between branches, count it, but if it falls on a thin crown area such as a feathery branch tip do not count it even though light is visible. Dead branches are considered open spaces.

PART III, SECTION 5, contd. (17)

(1955)
PART III PHOTOGRAMMETRY

B. Method of Construction, contd.

View of crown canopy as seen through "Moosehorn"

In the above diagram, 10 dots would be recorded as falling in open spaces in the crown cover.

These readings will be recorded in the column titled "Crown closure" under "Photo Volume" section on the back of the sample plot sheet. The readings must be made and recorded in the sequence shown in the diagram under "Crown closure" on the preceding page.

Example of Tally Sheet

<table>
<thead>
<tr>
<th>PHOTO VOL.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crown Closure</td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>Along tie line</td>
<td>At right angles</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sub Total</td>
<td>70</td>
<td>80</td>
</tr>
<tr>
<td>Plot Total</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>% Gap=Plot Total X 0.2</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>% Crown Closure = 100 - % Gap</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>
PART III  PHOTOGRAMMETRY

B. Method of Construction, contd.

(c) Plot Elevation

The elevation of each sample will be recorded in the space provided on the sample plot sheet. The sample elevation will also be marked on the back of the aerial photograph beside the "pin-pricked" position. This elevation will be determined by barometer and/or abney level readings. The topographic scale on the abney level gives the increase in elevation per chain of horizontal distance. Thus if the abney reading between two points is 20, and the distance between the points is 2 chains, the change in elevation is 40 feet (20 X 2).

Elevations in addition to those of the sample plots should be established for any points recognizable on the aerial photographs (swamps, lakes, creek junctions, etc.) These elevations should be spread over as much of the photo areas as possible during travel to and from the plots. The point for which the elevation is established should be "pin-pricked" on the photo. On the back of the photo, circle the "pin-prick" with pencil and record the elevation, date, and time.

(d) Crown-diameter

Where the sampling crew is instructed to obtain this measurement and record it for individual trees on the tally sheet, they will be provided with special equipment and procedural details. The principle involved is to provide further classification of stands and possible correlations between ground and air measurements, hence this measurement will always be that of the crown diameter of the tree which is visible from above.
Initially the air coding system of classifying timber stands was designed to provide a rapid, reasonably accurate method of typing extensive back areas, where more intensive ground surveys would necessitate too much time and manpower. This system has proved to be very effective for most areas and can be adopted to meet various specifications.

The project area is divided into a number of smaller units called flight plans. Two or three flight plans are covered in a normal day of flying. A flight plan has a number of pre-selected points marked on air photos to be observed in various timber types. These "calls" are recorded systematically for future reference when classifying or typing the area. Between "calls" the distribution and occurrence of types is observed so that changes in forest type may be mapped on the photos or at least noted on the photos as an aid in office typing.

Forest classification criteria and intensity of survey conform to either Special or Inventory standards. Air coding may also be used as an aid in any forest classification work in conjunction with ground coding, air photo volume techniques, and double sampling methods; its application is practically unlimited in strengthening field estimates. Its potentialities for reconnaissance in connection with a field report on development aspects can also be utilized.

Air coding involves the use of a two man survey crew, plus a pilot and a float plane. The map reader directs the pilot to pre-selected air call locations on the flight plan where the air coder records the required data on a standard form while the aircraft circles the spot. Depending on the size of the project, any number of two man teams may work under the direction of the section head.

It is well to appreciate the extensive areas classified by this method during a field season and the resultant necessity of devising a rapid and efficient system of processing the information to various inventory or special standards from the original "calls" together with typing and labelling the air photo in preparation for plotting on base maps.
SECTION 2 GROUND PLANNING

A. MAPS AND PHOTOS

1. Coverage

Full photo coverage on every flight plan facilitates map reading and ensures complete recording of pertinent stand data. However, gaps in photo coverage are not uncommon and can be supplemented by notations on small scale maps which can be transferred to the appropriate photos when they become available.

2. Photo Selection for Flight Plan

Photo laydown maps are preferred in selecting photos for the flight plan. If such is not available then a photo key map must be used. The difficulty in using the latter for photo selection arises during the typing stage, as these photos may not be used on the final base map. This situation is not serious but may result in double typing which should be avoided.


National Topographic and Mines and Technical Surveys maps, scale 1 in. = 4 miles, are most suitable for navigation from base to flight plan and return. Unfortunately, at the present these maps are not available for the entire province. However, Mines and Technical Surveys maps, scale 1 inch = 8 miles, provide province-wide coverage and are the type most commonly used by pilots of light aircraft.

B. FLIGHT PLANNING

1. Flight Plan Preparation - General

(a) Type of Aircraft

At this date a satisfactory combination of power, maneuverability, cruising range and economy indicates that the float equipped De Haviland Beaver is the most suitable aircraft for use in this type of work.

(b) Crew

The normal air coding crew includes a map reader and an air coder. The map reader is seated beside the pilot. It is his duty to follow the predesignated route of the flight plan. He must direct the pilot to the indicated air call locations, and enter on the photograph the air call number applied to the stand being described and recorded by the air coder who is seated directly behind him.

PART IV SECTION 2

(2)

(1957)
(c) Limiting Factors and Procedure

Actual flying time is primarily limited by the fuel capacity of the aircraft used, and secondarily influenced by terrain and weather. Furthermore, the total area coded in the course of a given flight is influenced by the distance from aircraft base to point of commencement and the number of forest types represented in the flight plan area. With these limiting factors in mind, large areas are divided into a number of "Flight Plans". Each "plan" commences at a prominent topographical feature easily discernable on the aerial photograph and topographic map.

From this point, maintaining continuous photo coverage of the projected area, the flight plan proceeds as topography permits. Each photograph included in the plan is marked in color with arrows indicating the direction of flight. Orientation is achieved by indicating north on each photo.

(d) Air Calls

During the process of assembling a flight plan, each photograph is carefully examined to ascertain variations in Forest cover. These photo-visible variations are marked with a colored crayon and designated "air call" locations. At these points the map reader instructs the pilot to circle and the air coder is required to classify or "code" the forest cover. These "call" locations thus serve as a guide in coding, and assure that major forest types will not be overlooked. Any major types observed during field examination that were not originally marked for air calls are also coded.

(e) Processing

Following the flight a summarizing process groups duplicate field data (i.e., calls which do not record significant stand structure variations) into recognized classes or types. Standard code sheets are then completed describing same. The applicable code sheet references are then entered on the back of the photographs beside the air call numbers and delineation of types can proceed.

2. Individual Flight Plan Preparation

(a) All aerial photos covering the proposed flight plan area are laid out to form a rough mosaic.

(b) The nature of the terrain will determine the method of flight planning to be employed.
(i) Strip Method

This method is employed in areas characterized by flat or low rolling terrain (abrupt variations in elevation should not exceed 700 feet). The course of the flight plan will conform with that in which the area was photographed. In inventory areas (photo scale 1 inch = 40 chains) alternate flight lines are used. More intensive surveys (photo scale 1 inch = 40 chains or 1 inch = 20 chains) require the utilization of adjacent flight lines.

(ii) Valley Method

In mountainous country the flight plan commences at the headwaters in order that the aircraft can maintain altitude throughout the flight plan and the pilot can familiarize himself with local valley conditions en route to the point of commencement. If the valley sides are forested to elevations in excess of 1000 feet above the valley floor it is expedient to complete calls at upper elevations on both sides of the valley before descending to calls on the valley bottom.

In a survey of any given intensity the irregularities typical of mountainous terrain contrasted with the straight line nature of photo flight lines necessitate crossing from flight line to adjacent flight line in order to effect complete coverage. Flight plan and flight line direction thus seldom coincide as they do when the strip method is employed.

The following is a typical example of a flight plan:

FLIGHT PLAN 49  (Zone 4)

Phase #1 - From Burns Lake, S82°W for 34 miles to West end of Francois Lake on photo B.C. 1903:28.

Phase #2 - Proceeding due South B.C. 1903:28(5) (Ground check)
1903:30(2)
1903:32(2)
1903:34(3)
1903:36(2) Ootsa L. (ground check)
Phase #3 - Continuing south B.C. 1903:28(2) Ootsa Lake
       1903:40(2)
       1903:42(2)
       1903:44(3) Michel Lake
           (possible ground check)
       1903:46(2)
       1903:48(1) Goodrich Lake
           (possible ground check)

Phase #4 - From B.C. 1903:48 due West across B.C. 1912:68(2) to B.C. 1904:51

Phase #5 - Proceeding due north B.C. 1904:51(2)
       49(2)
       47(1)
       45(3)
       43(3) Sinclair Lake
           (ground check)

Phase #6 - Continuing North B.C. 1904:41
       1904:39
       1904:37
       1904:35 End on Nadina River

Phase #7 - Return to Base (Burns Lake).

Flight plans are made out in triplicate.
- 1 remains with photos in the aircraft
- 1 remains at the aircraft base
- 1 remains with the main control radio.

This flight plan is divided into 7 phases for easy reference when the pilot is reporting his position (see Part VI, Section 1 - Communications). The number of phases may vary depending on the size of the flight plan.

3. Notes on Flight Planning

(a) Do not use pre-typed photos. This alters the shape of topographic features used in map reading.

(b) Air calls

- 40 air calls per flight plan require approximately 3 to 3 1/2 hours for completion using the valley method while 50 air calls consume a similar amount of time on the strip method. Any flight plan with more than 60 air calls will be very long.
(c) When the flight plan is prepared its course is described in india ink on the most suitable topographic map available together with arrows indicating direction of flight, "phase" divisions, and flight plan number. Additional copies for use by radio control stations can be photostatted from the originals.
1. Map Reader

The map reader is usually the senior member of the two man crew. For increased efficiency, he should study the performance of the aircraft to learn:

(a) approximate cruising range in hours and ground miles.
(b) required distance for takeoff and landing.
(c) water and shoreline conditions which will permit ground checks.
(d) time required to fly across 20 chain and 40 chain aerial photographs.
(e) approximate time required to fly 1, 5, 10 or 20 miles and correlate to the scale of topographic maps in use.

Considerable judgement is required of the map reader while in the air. Although he may be limited to the area covered by the flight plan, he should be flexible within this flight plan; he should include or discard points marked on the photos for air calls, taking into account the standard of coverage needed and the difficulty of the area for office interpretation. A heterogeneous area will require more air calls than one with only a few broad types. However, more map notes on the photograph, interspersed with a judicious selection of air calls, should produce a sufficiently accurate answer in difficult areas.

A typical photo which confronts the map reader has three marked call points. By hand gestures, he directs the pilot to one of the call points and then indicates that he wants the plane to circle (depending on the extent of the type, this may be a shallow curve over a large area or a steep turn if the type is smaller). He then describes to the air coder the extent of the type to be called. While the air coder is recording, the map reader locates the direction to the next call. He should have time to make map notes of surrounding types on the photo (species, height and stand structure), draw rough type lines, and appropriately label non-forested areas. The resultant photo will have enough air calls, map notes, and rough type lines to control the interpretation of photos in the office.

The pilot circles the type until the air coder indicates he has all pertinent data recorded. The pilot is then directed to the next air call. This type may be similar to the one just called - if so, the map reader need only write the previous air call or type number on the face of the photo, and then proceed to the third call point. If he sees an extensive type not previously marked on the photo, he should make an additional air call.
The success of any individual flight plan depends on the map reader. Each flight plan should be carefully studied under stereo before takeoff. His ability to direct the pilot, to make an adequate number of map notes, to choose his ground checks skillfully, and to check on the air coder’s work can well mean the difference between a successful flight or one that is of limited value for photo interpretation and typing.

2. Air Coder -- Air Call Procedure

The air coder records the data of individual types on the air coding sheet. He should feel completely at ease in the aircraft so that he can concentrate fully on the forest. If he allows himself to be distracted by the circling of the plane and the work of the map reader, his efficiency is impaired. Absolute concentration on the forest cover is needed with the air coder calling on all his forestry experience and training to describe the stand.

As the aircraft circles, the map reader indicates the type on the ground which is to be described. He then gives the aerial photo and flight number to the air coder who enters them on the air coding sheet. The air coder then tells the map reader what air call number to use (all numbers for the season are consecutive from one). The map reader then pricks through on the photo at the point where this call is to be made; circles it on the back of the photo and then enters the air call number beside it. Each air call number will be accompanied by the year of survey in brackets, i.e. 1733 (56).

If this same air call number is carried over by the map reader to what he thinks is a similar type, he then writes it on the front of the photo as an aid to typing. It should not be written on the back of the photo. Only the original type numbers which were actually circled by the aircraft and recorded by the air coder will be printed on the final base map.

i.e. type number 133 is recorded by the air coder as mature spruce-tamarack. As the plane circles, the map reader sees an extensive type on the opposite side of the valley from this air call, similar in every respect to type number 133. He then writes number 133 on the face of the photo.

Confusion will result if one type number is carried over too great a distance (2 photographs at the most). To remember what type 133 is for a whole flight plan is an impossibility. The best procedure, when in doubt about a type, is to circle and enter it on the air coding sheet. When he has finished, the air coder notifies the map reader who then indicates to the pilot the direction to the next air call point.
To aid him in this description the air coder refers to a form called the air coding reference sheet. (F.S. 489 - see Appendix 5). An explanation of its use follows the Stand Structure section of the Air Coding Sheet explanation. It simply supplies, on a form of convenient size, an orderly arrangement of the code sheet check-off items which must be referred to in completing the air coding sheet. Its use will become evident.

3. Technical Operations

(a) Aircraft

Past experience has indicated that the following criteria are desirable for work of this nature.

(a) reserve of power
(b) highly manoeuvrable
(c) high cruising speed and low stalling speed
(d) cruising range 3 1/2 - 4 hours
(e) good visibility
(f) float equipped - dropping hatch installed

(b) Pilot

It is necessary to have a pilot who has a wide range of experience in flying float equipped light aircraft in both coastal and interior zones. His experience and training however cannot be fully utilized unless he becomes familiar with and shows an interest in, the air coding system, is thoroughly briefed before each flight plan and has a fairly detailed preview of the projected seasonal operations. In all situations involving aircraft safety his decisions will be final. Arrangements for adequate gasoline and oil supply and suitable bases of operation are his responsibility and emphasize the necessity of long range planning and co-operation between pilot and party chief.
A. EXPLANATION & USE OF AIR CODING SHEET (Appendices 3A and 3B, front & back respectively).

Following is a summary of the columns found on the air coding sheet, indexed as they appear on the sheet.

1. Location

These columns establish the location of the air call.

(a) Air call number (or forest type number)

Air call numbers are consecutive from one at the start of the field season. They are entered on the back of the photograph by the map reader where the air call is made. Thus it is possible to locate the exact, original location of the call number.

(b) Code sheet

Code sheet numbers are added during the summarization of the air calls which are grouped under their appropriate code key. This is done on the ground after the flight plan has been completed (see Ground Compilation).

(c) Photo Number

This is the flight and photo number on which the air call is made. It is passed by the map reader to the air coder at the time when the map reader is indicating the point on the ground to be air coded.

(d) Region Number

(e) Compartment Number

Completed on the ground.

2. Stand Structure

Check-off columns are in the following order and descriptions are derived from Part I of this Manual.

(a) Class Main Crop Immature (St. Str. 1)

Enter number corresponding to Mode of Establishment of Class Main Immature (Item 5).

(b) Class Main Crop Mature (St. Str. 2)

Enter number corresponding to Vigor of Class Main Mature (Item 6).
(c) Class Main Crop Young Non-Commercial (St. Str. 3)

Enter number corresponding to Reason for Classing Main Young Non-Commercial (Item 8).

(d) Class Main Crop Grown-up Non-Commercial (St. Str. 4)

Enter number corresponding to Reason for Classing Main Grown-up Non-Commercial (Item 7).

(e) Class Secondary Crop Immature (St. Str. 5)

Enter number corresponding to Development of Secondary Immature (Item 10).

(f) Class Secondary Crop Mature (St. Str. 6)

Enter number corresponding to Nature of Secondary Mature (Item 9).

(g) Class Secondary Crop Young Non-Commercial (St. Str. 7)

There is no item number for stand description on the code sheet. If this type of stand appears, just use a check-off under this column.

(h) Class Secondary Crop Grown-up Non-Commercial (St. Str. 8)

There is no item number for stand description on the code sheet. If this type of stand appears, just use a check-off under this column.

(i) Class Main Crop NSR (St. Str. 9)

Enter code number for special corresponding to Per Cent Stocking (Item 32).

The two columns headed 3 and 9 are used only when the type is either Main Crop Young Non-Commercial (3) or Main Crop NSR (9).

31. Seed-tree Occurrence (NSR and Young Non-Commercial) - (Item 31).

Enter proper descriptive number in this column; (ie.) enter code number 1 if seed source is marginal - available.

33. Reforestation Possibilities (NSR and Young Non-Commercial) (Item 33).

Enter proper descriptive number in this column; (ie.) enter code number 5 if not plantable - natural stocking.
The three columns headed 1, 3, and 9 are used only when the type is main crop immature 20 years or less, main crop young non-commercial or main crop NSR.

34. **Ground Debris (Item 34).**

Enter proper descriptive number in this column; (ie) if ground debris is 30% enter number 2.

35. **Number of Snags per Acre (Item 35).**

Enter proper descriptive number in this column; (ie.) if there are 40 snags per acre enter code number 4.

36. **Average DBH of Snags (Item 36).**

Enter proper descriptive number in this column; (ie.) if the average snag DBH is 20 inches enter code number 3.

Refer to the coding manual for detailed explanations of these stand description headings.

Describing the stand in the air has certain advantage over descriptions made on the ground. By viewing first from approximately 1000 feet above the ground, you gain an overall picture - is it immature, N.S.R., Non-Productive or Young Non-Commercial etc. After looking it over from this height and deciding on its stand structure, you can then drop down to a lower height for a closer look at a point which you judge to be average for the stand. You then can make your entries for species, height, age, and stocking.

An example of this would be a burned area. As you approach the denuded area, adjacent productive forest cover and evidence of some type of ground cover eliminates the possibility of using a non-productive classification. Closer inspection reveals sufficient immature cover plus an excellent seed source, thus eliminating an N.S.R. classification. The only remaining calls are young non-commercial or main crop immature and for this decision you need to drop down to a lower height after selecting a point which is average for the stand. Your decisions at this height will then concern species, height, growth, and condition.

The air coding reference sheet simply supplies an orderly arrangement, on a form of convenient size, of the code sheet check-off items which must be referred to in completing the air coding sheet.
3. Species

Air Coding Sheet Check-off

When entering species in these columns, follow the same rules laid down in Part I, Item 3, under Forest Type. The species entered under main is the dominant species forming the type by applying the 20 percent rule. Associates are the remainder of the species in the type by the 20 percent rule. When distribution by volume or number of stems is equal the most economically important species should be entered under main. For example, a CHF type of equal volumes would be coded FCH.

Columns titled S - enter species.

Columns titled % - enter % of volume or number of trees.

Columns titled D - enter average DBH for that species to the nearest 2 inches.

In the column titled Minor, enter those species comprising less than 20% of the volume or number of trees provided they are economically important or numerous enough to warrant mention. E.g. White pine entered even though it forms less than 10% of the volume of a hemlock-cedar type.

These minor species aid in photo interpreting. For instance, a coastal cedar-hemlock code sheet with minor amounts of spruce has the same code key as a cedar-hemlock code sheet, with no minor species. The former would normally be applied to valley bottom types while the latter would be most frequently used on the mid and upper slopes.

4. Age

Age is recorded direct to the nearest ten years for each species. Do not classify by inventory or special age classes. In immature under twenty years of age estimate to the nearest 2 to 5 years.

Age is not estimated in mature stands because of the difficulty of accurate determination. Simply enter M for mature and OM for overmature.

(a) Age estimation in immature stands

How can age be estimated? Pick out an average tree for the type and count the whorls. If the whorls are not very close together, that means good annual growth and therefore the height will be a good indicator of age.
Admittedly, the closely spaced whorls on the lower sites will be more difficult but the estimator can draw on his experience from ground checks to mentally apply a height-age relationship for the various sites in the region.

Older immature stands are always difficult for age estimations. Clues to look for are crown vigour and an unbroken forest canopy.

If the decision is difficult, look at the boles and if they are of large size, call the stand mature. In borderline cases, do not hesitate to call it older immature.

5. Height

Height is recorded direct to the nearest ten feet regardless of code height classes. Trees under twenty feet can be recorded to the nearest two to five feet.

There are several methods by which height can be estimated. The estimator may get used to one height (say) 80 feet and estimate up or down from that. Past experience or pre instruction may serve to inform him of prevalent heights for each species in the region being classified.

A ground check early in the flight plan will give a standard height to estimate other heights. By measuring a tree on the ground - then re-examining it after take off, it is possible to have a mental yardstick by which to judge other heights.

6. Stocking Class

Stocking class, i.e. number of trees per acre, is recorded by using the codes listed in Part I, Item 42, and on F.S. 489, Air Coding Reference Sheet.

7. Canopy

(a) Total (%)

Crown density, crown diameters and height do reflect volume quite reliably - so indicate crown, or canopy density in tenths, direct. This is the total forest canopy, and can be compared to estimating the amount of sky that is covered by cloud - 6/10 or 8/10 cloud cover.

i.e. The forest cover which includes all stand elements (immature and mature) covers 8/10 of the ground.

(b) Mature trees (%)

This is an estimate of the number of trees 13"+ (except for Pl and deciduous which are 7"+) expressed as a percentage of the total canopy. i.e. The total canopy is 6/10 and the number of mature trees, 13"+ is 8/10 of the total canopy. Presumably the other 2/10 is immature or trees under 13" DBH.
(c) Merchantable (%)

This is a percentage of the number of mature trees considered merchantable. i.e. 5/10 of the stand is mature trees; 7/10 of these mature trees are merchantable. This column supplies valuable information for a secondary mature stand. i.e. The total canopy is 8/10 - 3/10 of this total canopy consists of mature trees and 7/10 of the mature trees are merchantable.

8. Condition

Refer to Part I, Item 11 of the Coding Manual for a description of this column. The code number is entered direct.

Omit Code 4 and 5 owing to the difficulty of assessing stands in the air that are slightly diseased or slightly infested. A special note should be made regarding the presence or absence of groups of red top Douglas fir, characteristic of the work of the Douglas fir bark beetle.

9. Remarks

Additional information useful for typing or describing the stand should be noted here, i.e. evidence of ground fire, disease, windthrow, snow damage.

10. Sketch Map (on the back of the Air Coding Sheet)

This map is used for specialized work on a small area (compartment, block, etc.). The drainage pattern for this area can be drawn on the map to any scale.

It is expedient to complete the flight plan classification in the normal manner. A second flight or flights will then be undertaken to describe the area.

For example, a compartment has three creeks which converge to form a small drainage. The area can then be divided into 3 blocks on the sketch map, each block consisting of one of these creeks. In the left hand margin under Compartment Description, block one is entered. Any applicable data such as priority of cut, site, description and distribution of species, merchantability and fire hazard can be described on the right of this ruled page.

Block two and three can be described in a similar manner. These rough notes should be a helpful guide to a more complete compartment description which will be written later in the field office on the Forest Description Sheet (FS 486, Appendix 2).
PART IV  SECTION 4  AIR CODING SHEET, contd.

Accessibility lines, operability lines, road location, priority of cut areas, and lookout locations can be drawn on the sketch map for easy reference at a later date.

B. GROUND CHECKS

During the flight plan the map reader will take advantage of suitable landing spots for ground checks so that the air crew can verify the air calls by walking through the type, checking species and measuring ages and heights.

They are valuable for the following reasons.

(a) To gain confidence in the ability to make accurate height, age, and species composition calls from the air.

(b) To provide a standard for height and age determination in the air. After measuring the trees on the ground, take off and re-circle the trees which were measured. Knowing their actual height, it is possible then to grade subsequent height calls up or down, using the ground check as a standard.

(c) Frequent ground checks on a variety of immature sites establishes a reliable age-height relationship for the area concerned.

(d) To become familiar with visual characteristics of minor species.

(e) To correlate crown canopy as seen from the air with number of stems per acre. Frequent ground checks should be made during the training period. This requires a careful selection of flight plans for adequate landing places. Later on in the season, two to three ground checks per flight plan are adequate, providing one is completed early in the flight. In areas devoid of landing places, but readily accessible on foot or by vehicle, calls accurately located on aerial photographs can be ground checked following the training flight plan.
PART IV  SECTION 5  IDENTIFICATION OF SPECIES

(a) General

Although a typical example of any given species varies sufficiently from any other species to be readily recognized, individual variation within each species is such that it is impossible to ascribe a number of specific characteristics to any species which would not be contradicted, at least in part, within the species and doubtless duplicated by typical and atypical individuals within other species.

  e.g. - Reddish brown bark is common to mature hemlock, Douglas fir, some spruce and balsam.

The establishment of specific criteria as a guide to field identification of species is further confused in that the genera of spruce, larch, hemlock, and balsam are each represented by two or more species in this province which often display marked disparity in form but do not warrant individual (specific) recognition for purposes of forest classification.

  e.g.: (i) The crowns of mature Sitka spruce and black spruce may be described as - short, rather open and long, narrow respectively.

  (ii) The crowns of mature coast balsam fir and alpine balsam fir are commonly "dome-like" and "spire-like" respectively.

Furthermore, it is important to note the marked effect of age, site, season and geographical location upon the form and colour of all species. For example:

AGE:  (i) Crown form of coast balsam
  immature:- spire-like
  mature :- dome-like or pyramidal

  (ii) Bark characteristics - Douglas fir
  immature:- smooth, grey-brown
  mature :- deeply ridged, reddish brown

  (iii) Crown form - red cedar
  youthful :- long, narrow, conical
  mature :- pyramidal, irregular

SEASON:  Fall leaf pigmentation - all deciduous and larch.

SITE:  (i) Crown form - lodgepole pine
  poor site - rounded, open
  good site - narrow conical

PART IV, SECTION 5

(17)

(1957)
Crown length - hemlock and Douglas fir
  open grown - branches to ground
  well stocked - crown 1/2 to 1/3 total height

REGION: Stem and Crown form - Douglas fir
  Interior - crown commonly over 1/2 total
  - sweep common, taper pronounced
  Coast - crown commonly less 1/2 total
  sweep and pronounced taper uncommon

(b) Key to aerial identification of species

Considering the foregoing observations, it is obvious that the
following key cannot be relied upon to unerringly identify, or
specifically apply to, every individual tree within a species
or genus regardless of age, site, season, etc. It is employed
rather as a device to list in an orderly, comparative manner,
the general criteria of form and colour which apply to typical
examples of each species. In so doing, it is hoped that the
air coder in training will become more acutely aware of the
physical characteristics most important in the aerial identifi-
cation of any species.

KEY TO AERIAL IDENTIFICATION OF SPECIES

1. Coniferous
2. Deciduous
3. Crown form conical (PlSBCy)
5. Needles yellow green (Pl, Cy)
6. Crown symmetrical, usually less than 1/2 height.
   Branches short, horizontal, fairly open.
   Stem tall slender, bark: - grey-brown to blackish.
   lodgepole pine
7. Crown form irregular, usually more 1/2 height.
   Branches long drooping and feathery in appearance,
   Stem commonly much tapered, bark: - greyish.
   yellow cedar (Coast)
8. Needles mid or dark green (S,B)
9. Branches regularly whorled, symmetrical - commonly
   to ground. Crown narrow, spirelike.
   balsam (Interior)
    Crown narrow, somewhat open, columnar.
    spruce (Interior)

12. Needles yellow-green (L, C) 13, 14


15. Needles mid green (H, F, Py, S) 16, 19

16. Crown open more or less irregular (F, Py) 17, 18


19. Crown dense usually roughly symmetrical (H, S) 20, 21


21. Leader erect. Upper branches usually ascending - lower drooping. Bark: reddish brown - scaled. spruce (Coast)

22. Needles dark green. Crown pyramidal or domelike - densely branched at tip. Bark: russet brown - ridged. balsam (Coast)

23. Leaves light green (Bi, A, Wi) 25, 26

24. Leaves mid or dark green (Mb, D, Cot) 29, 30

25. Form bushlike seldom exceeding 20 ft. in height Stem seldom visible. Leaves commonly olive green or occasionally brownish. willow
26. Form treelike usually over 40 ft. in height (Bi, A)  27, 28
27. Stems commonly crooked or sweeping often in groups or clusters.
   Leaves shiny - branchlets somewhat pendulous.
   Bark: white or reddish brown.  birch
28. Stems commonly erect, ranked in appearance.
   Branches short, straight, pointing upwards.
   Leaves with paler underside - tremble in light breeze.  aspen
   (Interior)
29. Stems erect, little taper, crown short.
   Leaves lighter in color on underside, shiny above.
   Bark: greyish, ridged.  cottonwood
30. Stems commonly with sweep or variably crooked and forked
   (Mb, D)  31, 32
31. Form more or less billowy, spreading, large branches.
    Often on lower third.
    Leaves very large - margin much indented.
    Bark: brownish grey.  maple
    (Coast)
32. Form more or less linear - crown usually confined to upper third.
    Leaves fairly small, margin entire.
    Bark: smooth, blotchy grey.  alder
    (Coast)

**DIAGRAMATIC KEY TO DESCRIPTIVE USAGE**

<table>
<thead>
<tr>
<th>CONICAL</th>
<th>PYRAMIDAL</th>
<th>BRANCHES REGULAR</th>
<th>BRANCHES IRREGULAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>taper</td>
<td>spike top</td>
<td>leader bent</td>
<td>branchlets feathery</td>
</tr>
<tr>
<td>gradual</td>
<td>taper</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>pronounced</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>CROWN - SHORT, OPEN</th>
<th>CROWN - LONG, DENSE</th>
<th>BRANCHES SLENDER</th>
</tr>
</thead>
</table>

PART IV, SECTION 5, contd.
(20)
(1957)
DIAGRAMMATICAL REPRESENTATION OF KEY TO THE AERIAL IDENTIFICATION OF CONIFEROUS SPECIES

CONIFEROUS

crown form conical (Pl,Cy,S,B)

needles yellow green (Pl,Cy)

needles mid or dark green (S,B)

crown form symmetrical, semiopen, branches short, horizontal.
stem-tall slender
bark grey-brown to blackish

lodgepole pine (PROVINCIAL)

yellow cedar (COAST)

crown form irregular, long, branches regularly whorled, stem commonly much tapered
bark greyish

red cedar (PROVINCIAL)

needles whitish green

long, in tasseled clumps.
crown form roughly symmetrical,
occasional long projecting branches,
cones long, conspicuous.
bark reddish-brown, plated

white pine (PROVINCIAL)

crown form pyramidal

(Pw,H,F,C,L,Py,B,S)

needles mid green (F,Py,S,N)

densely branched at tip,
bark russet brown ridged

balsam (COAST)

needles yellow green (L,C)

crown fairly short, open

branches small, short horizontal
stem clear, little taper lower half.
bark orange-brown plated,

deciduous

larch (INTERIOR)

needles dark green

crown pyramidal or domelike,
densely branched at tip,
bark russet brown ridged

balsam (COAST)

crown fairly long

branches long irregular, drooping.
stem commonly much tapered
spike top common

red cedar (PROVINCIAL)

needles yellow green (L,C)

crown more or less irregular

(F, Py)

upper drooping

leader bent (whiplike)
bark yellow brown, plated

heminck (PROVINCIAL)

needles in tasseled clumps
cones conspicuous
branches irregular

Douglas fir (PROVINCIAL)

needles yellow green (L,C)

crown more or less irregular

(F, Py)

upper drooping

leader erect

upper branches ascending

lower drooping

bark reddish brown, scaled

spruce (COAST)

needles yellow green (Pl,Cy)

crown more or less irregular

(F, Py)

upper drooping

leader commonly bent (whiplike)
bark red, dark reddish brown, grooved

hemlock (PROVINCIAL)

needles yellow green (L,C)

crown fairly short, open

branches small, short horizontal
stem clear, little taper lower half.
bark orange-brown plated,

deciduous

larch (INTERIOR)

needles yellow green (L,C)

crown more or less irregular

(F, Py)

upper drooping

leader bent (whiplike)
bark yellow brown, plated

heminck (PROVINCIAL)

needles yellow green (L,C)

crown more or less irregular

(F, Py)

upper drooping

leader straight

upper branches ascending

bark reddish brown, scaled

spruce (COAST)

needles yellow green (Pl,Cy)

crown more or less irregular

(F, Py)

upper drooping

leader bent (whiplike)
bark reddish brown, grooved

hemlock (PROVINCIAL)

needles yellow green (Pl,Cy)

crown more or less irregular

(F, Py)

upper drooping

leader straight

upper branches ascending

bark reddish brown, scaled

spruce (COAST)

needles yellow green (Pl,Cy)

crown more or less irregular

(F, Py)

upper drooping

leader bent (whiplike)
bark reddish brown, grooved

hemlock (PROVINCIAL)

needles yellow green (Pl,Cy)

crown more or less irregular

(F, Py)

upper drooping

leader straight
DIAGRAMMATIC REPRESENTATION OF KEY TO AERIAL IDENTIFICATION OF DECIDUOUS SPECIES

DECIDUOUS

leaves light green (Wi, A, Bi)

form: bushlike.
seldom exceeding 20 ft.
stems rarely visible.
leaves commonly olive green or brownish.
Willow (INTERIOR)

leaves mid or dark green (Cot, Mb, D)

form: tree-like
usually over 40 ft. crown short.

(A, Bi)

leaves shiny, lighter beneath.
bark greyish, ridged.
cottonwood
(PROVINCIAL)

stems commonly crooked or sweeping, often in groups or clusters.
leaves shiny, branchlets somewhat pendulous.
bark white or reddish brown.
birch
(PROVINCIAL)

stems commonly erect
ranked in appearance.
branches short, straight, pointing upwards.
leaves lighter on underside - light breeze causes characteristic trembling.
aspen (INTERIOR)

stems commonly erect, little taper.
stems commonly with sweep or variably crooked or forked.

(Mb, D)

leaves shiny, lighter beneath.
bark greyish, ridged.
cottonwood
(PROVINCIAL)

form billowy, spreading
large branches often on lower third.
leaves very large - margins much indented.
bark - brownish grey.
broadleaf maple (COAST)

form more or less linear crown usually confined to upper third.
leaves fairly small, margin entire.
bark blotchy grey.
Alder (COAST)
Left - abies grandis - true fir - coast - mature, vigorous; crown sharply pyramidal, tip of crown heavily branched dense.

Right - "grandis" - overmature - note: crown has become rounded and dome-like but retains characteristic density. Note also overmature red cedar with spike top and broadening crown, typical of advanced age.

Below - black spruce:
crown conical somewhat spirelike, branching - commonly to ground, irregular, often forming thick clumps particularly at tip of crown. Compare with interior balsam.

Below - abies lasiocarpa (balsam) interior: crown conical, spirelike, symmetrical; branches regularly whorled commonly to ground. Compare with black spruce.

Above - Larch (winter):
crown narrow, pyramidal, fairly open. Branches - slender, horizontal, irregular. Stem evenly tapered, bark light reddish brown, plated. Note immature larch to left and yellow pine right background.
**Left** Douglas fir, interior: crown pyramidal, fairly open, irregular. Note sweep and abruptness of taper common to interior fir.

**Right** Douglas fir, coast: crown pyramidal, fairly open, irregular — note absence of sweep and degree of taper.

**Below** Lodgepole pine —
Crown: conical, regular, fairly open, stem tall slender, bark greyish brown.

**Above** Yellow pine — crown pyramidal, irregular, fairly open, branches often large and crooked; long needles in tasseled clumps, bark yellowish brown, plated.

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PART IV SECTION 5, contd.
(24) (1957)
Left  Sitka spruce (coast) crown pyramidal, leader erect, branches irregularly whorled, upper branches ascending, lower drooping. Stem straight, taper gradual. Bark reddish brown, scaly.
Right  Immature birch (winter) note cluster of stems common to this species and shiny white bark with black markings.

Below  Cottonwood (Immature) - note up-pointing branches, shiny leaves and near-white bark coloration.

Below Left to right Larch and douglas fir, immature (interior). Note symmetrical feathery crown of larch and slender somewhat open, irregular crown of fir.

Above  White pine - crown pyramidal, irregular (occasional long protruding branches); long needles in tasseled clumps; bark - greyish brown, plated.

PART IV SECTION 5, contd.
(25) (1957)

**SPECIES:**
- **Spruce:** - height approx. 110 feet. Crowns: basically conical, rounding at tips, fairly short (less than \( \frac{1}{2} \) total height). Branches: fairly dense, irregular, somewhat drooping.
- **Balsam:** - height approx. 90 feet. Crown: conical (spirelike), symmetrical, dense, usually over \( \frac{1}{2} \) total height. Branches: fairly short, horizontal, regular.
- **Cottonwood:** - note splayed top characteristic of overmaturity, large diameter, clear stem with little taper.

- Note: - symmetrical, spirelike crown and regular branching of balsam.
  - broad (pyramidal) crown, fine branch texture and light color of cedar.
  - narrow columnar crown of spruce.

- Note: - Vigorous, fairly long, somewhat open, spreading crown. Branches pointing upward, leaves shiny. Stem straight, whitish-grey.

PART IV SECTION 5, contd.

(26) (1956)
Right: SABI, immature. Note:— sharply pointed crowns of spruce.  
- long clear stems of aspen.  
- linear tapered crown and absence of stem exposure in birch.  
Grayling R. Sept./56.

Above: immature PIBI. Crow R.  
Note:— long, fairly narrow, gently tapered crown of birch.  
- soft texture of lodgepole pine; compare crown and texture with black spruce at right center. Sept./56.

Below: Aspen (mature) Peace R.  
Note:— clear straight stems little taper, standing in ranks.  
Short rounded crown, white bark, height approx. 50 ft.

Left: OM interior hemlock, Pr. George.  
Note:— dense crowns, numerous dead tops.  
Long, slender sweeping branches which give feathery or snowflake appearance from above.  
Note occasional balsam.
(c) Secondary factors which aid in Identification

Although specific identification is based primarily upon the gross form characteristics used in the key, there are a number of secondary factors which, although general in application, are instrumental in narrowing the field of possibilities. They represent an awareness of the effect of regional location, topographic local, aspect, site, history and succession upon species distribution and forest cover associations.

Distribution and Association of species as influenced by -:

1. **Regional Location**

   A comparative analysis of the species range maps depicted herein reveals the expected regional location of species and associations throughout the province.

   For example:

   (1) Yellow pine is confined to south central and eastern B.C. Its associates may be interior Douglas fir, larch, lodgepole pine, aspen, etc.

   (ii) Yellow cedar is confined almost exclusively to the western slopes of the coast range and coastal islands. Its associates are usually red cedar, hemlock, balsam, etc.

   (iii) Hemlock is found in the coastal rain shadow, Kootenay and Shuswap rain forest and Prince George plateau areas. Its associates are Douglas fir (coast and interior) red cedar, yellow cedar (coast), balsam, spruce, white pine, alder, etc.

   (iv) The northern extremity of Douglas fir is in the vicinity of Dean Channel on the coast and about 100 miles north of Prince George in the interior of the province.

   (v) Larch occurs only in the southeast and northeast corners of the province. Usually associated with spruce and or lodgepole pine in the north and variously associated with interior Douglas fir, lodgepole pine, yellow pine, spruce and balsam in the south.

2. **Topographic Location**

   In most areas certain species or species combinations are more or less confined to certain topographical units.
PART IV SECTION 5 IDENTIFICATION OF SPECIES, contd.

For example:

(i) In the Bute Inlet area, yellow cedar, balsam and hemlock commonly occur at elevations in excess of 2000 feet. The lower slopes and valley bottoms are covered by various associations of hemlock, Douglas fir, red cedar and alder.

(ii) In the Canol Flat - Palliser River region, main lowland valley bottoms and lower slopes support pure or variously mixed stands of Douglas fir, yellow pine, western larch and lodgepole pine. Upper valleys support Douglas fir, western larch, lodgepole pine, spruce and some cedar. Sub alpine and headwater sites are mostly limited to spruce-balsam associations with minor amounts of white bark or limber pine and alpine larch.

(iii) In the Finlay River watershed spruce and lodgepole pine dominate the broad valley bottoms and lower slopes with minor amounts of cottonwood bordering the major watercourses. The upper slopes are commonly covered by spruce and balsam.

(iv) In the vicinity of Bella Bella, hemlock, yellow cedar, lodgepole pine and red cedar occupy most of the low lying coastal area and hemlock-balsam associations most commonly occur in upland valley bottoms and upper slopes.

3. Aspect

In a given area or region, and within an altitudinal range from sea level to about three thousand feet, slope exposure (aspect) has a marked effect upon such vital factors as mean annual and daily temperatures, humidity and water retention. These factors, modified by degree of incline, soil deposition and soil type, are instrumental in determining the forest composition. It is thus possible to recognize general rules of expected occurrence based upon slope exposure.

For example:

(i) In the San Joseph River drainage, northern Vancouver Island, red cedar and associations thereof are usually confined to southerly exposures. Northerly exposures support hemlock-balsam associations.

(ii) In the Bute Inlet area, the incidence of Douglas fir and red cedar is far greater on southerly exposures. Hemlock and balsam dominate the northerly aspects.

PART IV SECTION 5, contd.

(39).

(1957)
4. Site

Every tree species has certain basic habitat (site) requirements which assure optimum growth and favorable reproduction. However, most species are capable of establishing and reproducing on a fairly wide range of sites. Nonetheless, individual (specific) adaptations or tolerances frequently favor the establishment of a certain species on a given site.

Thus:

(i) Throughout most of the province, black cottonwood (usually associated with spruce) is most commonly found growing on alluvial soil, along stream margins or valley bottoms.

(ii) Alpine balsam fir variously associated with spruce, hemlock or yellow cedar is usually an important element of subalpine stands.

(iii) In the northeastern sector of the province black spruce, with minor amounts of eastern larch and jack pine, occupies much of the extensive low site muskeg area.

(iv) On marginal or low site areas throughout the dry interior, lodgepole pine and Douglas fir are common associates.

(v) Shallow soiled, rocky or swampy sites in the Cape Scott area commonly support an association of yellow cedar, hemlock and lodgepole pine as does much of the coastal area in the vicinity of Bella Bella.
Brush species such as willow and alder commonly border the meandering streams and extensive swamps characteristic of the interior plateau area.

5. History

Re-establishment of forest cover following partial or complete denudation of any description is primarily dependent upon seed source. However, the condition of the seed bed following denudation is often an important factor in determining the forest association which will become established. Consequently, type of history or disturbance often presents a clue to the resultant forest cover.

For example:

(i) Lodgepole pine in pure, even-aged stands or variously associated with Douglas fir, aspen or spruce frequently establishes following hot clean burns in the central interior.

(ii) In the east Kootenay area, larch is a common associate of lodgepole pine and Douglas fir following clean burns on lowland, southerly or flat exposures. Debris-choked northerly exposed slopes not uncommonly result in willow-lodgepole pine associations. The latter association is also common in the Carp Lake area north of Prince George.

(iii) Selective logging in open grown interior Douglas fir stands usually permits regeneration in fir.

(iv) In the north coast region clear patch logging usually results in pure even-aged alder stands or alder-hemlock associations. Slide areas frequently re-establish in alder with varying amounts of sitka spruce, particularly on southerly or westerly exposures.

(v) On the south coast the most common association following logging, log and burn or burn is hemlock-Douglas fir-red cedar-alder.

(vi) In the Morice Lake area, clean burns are almost invariably followed by dense stands of lodgepole pine. Less severely burned sites are usually occupied by a balsam-lodgepole pine association.

6. Succession

On virgin alluvial soil or denuded forest lands, a succession of plant associations commonly occurs which lead eventually to a climax forest type.
Frequently the deforested or virgin site is sufficiently receptive to the establishment of forest cover species to eliminate early successional stages involving mosses, lichens, grasses, shrubs, etc. However, a succession of forest cover elements commonly occurs. Certain inherently tolerant or adaptable species are first to occupy the unforested sites. Their presence alters the physical and chemical environment thus encouraging the establishment of succeeding climax elements. The association composed of the original (pioneer) species or species and the succeeding climax species is thus referred to as a nurse crop association.

Some examples are:

(i) On riverside alluvial deposits the pioneer cottonwood is frequently succeeded by climax spruce.

(ii) On areas denuded by logging in the north coast region, pioneer alder is succeeded by climax hemlock.

(iii) Where lodgepole pine or lodgepole pine-aspen are commonly pioneer species in fire denuded areas, a succession of climax spruce or Douglas fir frequently occurs.

7. Light - Source and Intensity

The light intensity and the position of the sun in relation to the observer have a very marked effect upon the degree of color contrast evident in mixed stands.

For example:

(i) In cedar-hemlock stands, the cedar component becomes much more evident if observed when the sun is low in the sky. (i.e., the angle of incidence is approaching zero).

(ii) On extremely dull days and in deeply shadowed areas - color contrast is reduced to a minimum.

(iii) The characteristic whitish green needle color of immature balsam appears much more vividly when observed with the sun behind the observer. This is particularly noticeable in spruce-balsam stands.

(iv) Similarly, in youthful, even-aged mixed stands, the yellowish-green foliage of lodgepole pine appears in most definite contrast to associated spruce or Douglas fir when the observer keeps the sun at his back.
DISTRIBUTION OF FOREST COVER SPACES IN BRITISH COLUMBIA

- Western white pine
- Lodgepole pine
- Yellow cedar (coastal)
- Yellow pine (interior)
- Douglas fir
- Hemlock sp.
DISTRIBUTION OF FOREST COVER SPECIES IN BRITISH COLUMBIA

red alder (coastal)
larch—eastern, western & mountain (interior)

spruce: interior—black, white, Engelmann coastal—Sitka

balsam

aspen

cottonwood— black cottonwood
— balsam cottonwood

PART IV SECTION 5, contd. (34) (1957)
A. STEREOGRAMS

Any air call location having sufficient photographic clarity can be designated as a possible stereogram location. All prospective stereogram locations are numbered consecutively and listed with photo and code key references. The process of stereogram construction is outlined in this manual, Part II, Section 9, G - Twenty Chain Inventory.

B. AIR CALL SUMMARY SHEET (F.S. 488) - EXPLANATION (Appendix 4)

On completion of the field work it is necessary to utilize the numerous "calls" and map notes, etc. to produce typed photos preliminary to plotting on a base map. A process of sorting, grouping, and summarizing calls into standard inventory or special code sheets is necessary. (Appendix 1A and 1B). This phase is carried out through the use of the Air Call Summary Sheet.

This process summarizes the numerous air calls into a smaller group of code sheets, more easily managed for typing purposes. There may be 4000 air calls at the end of the summer which are summarized into 300 code sheets.

There are thirteen summary types, each listed on a separate air call summary sheet. They are as follows:

1. $F = F$, FP
2. F plus pulp = FH, FHB, FHBS
3. FS = FSP1, FSPy, FSL
4. FPy = FPyPI, FPyL
5. FL = FLP1, FLPw, FL plus pulp
6. FC = FCH, FCS, FCS, FCHB
7. C = CH, CS, CB, CC, CH, CHS
8. H = HB, HB5, HS, HPw
9. S = SB, SLP, SBP, SL
10. Pl = Pl plus deciduous
11. Deciduous
12. Non-Commercial
13. N.S.R.

Summary types 1 - 11 correspond to the 11 summary type groups as outlined under Type Group for Compartment Area Classification in the Forest Tabulation Manual.

It is now possible to enter air calls onto the appropriate summary sheet. (ie.) Air call number 541 is a mature SLPB type. It will then be entered on air summary sheet number 9. If there is already a code sheet listed on sheet number 9 which has the same code key as air call number 541, then that code sheet number is entered in two places.
1. Under the code sheet column on the Air coding sheet, opposite air call number 541.

2. On the back of the photo where air call 541 has been inscribed.

If there is no stand structure key on air summary sheet number 9, identical to air call 541, make out another code sheet from this air call information. Then enter code sheet label as outlined above. Similarly all N.S.R. air calls will be summarized into code sheets on air call summary sheet 10 and all pure deciduous air calls will be summarized into code sheets on air call summary sheet 11.

In making out code sheets from the air call summary sheet information, keep in mind the intensity of survey and apply the appropriate code key (inventory or special) to describe the stand structure. Each special unit requires a separate set of air call summary sheets.

C. TYPING - USE OF AIR CALL SUMMARY SHEET

What is the reason for the air call summary sheet? Anyone interpreting types in the office has a breakdown of the code sheets by species combination. If the interpreter has a type with no air calls but from his experience in the area, he knows that it will fall into a certain age, height, and stocking class and that FPI is the species association, he refers to air call summary sheet number one and selects the appropriate code sheet.

Refer to Part II, Section 1 - General Instructions on Typing - for instructions on typing.
A. COMMUNICATIONS

1. Objectives

It is necessary to maintain a close check on the position of the aircraft during any flight plan owing to the great distances covered in a short time. Our radio facilities should be utilized to the fullest extent to meet this objective. Close liaison is necessary between all stations concerned so that they will be advised when a flight is completed, when the aircraft has landed for ground checks, meals, or refueling, and when the aircraft is again airborne. This is imperative to prevent stations from standing by needlessly, but to have them alerted when required.

It is absolutely necessary that all stations know when the plane has taken off or landed on any Forest Surveys flights.

2. Communication Set-up

(a) Ground

Radio stations located at region headquarters and a set operated by the air coding section headquarters are the control stations for air coding communication. Either the air coding station or region control station near the base of operations will normally co-ordinate this phase of radio communication, thus acting as a main control station.

(b) Aircraft

The aircraft will be equipped to transmit and receive on any designated Forest Surveys frequency in addition to other frequencies normally carried. The pilot will be provided with a list of control stations when field operations commence.

(c) Procedure

On the first inter-region morning radio schedule or as soon as possible the main control station should advise of proposed take-off time if a flight is planned. Immediately the plane is airborne the pilot will call the main control stations and other control stations will be alerted. Details of the flight plan in the form of listed flight plans and mapped copies should be supplied to all nearby control stations, in the event the flight may progress closer to another control station, which may take over the duties of the main control if distance adversely affect radio reception between the aircraft and the original main control station. This permits flexibility in communications. If, at any time during the flight, the aircraft
cannot contact the main control station, the aircraft must attempt contact with other control stations. A control station not being called can repeat the message or give a "Roger" to the aircraft if he knows the station being called is not reading. However, it is not necessary for this station to pass messages second hand back to the main control station, except at time of take off, landing, emergency call or otherwise specifically instructed by the aircraft.

(d) Position Reports

It will be the responsibility of the map reader to hand the pilot a written note of position as the flight plan progresses for immediate transmission to Forest Surveys control stations. Reports must be brief and approximately at intervals of fifteen minutes.

The position should be reported by phase number and photo number rather than topographical features which are often garbled or incorrectly copied by station receiving.

At all take-offs, names of personnel on board must be included in the first position report.

Any changes in the flight plan must be reported to the main control station immediately.

A brief description of the route from base to flight plan area and of the route to base when flight plan completed, must be given and any major alterations must be reported.

(e) Ground Station Log Books

Each control station will maintain a log book to record information received from the aircraft. The record should be of a permanent nature. The following form is recommended.
### Example of Log Book

**Station: XMJ76 - Kemano**

<table>
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<tr>
<th>Date</th>
<th>Time</th>
<th>A/C</th>
<th>Flight Plan #</th>
<th>Position Phase #</th>
<th>Personnel Remarks</th>
<th>Station Answering</th>
<th>Operator</th>
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<td>61</td>
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<td>XMJ-76</td>
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<td></td>
<td></td>
<td>8</td>
<td>-</td>
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<td></td>
</tr>
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</table>

**Notes on Log Book**

(i) Station answering is the one which actually gives a "Roger" to the aircraft's message.

(ii) The radio operator must sign his name in full beside all entries in the log.

### B. EMERGENCY AND SAFETY PROVISIONS

1. **General**

The pilot is in charge of the aircraft and safety of the aircraft and passengers is at his discretion. All personnel must fasten
safety belts throughout the flight. If air dropping is being carried out, the dropper must wear an approved safety harness. Extreme care should be exercised when beaching and docking the aircraft, particularly if moving to the nose of the aircraft on the floats. Be absolutely sure the pilot is aware of your intentions and has killed the engine. Wait until the propeller blades have ceased to move.

2. Emergency Kit

(a) In aircraft

The following equipment is to be carried in the aircraft at all times in addition to that provided by the charter company.

(i) Survival kit

Sugar and salt
Rolled oats - 2 lbs.
Canned bacon or meats - 4
Dot Chocolate - 4 bars
Liptons soup - 6
Toilet roll - 2
Waxed matches - 2 boxes
Candle - 2
Insect repellent - 2 bottles
Tea - 1/2 lb.
Cooking pot
First aid kit - 10 man sealed
Fishhook and 20 feet of line
22 calibre rifle and box shells
1 tin water

These are outlined as possible contents but may be varied at the discretion of the air coding section head. The above contents will be carried in an equipment pack bag provided for that purpose.

(ii) Sleeping bags, fly camp - 2, with tarpaulins

(iii) Axe - single bladed, Hudson bay with sheath - 1

(iv) Radio - 1 model B, S.P.F. complete with serviceable batteries and aerial. Performance of the set is to be checked periodically by chief of party.

(v) Each man must have suitable boots, warm outer garment (jacket) and sheath knife on every flight.
PART IV  SECTION 7  SAFETY AND RESCUE PROVISIONS, contd.

(b) Headquarters

A ration parcel similar to that outlined for airdrops in the Operations Manual should be kept available at party headquarters. A parachute should be attached for instant use. A Number 1 First Aid Kit will be included with the food parcel.

3. Ground to Air Signals

The following signals, as approved by the Interdepartmental Committee on Search and Rescue (R.C.A.F.) are to be used in the event of a disabled aircraft having an unserviceable radio, or in any other field emergencies. Forest Surveys Division will use additional signals of specific use when carrying out food drops. They should be memorized or a copy should be carried on the person of all personnel.

N.B. The signals previously used in this connection have been replaced.

Wherever possible a smoke fire should be used to attract aircraft.

On no account will personnel leave the scene of their disabled aircraft until search and rescue operations have proven futile.

Approved R.C.A.F. emergency signals are as follows:

Require Doctor
Require medical supplies
Unable to Proceed
Require Food & Water
Require Firearms and Ammunition
Require Map and compass
Require Signal Lamp with Battery and Radio
Indicate Direction to Proceed
Am proceeding in this direction
Will attempt take off
Aircraft seriously damaged
Probably safe to land here
Require Fuel and Oil
All well
No
Yes
Not understood
Require Engineer

The following ground signals will be used by Forest Surveys Division personnel involved in food drop operations.

Drop 1 parcel
" 2 parcels
" 3 parcels

(These signals replace XXX series previously used.)

Everything okay (food drops found, do not require additional drops)

Note: " - Require doctor - serious injuries (formerly indicated by "n"). If this signal is used, rescue crews and medical aid will be dispatched to the scene by helicopter or ground crew immediately.
PART V STAND CLASSIFICATION BY TYPE LISTS

SECTION 1 GENERAL USE AND AGE AND HEIGHT CLASSES

A. Use of Type Lists

The coder must refer to the type lists when filling in the code sheet key, so as to determine what age, heights, and stocking class combinations are allowed for that particular type.

Example:
A coder has established a main stand mature fir-yellow pine type in a working circle area.

- A.M.H. = 90 feet
- Age = 170 years
- Stocking = 50 trees/acre (13"+)

(a) Coder refers to mature special type list.
(b) Under "Type" he finds FPy code 108.
(c) A.M.H. of 90 feet falls into 66-95 foot class or code "7".
(d) Under code "7" and opposite type "108", he finds letter "G".
(e) Referring to Index Table, he finds letter "G" allows combinations of age codes 3, 4, or 5 and stocking class codes 1, 2 and 3.
(f) Referring to age table, coder finds that age of 170 years is code "4" which is allowed.
(g) Referring to stocking class table, coder finds that 50 trees per acre (13"+) falls into code "3" group which is allowed.
(h) Key is as follows:

\[ 2(\text{FPy}) 108-4 - 7 - 3 \]

Summary of steps

(1) Find appropriate type list for type of survey (Inventory or special).
(2) Find applicable stand structure (i.e. Mature, Immature, Young Non-Commercial, etc.).
(3) Determine which species code is best suited to the stand.
(4) Find what height codes are permitted with the type.
(5) Determine which age codes are permitted in combination with the height.
(6) Finally determine which stocking classes are allowed with the age.

PART V SECTION 1

(1)

(1957)
PART V SECTION 1  GENERAL USE AND AGE AND HEIGHT CLASSES, contd.

B. Age Classes

1. Main Mature and Main Grown-up Non-Commercial

(a) Special: Code 1 = 41 - 80 years.
    2 = 81 - 120
    3 = 121 - 160
    4 = 161 - 250
    5 = 251 +
    11 = Py mature selection

(b) Inventory: Code 31 = 41 - 80 years
    32 = 81 - 120
    33 = 121 - 160
    34 = 161 - 250
    35 = 251 +


Special

Code 51 = 41 - 80
    52 = 81 - 120
    53 = 121 - 160
    54 = 161 +

3. Immature and young Non-Commercial

(a) Special: Code 1 = 1 - 5 years
    2 = 6 - 10
    3 = 11 - 20
    4 = 21 - 40
    5 = 41 - 60
    6 = 61 - 80
    7 = 81 - 100
    8 = 101 - 120
    9 = 121 - 140
    10 = 141 - 160
    11 = True immature selection (natural Py stands only)

(b) Inventory: Code 21 = 1 - 10 years
    22 = 11 - 20
    23 = 21 - 60
    24 = 61 - 100
    25 = 101 +
    11 = True immature selection (natural Py stands only)
C. Average Maximum Height Classes

1. Mature and Grown-up Non-Commercial

(a) Special: Code 5 = less than 65'
   7 = 66' - 95'
   9 = 96' - 125'
 11 = 126' - 155'
 13 = 156' - 185'
 15 = 186' - 215'
 17 = 216' +

(b) Inventory: Code 21 = less than 65'
   22 = 66' - 125'
   23 = 126' - 185'
   24 = 185' +

2. Immature and Young Non-Commercial

(a) Special: Code 1 = 0' - 6'
   2 = 7' - 12'
   above 12' -
   15' height classes
   3 = 13' - 27'
   4 = 28' - 42'
   5 = 43' - 57'
   6 = 58' - 72'
   N.B.
   THIS CODE TO BE
   USED ON BLOCK
   SURVEYS ONLY
   (unless instructed otherwise)
   7 = 73' - 87'
   8 = 88' - 102'
   9 = 103' - 117'
   10 = 118' - 132'
   11 = 133' - 147'
   12 = 148' - 162'
   13 = 163' - 177'
   14 = 178' - 192'
   15 = 193' - 207'
   16 = 208' - 222'
   17 = 223' +

(b) Inventory: Code 31 = 0' - 6'
   32 = 7' - 12'
   33 = 13' - 27'
   above 27' -
   30' height classes
   34 = 28' - 57'
   35 = 58' - 87'
   36 = 88' - 117'
   37 = 118'

PART V SECTION 1, contd.

(3)
(1957)
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<table>
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<th>Stocking Class</th>
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<tbody>
<tr>
<td>1. All Open forest with GUC, eg. 0-25% stocked.</td>
</tr>
<tr>
<td>2. All Semi-Open Forest with GUC; eg. 26 - 50% stocked.</td>
</tr>
<tr>
<td>5. All other types except on Block Surveys when codes 1 - 5 inclusive are used on a straight stocking class basis.</td>
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**LUMINATURE - SPECIAL**

**MAIN YOUNG NON-COMM. - SPECIAL**

---

**PART V SECTION 2**

(4)

(1957)
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<th>2 6-10</th>
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<th>4 21-50</th>
<th>5 51-100</th>
<th>6 101-150</th>
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(c) Coastal types only.

(1) Interior types only.
### Immature - Inventory

#### Secondary Immature - Special

#### Main Young Non-Comm. - Inventory

#### Secondary Young Non-Comm. - Special

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(c) Coastal types only
(i) Interior types only
### MATURE - SPECIAL (Stand Structure\(^2\))

**MAIN CROP GROWN-UP N.C. - SPECIAL**

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** Stocking Class 1 reserved for Open Forest with GUC (Main stands only)
MATURE - SPECIAL (Stand Structure 2)
MAIN CROP GROWN-UP N.C. - SPECIAL

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(1957)
### PART V SECTION 2 TYPE LISTS, contd.

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## Mature - Inventory (Stand Structure 2)

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**Addition**

2-Py-11-22-2 (For Py Mature Selection)

- (c) Coastal types only
- (i) Interior types only

Stocking Class 1 reserved for Open Forest with GUC (Main stands only)
### Type Lists, contd.

**Mature - Inventory (Stand Structure 2)**

**Main G.N.C. (S.S. 4) - Inventory**

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| E FC+pulp+Dec. (c) | 2986 | F F F   |
| C C-pulp+Dec. | 3243 | F F F   |
| L Pulp+Dec. | 4232 | F F F   |
| D SE+Cor. | 155  | D D D   |
| U P+Dec. (2) | 625  | C C C   |
| O Cot.+Dec. | 5028 | B B B   |
| U D+Dec. (c) | 2025 | A A A   |

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* Also allows 2-Py-11-22-2

**Part V Section 2, contd.**

(1957)
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SECONDARY CROP G.N.C. (S.S. 8) - SPECIAL

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<table>
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<th>STOCKING CLASS</th>
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<tr>
<td></td>
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<td>0 - 10</td>
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<td>2</td>
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<td>11 - 30</td>
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<tr>
<td>3</td>
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<table>
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</thead>
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<tr>
<td>A</td>
<td>51 52</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>52 53</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>53 54</td>
<td>2 1</td>
</tr>
<tr>
<td>D</td>
<td>53 54</td>
<td>2 1 3</td>
</tr>
<tr>
<td>E</td>
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<tr>
<td>F</td>
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</tr>
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<td>G</td>
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PART V SECTION 2, contd.

(14)

(1957)
### Secondary Mature - Special

#### Secondary Crop G.M.C. (S.S. 8) - Special

<table>
<thead>
<tr>
<th>TYPE</th>
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<td>F(S)</td>
<td>(1)</td>
<td>1(5)</td>
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<td>F(Py)</td>
<td>(1)</td>
<td>1(9)</td>
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<tr>
<td></td>
<td>F(L)</td>
<td>(1)</td>
<td>1(10)</td>
</tr>
<tr>
<td></td>
<td>C</td>
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<td>(1)</td>
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<td></td>
<td>L</td>
<td>(1)</td>
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<tr>
<td></td>
<td>P1</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>FC</td>
<td></td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>FC+pulp</td>
<td></td>
<td>2026</td>
</tr>
<tr>
<td></td>
<td>T+pulp</td>
<td></td>
<td>739</td>
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<td></td>
<td>FL</td>
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<td>109</td>
</tr>
<tr>
<td></td>
<td>Pulp</td>
<td>(c)</td>
<td>375</td>
</tr>
<tr>
<td></td>
<td>Pulp+C</td>
<td></td>
<td>1025</td>
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<td>D:Dec.</td>
<td>(c)</td>
<td>2025</td>
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<td></td>
<td>Cot+Dec.</td>
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</tr>
<tr>
<td></td>
<td>SB+Dec.</td>
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<td>534</td>
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</table>

(c) Coastal types only
(i) Interior types only
### AGE

<table>
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<tr>
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<tr>
<td>22</td>
<td>11 - 20</td>
</tr>
<tr>
<td>23</td>
<td>21 +</td>
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### HEIGHT

<table>
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<tr>
<th>Code</th>
<th>Ht. Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
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### STOCK. CLASS

<table>
<thead>
<tr>
<th>Code</th>
<th>% Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 - 10%</td>
</tr>
<tr>
<td>2</td>
<td>11 - 20%</td>
</tr>
<tr>
<td>3</td>
<td>21 - 40%</td>
</tr>
<tr>
<td>4</td>
<td>41 - 50%</td>
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### TYPE

<table>
<thead>
<tr>
<th>Species</th>
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<tr>
<td>P F</td>
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<td>U Pl</td>
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<td>1 2 3 4</td>
</tr>
<tr>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F F+Pulp</td>
<td>739</td>
<td>21 22</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>I FC+Pulp</td>
<td>2026</td>
<td>21 22</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>R FC</td>
<td>101</td>
<td>21 22</td>
<td>1 2 3 4</td>
</tr>
<tr>
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<td>1 2 3 4</td>
</tr>
<tr>
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<td>(i)</td>
<td>108</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>P Pulp</td>
<td>(c)</td>
<td>375</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>U Pulp+C</td>
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<td>1 2 3 4</td>
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<tr>
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<td>443</td>
<td>1 2 3 4</td>
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<td>21 22</td>
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<td>US Dec.</td>
<td>5028</td>
<td>21 22</td>
<td>1 2 3 4</td>
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(c) Coastal types only

(i) Interior types only

---

**PART V SECTION 2, contd.**

(16)

(1957)
### N.S.R. - INVENTORY

<table>
<thead>
<tr>
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<td></td>
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<td>11 - 20</td>
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<table>
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<th>Code</th>
<th>% Stock.</th>
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<tr>
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<td>0 - 20%</td>
</tr>
<tr>
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<th>AGE CODE</th>
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<td>1</td>
<td>21 22 23</td>
<td>1 3</td>
</tr>
<tr>
<td></td>
<td>U P1</td>
<td>8</td>
<td>21 22 23</td>
<td>1 3</td>
</tr>
<tr>
<td></td>
<td>R E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F F+Pulp</td>
<td>739</td>
<td>21 22</td>
<td>1 3</td>
</tr>
<tr>
<td></td>
<td>I FC+Pulp</td>
<td>2026</td>
<td>21 22</td>
<td>1 3</td>
</tr>
<tr>
<td></td>
<td>R FC</td>
<td>101</td>
<td>21 22</td>
<td>1 3</td>
</tr>
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<td></td>
<td>+ FP1</td>
<td>107</td>
<td>21 22 23</td>
<td>1 3</td>
</tr>
<tr>
<td></td>
<td>FPY</td>
<td>(i)</td>
<td>108 21 22 23</td>
<td>1 3</td>
</tr>
<tr>
<td></td>
<td>P Pulp</td>
<td>(c)</td>
<td>375 21 22</td>
<td>1 3</td>
</tr>
<tr>
<td></td>
<td>U Pulp+C</td>
<td>1025</td>
<td>21 22</td>
<td>1 3</td>
</tr>
<tr>
<td></td>
<td>L SEP1</td>
<td>(1)</td>
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<td>1 3</td>
</tr>
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<td>1 3</td>
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</tr>
<tr>
<td></td>
<td>U Dec.</td>
<td></td>
<td>5028 21 22</td>
<td>1 3</td>
</tr>
</tbody>
</table>

(c) Coastal types only
(i) Interior types only

---

*PART V, SECTION 2, contd.*

(17)

(1955)
# Forest Surveys and Inventory Division

## Code Sheet

### 4. Pathological

<table>
<thead>
<tr>
<th>Disease</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conf.</td>
<td>Blind wrens</td>
</tr>
<tr>
<td>Bl.</td>
<td>Blister rust</td>
</tr>
<tr>
<td>Sc.</td>
<td>Sooty mold</td>
</tr>
<tr>
<td>Ft.</td>
<td>Pycnidium bark crack</td>
</tr>
<tr>
<td>Fr.</td>
<td>Frass rash</td>
</tr>
<tr>
<td>Mi.</td>
<td>Mistletoe trunk infection</td>
</tr>
<tr>
<td>Lar.</td>
<td>Larch beetles</td>
</tr>
<tr>
<td>D.</td>
<td>Dried or broken top</td>
</tr>
</tbody>
</table>

### 5. Mode of Establishment of Class Main Immature

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>New forest established on exposed ground</td>
</tr>
<tr>
<td>2</td>
<td>New forest established under old tree</td>
</tr>
<tr>
<td>3</td>
<td>New forest—under old tree, same species</td>
</tr>
<tr>
<td>4</td>
<td>New forest—under nurse N.C.</td>
</tr>
<tr>
<td>5</td>
<td>True selection</td>
</tr>
</tbody>
</table>

### 6. Viper of Class Main Immature

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Youthful—min. rot.</td>
</tr>
<tr>
<td>2</td>
<td>Ripen—not breaking up</td>
</tr>
<tr>
<td>3</td>
<td>Overripe (deteriorate)</td>
</tr>
<tr>
<td>4</td>
<td>Decayed—2nd crop merch.</td>
</tr>
</tbody>
</table>

### 7. Season for Closing Main Grow-up N.C.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dead tree, deteriorating N.C. trees</td>
</tr>
<tr>
<td>2</td>
<td>Disturbed—no common, logging chance</td>
</tr>
<tr>
<td>3</td>
<td>Originally sparse—now scattered will trees</td>
</tr>
<tr>
<td>4</td>
<td>Originally overstocked, now stagnant</td>
</tr>
<tr>
<td>5</td>
<td>Normally merchantable—isolated N.C.</td>
</tr>
</tbody>
</table>

### 8. Reason for Closing Main Young N.C.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Doubt if common, stand will develop</td>
</tr>
<tr>
<td>2</td>
<td>Stand sparse, not likely to fill in</td>
</tr>
<tr>
<td>3</td>
<td>Dense N.C. brush</td>
</tr>
<tr>
<td>4</td>
<td>Stand overstocked, will stagnate</td>
</tr>
<tr>
<td>5</td>
<td>Normally merchantable—isolated N.C.</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Advanced immature, young</td>
</tr>
<tr>
<td>2</td>
<td>Old vats, both 1 and 2</td>
</tr>
<tr>
<td>3</td>
<td>Other story in main vol.</td>
</tr>
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</table>

### 12. Suggested Logging Method

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<tr>
<td>1</td>
<td>Hand logging</td>
</tr>
<tr>
<td>2</td>
<td>Horse logging</td>
</tr>
<tr>
<td>3</td>
<td>Cat logging</td>
</tr>
<tr>
<td>4</td>
<td>Skidder</td>
</tr>
<tr>
<td>5</td>
<td>High head</td>
</tr>
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<td>6</td>
<td>Shovel</td>
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### 13. Special Site Considerations

<table>
<thead>
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<th>Code</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>On or near existing drain</td>
</tr>
<tr>
<td>2</td>
<td>Subject to existing topography</td>
</tr>
<tr>
<td>3</td>
<td>Subject to erosion risk</td>
</tr>
<tr>
<td>4</td>
<td>Subject to erosion hazard</td>
</tr>
</tbody>
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### 14. Condition of Stand

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Healthy</td>
</tr>
<tr>
<td>2</td>
<td>Injured, damaged</td>
</tr>
<tr>
<td>3</td>
<td>Diseased, diseased trees</td>
</tr>
<tr>
<td>4</td>
<td>Diseased, slight</td>
</tr>
<tr>
<td>5</td>
<td>Diseased, heavy</td>
</tr>
</tbody>
</table>

### 15. Average D.B.H. (5%)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00</td>
</tr>
<tr>
<td>2</td>
<td>1.30</td>
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<td>1.60</td>
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</table>

### 16. Utilization

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sawlogs or pulp</td>
</tr>
<tr>
<td>2</td>
<td>Sawn logs, pulp, and minor products</td>
</tr>
<tr>
<td>3</td>
<td>Shingle products</td>
</tr>
</tbody>
</table>

### 17. Grazing Value

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grazing accessible—on ride through easily</td>
</tr>
<tr>
<td>2</td>
<td>Grazing accessible—difficult to ride through</td>
</tr>
<tr>
<td>3</td>
<td>Grazing accessible—no riding; stock can work through</td>
</tr>
<tr>
<td>4</td>
<td>Grazing inaccessible—stock cannot work through</td>
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</table>

### 18. Grazing Chance

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Good—no rough</td>
</tr>
<tr>
<td>2</td>
<td>Fair</td>
</tr>
<tr>
<td>3</td>
<td>Poor—excess rough</td>
</tr>
</tbody>
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### 22. Aerial Slopes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat</td>
<td>Flat or near flat</td>
</tr>
<tr>
<td>2</td>
<td>Nearly flat</td>
</tr>
<tr>
<td>3</td>
<td>Slope of 2 to 5%</td>
</tr>
<tr>
<td>4</td>
<td>Slope of 5 to 10%</td>
</tr>
<tr>
<td>5</td>
<td>Slope of 10 to 20%</td>
</tr>
<tr>
<td>6</td>
<td>Slope of 20 to 30%</td>
</tr>
<tr>
<td>7</td>
<td>Slope of 30 to 40%</td>
</tr>
<tr>
<td>8</td>
<td>Slope of 40 to 50%</td>
</tr>
<tr>
<td>9</td>
<td>Slope of 50 to 60%</td>
</tr>
<tr>
<td>10</td>
<td>Slope of 60 to 70%</td>
</tr>
<tr>
<td>11</td>
<td>Slope of 70 to 80%</td>
</tr>
<tr>
<td>12</td>
<td>Slope of 80 to 90%</td>
</tr>
<tr>
<td>13</td>
<td>Steep slope</td>
</tr>
</tbody>
</table>

### 23. Access

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Flat</td>
<td>Flat or near flat</td>
</tr>
<tr>
<td>2</td>
<td>Nearly flat</td>
</tr>
<tr>
<td>3</td>
<td>Slope of 2 to 5%</td>
</tr>
<tr>
<td>4</td>
<td>Slope of 5 to 10%</td>
</tr>
<tr>
<td>5</td>
<td>Slope of 10 to 20%</td>
</tr>
<tr>
<td>6</td>
<td>Slope of 20 to 30%</td>
</tr>
<tr>
<td>7</td>
<td>Slope of 30 to 40%</td>
</tr>
<tr>
<td>8</td>
<td>Slope of 40 to 50%</td>
</tr>
<tr>
<td>9</td>
<td>Slope of 50 to 60%</td>
</tr>
<tr>
<td>10</td>
<td>Slope of 60 to 70%</td>
</tr>
<tr>
<td>11</td>
<td>Slope of 70 to 80%</td>
</tr>
<tr>
<td>12</td>
<td>Slope of 80 to 90%</td>
</tr>
<tr>
<td>13</td>
<td>Steep slope</td>
</tr>
</tbody>
</table>

### 25. Access

<table>
<thead>
<tr>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat</td>
<td>Flat or near flat</td>
</tr>
<tr>
<td>2</td>
<td>Nearly flat</td>
</tr>
<tr>
<td>3</td>
<td>Slope of 2 to 5%</td>
</tr>
<tr>
<td>4</td>
<td>Slope of 5 to 10%</td>
</tr>
<tr>
<td>5</td>
<td>Slope of 10 to 20%</td>
</tr>
<tr>
<td>6</td>
<td>Slope of 20 to 30%</td>
</tr>
<tr>
<td>7</td>
<td>Slope of 30 to 40%</td>
</tr>
<tr>
<td>8</td>
<td>Slope of 40 to 50%</td>
</tr>
<tr>
<td>9</td>
<td>Slope of 50 to 60%</td>
</tr>
<tr>
<td>10</td>
<td>Slope of 60 to 70%</td>
</tr>
<tr>
<td>11</td>
<td>Slope of 70 to 80%</td>
</tr>
<tr>
<td>12</td>
<td>Slope of 80 to 90%</td>
</tr>
<tr>
<td>13</td>
<td>Steep slope</td>
</tr>
</tbody>
</table>

### 27. Stand Description

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main</td>
<td>Main stand</td>
</tr>
<tr>
<td>Stand</td>
<td>Stand</td>
</tr>
</tbody>
</table>

### 28. Basic Class Numbers

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Snowfield</td>
</tr>
<tr>
<td>2</td>
<td>Uplands, forested N.P.</td>
</tr>
<tr>
<td>3</td>
<td>Alpine</td>
</tr>
<tr>
<td>4</td>
<td>Lakeside</td>
</tr>
<tr>
<td>5</td>
<td>Rock slide</td>
</tr>
<tr>
<td>6</td>
<td>Glacial till</td>
</tr>
<tr>
<td>7</td>
<td>Sandbar</td>
</tr>
<tr>
<td>8</td>
<td>Tailing</td>
</tr>
<tr>
<td>9</td>
<td>Clay bank</td>
</tr>
</tbody>
</table>

### 29. Key

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>St.</td>
<td>Forest Type (Sp.)</td>
</tr>
<tr>
<td>Str.</td>
<td>Forest Type (Sp.)</td>
</tr>
</tbody>
</table>

### 30. Elements of Stand Structure

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Main crop immature</td>
</tr>
<tr>
<td>2</td>
<td>Main crop mature</td>
</tr>
<tr>
<td>3</td>
<td>Main crop young</td>
</tr>
<tr>
<td>4</td>
<td>Main crop grow-up</td>
</tr>
<tr>
<td>5</td>
<td>Secondary crop immature</td>
</tr>
<tr>
<td>6</td>
<td>Secondary crop mature</td>
</tr>
<tr>
<td>7</td>
<td>Secondary crop young non-commercial</td>
</tr>
<tr>
<td>8</td>
<td>Secondary crop grow-up non-commercial</td>
</tr>
<tr>
<td>9</td>
<td>Main crop N.S.</td>
</tr>
<tr>
<td>10</td>
<td>Main crop selectively logged</td>
</tr>
</tbody>
</table>

### 31. BASIS—ALL CARDS

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tree age</td>
</tr>
<tr>
<td>2</td>
<td>Tree size</td>
</tr>
<tr>
<td>3</td>
<td>Tree condition</td>
</tr>
</tbody>
</table>

### 32. Rec. orresp. Disturb.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Major disturbance</td>
</tr>
<tr>
<td>2</td>
<td>Minor disturbance</td>
</tr>
</tbody>
</table>

### 33. Class of Type

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hardwood</td>
</tr>
<tr>
<td>2</td>
<td>Softwood</td>
</tr>
</tbody>
</table>

### 34. L.S. Grade

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A.100</td>
</tr>
<tr>
<td>2</td>
<td>A.75</td>
</tr>
<tr>
<td>3</td>
<td>A.50</td>
</tr>
<tr>
<td>4</td>
<td>A.0</td>
</tr>
</tbody>
</table>

### 35. Stereogram Record

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
</tr>
</tbody>
</table>

### 36. Photo No.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
</tr>
</tbody>
</table>

### 37. Date

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Day, month, year</td>
</tr>
</tbody>
</table>

### APPENDIX 1A

1. **Region No.** (R. No.)
   - Code Sheet No.
2. **Compartment No.**
   - Project name
3. **Special No.** (if any)
   - Special

---

*F.S. 4321-1957*
### (28) MISCELLANEOUS HISTORY
(Write R.D., E.D., etc., Direct)

<table>
<thead>
<tr>
<th>M.</th>
<th>M.</th>
<th>M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Wind-burn.</td>
<td>23.</td>
</tr>
<tr>
<td>6.</td>
<td>Insects.</td>
<td>27.</td>
</tr>
<tr>
<td>8.</td>
<td>Fum.</td>
<td>29.</td>
</tr>
<tr>
<td>10.</td>
<td>Ice-storm dam.</td>
<td>31.</td>
</tr>
<tr>
<td>11.</td>
<td>Land clearing.</td>
<td>32.</td>
</tr>
<tr>
<td>12.</td>
<td>Old field cult.</td>
<td>33.</td>
</tr>
<tr>
<td>13.</td>
<td>Filling in swamp.</td>
<td>34.</td>
</tr>
<tr>
<td>14.</td>
<td>Recent alluvial deposit.</td>
<td>35.</td>
</tr>
</tbody>
</table>

### (29) DATE OF HISTORY

### (30) DEGREE OF DISTURBANCE

<table>
<thead>
<tr>
<th>Range</th>
<th>O</th>
<th>D</th>
<th>I.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0-10%</td>
<td>2.</td>
<td>11-30%</td>
</tr>
<tr>
<td>3.</td>
<td>31-50%</td>
<td>4.</td>
<td>51-75%</td>
</tr>
<tr>
<td>5.</td>
<td>76-100%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### (31) SEED-TREE OCCURRENCE
(N.S.R. and Y.N.C.)

### (32) PER CENT STOCK (N.S.R.)

<table>
<thead>
<tr>
<th>Species</th>
<th>S</th>
<th>S</th>
<th>S</th>
<th>S</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0-10%</td>
<td>2.</td>
<td>11-30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>31-50%</td>
<td>4.</td>
<td>51-75%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### (33) REFOREST. POSS. (N.S.R. and Y.N.C.)

### (34) GROUND DEBRIS
1. Negligible (0-10%). 2. Moderately 11-50%. 3. Heavy (51%).

### (35) No. SNAGS/ACRE
1. Negligible. 2. 0-10. 3. 11-30. 4. 31-100.

### (36) Acre. D.B.H. SNAGS
1. 10. 4. 28. 2. 16. 5. 40. 3. 22. 6. 63.

### (37) HAZARD RATE

<table>
<thead>
<tr>
<th>Extremes.</th>
<th>1-10</th>
<th>11-20</th>
<th>21-40</th>
<th>41-60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Age</td>
<td>Age</td>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>No./Acre</td>
<td>No./Acre</td>
<td>No./Acre</td>
<td>No./Acre</td>
<td></td>
</tr>
</tbody>
</table>

### (38) 100% STOCKING
7. Access to and building possibilities (access—present and or potential routes—roads, trails, river, etc., road-building—gravel deposits, topography, swamps, rock outcrops, etc.).

### (39) SITE INDEX
Site index is the mean age of the forest's dominant and/or co-dominant sample trees (item 31) plotted over age, using the age-height curves supplied.

### (40) LAND USE AND SITE GROUP

1. Forest: Productive Site Index to nearest 10
   - Forest productive
   - Forest low site
   - Forest non-productive

2. Forest: Low site
   - Forest productive
   - Forest non-productive
   - Forest non-productive

3. Forest: Non-productive
   - Forest productive
   - Forest non-productive
   - Forest non-productive

4. Range: Productive
   - See fieldman's pocket manual for age-height curves.

### (41) TREE-SPACING GUIDE

<table>
<thead>
<tr>
<th>Feet</th>
<th>Trees/Acre</th>
<th>Mature and G.M.C. Only</th>
<th>Immature and Y.N.C. Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x 2</td>
<td>1,000</td>
<td>0.00% Stocking</td>
<td>0.25% Stocking</td>
</tr>
<tr>
<td>3 x 3</td>
<td>2,732</td>
<td>1.00% Stocking</td>
<td>2.00% Stocking</td>
</tr>
<tr>
<td>4 x 4</td>
<td>4,144</td>
<td>2.00% Stocking</td>
<td>3.00% Stocking</td>
</tr>
<tr>
<td>5 x 5</td>
<td>6,250</td>
<td>3.00% Stocking</td>
<td>4.00% Stocking</td>
</tr>
<tr>
<td>6 x 6</td>
<td>7,776</td>
<td>4.00% Stocking</td>
<td>5.00% Stocking</td>
</tr>
<tr>
<td>7 x 7</td>
<td>9,000</td>
<td>5.00% Stocking</td>
<td>6.00% Stocking</td>
</tr>
</tbody>
</table>

### (42) STOCKING CLASS

<table>
<thead>
<tr>
<th>Species</th>
<th>No. Trees 13%</th>
<th>% of 100% Stocking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0-10 (O.F.)</td>
<td>0.25%</td>
</tr>
<tr>
<td>2.</td>
<td>11-30 (S.O.F.)</td>
<td>0.50%</td>
</tr>
<tr>
<td>3.</td>
<td>31-60</td>
<td>0.75%</td>
</tr>
<tr>
<td>4.</td>
<td>61-90</td>
<td>1.00%</td>
</tr>
<tr>
<td>5.</td>
<td>91+</td>
<td>1.25%</td>
</tr>
</tbody>
</table>

### APPENDIX 1B

(2)
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>DESCRIPTION</th>
<th>SPECIES</th>
<th>AGE</th>
<th>HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REMARKS AND AIR CALL No.
The lines of equal magnetic declination (also called isogonic lines) are marked 24°E, 25°E, etc. - The lines of equal annual change in the magnetic declination (also called isoporic lines) are marked Annual Change 3°W, 4°W, etc. - in British Columbia, magnetic north is east of astronomic north, Example: Correct compass offset at Prince George in 1956 27° 30' annual change is 4°W. Correct offset in 1957 is 27° 26'.
TOTAL HT. DOM. & CED.M.

CEDAR & HEMLOCK - INTERIOR

GOOD

MEDIUM

ROOB

SITE INDEX 130

110

100

90

80

70

60

50

40

TOTAL AGE
The total age of an individual tree is estimated by making a ring count on an increment borer core, or on a stump, usually at some convenient height above ground level. To this counted age must be added a correction factor based on the estimated number of years the tree required to grow to the height of the count. The counted age plus the correction factor is the estimated total age of the tree.

The amount of correction, or the time the tree required to grow to the height of the ring count, depends largely upon:

1. the height of the count,
2. site,
3. competitive factors during initial height growth.

The first two factors may be readily determined in the stand for which age determinations are to be made. The third factor, competitive conditions during stand establishment, is more difficult to estimate.

Three conditions of reproduction growth may be recognized. These are: free growth, moderate suppression, and heavy suppression. Due to the problems inherent in the application of correction ages, it is only feasible to estimate two broad subjectively determined classes. These are as follows:

Free growth - for stands which originated apparently free of competition, eg.: following clear cutting, following clear burning, or under a few scattered seed trees.

Moderate Suppressed growth - for stands which originated under competition, eg., following selective cutting, following ground fires, under heavy windthrow, or under a deciduous nurse crop.

The tables of correction ages contained in the following pages have been compiled from representative samples collected in widely separate localities in the Province. The correction ages presented should be considered to be of a very preliminary nature, final values are necessarily dependent upon further sampling and a more critical analysis of the results. However, it is anticipated that they will serve as a useful guide to the estimation of total ages in the field.
Correction ages for the species represented were derived from curves of age over height for free growth and moderately suppressed growth on good, medium, and poor sites where the data permitted. Lack of data precluded the presentation of correction factors for some species on some sites and one or other of the two growth conditions recognized.

The following comments are offered regarding the use of these tables in the field.

Site

Site is to be determined by reference to the site curves presented in another section of this booklet.

Height of Count

Increment borings should be made at the nearest one-foot interval to ground level. Variation in the number of years taken by individual trees to grow to a given height in similar stands increases substantially with the height of the age count. Thus, the higher up a tree is bored, the greater the possibility of error.

No attempt should be made to estimate total age on heavily suppressed advanced reproduction in uncut mature stands, where total ages for each species can be obtained by boring dominant and co-dominant trees.
Preliminary Stump Age—Total Age
Correction Factors

Douglas Fir

Coast & Interior

<table>
<thead>
<tr>
<th>Height of count (feet)</th>
<th>Age Correction (years)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good Site</td>
<td>Medium Site</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>4.5</td>
<td>9</td>
<td>14</td>
</tr>
</tbody>
</table>

Free Growth

<table>
<thead>
<tr>
<th>Height of count (feet)</th>
<th>Age Correction (years)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good Site</td>
<td>Medium Site</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>4.5</td>
<td>12</td>
<td>22</td>
</tr>
</tbody>
</table>

Moderately Suppressed Growth
## Preliminary Stump Age—Total Age

### Correction Factors

#### Western Red Cedar

#### Coast & Interior

<table>
<thead>
<tr>
<th>Height of count (feet)</th>
<th>Age Correction (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good Site</td>
</tr>
<tr>
<td>Free Growth</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>4.5</td>
<td>8</td>
</tr>
<tr>
<td>Moderately Suppressed Growth</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>4.5</td>
<td>8</td>
</tr>
</tbody>
</table>

Above factors may also be applied to yellow cedar.
PRELIMINARY STUMP AGE-TOTAL AGE CORRECTION FACTORS

WESTERN HEMLOCK

COAST & INTERIOR

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**Preliminary Stump Age-Total Age Correction Factors**

**Coast Balsam Species**

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* Data incomplete
## Preliminary Stump Age-Total Age

### Correction Factors

#### Interior Balsam Species

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### Correction Factors

#### Sitka Spruce

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### Preliminary Stump Age—Total Age

#### Correction Factors

**Interior Spruce Species**

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### PRELIMINARY STUMP AGE—TOTAL AGE

**CORRECTION FACTORS**

**WHITE PINE**

**COAST & INTERIOR**

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**Free Growth**
### PRELIMINARY STUMP AGE—TOTAL AGE

**CORRECTION FACTORS**

**LODGEPOLE PINE**

**COAST & INTERIOR**

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## PRELIMINARY STUMP AGE—TOTAL AGE

### CORRECTION FACTORS

#### YELLOW PINE

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## Preliminary Stump Age—Total Age

### Correction Factors

#### Western Larch

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For moderately suppressed growth, increase above factors by 50 per cent.
## Preliminary Stump Age-Total Age

### Correction Factors

#### Cottonwood

#### Coast & Interior

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PRELIMINARY STUMP AGE—TOTAL AGE

CORRECTION FACTORS

ALDER

COAST & INTERIOR

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### Preliminary Stump Age—Total Age

#### Correction Factors

**Maple**

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PRELIMINARY STUMP AGE–TOTAL AGE

CORRECTION FACTORS

BIRCH

COAST & INTERIOR

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## Preliminary Stump Age-Total Age

### Correction Factors

#### Aspen

#### Coast & Interior

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