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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 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 Number - The group of several compartments that the coder works in during the field season may be given a project number.

(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 describe a type separated from 453A85 by a dotted type line only.
  Type number will be 453A85

PART I Item 1

(1)
(1954)
(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: BC622:36

(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.
PART I Item 2 ELEMENTS OF STAND STRUCTURE

A. Stand Structure 1: - Main Crop Immature.

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

(i) less than 40 years of age (deciduous only).
(ii) less than 80 years of age (pure Pl stands only).
(iii) less than 120 years of age.
   (all stands other than pure Pl 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 volume 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) Grown up non-commercial aspen-spruce (4 - AS) or young non-commercial spruce-aspen (3 - SA).
   (Map notes only if small minor area).
(ii) Main stand immature spruce plus secondary stand of
grown-up non-commercial aspen.
(iii) Main stand immature spruce plus secondary volume of
aspen.
(iv) Main stand immature spruce-aspen.
(v) Main stand volume aspen plus secondary immature spruce.
(vi) Main stand grown-up non-commercial aspen plus secondary
immature spruce.

B. Stand Structure 2: - Main Crop Volume

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

(i) over 40 years of age (deciduous only).
(ii) over 80 years of age (pure Pl stands only).
(iii) over 120 years of age.
   (all stands other than pure Pl stands and deciduous)
   (e.g. FS; P1S; SP1; P1SB).

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

E.g. FS - 110' - 140 yrs. = volume
     Pl - 80' - 95 yrs. = volume
     P1S - 80' - 95 yrs. = immature
     D - 80' - 47 yrs. = volume

PART I Item 2
(3)
(1954)
C. Stand Structure 3:- Main Crop Non-Commercial Young.

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. Although any species combination may be used, the age classes 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.

\[\text{e.g. (i) Young non-commercial area of alder following slide.}
\]
\[\text{Mark thusly on back of photo: 3-D.}
\]
\[\text{(ii) Non-commercial Pl-Aspen. 3-PlA.}
\]
\[\text{(iii) Non-commercial Brush. 3-Br.}
\]

For extensive areas (100 + acres) of young non-commercial, regular code sheets should be made out rather than use map notes.

\[\text{e.g. - large burned-over area with young N.C. coming up.}
\]
\[\text{- stagnated stands classed as young N.C.}
\]

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

Area not covered, or only 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.

\[\text{(i) Grown-up non-commercial stand of Pl-Aspen less than 100}
\]
\[\text{acres such as windbreak or isolated strip.}
\]
\[\text{Record thusly on back of photo:- 4-PlA.}
\]
\[\text{(ii) Grown-up non-commercial Fir, 4-F.}
\]

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 volume type, except for the fact that any species combination may be used.
E. Stand Structure 5: - Secondary Crop 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 volume F, Fy and L stands.
(ii) secondary immature under nurse N.C. crop.
   (e.g. spruce coming up under nurse aspen or nurse Pl 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 Pl 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 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.
       PL 17 years
       L 75 years
       Label on photo should be: 1-109
       (L-1880) O CON CROSS SHEET IN ITEM 31

F. Stand Structure 6: - Secondary Crop Volume

Secondary volume is volume in seed trees or mature vets and/or deciduous either in main stand or in remnants of older age classes, but 40 years or older and ready for cutting.

Rules for Secondary Volume

(i) Do not recognize secondary stand volume if main stand is volume; (i.e., do not code as such).

(ii) Do not recognize advanced immature as secondary volume.
   (Trees should be classed as immature until they reach their maturity age.)
PART I Item 2 ELEMENTS OF STAND STRUCTURE, contd.

F. Stand Structure 6: Secondary Crop Volume, contd.

Rules for Secondary volume, contd.

(iii) Do not recognize secondary volume unless this volume constitutes a satisfactory logging chance.

(iv) Do not recognize secondary volume if values do not warrant disturbing the main crop.

A good general rule to remember is: "To mention the word 'volume' invites logging".

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.

(ii) Secondary crop young non-commercial should NOT be used unless it constitutes an important part of the stand. (For typical stands of SB, HB, HC, etc., where there is always a typical scattered suppressed under-story, check off main stand volume 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 main stand immature except for the fact that any species combination may be used.

H. Stand Structure 8 - Secondary Crop Grown-up N.C.

This classification must NOT be checked if main stand is grown-up non-commercial. Some examples of secondary grown-up non-commercial are:

(i) Old F vexts 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.

In coding this type of stand, use any species combination, and the applicable secondary stand volume code for age and height. Use Stocking class 2 only.

I. Stand Structure 9 - Main Crop Not Satisfactorily Re-Stocked

This classification applies to young stands that are less than 51% stocked and usually less than 21 years of age. (Exception - Py)

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, re-classify as immature.

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

(iv) The code Key (Item 3) need not be filled in if denudation occurred within the last five years.

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

The percent stocking of N.S.R. stands is determined by the quadrat tally (see tally manual). The general rule is to double the percent mil-acres stocked to obtain percent area stocked. e.g. Quadrat tally shows 17% of mil-acres stocked (m.a.s.). Therefore (17% X 2) = 34% of area stocked.

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
I. Stand Structure 9 - Main Crop Not Satisfactorily Re-Stocked, contd.

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. Check with supervisor.

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 volume 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.

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

classifications such as, immature with secondary volume 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 volume or main stand immature with secondary stand volume. (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 N.C.
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.

\[ \text{e.g. } 2 - \text{F(S)} \ 1(5) - 4 - 9 - 4 \]
\[ 7 - 8 \]

B. Forest Type

The forest type is found as follows:

(i) Volume 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.
PART I  Item 3  KEY, contd.

B. Forest Type, contd.

e.g. 80 yr. old immature stand

H - 160 trees/acre; ave. diam. 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 volume forest type on an inventory survey:

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

(b) Coder looks up volume 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 volume 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)L)(5) main stand Fir with minor amounts of Spruce or similar species. (All interior except Py and L areas).

(c) (F(Py)L)(9) main stand Fir with minor amounts of Yellow Pine.

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

All interior pure Fir volume stands MUST fall into one of the last three categories. All coast pure Fir volume 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.
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 stands except pure Pl and pure deciduous types, where number of trees 7"+ will be the basis.

Certain stand structure elements have fixed stocking classes:

- Immature (all areas except S.O.R.) - stocking class 5 only
- Immature (S.O.R.) - stocking class 1 only
- Main young non-commercial (all areas except understocked) - stocking class 5 only
- Main young non-commercial (understocked) - stocking class 2 only

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
- Secondary immature (Special) - stocking class 5 only
- Main crop grown-up non-commercial (Special) - stocking class 4 only
- Main crop grown-up non-commercial (Inv. and Race) - stocking class 3 only
- Secondary crop grown-up non-commercial (Special) - stocking class 2 only

**F. 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 KEY, contd.

F. 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;

e.g. 1954 Sample tree date: F-43 yrs.
F-47 yrs.
C-39 yrs.
H-85 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  STAND DESCRIPTION

The percentage composition and average diameter 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. The percentages and average diameters 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 and having an average diameter of 26 inches. This means that the fir comprises 40% of the secondary stand only, and not the type as a whole; and similarly the fir in the secondary stand only had an average diameter of 26 inches.

Rules:

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

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

(iii) Mention all species comprising at least 10% of the stand.
PART I Item 5  LAND USE AND SITE GROUP

The following are the Land Use and Site Group classifications 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)

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)

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)

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

For non-productive areas where a code sheet is not warranted, map notes may be used. These map notes are:

"10" - Basic class number "10" is used to describe forest cover growing on all 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 that erosion has stripped the land of much of its soil, leaving the area non-productive.
C. Forest Non-Productive Site (Code 3), contd.

"12" - Basic class number "12" is used to describe forest cover growing on all lowland non-productive areas of 100 acres or less. All map notes in lowland non-productive areas should be accompanied by the species present. e.g. 12(F)
12(P1L)

Where a lowland non-productive area is more than 100 acres, a regular code sheet should be made out.

D. Range Productive Site (4000 series)

The coder shall only use this classification if:

(i) stand is very open (stocking class 1)

(ii) 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 forest rather than as semi-open range.
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 diameter).

(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) Put down total age and also number of years required for the tree to grow to bored height. For this latter figure, the range will vary with the height of the boring, and the rate of growth of the tree. It would take 5 - 10 years for trees developing freely to grow 4 - 5 feet high, whereas suppressed trees or those formerly suppressed may take up to 25 years to reach the same height.

(vi) If possible, get ages from stumps in cut-over portions of the type.

Definitions

(i) **Dominant Trees**: Trees with crowns extending above the general level of the crown cover and receiving full light from above and partly from the side; 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 and receiving full light from above but comparatively little from the sides; 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; receiving a little direct light from above, but none from the sides; usually with small crowns considerably crowded on the sides.
Definitions, contd.

(iv) Over-topped trees: Trees with crowns entirely below the general level of the crown cover receiving no direct light either from above or from the sides. Over-topped trees will respond to release.

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 Pl stand may require but one sample tree, whereas a less uniform stand of Py 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.
PART I Item 7  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.
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 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 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 60-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 Pl 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.

PART I Item 8

(21)
(1954)
PART I Item 9 MAIN STAND YOUNG NON-COMMERCIAL CLASS

Code 1. Doubt if commercial stand will develop.
   e.g. (i) Young F stand, badly damaged as a result of logging the old vats.
   (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 liable 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. Pl 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 center of large burn.
   (ii) Patch of F. immature in open range.
PART I Item 10 MAIN STAND VOLUME CLASS

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.
A. Code Sheet Check off

Code 1. Secondary volume consisting of advanced growth of immature stand or stands. (Do not use unless instructed.)

Code 2. Secondary volume consisting of partial commercial volume remnant of

(a) deteriorated stand;

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

Code 3. Secondary volume consisting of advanced growth of immature stand or stands, plus a partial commercial remnant of deteriorated stand or devastated previous volume stand. (Do not use unless instructed).

Code 4. Other age class and/or height class of volume in a main stand volume. (Do not use unless instructed).

Note: Secondary volume should be checked off only if the stand provides a feasible and satisfactory logging show. If the volume present does not warrant the disturbance of the main crop, then the secondary grown-up non-commercial classification should be used to describe the stand, rather than secondary volume.

RULE: The word "volume" invites cutting.
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 in 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.
(v) Code 5 - True all aged immature forest in which all ages of trees except merchantable are represented.

   e.g., Py stand of all ages with some old vats classified as non-commercial, but with NO trees of commercial value as yet.
PART I  Item 13  SECONDARY CROP IMMATURE CLASS

Code 1. Poor development.

2. Fair development

3. Good 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 14  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 15 UTILIZATION VALUE - Volume stands (main or secondary) only.

Code 1. Primarily saw logs and/or pulp


Code 3. Minor Products

  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 16  MISCELLANEOUS HISTORY

A. Code Sheet Check off.

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

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 rotations by careful marking of trees to be cut, and minor product cutting (e.g., poles, piles, ties, etc.) only.

16. Burning

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

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

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

6. Defoliating insects: insects which attack the needles or leaves of the tree; e.g., 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 base of tree, insect tunnels, etc.

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

5. Floods
A. Code Sheet Check off, contd.

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

12. Old field cultivation: former cultivated field, now reverted to forest.

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

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


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

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

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

39. Selectively logged - marked: partial logging of stand that has been marked.

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.
A. Code Sheet Check off, contd.

Code 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.

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 - cedarpoles 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.

19. Logging: burning; re-burning.

17. Burning: re-burning.


21. Defoliating insects; burning.

22. Cambium insects; burning.

23. Fumes; burning.

24. Disease; burning.
PART I Item 16 MISCELLANEOUS HISTORY, contd.

A. Code Sheet Check off, contd.

Code 25. Ice storm; burning.

26. Land clearing; burning.

27. Logging; windthrow.

B. Rules on Disturbances for Miscellaneous History

(i) 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.

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

PART I Item 17  SITE INDEX

The graph shows average maximum height plotted over age. Interpolate in graph to nearest site index class and check off in appropriate square.

In deciduous, N.S.R., young immature and over-stocked P1 stands, use previous crop remnants or surrounding timber to estimate site index.

PART I Item 18  SEED TREE OCCURRENCE (N.S.R. and Main Stand Young N.C. 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 19  Reforestation Possibilities

(N.S.R. and Main 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 20 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
21% + stocked = (Py only) reclassify as immature.

B. Examples

(i) HC stand; ½ years of age; 200 trees/acre
   % stocking = \( \frac{200 \times 100}{750} \% = 27\% \) stocked

(ii) F stand; 3 years of age; 450 trees/acre
    % stocking = \( \frac{450 \times 100}{1000} \% = 45\% \) stocked

(iii) 25 chain quadrat tally shows 13 of the 80 mil-accres
     stocked.
     Total species tallied were: P1- 9 trees;
     S-5 trees; B-2 trees. Age = 9 years
     % of mil-accres stocked (m.a.s.) = \( \frac{13}{80} \times 100 \% = 16\% \)
     % of area stocked = \( \frac{16 \times 2}{100} = 32\% \)
     100% stocking for 9 year old stand = 1000 trees/acre
     \( \frac{32}{100} \times 1000 \) = 320 trees/acre

     Therefore P1 has \( \frac{9 \times 320}{16} = 180 \) trees/acre
     S has \( \frac{5 \times 320}{16} = 100 \) trees/acre
     B has \( \frac{2 \times 320}{16} = 40 \) trees/acre

PART I Item 20

(36)

(1954)
PART I Item 21  PERCENT DEBRIS

(N.S.R., Main crop 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 22  NUMBER OF SNAGS PER ACRE

(N.S.R., Main crop 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 23  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 24 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 volume timber or ten-year old immature.

Any further elaboration on the logging chance of an area can be made on the back of the code sheet in the space provided for type and area description.

PART I Item 25 HAZARD RATE

Code 1. Extreme danger.


A. Factors Affecting Hazard

(i) 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) 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, swampy 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.
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 Count: 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 dist-
urbance in a stand.

(a) Most recent disturbance in volume timber stand.
e.g. Main stand volume that was logged select-
ively for cedar poles in 1935 - 1937:
R.D. = 1935 - 1937
E.D. = None
E.E.D. = None

(b) Most recent disturbance that disturbed an immature
stand which was established by some previous
disturbance.
e.g. A Douglas Fir stand was established as a
result of a fire in 1892. It was logged
selectively in 1948 for piling:
R.D. = 1948
D.R. = 1890 (taken to nearest 10)
(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 wood, 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, an 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 preceded 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)**

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

1907
1

1907
1

1907
1

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 27  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 the percentage of the stand
disturbed. (area disturbed)

PART I  Item 28  AVERAGE D.B.H. - 9"+ (Main and secondary stand
                volume only).

Code 1 = 10"
       2 = 12"
       3 = 16"
       4 = 22"
       5 = 28"
       6 = 40"+
PART I Item 29  SPECIAL SITE CONSIDERATIONS

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

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

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.

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

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 30  GRAZING VALUE

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

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

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

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

5. No grazing - little or no feed.
PART I Item 31 MAP NOTES

A. Seed Trees

In the space provided, enter the species of seed trees or vats 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 is considerable values in pole 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.

PART I Item 32 ELEVATIONS

Code 1. 0 - 2000 feet

2. 2000 - 4000 feet

3. 4000 - 6000 feet

4. 6000 - 8000 feet

5. 8000 + feet
Code 1. With

2. Without

Understory is defined as 200 + potential crop trees per acre established over a fair range of diameters up to 12" D.B.H. In other words, the understory would be the minimum stand left by cutting 14" D.B.H. and over 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: HBSC
- Lower Coast Region: FCH

When understory is present (i.e. Code 1 is checked) the species comprising 20% or more of the understory should be checked.
Individual trees in mature stands or stands approaching maturity, contain varying amounts of decay. Thus, in cruising stands of this type, the estimation of cull in individual trees is subject to considerable error. It would, therefore, be advantageous to know which trees are most likely to contain decay, particularly those which are likely to contain excessive amounts of decay. Recent pathological studies have shown that two broad classes of living trees are clearly recognizable in stands of this character. As the classification of trees is made on the basis of the presence or absence of external signs of decay, it is anticipated that each class of tree so defined will represent a different potential loss factor within the stand.

All living trees in the stand 5.1 inches D.B.H. and over can be classed as:

Residual: - living trees that bear no visible sign or signs of decay.

or

Suspect: - living trees that bear one or more of the following signs of decay.
(a) Conks
(b) Blind conks
(c) Scars
(d) Fork or pronounced crook
(e) Frost cracks
(f) Trunk infections of mistletoe
(g) Large rotten branches
(h) Dead or broken top

Trees will be classed as "Suspect" on the basis of the above signs only. No other signs or defects are to be used as a basis for Suspect classification. Provision is made on the code sheet for the recording of any additional abnormalities or defects which may be present in the stand such as burls, woodpecker infestation, butt swell, cankers, etc. In the absence of any one of the suspect characters listed above, such trees will be classed as residual.

Residual trees contain hidden decay only. Suspect trees contain hidden decay, plus decay which is indicated by the presence of visible signs. It is not implied that Residual trees are entirely free of decay, or that Suspect trees are complete culls. It is implied that Suspect trees, as a class, are more defective than Residual trees, due in part to their associated defects which may have provided entrance for wood-rotting fungi.
It is absolutely essential that each tree be viewed from all sides before being classed as Residual or Suspect.

The following is a brief explanation of the external signs of decay. A more complete description can be found in the tally manual.

(a) Conks
Conks are the most certain and reliable indications of decay. They appear most frequently on the underside of dead branch stubs, on branch scars, or on the underside of live branches in the crown. Certain of the fungi causing root and butt rots produce sporophores which appear typically on the soil growing from the roots of the tree.

(b) Blind Conks
Blind conks appear typically as pronounced swellings around branch stubs. The swelling results from an attempt of the tree to heal over an abortive conk, the beginning of a new conk, or the point from which an old conk has dropped. Blind conks and conks often appear together on the same tree. They are analogous to conks as indicators of decay. The terms "swollen knots", "blind knots", "punk knots", are synonymous.

(c) Scars
Under this heading include scars which are open or healed over. Decay is not normally associated with very recent scarring. Therefore, do not consider scars in which the exposed wood tissues appear fairly fresh. It is recognized that it is very difficult to ascertain the age of scarring on standing trees. However, include in the suspect category any scar which is healed over, or any open scar which shows weathered wood tissues. Scars may be of the following origin; fire, broken branches, lightning strikes, old blazes, logging damage, or falling trees, etc.

(d) Fork or Pronounced Crook
Fork or pronounced crooks are reliable indicators of decay where open scarring results from the breaking of one or both forks, or from abnormal pressure at the juncture of the forks. Do not include fork or pronounced crook which is confined to the top of the tree above the merchantable portion of the trunk. Fork or pronounced crook in this category frequently develops from malformations of the terminal leader due to insect or mistletoe attack, are generally recent in origin, and are seldom associated with decay.
(e) **Mistletoe Trunk Infections**
Under this heading, include only those infections which are confined to the merchantable portion of the trunk. Trunk infections of mistletoe are indicated either by abnormal swellings or malformation of the trunk at the point of infection, or by clusters of dead or broken branches on or immediately adjacent to the trunk. Do not include mistletoe which is confined to the branches unless such infection has clearly extended to the trunk.

(f) **Large Rotten Branches**
Large rotten branches which appear typically on old growth Douglas fir, spruce, hemlock, and balsam are often indicative of decay, when they appear singly, or in groups on the lower trunk.

(g) **Dead or Broken Top**
Under this heading include only those which are not of recent origin. In this case the term "Recent" described under Scars applies.

The pathological factors (if any) are to be recorded as Heavy (H), Medium (M), or Light (L) under the applicable species. In addition, the percent of suspect trees by species is to be estimated.
PART I  Item 35  ASPECT

Code 1.  Flat

2.  North

3.  North-east

4.  East

5.  South-east

6.  South

7.  South-west

8.  West

9.  North-west

Aspect is the general direction of slope.

PART I  Item 36  AVERAGE SLOPES

Code 1.  Flat or moderate  (0 - 20 topographic abney reading)

2.  Medium (20 - 40 topographic abney reading)

3.  Steep generally (40 - 60 topographic abney reading)

4.  Excessive (60 + topographic abney reading)

PART I  Item 35, Item 36  
(50)

(1954)
PART I  Item 37  SILVICULTURAL SYSTEM

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 (eg. 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.
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 the most 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.

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.
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. Should space for type description on the code sheet prove insufficient for any type, additional remarks are to be made on a 'skeleton' code sheet. This skeleton code sheet will be labelled with the original code sheet number and must be attached to same.

Code sheet type descriptions are to take the place of the former compartment type description sheet, and should therefore, 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 (where applicable) as closely as possible.

Description of Forest

The coded types in each compartment will be described separately under one of the following headings:

1. Mature forest types
2. Immature forest types.
3. N.S.R.
4. N.C. types.

Types in 1. and 2. may be broken down into sub types, if these are significant for management purposes, and each described as part of the main type.

A. Mature Types

1. General Description

Describe type and sub types. This sub-type description should include minor variations in the stand whether typed out or not. For example, in an over-mature 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 would be logged.

The condition of the main crop and any secondary crops are to be described stressing any conditions such as occurrence
of insect or fungal attacks, and signs of decadence occurring on one or several species. Other worthwhile information that should be recorded for mature types include:

- Diameter ranges by species (main and secondary stands)
- A.M.H. and height range by species (main and secondary stands)
- Age distribution in uneven aged types.
- Stocking (mention any unusual conditions important for management purposes.)
  eg. Dense groups of 100 year old Douglas fir requiring thinning in an uneven aged yellow pine-fir type.

2. Forest Site Potentiality

Does this present forest type appear to be the most valuable which the site will support? Base this statement, if one can be made, on observations in similar sites in the same locality.

3. Regeneration conditions in the forest type

(a) Present regeneration in the type, by species present, average age, height, and condition.
  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 healthy."
  Note any obviously preferred seed bed conditions and any preferred light and moisture conditions for regeneration.

(b) Ground vegetation related to the regeneration problem in the type.
  eg. "On good sites and especially where the crown cover is light, dense devils club and salmon-berry appear to hinder the regeneration of spruce".

(c) Depth and condition of organic material.
  eg. "About 3 inches of undecayed organic litter above 6 inches of raw humus. Seedlings appear to dry out and die a few months after establishment."

PART I Item 39, contd.
(54)
(1954)
(d) Condition of crop trees as seed bearers. The average crown length as a percentage of total height is a useful factor. Mention any relevant factors (eg. the presence of good tree types which could be favoured as seed bearers in a logging plan).

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

4. Site
A general description of the average site (based on a combination of the observed forest stand, ground vegetation and soil) in the area covered by the forest type.

5. General Vigour
A short written description should be made describing the rate of growth and relative vigour of the stand. Abnormal mortality in the stand should be noted with the accent on that occurring within the last ten years.

6. Silvicultural System
On the basis of the observed forest condition, rate the type, or even certain elements in the type, for priority of cutting. If the party chief feels qualified, on the basis of his knowledge of stand condition, regeneration conditions, and topography, he may recommend a suitable silvicultural system for the forest type. Naturally he may recommend various priority cuttings which are necessitated by factors such as decadence (static or negative growth) in a certain percentage of the type, and a silvicultural system applicable to the whole type after the priority cuttings are completed. eg. "In an uneven aged Py stand, immediate cutting of poor risk veterans scattered throughout the type is recommended, followed by a group selection system for the whole type".

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.
PART I Item 39 TYPE AND AREA DESCRIPTION, contd.

7. Stand History

Stand histories should be noted as to stand origin and subsequent history.

8. 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.

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

9. Grazing Possibilities

B. Immature Types

1. General Description

Describe type and sub types as to vigour, form, competition, insect and fungal attacks, etc., etc.

In addition, all immature types should be described as to:

- Diameter range of the type (main crop and secondary crop if present). May also be stated for sub types if necessary.
- Height range and average maximum height (main crop and secondary crop if present). May also be stated for sub types if necessary.
- Age. Average age in even aged types. Age range and average age in uneven aged types. State for main crop and secondary crop if present.
- Stocking. This is a very important factor in immature types and a good word picture of stocking conditions in the type, and sub types (if applicable) is necessary.
- Growth - Drain data will be calculated from sample plot information in Victoria. However, any general information on this subject gained from field sampling should be stated.

PART I Item 39, contd.

(56)

(1954)
2. Forest Site Potentiality

Does this present forest type appear to be the most valuable which the site will support? Base this statement, if one can be made, on observations in similar sites in the same locality.

3. Thinnings

- State if any thinning is desirable in the type, for stand improvement (eg. for reasons of overstocking, or to favour a valuable species), and outline present utilization values, if any, of such thinning material (eg. P1 ties, C poles). Future utilization values may also be stated (eg. "Dense 100 year old Hemlock type, diam. range 12" - 16", would benefit by thinning. Such thinnings would be of suitable size and form for poles.) Mention any conditions of stagnancy where future values are seriously prejudiced and recommend thinning if the site value and accessibility justify it.

4. Stand history

See item 7. under mature types.

5. Fire Hazard

See item 8. under mature types.

6. Site

See item 4. under mature types.

C. N.S.R. Types

The following points should be described in a general way:

1. Percent stocking by species and distribution of the stocking (ie. in groups or sparsely scattered).

2. Chances of satisfactory stocking considering the factor of seed source, seedbed conditions, ground vegetation, slash, nurse species, aspect, slope, etc., of the area.
3. State the priority for planting according to the above factors, and other factors as access, site value, fire hazard, etc.

4. State the present fire hazard condition.

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.

eg. "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 40 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 scrub - Scattered scrubby trees of no potential use in upland areas.

Denuded non-productive areas that are normally classified as "10" (when trees are present) shall be labelled "N.P." with burn symbol, and shall be separated from "10" by a dotted type line.


Code 12. Lowland scrub - Minor lowland non-productive areas (100 acres or less) can be labelled with basic class number "12" accompanied by the species present. eg. 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.
PART I Item 40  BASIC CLASS NUMBERS, contd.

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 52. Urban - district municipality.


Code 55. Airport.

Code 56. Isolated summer resort.

Code 57. Isolated industrial plant.

Code 58.

Code 59.
Code 60. Artificial hay field - irrigated open range only.

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).

eg. Solid type line between 10 and 2.
Dotted type line between 60 and 63.
PART I Item 41 AGE CLASS

A. Main Volume and Main Grown-up Non-Commercial

1. Special: Code 1 = 41 - 80 years
   2 = 81 - 120
   3 = 121 - 160
   4 = 161 - 250
   5 = 251 +
   11 = True volume selection

2. Inventory: Code 31 = 41 - 80 years
   32 = 81 - 120
   33 = 121 - 160
   34 = 161 - 250
   35 = 251 +

B. Secondary Volume and Secondary Crop Grown-up Non-Commercial

Special and Inventory

Code 51 = 41 - 80
   52 = 81 - 120
   53 = 121 - 160
   54 = 161 +

C. Immature and young Non-commercial

1. 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

2. Inventory: Code 21 = 1 - 10 years
   22 = 11 - 20
   23 = 21 - 60
   24 = 61 - 100
   25 = 101 +
   11 = True immature selection

PART I Item 41
(63)
(1954)
PART I Item 42 AVERAGE MAXIMUM HEIGHT

A. Volume and Grown-up Non-Commercial

1. Special: Code 5 = less than 65'
   7 = 66' - 95'
   9 = 96' - 125'
  11 = 126' - 155'
  13 = 156' - 185'
  15 = 186' - 215'
  17 = 216'

2. Inventory: Code 21 = less than 65'
   22 = 66' - 125'
   23 = 126' - 185'
   24 = 185'

B. Immature and Young Non-Commercial

1. Special: Code 1 = 0' - 6'
   2 = 6' - 12 1/2'
   3 = 12 1/2' - 27 1/2'
   4 = 27 1/2' - 42 1/2'
   5 = 42 1/2' - 57 1/2'
   6 = 57 1/2' - 72 1/2'
   7 = 72 1/2' - 87 1/2'
   8 = 87 1/2' - 102 1/2'
   9 = 102 1/2' - 117 1/2'
  10 = 117 1/2' - 132 1/2'
  11 = 132 1/2' - 147 1/2'
  12 = 147 1/2' - 162 1/2'
  13 = 162 1/2' - 177 1/2'
  14 = 177 1/2' - 192 1/2'
  15 = 192 1/2' - 207 1/2'
  16 = 207 1/2' - 222 1/2'
  17 = 222 1/2'

2. Inventory: Code 31 = 0' - 6'
   32 = 6' - 12 1/2'
   33 = 12 1/2' - 27 1/2'
   34 = 27 1/2' - 57 1/2'
   35 = 57 1/2' - 87 1/2'
   36 = 87 1/2' - 117 1/2'
   37 = 117 1/2'

(64)

(1954)
### 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>

### 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>
<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>

### (65)

### (1954)
PART I Item 45  TOTAL STOCKING CLASS

A. Volume and Grown-up Non-Commercial
   Number of trees 13"+ (all species except Pl and
deciduous)
   Number of trees 7"+ (Pl and deciduous only)

1. Inventory
   Code 1. 0 - 10 trees (reserved for S.O.R. - main
       stands only).
       2. 11 - 30 trees
       3. 31 + trees

2. Special
   Code 1. 0 - 10 trees (reserved for S.O.R. main
       stand only)
       2. 11 - 30 trees
       3. 31 - 60 trees
       4. 61 - 90 trees
       5. 91 + trees (do not use unless instructed)

B. Immature and young non-commercial

1. Inventory
   Use stocking class 5 always except in the following
   two cases.
   (a) S.O.R. areas - use stocking class 1 only
   (b) Areas classed as main young non-commercial because
       of understocking, use stocking class 2 only.

2. Special
   Code 1. 0 - 25% stocked
       2. 26 - 50% "
       3. 51 - 75% "
       4. 76 - 100% "
       5. 101%+  "

PART I Item 45
(66)
(1954)
PART II  MISCELLANEOUS INFORMATION

PART II  SECTION 1  GENERAL RULES ON TYPING

A. Forest types 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. Volume 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.

<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.

(1)

(1954)
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. type descriptions and all sample tree data.
3. sawmills, schools, post-offices, look-outs, etc.
4. 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 type 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  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 scrub or alpine line down to include these slides. A type can only be classed as a non-commercial type if it is growing on a productive area.

3. DO NOT type out snow fields separately from alpine, 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 scrub 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 volume 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.

PART II, SECTION 1, contd.

(3)

(195$)
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 difference in the key structure.

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

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

B. Dotted Type Line

A dotted type line is used to separate:

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

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

3. Stands having any worthwhile differences other than those affecting the Key factors. (e.g dotted type lines between stands having substantial difference in history, etc.)
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 types are to be separated and their main stands and their secondary volume stands (if any) are similar, then a "B" code sheet must be used for the sub type.

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

1. "B" code sheets must always be related to on "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 type line.

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

eg. 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, axe 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.

8. Do not group code sheets indiscriminantly. 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.
PART II SECTION 4 STEPS IN CODING, TYPING AND COMPLETING COMPARTMENTS, contd.

9. The coding party chief is responsible for seeing that compartments are complete; i.e. 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.

Graze pencil to be changed to ink.
Compartment revision

Compartment revision is 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. All new type lines and labels should be put on the original typed photographs with a yellow grease pencil. In addition, all type lines found to be in error and all original labels are to be crossed out on the photograph using this pencil.

4. All new type lines and labels are to be carefully sketched 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. Great 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.

6. Coder should keep a record of every code sheet made out in a pocket-size notebook. 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 the code sheet 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.

10. All completed compartments must be sent to Victoria as soon as possible and should include all typed photographs 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.

eg. 20 chs. 2 - FC-4-9-4
     25 chs. 2 - FC-4-9-3
     30 chs. 1 - F-6-35-5
     etc.
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 tallying and reference should be made to the tally manual 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.

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 chainman, 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 chainman 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 take out types that are found by ground observation but are difficult to see on the photograph.

Coders 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 this respect, coders should avoid deviating from proposed lines in order to examine small types or sub-types missed by strips.

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, 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 in the "remarks" section of the code sheets 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 "skeleton" code sheets 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 (particularly the "remarks" sections), 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, the approximate range of elevations, slopes 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 degrees 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 gulleys, where coarse textured sandy soil occurs."
PART II SECTION 7 COMPARTMENT DESCRIPTION, contd.

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 stands), 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 prescrip-
tion. 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:

1. Occurrence by topographic location and associated species.
   e.g. White spruce occurs in mixture with balsam and minor amounts 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 understory except in the more open spruce-balsam stands on poor sites.
2. 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 blow-down have occurred. In the blowdown patches spruce bark beetles are present in small numbers, and have not yet attacked the adjacent standing timber.

3. 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 understory 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 we have outlined.
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 lot 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.

PART II, SECTION 8
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(1954)
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.

![New Blaze](image1) ![Healed over Blaze](image2)

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 in 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,
creaks 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.

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

15 ch.

Scale: One Square = 5 ch.

Forest Service
(Surveys)

Form F.S. 226
PART II  SECTION 8  LOCATION OF SURVEY POSTS, contd.

Now if position of the post can be pin pointed on the photo, pin point it and mark it on the back of the photo.

The flag must be posted in a place that can be pin pointed on the photo. On the back of the photo show the flag location with an "X" with the label "Flag", and the size and species of tree where flag posted. If posted elsewhere than on tree say where posted, show cardinal directions and distances from post to flag.

e.g. Continuing with previous example figure below shows correct notations on back of photo.

\[
\begin{array}{c}
\text{\ding{51}} \text{ SE Lot 457} \\
\text{X Flag on 16" F} \\
15 \text{ ch. E, 5 ch. S} \\
\text{from SE Lot 457}
\end{array}
\]

N.B. Do not mark position of corner post on photo unless it can be pin pricked.

It is absolutely necessary that the above procedure for showing positions of flags and posts is followed, in order that the posts and flags can be placed accurately on the final cruise map, and in order that the posts and flags can be found again by someone using the map.
PART III PHOTOGRAFMETRY

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).
PART III PHOTOGRAMMETRY

2. Types of vertical aerial photographs used cont'd

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 12038-95). 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.

(a)

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

Where

\[P = \text{the distance between two points on a photograph.}\]

\[G = \text{the distance between the same points on the ground.}\]

(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.

\[
\text{Scale} = \frac{2.6}{(104)(2.6)(12)} = \frac{2.6}{82368} = \frac{1}{31.680}
\]

(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:

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

then by similar triangles

\[
\frac{P}{G} = \frac{F}{H}
\]

Therefore: \[
\text{Scale} = \frac{F}{H}, \text{ where}
\]

\[ F \] 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 5,85 inches.
PART III PHOTOGRAMMETRY

C. Some Elementary Mathematical Characteristics of Vertical Aerial Photographs cont'd.

Therefore 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.

![Diagram of scale change due to relief](image)

\[ \text{Scale} = \frac{F}{H-h} \]

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

\[ = \frac{5.85}{(17,500-2,000)12} = \frac{5.85}{186,000} \]

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

PART III SECTION 1. cont'd.

(1954)
PART III  PHOTOGRAMMETRY

2. Scale Change Due to Relief cont'd

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

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

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

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 field men 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 60% 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 cont'd.

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-interpretive 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 of 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.
PART III: PHOTOGRAMMETRY

3. Texture cont'd.

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

\[\text{MAP}\]

\[\text{BC 1427:99}\]
PART III PHOTOGRAMMETRY

B. Transferring a point from Photograph to Map cont'd.

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.
C. Transferring a point from Map to Photograph

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:

\[ \text{MAP} \]

\[ \text{Photo centre} \quad 52^\circ \quad \text{Flight line} \]

\[ \text{BC 1427:99} \]

\[ \text{BC 1427:100} \]
C. Transferring a point from map to photograph cont'd.

1. Point (a) on the map is to be transferred to photo B.C. 1427:99. 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 SECTION 5
(1954)

(15)
PART III PHOTOGRAMMETRY

B. Method of Construction cont'd.

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 PHOTOGRAMMETRY

B. Method of Construction cont’d.

(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 PHOTOGRAMMETRY

B. Method of Construction cont'd

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>Crown Closure</th>
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<tbody>
<tr>
<td>Readings</td>
<td>Along the line angles</td>
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<td>2</td>
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<td>19</td>
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<td>10</td>
</tr>
<tr>
<td>Sub Total</td>
<td>70</td>
</tr>
<tr>
<td>Plot Total</td>
<td>150</td>
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<tr>
<td>% Gap Plot</td>
<td>Total x 0.2</td>
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<tr>
<td>% Crown Closure =</td>
<td>70</td>
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</tbody>
</table>

PART III SECTION 5 cont'd.

(1954)
PART III PHOTOGRAMMETRY

B. Method of Construction cont'd.

(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.

(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.
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 volume 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 special volume type list.
(b) Under "Type" he finds PPY code 108.
(c) A.M.H. of 90 feet falls into 66-95 foot class or code "G".
(d) Under code "G" and opposite type "108", he finds letter "O".
(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(PPY) 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. Volume, Immature, Young N.C. 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 IV

(1)

(1954)
### PART IV STAND CLASSIFICATION BY TYPE LISTS

#### AGE

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<td>7</td>
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<td>All types except S.O.R.</td>
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#### Index

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**IMMATURE - SPECIAL**

**SECONDARY IMMATURE - SPECIAL**

**MAIN YOUNG NON-COMM. - SPECIAL** (any species combination)

**SECONDARY YOUNG NON-COMM. - SPECIAL** (any species combination)

**PART IV, contd.**

(2)

(1954)
### TYPE CODES

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### AGE CODES

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(c) Coastal types only

(i) Interior types only

PART IV, contd.

(1954)
PART IV  STAND CLASSIFICATION BY TYPE LISTS

IMMATURE - INVENTORY
SECONDARY IMMATURE - SPECIAL INVENTORY
MAIN YOUNG NON-COMM. - SPECIAL INVENTORY (any species combination)
SECONDARY YOUNG NON-COMM. - SPECIAL INVENTORY (any species combination)

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PART IV, contd.

(4)

(1954)
## Part IV Stand Classification by Type Lists

### Immature - Inventory
- **Secondary Immature - Special**
- **Main Young Non-Comm. - Special & Inventory** (any species combination)
- **Secondary Young Non-Comm. - Special**

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(c) Coastal types only
(i) Interior types only

---

(5)

(1953)

---

**PART IV, contd.**
### PART IV STAND CLASSIFICATION BY TYPE LISTS

**VOLUME - SPECIAL** (Stand Structure 2)

**MAIN CROP GROWN-UP N.C. - SPECIAL** - Use any species combination
- Use stocking class 4 only

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#### STOCKING CLASS

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**S.O.R. only**

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**Stocking Class 1 reserved for S.O.R.**

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PART IV, contd.

(6)

(1954)
### Stand Classification by Type Lists

**Volume - Special (Stand Structure 2)**

**Main Crop Grown-Up N.C.** - Use any species combination

- Use stocking class 4 only

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* 2 - Py - 11 - 7 - 2 (For Py Volume Selection Use Height Codes 7 or 9)
  2 - Py - 11 - 9 - 2 and Stocking Class 2*

---

**PART IV, contd.**

(1954)
### Part IV  Stand Classification by Type Lists

**Volume - Special (Stand Structure 2)**

**Main Crop Grown-Up N.C. - Special**
- any species combination
- use stocking class 4 only (Main G.N.C. only)

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**Part IV, contd.**

(1954)
### PART IV  STAND CLASSIFICATION BY TYPE LISTS

#### VOLUME - SPECIAL (Stand Structure 2)

MAIN CROP GROWN -UP N.C. - SPECIAL

- any species combination
- use stocking class 4 only (Main G.N.C. only)

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### PART IV, contd.

(9)

(195%)
## PART IV STAND CLASSIFICATION BY TYPE LISTS

### VOLUME - INVENTORY (Stand Structure 2)

**MAIN G.N.C. (S.S. 4) - INVENTORY**

- any species combination (for Main G.N.C.
- Use stocking Class 3 only only)

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**AGE**

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<td>121 - 160</td>
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<td>35</td>
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**HEIGHT**

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<tr>
<td>23</td>
<td>126 - 185</td>
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**STOCKING CLASS**

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<td>2</td>
<td>11 - 30</td>
</tr>
<tr>
<td>3</td>
<td>31 +</td>
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Addition * 2-Py-11-22-2 (For Py Volume Selection)

(c) Coastal types only

(i) Interior types only

Stocking Class 1 reserved for S.O.R. (Main stands only)
## Part IV  Stand Classification by Type Lists

### Volume - Inventory (Stand Structure 2)

**Main G.N.C. (S.S. 4) - Inventory**

- any species combination (for Main G.N.C. only)
- use Stocking Class 3 only

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<td><strong>SP</strong> (i)</td>
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<td><strong>D</strong></td>
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<tr>
<td><strong>F+Dec.</strong> (i)</td>
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<td><strong>E</strong></td>
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<td><strong>FC+pulp+Dec(c)</strong></td>
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<td><strong>S</strong></td>
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Addition: *2-Py-11-22-2* (For Py Volume Selection)

(c) Coastal types only

(i) Interior types only

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**Part IV, contd.**

(11)

(1954)
### PART IV  STAND CLASSIFICATION BY TYPE LISTS

**SECONDARY VOLUME - SPECIAL**

**SECONDARY CROP G.N.C. (S.S. 8) - Special**

- use any species combination (for G.N.C.
- use stocking class 2 only only)

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<th>Code</th>
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<td>31 +</td>
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<td>161 +</td>
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**PART IV, contd.**

(12)

(1954)
## Part IV

Stand Classification by Type Lists

Secondary Volume - Special

Secondary Crop G.N.C. (S.S. 8) - Special

- Use any species combination (for G.N.C. only)
- Use stocking class 2 only

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(c) Coastal types only
(1) Interior types only

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Part IV, contd.

(13)

(1954)
### AGE

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### HEIGHT

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### STOCKING CLASS

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PART IV, contd.

(1954)
### PART IV  STAND CLASSIFICATION BY TYPE LISTS

#### SECONDARY VOLUME - INVENTORY

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(c) Coastal types only

(i) Interior types only

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PART IV, contd.

(15)

(1954)
### PART IV STAND CLASSIFICATION BY TYPE LISTS

**N.S.R. - INVENTORY**

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(c) Coastal types only  
(i) Interior types only

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(1954)