

Timber Inventory Guidelines for Woodlot Licences

Community Forests and other Small Areas

Overview

Periodically the Forest Service or a Licensee wishes to improve the timber inventory of a small land area. Examples of “small” areas include but are not limited to Woodlots, Community Forests, Parks, Private Lands, or Indian Reserves. “Small” areas could also be watersheds or planning units up to about 10,000 hectares. These guidelines apply equally to Woodlot Licences as defined in the Forest Act and to the small areas noted above.

The main objectives of small area inventories are:

- 1) To produce timber data to support land use decision making.
- 2) To contribute to the provincial inventory database by conducting work to recognized standards. This is often a condition to receive provincial funding for the inventory project.

A brief overview of the process of small area inventory is presented in Figure 1: *Woodlot & Small Area Inventory Flowchart* and the accompanying text in Table 1: *Woodlot & Small Area Inventory Steps*.

Before you begin:

Check whether VRI has already been completed for the tenure area under TSA inventory work. Also check whether a VRI of the TSA is planned. In these cases, an independent VRI of the tenure area is not necessary. The stand delineation on the TSA, including the woodlot or Community Forest will already be to VRI standards. Consideration may be given to an update of the tenure area based on existing stand delineation and extensive field work.

Figure 1: Woodlot & Small Unit Inventory Flowchart

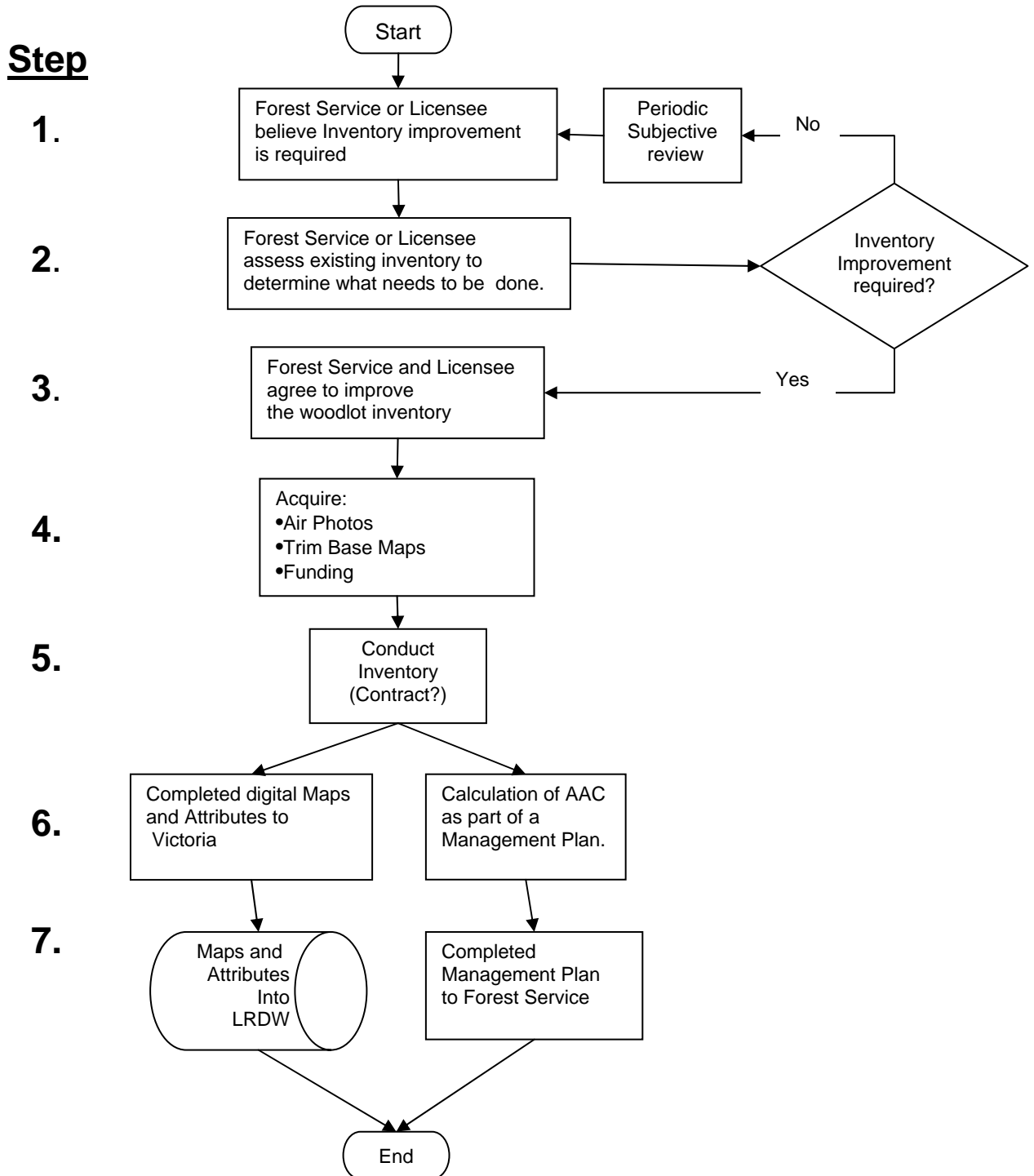


Table 1: *Woodlot & Small Unit Inventory Steps.*

The seven generalized steps in conducting an inventory update or reinventory of a woodlot or small area are:

1)	The process begins when a party interested in a land parcel believes the inventory is inadequate to address planning and management needs. The usual scenario is that species composition and stand volumes of a proposed or actual woodlot are thought to be unreliable.
2)	The Forest Service or a licensee, in consultation with VRI staff may conduct a brief, fieldwork based, assessment of the existing inventory to determine what, if anything, requires improvement. In particular, the polygon delineation and polygon descriptions in the Vegetation Inventory are assessed. Upon completion of this assessment, resource managers will know what aspects of the resource inventories, if any, require improvement.
3)	Assuming some form of inventory improvement is identified, the party responsible for the inventory and VRI staff develops a plan of action. The 1 or 2 page VPIP (written Project Implementation Plan) outlines where, what, who, when and how the inventory is to be done. The key questions to be answered are: <ul style="list-style-type: none"> • Where is the Wood Lot or area of interest? • What work will be done? • Who will do the work? • What is the standard for the work? (VRI and Digital Mapping Standards) • When will the work be done? • How will the work be paid for?
4)	The source material required to conduct the inventory work, including funding, are secured.
5)	The inventory work is conducted and the results are collected to the prescribed formats and standards.
6)	Once the inventory work is completed, the digital maps and attributes are forwarded to the Content Section, Resources Information Branch. In the case of Woodlot Licences, the inventory is used to calculate an AAC and incorporated in a Management Plan.
7)	The digital maps and attributes are stored in the Land and Resource Data Warehouse. (LRDW) The final step is for the Forest Service is to receive the Management Plan including the inventory and AAC calculation.

Introduction

A Woodlot Licence is an agreement between the Crown and a Licensee to manage a specific parcel of forest land in accordance with a management plan. These guidelines were developed to address the requirements for a timber inventory and proposed allowable annual cut in woodlot licence management plans as specified in section 45 of the Forest Act.

Section 45 of the Forest Act states that a management plan must include "...inventories prepared in the manner, presented in the format and meeting the specifications required under the woodlot licence, of the *timber* (italics added) resources within the woodlot licence area;" (Forest Act, Section 45 (1) (f) (ii))

The party responsible for the inventory should seek agreement with forest district and VRI staff on the requirements for the timber inventory prior to embarking on the project.

Please keep in mind that these are guidelines. Individuals are encouraged to consider the specific conditions in the area of interest and circumstances within the Forest District. Woodlot Foresters in consultation with VRI Inventory staff may adjust the guidelines to address local requirements.

Guiding Principles for Woodlot Licence & Small Area Inventories

- 1) The Vegetation Resources Inventory (VRI) is the Provincial Standard and inventories are stored on the Land and Resource Data Warehouse. (LRDW <http://srmwww.gov.bc.ca/g/lrdw.html>) Woodlot and small area inventory projects receiving government funding will be completed to the VRI standard and be added to the VRI coverage on the LRDW.
- 2) The detailed procedures for Vegetation Resource Inventory are contained in the various manuals available at: <http://srmwww.gov.bc.ca/vri/standards/index.html> The timber inventory guidelines for woodlots and other small areas present a decision model answering the question, "What needs to be done?" Answers to specific questions about inventory standards and procedures are found in the full manuals at the above mentioned web site.
- 3) Stand delineation and description will be to the VRI standard. Vegetation attributes necessary to run the Woodlot AAC program are of primary importance. These attributes are:
 - a. Species Composition
 - b. Age
 - c. Height

- d. Crown Closure
 - e. Site Index
- 4) When possible, the party responsible for the inventory will make estimates of all the VRI attributes for all the polygons in the woodlot.
 - 5) In the event that a Woodlot Licensees provides sufficient documentation of a systematic error (i.e. age) in his current inventory or requests linework and attribute updates, inventory staff can review and make recommendations for incorporation of new data into the existing data base. Editing or correcting some of the attributes and linework of a woodlot inventory is known as *inventory update*. Replacement of an existing inventory with a new inventory is known as *reinventory*.

Decision Model for Determining Woodlot Licence Inventory Requirements.

Woodlot Licensees and the District Manager often feel intuitively that a woodlot inventory needs improvement. Several questions present themselves:

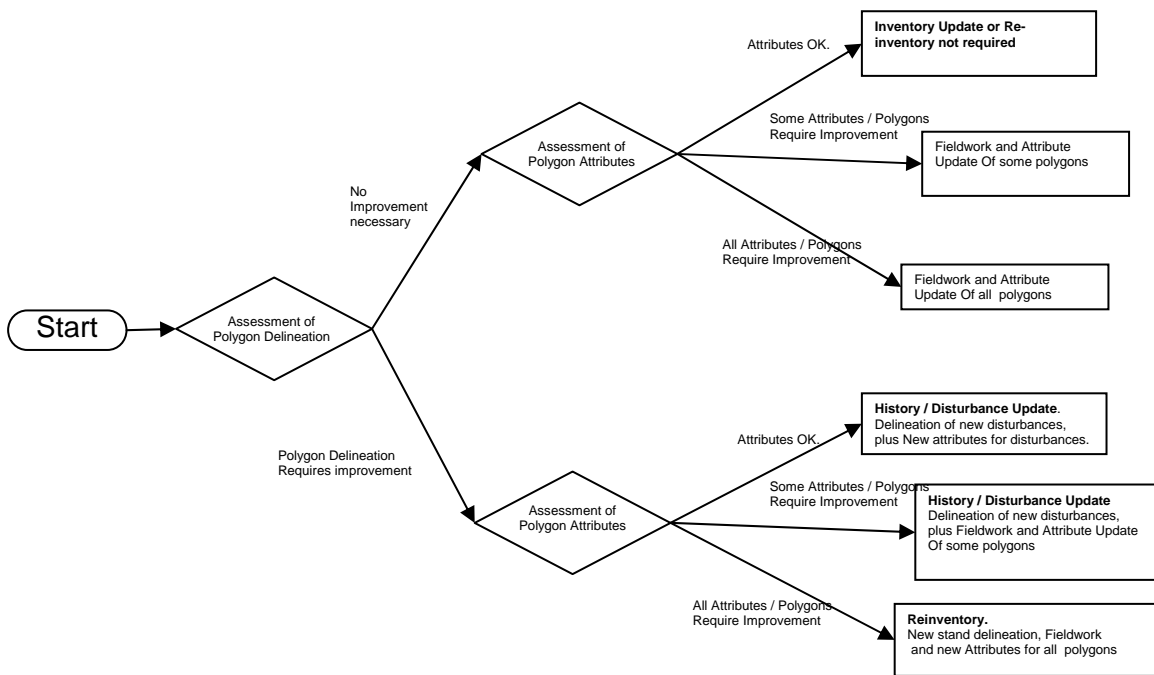
- 1) What aspects of the inventory need to be improved?
- 2) Can a simple update to the existing inventory satisfy the needs for MOF and the Woodlot Owner or is a total reinventory required?

The decision model that follows involves assessing four aspects of the existing inventory, and presents options based on the results of the assessments. The four aspects of the inventory considered in the process are:

1. Polygon delineation
2. Polygon attributes
3. Digital data storage and presentation
4. Optional surveys

Figure 2 is a Decision Tree showing the possible outcomes of assessing the existing polygon delineation and attribute descriptions in an inventory of a woodlot.

Figure 2: Woodlot & Small Area Inventory Decision Tree



1. Polygon Delineation

Polygon delineation is the process used to divide the landscape into similar areas (polygons) according to defined criteria. Polygon delineation is based on observable differences in vegetated or non-vegetated land cover using mid scale aerial photography.

A certified photo interpreter must compare the existing delineation to what is visible on new air photos.

Is the polygon delineation reasonable to achieve woodlot inventory requirements?

- Yes No Action is required.
- Marginal Have a certified photo interpreter fine tune the polygon delineation. Plan to derive attributes for the new polygons and then update the digital files.
- No Have a certified photo interpreter begin a complete re-inventory by doing new polygon delineation on the most recent aerial photographs.

2. Field Work and Polygon Attributes

Delineated polygons are assigned descriptions that are estimates of land cover characteristics. A check of the existing polygon attributes is required. To do this, the party responsible for the inventory should establish ground calls or observations in randomly picked polygons in the woodlot licence. A minimum of 10 polygons and up to 20% of the polygons on the woodlot should be visited. The person doing the work must have the skills and training needed to make accurate and reliable measurements of tree specific attributes. If ecology or site index is a major concern in the woodlot in question, perhaps a certified silviculture surveyor or ecologist should assess those attributes.

The attributes gathered from the ground calls should be compared to the existing polygon attributes.

Are the polygon attributes reasonable to achieve woodlot inventory requirements?

- Yes No Action is required.
- Marginal Use the ground call data to update the polygon attributes in the inventory database. Plan more ground calls to improve the rest of the inventory.
- No Plan systematic visits to all polygons to improve the attribute data throughout the woodlot.

3. Digital Data Storage and Presentation

Inventory data was traditionally compiled as hand drawn maps. Land areas and timber volumes were compiled in tables. Now the maps and data are stored in computers but the information is essentially the same. Maps are a “picture” of the area, whether drawn by hand or by computer, and the tables can be on paper or stored in computer spreadsheets.

Does the current digital data storage and presentation meet the woodlot inventory requirements? Does it conform to the provincial inventory mapping and attribute standards?

- Yes No Action is required.
- No 1) Plan to re-do the digital file and incorporate the new information in the Provincial Inventory database. This may require a re-inventory if the assessments of polygon delineation and polygon attributes were also found to be inadequate.

4. Optional Surveys

The management plan of a Woodlot Licence "...includes any other inventories ...that the district manager ...requires..." (Forest Act, Section 45 (1) (f) (vii))

This guideline deals exclusively with the timber inventory requirements necessary to calculate an AAC in a woodlot management plan. Optional survey requirements for the management plan should be discussed with Forest District staff.

Preparation of an Inventory Agreement

After following the decision model above, a Woodlot Forester in a Forest District office and a Woodlot Licensee will have improved their understanding of the current state of the inventory on the woodlot licence area. A brief 1 or 2 page plan to improve the inventory should be prepared. Woodlot Licensees and Forest District staff are all working in unique circumstances. The format below is for consideration only. The form and content of the agreement should be modified to address the specifics of each situation. An inventory agreement could include the following information:

1. Description of the current inventory:
 - Year and scale of photography and Year of Inventory
 - Are new base maps, or photos available?
2. Description of the inventory assessment:
 - Who did it? When? How much work did they do?
 - Results of the inventory assessment. What requires improvement?
 - Polygon delineation
 - Polygon attributes
 - Digital data storage and presentation
 - Optional surveys
3. The agreement should specify the following:
 - Polygon Delineation requirements
 - Name of Photo Interpreter to do the work, and Certified Photo Interpreter to support project.
 - Polygon Attributes requirements (include field work plan to derive attributes)
 - Name of cruiser or surveyor expected to do the fieldwork.
 - Digital data capture, storage and presentation
 - Optional Surveys
 - Standards
 - Schedule
 - Funding - Estimated cost of inventory & special studies and who will pay? Ministry of Forests, Licensee, outside sources like FIA? Cost sharing agreements?
 - Support from Ministry of Forests and inventory staff (limits to support)
 - Data Exchange Agreement (DEA) – The Provincial Government will provide TRIM base maps and current VEG cover maps free of charge if the inventory

is completed to provincial standards and the finished product is given to the Province for incorporation in the provincial data base. Contact BMGS Branch to discuss data exchange opportunities. The DEA Coordinator's E-mail address is: bmgds@Victoria1.gov.bc.ca

- Conditions for amendment of the agreement.
- Agreement Signatures: The Woodlot Licensee, person preparing the agreement (if not the licensee) and the District Manager should sign the agreement.

Standards and Procedures

The standards and procedures for photo interpretation may be found at the following URL: <http://srmwww.gov.bc.ca/tib/vri/vri/standards/index.html#photo>
Section 2 of the procedures is on polygon delineation, while Sections 3 through 10 address polygon attributes. Ground Call procedures are included at the same URL as the standards and procedures for photo interpretation.

From time to time, the Photo Interpretation Procedures manual and Ground Call Procedures will be updated so make sure the most recent edition is consulted.

Digital mapping standards are the responsibility of the Content Management Section, Resource Information Branch. The section manager should be contacted at (250) 953-4982 to answer questions to do with the digital mapping standards.

Standards and procedures for optional surveys are the responsibility of the appropriate agency. Check the Resource Information web site (<http://srmwww.gov.bc.ca/tib/>) to find the latest standards on optional surveys.

Licensees should be careful to confirm the standards with the Ministry before they begin work to avoid the risk of doing a good job to the wrong standard. Standards can be specified the woodlot inventory agreement, but if several years transpires between the agreement being made and the completion of the work, standards should be confirmed again when work is about to begin.

Technical Guidelines:

Polygon Delineation:

The polygon delineation guidelines in the *Photo Interpretation Procedures* are designed to achieve a level of detail necessary for provincial inventories. The minimum polygon size should be stated in the inventory agreement and be adequate to address local woodlot information needs. Overly zealous polygon delineation is to be avoided because perceived stand variation on air photos is sometimes difficult to distinguish on the ground. Over zealous delineation will create an unmanageable number of polygons and add little value to the inventory.

Fieldwork:

Fieldwork is conducted to enhance the estimation of polygon attributes. Polygon by polygon accuracy of attributes in woodlot inventories is achieved by establishing observations in a high proportion of polygons. A balance between accuracy, efficiency and cost for fieldwork must be maintained. More plots are required in variable and complex polygons. Fewer plots are required in consistent and simple polygons. The inventory agreement should set minimum fieldwork requirements based on the local conditions.¹

The minimum level of fieldwork in woodlot inventories will be ground observations to improve estimates of timber attributes. Vegetation inventory sampling and adjustment of the woodlot inventory will not be done.² Vegetation inventory samples which are part of a District sampling plan may occur in the Crown or private portion of a woodlot.

Final polygon delineation and description.

After the fieldwork is completed and summarized, each polygon on the woodlot is numbered, and described in detail in the approved format. Ideally, the fieldwork, and polygon descriptions will be completed by the same certified photo interpreter doing the polygon delineation and final descriptions. Polygon descriptions will follow the latest Vegetation Resource Inventory Procedures and will be input and validated using VEGCAP.

Digital Mapping

Polygon boundaries and attributes must be captured according to Resource Information standards and submitted in the approved format.

Administrative Guidelines:

Forest Service and inventory staff are available to advise licensees, particularly on the development of a woodlot inventory agreement.

In general, the steps in completing a woodlot inventory would be:

1. The party responsible for the inventory develops and gets approved a woodlot inventory agreement.
2. Polygon delineation and digitizing (If delineation is adequate, go straight to step 4.) The photo interpreter does not need to be certified, but should be identified and approved of in the woodlot inventory agreement.

¹ “Minimum” requirements must be established case by case. Factors influencing “minimum” requirements include objectives of inventory, interest, skills and abilities of licensee, cost and current state of inventory.

² Vegetation Inventory Sampling is a very formal, carefully controlled system of measuring and compiling a sample and adjusting a population. The standards and procedures are designed for Timber Supply Areas and large management units. Vegetation Inventory Sampling is not suitable for woodlots and small area inventories.

3. A certified photo interpreter reviews and approves the polygon delineation.
4. Fieldwork.
5. Final delineation and description of polygons.
6. Digital maps finished and attributes entered in VEGCAP.
7. Completed woodlot or small area inventories are sent to the local Forest Service office and to the Content Section, Resources Information Branch.

Data Exchange Agreements

Data Exchange Agreements (DEA) allow the ministry to provide digital map files free of charge to the party responsible for the inventory in exchange for digital map files updated with completed woodlot inventories.

Data Exchange agreements benefit both the woodlot licensee and the provincial government. The ministry receives the best possible data for the woodlot area in exchange for storing and maintaining the information on the provincial inventory database. The licensee receives digital copies of the map files of the woodlot in exchange for the woodlot data.

Requirements for “certified Air Photo Interpreter”

All photo interpretation must be done by, or under the supervision of a certified air photo interpreter. The party responsible for the inventory may do their own polygon delineation on the air photos. This work should be reviewed and fine tuned, if necessary, by a certified photo interpreter. The inventory agreement should specify the certified photo interpreter to oversee the work.

The fieldwork notes, final polygon delineation and attributes should also be reviewed by the same certified air photo interpreter. This check is for information “correctness”. Validation programs attached to data capture routines check for completeness and consistency.

Support to Licensee

Forest Service and inventory staff are available for advice only. If licensees are unable to do the work themselves, they are encouraged to hire an inventory contractor to develop the inventory plan and conduct the work. The list of qualified VRI photo interpretation contractors may be found at <http://srmwww.gov.bc.ca/vri/contractinfo/index.html>

Submitting Completed Inventory Updates and Reinventories.

The Resource Information Audit staff of the Content Management Section, Resources Information Branch are responsible for handling all reinventories. Call (250) 953-4982 to find out how to submit completed reinventories.

Regular updates for harvesting and silviculture activities within the woodlots are governed by the Ministry of Forests RESULTS (Reporting Silviculture Updates and Land status Tracking System) guidelines. As of June 1, 2005, Woodlot licensees will submit their harvesting and silviculture updates using the Electronic Submissions Format (ESF) to RESULTS. Update information from RESULTS will be “cut it in” to the Vegetation files on the LRDW to provide a complete updated coverage to clients.

Administration Boundary:

The woodlot boundary may become an artificial polygon boundary during woodlot inventories. **Please note:** this recommendation is contrary to the widely accepted mapping principles of Geographic Information Systems and does not apply to inventories of small areas other than woodlots. Normally, the polygons delineated for vegetation inventory are independent of administrative boundaries. However, in the case of woodlots, the benefits are expected to balance the risks.

Several practical considerations make the woodlot boundary a logical perimeter for the polygon delineation:

- New work in Woodlots may be highly detailed. *Tying in* to the lower level of detail outside woodlot boundary is labor intensive, and adds little, if any value to the inventory.
- Having the woodlot boundary as part of the polygon delineation will allow woodlot inventories to be protected from change in regular vegetation inventory projects.
- Polygon slivers along the Woodlot administrative boundary will be eliminated.

Options for Woodlot Licence Inventories

Four options for Woodlot Licence Forest Inventories are presented. The first option incurs the least cost and has the greatest uncertainty.

The options are not mutually exclusive. Licensees and Forest Service staff are encouraged to consider the local circumstances and “mix and match” components of each option to fulfill their requirements.

Level 1: Inventory Assessment and Polygon Attributes Improvement through Ground Calls

The purpose of this level of inventory is to provide the Woodlot Licensee with site specific and local knowledge of the timber resources of the Woodlot area. This information will assist the licensee in developing a management plan and provide basic timber information for the determination of AAC. The provincial inventory database will also be updated.

Process:

Starting with the existing Forest Cover Inventory map of the Woodlot Licence area, the process for conducting this level of inventory is:

1. Have a certified photo interpreter check the existing stand delineation. (The list of certified photo interpreters is available at this web site <http://srmwww.gov.bc.ca/vri/contractinfo/index.html>)
2. Locate on the map easily accessible locations in the main forest polygons.
3. Navigate carefully to each of those locations and establish an Observation of relevant attributes.
4. Before leaving each location, summarize the Species Composition, Age, Height and Site Index (timber attributes) on the observation form and compare the observed timber attributes to those already in the inventory database. Note any anomalies in the attributes, or items of interest for the management plan.
5. Use the observation data to complete a new polygon description.
6. Compare the attributes gathered in the observations to the attributes in the existing database. Use this information to support the decision or recommendation to conduct a re-inventory.
7. Submit the updated VEGCAP digital file to the Vegetation Update specialist, Resource Information Branch.

Products:

The products of this level of inventory are:

1. The inventory assessment done to support the decision model discussed previously.
2. Updated timber attributes for the major forested polygons in the area of interest.
3. An updated inventory map (after the new data is entered in the LRDW)
4. The information required to make a rational decision about the need for further Woodlot Inventory improvements.

Level 2: All Polygon Attributes Improved through Ground Calls

Purpose:

The purpose of this level of inventory is to improve the attribute descriptions on all forested polygons in the Woodlot Licence area. These new attributes will be suitable for determining the AAC of the Woodlot Licence.

Process:

The steps to conduct this level of inventory are:

1. Have the existing polygon delineation confirmed by a certified photo interpreter. (The list of certified photo interpreters is available at this web site <http://srmwww.gov.bc.ca/vri/contractinfo/index.html>)
2. Depending on the size and complexity of each forest polygon, the photo interpreter spots the location on the photo for one or two ground observations per polygon. The photo interpreter also indicates if these observations are to be one, two, or three plots each. (One observation of one plot for small and simple polygons. Two observations or more plots for large polygons with complex attributes.)
3. Accurately transfer the observation locations to the existing maps of the Woodlot area.

4. Establish and mark on the ground a tie point for each observation.
5. Navigate carefully and establish an observation.
6. Before leaving each location, summarize the Species Composition, Age, Height and Site Index (timber attributes) on the observation form and visually confirm the timber attributes. Note any anomalies in the attributes, or items of interest for the management plan.
7. Use the observation data to complete a new polygon description
8. Enter the updated VEGCAP digital file in the LRDW.

Products:

The products of this level of inventory are:

1. Updated timber attributes for all of the forested polygons in the Woodlot Licence area.
2. An inventory map with updated labels

Level 3: New Polygon delineation. Attributes on polygons Improved through Ground Calls or photo Interpretation.

Purpose:

The purpose of this level of inventory is to improve the stand delineation and attribute descriptions of forested polygons in the Woodlot Licence area. These new attributes will be suitable for management planning, and may be used to determine the AAC of the Woodlot Licence.

Process:

The steps to conduct this level of inventory are:

- 1) Delineate new polygon boundaries on the most recent aerial photographs
- 2) Have these boundaries confirmed by a certified photo interpreter. (The list of certified photo interpreters is available at this web site <http://srmwww.gov.bc.ca/vri/contractinfo/index.html>)
- 3) Have the new polygon boundaries digitized.
- 4) Depending on the size and complexity of each forest polygon, the photo interpreter spots the location on the photo for one or two ground observations per polygon. The photo interpreter also indicates if these observations are to be one, two, or three plots each. (One observation of one plot for small and simple polygons. Two observations or more plots for large polygons with complex attributes.)
- 5) Establish and mark on the ground a tie point for each observation.
- 6) Navigate carefully and establish an observation.
- 7) Before leaving each location, summarize the Species Composition, Age, Height and Site Index (timber attributes) on the observation form and visually confirm the timber attributes. Note any anomalies in the attributes, or items of interest for the management plan.
- 8) Use the observation data to complete a new polygon description.
- 9) Integrate the digital map and VEGCAP digital files into the LRDW.

Products:

The products of this level of inventory are:

- 1) A new woodlot inventory including new polygon boundaries and new timber attributes for all of the forested polygons in the Woodlot Licence area.

Level 4: New Polygon delineation. All Attributes Improved through Ground Calls. - Similar to Level 3, but ground calls are established in all polygons.