Woodlot Licence

Timber Resources Inventory Handbook

Forest Tenures Branch
Forest Analysis and Inventory Branch

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Document Change Control

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1.1	February 2019	Update template and replaced broken web links.

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Table of Contents

1 Introduction

1.1 About This Handbook

This handbook provides staff of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), holders of woodlot licences and their service providers with guidelines and information for the preparation and presentation of timber resource inventories for woodlot licences in British Columbia.

This handbook provides guidance and technical specifications for carrying out timber resource inventories. Some additional procedures and specifications for field work, photo interpretation and data management are provided by the resource materials referenced in this handbook.

Handbook structure

Part 1 – Introduction provides context for the handbook and for woodlot licence inventories.

Part 2 – Recommended Process offers a way for licensees and FLNRORD staff to work together during the assessment, planning, and inventory work phases so that the resulting inventory can be properly utilized in timber supply modelling and submitted for approval as part of a new management plan.

Part 3 – Timber Inventory Methods presents options for conducting inventory work that is appropriate to the woodlot licence area and circumstances.

Part 4 – Inventory Standards and Guidance identifies standards and/or guidance for conducting inventory work components: polygon delineation, fieldwork, and polygon attributes.

Part 5 – Inventory Products and Deliverables identifies how inventory work is to be submitted in/with a new management plan.

Part 6 – Appendices contains reference material, including a glossary and links.

1.2 Applicability

This handbook is an “applicable handbook” as referenced in woodlot licence documents regarding the manner, format and specifications for preparing and presenting an inventory of the timber resources in the licence area in a Management Plan.

For the purposes of a woodlot licence timber inventory, this handbook replaces Timber Inventory Guidelines for Woodlot Licences Community Forests and other Small Areas (2008).

This handbook applies to both the Crown and private land portions of woodlot licences.

1.3 Purpose of Inventory

The purposes of a woodlot timber resource inventory are to:

- Provide the vegetation cover data required to model timber supply over time on the woodlot licence.
- Support a licensee's allowable annual cut (AAC) proposal.
- Support a district manager's AAC determination.

1.4 Requirements

1.4.1 Regulatory Framework

The requirement for a woodlot licence timber resource inventory arises from section 45(1)(f) of the *Forest Act* which requires the holder of a woodlot licence to submit for approval a management plan that includes an inventory of timber resources in the woodlot licence area.

The inventory must be prepared in the manner, presented in the format, and meet the specifications referred to in (i) any directions of the District Manager and (ii) any applicable handbook, including this handbook.

There is no legislative provision or regulatory authority outside of the management plan process for FLNRORD to require a new or revised inventory of the timber resources on a woodlot licence.

A district manager who decides a new or revised management plan is required must give written notice to the woodlot licensee to submit a new management plan by a specified date. It is recommended that the notice provide a rationale for the decision to require a new management plan.

The holder of the woodlot licence may wish to initiate improvements to the woodlot licence timber inventory at any time.

If a district manager or the holder of a woodlot licence decides that a new management plan is needed, then the district manager and/or the holder of the woodlot licence will need to determine what, if any, timber resource inventory work is required. Section 2.1 provides

guidance for assessing whether the existing[1] woodlot inventory meets the purposes specified in section 1.3 and is prepared in the manner, presented in the format, and meets the specifications in this handbook and/or directions from the district manager.

The acceptability of the timber inventory must be considered by the district manager when making a decision to approve or not approve a woodlot licence management plan.

1.4.2 Standards and Procedures

This handbook assumes that the timber inventory data will be used with the current version of the Woodlot for Windows (W4W) program to model timber supply. Data requirement specifications and field sampling procedures are written accordingly.

Vegetation Resources Inventory (VRI) is a provincial inventory design based on photo interpretation and ground sampling

If a Licensee chooses to use a different timber supply model that is acceptable to the district manager, the data specifications and field procedures in the handbook may not be sufficient to support that model.

In some cases, an inventory assessment may find that either the current provincial Vegetation Resources Inventory (VRI) data or the existing woodlot inventory, potentially with updates for disturbances in either case, is suitable for use as a timber resource inventory in a woodlot licence management plan.

When developing an inventory plan, as described later in this handbook, be mindful that the published Provincial VRI inventory standards are not directly applicable to woodlot licence timber inventories because woodlot licence timber inventories are not incorporated into the provincial VRI data set. However, the VRI standards can still be useful for planning and evaluating a woodlot inventory if adjusted to match the small scale and specific purpose of a woodlot licence timber inventory.

Although a licensee may submit professionally signed reports proposing objectives and standards and/or presenting inventory results as part of a new management plan without district staff involvement, the district manager has discretion as to whether or not the timber inventory proposal or results are acceptable.

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[1] The existing woodlot inventory referenced in this handbook is the timber resource inventory information used in the most recent long term AAC determination in the current Management Plan.

1.5 Professional Involvement and Other Guidance

A woodlot licence timber inventory falls within the scope of professional practice as per the *Foresters Act*. Generally, a forest professional is involved in

- the assessment of the existing inventory,
- developing the inventory plan, and
- inventory work.

Refer to the link provided in Section 6.4 for more information regarding professional reliance in the woodlot licence program.

The role of the professional is to provide knowledge and expertise to ensure that the assessment, plan or inventory work:

> (a) is consistent with the purposes of a timber resource inventory (section 1.3),
>
> (b) addresses any issues or concerns raised by the district manager in a written notice provided to the licensee that a new management plan is required,
>
> (c) is prepared in the manner, presented in the format and meets the specifications contained in this handbook or directed by the district manager, and
>
> (d) meets the standards for professional work set by the Association of BC Forest Professionals.

As discussed in Section 2, a licensee may, with the involvement of a professional, assess the suitability of the existing woodlot inventory and/or the current VRI and prepare a report proposing the objectives and standards for a woodlot timber inventory. The report should allow a district manager to make an informed decision. It is the prerogative of the district manager to determine the extent to which he/she wishes to rely on a professional's input when evaluating a woodlot timber inventory.

Section 2 of this handbook recommends a process where the licensee and/or the professional seek feedback from FLNRORD so that potential issues may be identified and addressed during the inventory rather than waiting for the review of the completed inventory during the management plan approval process. When necessary, district staff can seek additional guidance from the Forest Analysis and Inventory Branch. It is, however, the district manager who is responsible for deciding the format and specifications for a management plan and the timber inventory contained therein.

The licensee will, with the involvement of a professional, submit the completed timber inventory as part of the management plan for consideration and approval by the district

manager. Qualified professionals are accredited through the Association of BC Forest Professionals and are accountable for their work and for any work that they supervised.

1.6 Technological Change

Improvements in remote sensing, field equipment and computing power are creating new possibilities for timber inventories. While this handbook identifies standards and recommended practices appropriate at this time (2019), licensees or their contractors may wish to use new or innovative processes that provide reliable inventory information. This handbook has built-in flexibility to allow adaptations to technological change.

Where licensees or their contractors wish to use new technology or a new process to obtain woodlot licence timber inventory data, they must get approval from the district manager. If a proposal has technical merit and low risk to the Crown, it should be considered for inclusion in the Inventory Plan described in Section 2.2 of this handbook. Approval of woodlot licence inventories relying on new technologies remains at the discretion of the district manager.

2 Recommended Process

As explained in Section 1.4.1, there is no legislative or contractual approval process for a woodlot licence inventory on its own. It is a licence requirement that a completed management plan, including a timber inventory, be submitted to the district manager for approval.

This part of the handbook describes a phased approach for the inventory work and review (see table below). A licensee or professional may opt to combine or split the phases for the purposes of garnering feedback as and when required.

The intent is that during, or at the end of, each phase, the licensee or professional will receive approval or feedback from the district manager regarding any potential issues that could affect the acceptability of the work completed in that phase for use in subsequent inventory phases, in timber supply modelling and/or in the management plan.

Following this recommended process should prevent situations where a management plan will not be approved by the district manager due to inventory issues that could have been identified and resolved during the inventory work.

Phase	**Outcomes**
Assessment of the Existing Woodlot Inventory and/or Current VRI (Section 2.1)	Evaluates the existing woodlot inventory and/or current VRI with respect to meeting the purposes described in section 1.3, and identifies what, if any, timber resource inventory improvements are needed.
Inventory Plan (Section 2.2)	Establishes the scope, methods, and procedures for the chosen inventory method, including specifying the standards and setting the timeframe.
Inventory Work (Sections 2.3, 3 and 4)	May include polygon delineation, sampling plan, fieldwork, or polygon attribute interpretation. The work outcomes of this phase will depend on the inventory method(s) specified in the inventory plan.

Inventory Products with management plan submission (Section 5)	Outlines inventory information and W4W analysis required with the management plan submitted to the district manager for approval. For more information, see the Management Plan handbook.

2.1 Assessing the Existing Woodlot Inventory and Current VRI

Many woodlot licenses will wish to assess the potential to use, or use with revisions, the existing woodlot inventory or the current VRI. This section outlines the assessment procedures.

The purpose of the assessment is to determine if the existing woodlot inventory or current VRI satisfies the inventory purpose defined in Section 1.3. The inventory assessment determines if inventory work is required and, if yes, what inventory work is required. It is expected that the inventory assessment will be a signed and sealed professional report.

An inventory assessment is not required if a Licensee wishes to complete a full inventory with completely new polygon delineation and polygon attributes on the entire woodlot.

Fieldwork to support an assessment may be desirable. Licensees or professionals may choose to discuss the level and extent of field work to be undertaken with the district manager. Examples of fieldwork use to support an assessment include but are not limited to:

If a general check of polygon attribute quality is desired, field verification should be carried out in randomly selected polygons in the woodlot licence. Subject to professional guidance considering the factors above, a minimum of 10 polygons should be visited.

If systematic error is suspected in the existing woodlot inventory or the current VRI, for example, the ages of older stands are thought to be systematically overestimated by 30 to 40 years, the field verification should focus on the polygons in question.

If a portion of the woodlot was impacted by a natural disturbance, raising questions regarding the reliability of the existing woodlot inventory or the current VRI data, per Section 1.3, the field verification should focus on the disturbed area.

The VRI data set contains the date and source of inventory information and in some cases the name(s) of field assessors and or photo interpreter.

2.1.1 Assessing the Existing Woodlot Inventory

The existing woodlot inventory referred to in this handbook is the timber resource inventory used in the most recent long term AAC determination in the current Management Plan.

If the licensee and professional have concluded that they do not wish to use any part of the existing woodlot inventory, an assessment of the existing woodlot inventory and an assessment report are not required.

The assessment of the existing woodlot inventory should consider:

- the current condition of forests;
- the type and nature of disturbance event(s) that may have occurred;
- any fieldwork undertaken for the assessment
- the timber supply model planned to be used for any timber supply modelling, and
- any other relevant factors the professional doing the work identifies.

An inventory assessment report should include:

- The purpose of the assessment.
- A description of the existing woodlot inventory, including date and source of inventory information and name(s) of field assessor and/or photo interpreter, if known.
- A description of the methods used to assess the existing inventory information.
- The timber supply model planned to be used for any timber supply modelling.
- A statement indicating whether the existing woodlot inventory is adequate or needs improvements to model timber supply over time.
- If improvements are needed, a description of improvements needed.
- A brief rationale explaining the conclusions that have been reached.

2.1.2 Assessing the Current VRI

Before the current VRI can be used as woodlot timber resource inventory, it should be assessed.

The intent of this Handbook is not for a Woodlot Licensee to carry out additional quality assurance work on the provincial VRI data set. Rather, the assessment of the VRI data set should consider the same factors as listed above for the existing woodlot inventory.

If an initial review finds the VRI adequately represents the timber resource of the woodlot for timber supply analysis purposes, then the focus of the VRI assessment should be:

1. Whether disturbances have occurred since the VRI interpretation date that would significantly impact the long run, sustainable AAC for the woodlot, and

2. If and how the VRI can be updated to reflect these disturbances.

(see Section 4.1 Recent Disturbance Updates).

A VRI assessment report should include:

- The purpose of the assessment.
- A description of the VRI data, including reference year, date of imagery used, projection year, and name of photo interpreter.
- A description of the methods used to assess the VRI data.
- The timber supply model planned to be used for any timber supply modelling.
- A statement indicating whether the VRI data is adequate or needs improvements.
- If improvements are needed, a description of improvements needed.
- A brief rationale explaining the conclusions that have been reached.

2.1.3 Outcomes of Assessment

The inventory assessment will be presented in a professional report, which may also include an inventory plan (see Section 2.2). This handbook recommends that the assessment report be reviewed by the district manager before proceeding with further work, but this is not a legal requirement.

If the inventory assessment finds the existing woodlot inventory or the current VRI is adequate and reflects recent disturbances, this handbook recommends that the assessment report be submitted to the district manager.

If the inventory assessment finds that improvements are required to either the existing woodlot inventory or the current VRI, several potential courses of action are available:

1. The licensee may submit the assessment to the district manager and seek directions for the inventory plan (see 2.2).

2. The licensee and professional may continue with inventory work using a phased approach with reviews by the district manager at selected work milestones.

3. The licensee and professional may continue with inventory work without further discussion with FLNRORD and submit the completed woodlot timber inventory with a management plan for approval.

When the inventory assessment identifies significant shortcomings (per the assessment criteria) in the existing woodlot inventory or current VRI, this handbook recommends that the licensee and the forest professional work with the district manager to determine what improvements to the timber inventory are required.

2.2 Inventory Plan

If the inventory assessment determines that the existing woodlot inventory or current VRI does not meet the purposes defined in Section 1.3, an inventory plan should be prepared. An inventory plan, formulated with due consideration of the findings of the inventory assessment described in the previous section, sets out the approach to achieving the inventory purposes per Section 1.3.

The inventory plan may propose that the existing woodlot inventory or the current VRI data, updated for disturbance if appropriate, be used as new inventory for the woodlot. If so, the inventory plan will only describe the methods to be used to update the existing woodlot inventory or current VRI for disturbance.

2.2.1 Inventory Scope

The inventory plan will identify the geographic extent of the area to be inventoried, and the type(s) of inventory work to be carried out in that area (per Section 3).

If the District Manager has provided directions which contain additional specifications regarding the preparation of and/or presentation format of the timber inventory, identify those specifications in this section.

2.2.2 Inventory Methods

The inventory plan will:

- Describe the method(s) that will be used to achieve an acceptable timber resources inventory per Section 1.3. (Refer to Part 3 for inventory options.)
- Provide a rationale for the selected method(s).
- Refer to or state standards and specifications for the planned inventory work.
- Describe methods to be used to ensure recent disturbance updates are reflected in the new inventory.
- Describe the procedures of any planned photo interpretation.
- Describe the procedures of any planned field work.
- Estimate the timelines for completing the planned inventory work.

2.3 Inventory Work

Inventory work should proceed consistent with the inventory plan.

Licensees are responsible for:

- ensuring the inventory work is completed to the standards set out in the inventory plan, and
- engaging qualified forest professionals for all aspects of the work that fall under the scope of professional practice.

As noted above, the licensee and professional may complete inventory work without discussion with FLNRORD and submit the completed woodlot timber inventory in a management plan for approval.

This handbook recommends a phased process where the licensee and/or the professional seek feedback from the district manager at logical work milestones so that potential issues that could affect the acceptability of the work completed in that phase may be identified and addressed during the inventory.

Following this recommended process should prevent situations where a management plan will not be approved due to inventory issues that could have been identified and resolved during the inventory work.

The main inventory work milestones are:

4. Polygon Delineation
5. Sampling Plan
6. Fieldwork
7. Polygon Attribute Interpretation
8. Completion of Inventory Work

The work process for woodlot timber resource inventories is highly variable. The licensee and professional will choose which milestones are appropriate in their situation, and they may identify other milestones.

If a licensee and their professional choose to request that the district manager conduct an interim review of the inventory work, they should carefully consider the deliverables listed in Section 5 for the Management Plan and supporting documents and supply the full suite of applicable deliverables to facilitate the review. The licensee and professional may choose to discuss the material to be provided with the district manager.

This handbook recommends that FLNRORD review the inventory products prior to their use for timber supply modelling.

3 Timber Inventory Methods

Depending on the results of the assessment of the existing woodlot inventory and/or the current VRI information discussed in Section 2.1, the inventory plan can design an inventory method that reflects one of the four options below. In all cases, recent disturbance is to be added to the data set using the methods established in the inventory plan.

3.1 Use Existing Woodlot Inventory

If there are no significant deficiencies, the existing woodlot inventory is used with no changes except for recent disturbance updates.

3.2 Use Current VRI

If there are no significant deficiencies, the current provincial VRI is used with no changes except for recent disturbance updates.

3.3 Use Polygons and Change Attributes

Other than recent disturbance updates, polygon delineation from the current VRI or existing woodlot inventory is retained. Attributes for some or all polygons are changed based on fieldwork or photo interpretation supported by fieldwork.

If fieldwork only (no photo interpretation):

Attributes can only be updated in polygons that have been sampled in the field.

If photo interpretation supported by fieldwork:

The fieldwork will provide:

- updated attributes for polygons sampled in the field, and
- calibration to assist the photo interpreter when estimating attributes in polygons without fieldwork.

It is recommended that the photo interpreter participate in the fieldwork as local knowledge is essential for estimating polygon attributes.

3.4 Change Polygons and Attributes

Some or all polygon delineation from the current VRI or existing woodlot inventory can be modified based on photo interpretation.

Attributes for some or all polygons are changed based on fieldwork or photo interpretation supported by fieldwork.

If photo interpretation with no fieldwork:

Polygon delineation can be adjusted.

Attributes other than crown closure and non-vegetated area cannot be adjusted.

If fieldwork with no photo interpretation:

- Attributes can only be updated in polygons that have been sampled in the field.

If photo interpretation supported by fieldwork:

- The fieldwork will provide
    - updated attributes, and
    - calibration to assist the photo interpreter when estimating attributes in polygons without fieldwork.
- It is recommended that the photo interpreter participate in the fieldwork as local knowledge is essential for estimating polygon attributes.

4 Inventory Work Standards & Guidance

Depending on the inventory method selected, one or more of the following inventory standards and guidance will apply to the new woodlot inventory.

Licensees are responsible for:

- ensuring the inventory work is completed to the standards set out in the inventory plan, and
- engaging qualified forest professionals for all aspects of the work that fall under the scope of professional practice.

4.1 Recent Disturbance Updates

Timber inventory data must be updated to reflect recent disturbances from logging activities and/or significant natural disturbances which are not shown in the existing woodlot inventory or the current VRI data set.

4.1.1 Logging Activity Disturbances

The spatial extent of recent harvesting activity and vegetation cover attributes for recently harvested areas must be added to the inventory data.

Vegetation cover information based on field surveys that has been reported to the RESULTS system has met a set of data standards and professional practice requirements. Such RESULTS data can be used to update existing inventory data or current VRI data for disturbance. The survey's reference year and age should be used to calculate year of establishment to accurately reflect current age in W4W

Recent silviculture surveys may be used to update attribute information if current vegetation cover has not been entered into RESULTS.

Harvested areas with no vegetation cover data will be classified as NSR.

A rationale should support the choice of attribute data used.

4.1.2 Natural Disturbances

Recent natural disturbances can affect stand yield prediction to an extent that timber supply modeling based on the existing inventory data will be unreliable. The inventory data should be

updated to reflect any recent natural disturbances that would significantly impact the long run, sustainable AAC for the woodlot.

Updates will require that the spatial extent of recent natural disturbances and vegetation cover attributes for disturbed areas be added to the inventory data.

A rationale should describe the process used to update inventory data for any natural disturbances or to support decision not to update.

4.2 Polygon Delineation

Polygon delineation is based on observable differences in vegetated or non-vegetated land cover using stereoscopic viewing of mid-scale aerial photography.

The most recent/suitable aerial imagery available should be used.

Delineating polygons provides boundaries for similar or "like" vegetated or non-vegetated land covers. Accurate delineation provides logical units for the estimation of attributes.

VRI polygon delineation standards and techniques are detailed in the VRI Photo Interpretation Procedures available from the hyperlink in Appendix 6.4. Although this document provides guidance on polygon delineation the key assessment is the suitability of the polygon for the woodlot licence, i.e. Does the delineation reflect the actual polygon boundaries?

The air photo interpreter should participate in the inventory fieldwork. Field-based knowledge of the vegetation cover is even more essential if polygon attributes will also be derived from photo interpretation.

4.3 Fieldwork

Reference sources which are available from the hyperlinks in Appendix 6.4 include VRI Ground Sampling Procedures and VRI Field Calibration Procedures for Photo Interpretation.

Inventory field plots are essentially modified cruise plots. The number and location of plots should be proposed in a sampling plan. Plots may be located in representative areas selected by the photo interpreter or can be grid based.

4.3.1 Sampling Plan

If the inventory plan includes fieldwork, a sampling plan should be developed prior to field work. This step may not be possible until after polygon delineation has been carried out.

A sampling plan should:

- describe the type of fieldwork,
- indicate how many polygons will be visited,
- describe what attribute data will be collected,
- include a sampling plan map showing the planned sample plot locations, and
- include a rationale for the choice of polygons to be visited.

The sampling plan may be amended by the forest professional overseeing the inventory work as they deem appropriate and representative.

The licensee may request review and comment on a field sampling plan from district manager prior to commencement of the fieldwork.

4.3.2 Fieldwork Plots

The following are the default minimum standards for field plots and measurements. To deviate from these standards, alternative standards should be documented in the inventory plan and discussed with the district manager.

- Variable radius plots are preferred. BAF size should be selected to get 4-8 live trees in the tally.
- Fixed radius plots, 3.99 or 5.64 m, should be used in stands with average diameter < 12.5 cm. The forest professional should determine how future yields on small diameter stands will be modelled in W4W and ensure that all required information is gathered in the field survey.
- Minimum diameter for the tally can vary depending on timber type. The standard 12.5 cm or 17.5 cm can be used; with 7.5 cm for smaller stands. The field plots must measure to at least the same minimum stem diameter that will be used in yield prediction in W4W. The same minimum diameter must be maintained for all plots in the same data summary unit.
- For each full measure plot, record:
    - date of fieldwork,
    - names of personnel doing field work,
    - plot identifier,
    - BAF of prism or plot radius,
    - minimum stem diameter measured, and
    - height and age where applicable, as specified below.

- For each tallied tree in a full measure plot, record:
    - tree species,
    - diameter at breast height,
    - tree class (1 through 7), and
    - crown class (dominant, co-dominant, intermediate, suppressed).

  Tree class is required, but individual pathological indicators are not required to be collected.

- Height and breast height age will be measured on at least one representative dominant or co-dominant tree of the leading species on each plot. Height/age measurement trees must be identified as to whether they are suitable Site Index trees.
- All count plots (full measure & prism sweep count) must have UTM coordinates and stakes or field markers so that field measurements are verifiable.

Basal area is a significant driver in VDYP7, which Woodlot for Windows uses to predict yields in natural stands. Stems/hectare also drives volume estimates, but to a much lesser extent than basal area. Having an accurate basal area is important for getting a good yield estimate. Prism sweep count plots can be used in addition to full measure plots to increase basal area measurement intensity and reliability.

- For each prism sweep count plot, record:
    - date of fieldwork,
    - names of personnel doing field work,
    - plot identifier,
    - BAF of prism,
    - minimum stem diameter counted, and
    - stem count by species.

4.3.3 Fieldwork Compilation

The field survey data will be compiled to produce a summary for each timber inventory polygon assessed which lists:

- Species Composition: calculated based on basal area of trees or, for stands with average diameter < 12.5 cm, stems per hectare.
- Average Age: the average total age of the dominant and codominant stems of the leading species in the polygon. Total age is calculated from breast height age plus a "years to breast height" age correction. Age corrections are generally obtained from the Site Tools program.
- Average Height: the average measured height of the dominant and codominant stems of the leading species in the polygon.
- Average Stand Density: the average stems per hectare - stratified into live and dead stems.
- Average Site Index: the average of the site indices calculated from the leading species site index measurements using the current version of Site Tools or from SIBEC for stands with average diameter < 12.5 cm.
- Minimum stem diameter: the minimum diameter at breast height of tallied stems.
- Date: the date(s) of field survey data collection.

4.4 Polygon Attribute Interpretation

Attributes for each delineated polygon are the vegetation cover characteristics that are measured in the field or interpreted from imagery supported by field work. Crown closure and percentage of polygon occupied by non-vegetated component are best assessed from imagery.

The attributes required in a woodlot licence timber inventory are mainly dictated by the information necessary to model timber supply. Unless FLNRORD has agreed to a different model proposed by the licensee, Woodlot for Windows will be used for timber supply modeling. The data requirements for Woodlot for Windows are listed in Appendix 6.3.

Stand age is handled in W4W using:

- a combination of measured or interpreted age and reference year, or
- year of stand establishment.

Year of stand establishment overrides and is more suitable if the vegetation cover will contain multiple reference years. See the W4W 4.2 user guide Section 6.1 for more information.

Importing the new inventory data set into W4W and calculating yields without any other adjustments enables checking of the predicted MAI in each polygon for reasonableness. This initial W4W.WLT file may be requested by the district manager but is not considered a final inventory product.

4.5 Completion of Inventory Work

Checks, reviews and comment by FLNRORD on:

- interim inventory work submitted by licensee with a request for FNLRORD review
  and/or
  completed inventory work submitted with a management plan will be at the discretion of FLNRORD.

5 Inventory Products

5.1 Interim Review

This handbook recommends that the district manager review the final inventory products prior to their use for timber supply modelling and subsequent inclusion in a management plan submission.

The district manager's review will be facilitated by providing some of the materials listed in Section 5.2 below. Discuss with the district the inventory products from Section 5.2 that the district manager requires to support an interim review.

5.2 Inventory Submission with Management Plan

The Woodlot timber resources inventory will be submitted to FLNRORD for review and approval as a component of a new management plan for the woodlot licence.

5.2.1 Management Plan Content

The management plan template specifies that timber resources inventory information shall be included in Section 3.1 of the management plan.

Suggested content to be supplied in management plan Section 3.1 includes:

- Summary description of source of timber resource inventory and any inventory work carried out.
- Year(s) of imagery used in any photo interpretation.
- Season(s)/Year(s) of fieldwork.
- Reference Year(s) of polygon attributes.
- If applicable, Projected Year of polygon attributes.
- Year timber resource inventory was completed.

This content is intended to be a summary, not a polygon by polygon list.

The management plan Section 5.0 Proposed Allowable Annual Cut should specify if the material identified in Section 5.2.2 below is included in the management plan or submitted under separate cover. This will facilitate filing and recover of the material in the future.

The management plan template requires that the Volume Calculation Report created by W4W be included in management plan as Appendix 1.

The following information should be added to the introduction section of the Volume Calculation Report:

- Summary description of source of timber resource inventory and any inventory work carried out (duplicate of material in Section 3.1 of management plan).
- Except for instances where (a) no new timber inventory work has been done or (b) where a completely new timber inventory has been done, a description of general differences and reasons for the differences between previous timber resources inventory and new timber resources inventory. (If previous timber resources inventory cannot be located, this requirement may be waived.)
- A description of method(s) and data sources used to update the timber resource inventory for recent disturbances, and rationale to support these choices.
- A description of methods used to record stand age in inventory data (See Section 6.1 of W4W 4.2 user guide.)

Note that other information required for Appendix I is detailed in the MP Template and Handbook.

5.2.2 Supporting Documents

Supporting documents provide details on the timber resources inventory and will be used by the district manager to assess the inventory.

Supporting documents can be submitted as a management plan appendix and/or under separate cover, depending on district preference.

If some or all documents were previously submitted for district manager review and no changes were required, re-submission is not necessary.

Supporting documentation will vary with the nature of inventory work carried out. Some material in the list below may be not applicable in specific situations.

1. The Inventory Assessment Report.
2. The Inventory Plan.
3. The Sample Plan, if separate from the inventory plan.
4. If air photo interpretation was used in the inventory process, identify:
    - the date, scale, and type of imagery used.
    - stereoscopic viewing method (hardcopy or softcopy) and name of person who completed the work.

describe the amount of fieldwork, type of fieldwork, and location of polygons visited in support of the air photo interpretation.

5. If air photo interpretation was used, copies of the softcopy (digital) or hardcopy imagery used, including any polygon delineation outlines.

6. For polygons where attributes were derived from plot samples, a summary table of the polygon attributes listed in Section 4.3.2, and a list of the plots used to derive those attributes.

7. Copies (paper or digital) of all plot cards filled in during fieldwork.

8. A georeferenced spatial data file of the location of the measured field plots, including plot id numbers.

9. A georeferenced spatial and attribute data set of the new timber inventory data suitable for import into W4W. For W4W Version 4.2, this is a shape file with the attribute structure discussed in Appendix 6.

10. An Excel table of inventory attributes by polygon. Where the inventory method has retained some existing polygon delineation, identify polygons that have updated spatial or attribute data. This table will be the shape file data set with update status added as required.

11. Where an inventory update has retained some or all existing polygon delineation and has updated polygon attributes, an Excel table that lists the old and new leading species, age, height, basal area, crown closure, stems/ha and site index by polygon for all polygons with changed attributes, organized by new inventory polygon number.

12. A georeferenced pdf map file at a map scale of from 1:5000 to 1:10000 of the new timber inventory showing:

    - Inventory polygons, polygon numbers, and vegetation cover labels
    - Location of the field plots measured during inventory
    - Woodlot boundaries
    - Roads
    - Water features

    Note: Forest cover labels may be supplied in a table as an insert on the map, if labelling of each polygon is not possible.

13. Paper plot of the above map.

14. If the existing timber inventory data is available in a current digital spatial data format with accurate georeferencing:

    - a georeferenced .pdf map file at a native map scale of from 1:5000 to 1:10000 of the existing timber inventory showing:

        - Inventory polygons and polygon numbers
        - If practicable, vegetation cover labels
        - Woodlot boundaries
        - Roads
        - Water features

    - a copy of the old timber inventory spatial data file.

      This submission requirement may be waived if the district agrees in writing.

6 Appendices

6.1 Glossary of Terms and Abbreviations

FLNRORD	Ministry of Forests, Lands, Natural Resource Operations and Rural Development
VRI	Vegetation Resource Inventory
W4W	Woodlot for Windows (timber supply model)
VDYP7	Variable Density Yield Prediction software, Version 7
spatial	Mapped polygon extent(s) in a GIS data format.
attribute	Vegetation cover information which applies to a polygon (e.g. species composition, basal area, etc)
data set	GIS data that contains linked spatial and attribute information. Many formats possible. W4W Ver 4.2 uses ESRI shapefiles for input.
Existing woodlot inventory	The existing woodlot inventory is the timber resource inventory information used in the most recent long term AAC determination in the current Management Plan

6.2 Polygon Attributes Required by Woodlot for Windows

W4W Version 4.2 requires the following polygon attributes to be filled with valid data:

- Species Composition (e.g. SPEC_CD_1 & SPEC_PCT_1)
- Basal Area (BASAL_AREA)
- Density (LIVE_STEMS)
- Leading Species Age (PROJ_AGE_1 or YEAREST)
- Leading Species Height (PROJ_HT_1)
- Crown Closure (CR_CLOSURE)
- Site Index (SITE_INDEX)
- Non-forest descriptor (NFOR_DESC), if any
- Non-productive descriptor (NP_DESC), if any
- Non-vegetated component and percent of coverage (e.g. NVEG_PCT_1), if any
- Reference year (REF_DATE)

- Forest management landbase code (FMLB)
- Biogeoclimatic Zone (BEC_ZONE)
- Projection Date (PROJ_DATE)
- Polygon Number (POLY_ID)
- Mapsheet Number (MAP_ID)
- Forest Cover Label (FULL_LABEL)

Attribute definitions and standards are per the VRI data dictionary, field measurement and air photo interpretation manuals. Hyperlinks to these documents are available under Section 6.4.

The W4W's field names for these attributes are provided above in parentheses.

6.3 Data Structure Required by Woodlot for Windows

The fields listed in the data structure table below **must** ALL be present in the shape file database to enable successful import of the final inventory into W4W.

Only those fields marked as "DATA REQUIRED" **must** contain data for each polygon. The other fields can contain valid information or no data (blank or 0) without any impact on outcomes. Note that the information in the VRI volume fields is not used by W4W.

The shapefile can contain additional data items of interest to the user. Provided that these additional fields do not use a defined VRI field name, they will be ignored by W4W.

The meaning of the abbreviated field names is defined in the W4Ws 4.2 User Guide. The field type codes are: C: Character and N: Numerical. The field lengths are the number of characters or numbers allowed. The field decimals are the number of decimals allowed. The Field Content Notes are for clarification only and not part of the data structure table.

FIELD_NAME	FIELD_TYPE	FIELD_LEN	FIELD_DEC	Field Content Notes
POLY_ID	N	9	0	DATA REQUIRED Data import is simplest when MAP_ID/POLY_ID pair resolves to unique identifier.
BCLCS_LV_1	C	4	0	Data Optional. W4W determines nonforest and non-productive areas from NVEG_TYP and NP_DESC entries.
BCLCS_LV_2	C	4	0	
BCLCS_LV_3	C	4	0	
BCLCS_LV_4	C	4	0	
BCLCS_LV_5	C	4	0	
SPEC_CD_1	C	4	0	DATA REQUIRED
SPEC_CD_2	C	4	0	
SPEC_CD_3	C	4	0	
SPEC_CD_4	C	4	0	
SPEC_CD_5	C	4	0	
SPEC_CD_6	C	4	0	

SPEC_PCT_1	N	4	0
SPEC_PCT_2	N	4	0
SPEC_PCT_3	N	4	0
SPEC_PCT_4	N	4	0
SPEC_PCT_5	N	4	0
SPEC_PCT_6	N	4	0

FIELD_NAME	FIELD_TYPE	FIELD_LEN	FIELD_DEC	Field Content Notes
LIVE_STEMS	N	6	0	DATA REQUIRED if VDYP 7 Volume Calculation used
DEAD_PCT	N	4	0	Data Optional. Enter if available/relevant
DEAD_STEMS	N	6	0	Data Optional. Enter if available/relevant
PROJ_AGE_1	N	4	0	DATA REQUIRED
PROJ_HT_1	N	6	1	DATA REQUIRED
PROJ_DATE	C	8	0	DATA REQUIRED
REF_DATE	C	8	0	DATA REQUIRED
YEARESTAB	N	6	0	Data Optional. Simplest method to define stand ages where data set contains multiple dates of attribute interpretation. See W4W user manual.
BASAL_AREA	N	8	1	DATA REQUIRED if VDYP 7 Volume Calculation used
CR_CLOSURE	N	6	0	DATA REQUIRED if LIVESTEMS and BASAL_AREA not available to support FIPSTART volume calc method. See W4W user manual
SITE_INDEX	N	6	1	DATA REQUIRED
EST_SI	N	9	0	

EST_SI_SPC	C	6	0	
FMLB	C	1	0	DATA REQUIRED
NFOR_DESC	C	4	0	DATA REQUIRED if applicable
NP_DESC	C	5	0	DATA REQUIRED if applicable
BEC_ZONE	C	4	0	DATA REQUIRED
BEC_SZONE	C	3	0	Data Optional
BEC_VAR	C	1	0	Data Optional
NVEG_PCT_1	N	4	0	DATA REQUIRED if applicable
NVEG_PCT_2	N	4	0	
NVEG_PCT_3	C	6	0	
NVEG_TYP_1	C	10	0	
NVEG_TYP_2	C	10	0	
NVEG_TYP_3	C	10	0	
POLY_AREA	N	8	1	W4W recalculates area on import.
MAP_ID	C	7	0	DATA REQUIRED but does not have to be a map sheet name. Can be '1' or 'A' or whatever.
OPEN_NUM	C	5	0	

FIELD_NAME	**FIELD_TYPE**	**FIELD_LEN**	**FIELD_DEC**	**Field Content Notes**
SI_DATA_CD	C	4	0	
LVLSP1_125	N	9	0	W4W recalculates all volumes regardless of data supplied in these fields.
LVLSP1_175	N	9	0	
LVLSP2_125	N	9	0	
LVLSP2_175	N	9	0	
LVLSP3_125	N	9	0	
LVLSP3_175	N	9	0	
LVLSP4_125	N	9	0	
LVLSP4_175	N	9	0	

LVLSP5_125	N	9	0	
LVLSP5_175	N	9	0	
LVLSP6_125	N	9	0	
LVLSP6_175	N	9	0	W4W recalculates all volumes regardless of data supplied in these fields.
LVLTOT_125	N	9	0	
LVLTOT_175	N	9	0	
DVLSP1_125	N	9	0	
DVLSP1_175	N	9	0	
DVLSP2_125	N	9	0	
DVLSP2_175	N	9	0	
DVLSP3_125	N	9	0	
DVLSP3_175	N	9	0	
DVLSP4_125	N	9	0	
DVLSP4_175	N	9	0	
DVLSP5_125	N	9	0	
DVLSP5_175	N	9	0	
DVLSP6_125	N	9	0	
DVLSP6_175	N	9	0	
DVLTOT_125	N	9	0	
DVLTOT_175	N	9	0	
C_I_CODE	C	1	0	
FEATURE_ID	N	14	0	
INV_STD_CD	C	10	0	
LBL_CTR_X	N	12	0	
LBL_CTR_Y	N	12	0	

FIELD_NAME	**FIELD_TYPE**	**FIELD_LEN**	**FIELD_DEC**	**Field Content Notes**
FULL_LABEL	C	60	0	DATA REQUIRED for map label to display in W4W

C_CLASS	C	20	0
C_CLASS1	C	8	0
C_CLASS2	C	16	0

Data Optional - Add classifiers as required to describe WL landbase constraints.

Can use own labels e.g. C_MDWR. See W4W manual.

6.4 Links to References

Professional reliance in the woodlot licence program

Interim-guidance-roles-responsibilities.pdf

VRI Photo Interpretation Procedures

https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/forest-cover-inventories/photo-interpretation/standards

VRI Field Calibration Procedures for Photo Interpretation

https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/forest-cover-inventories/photo-interpretation/standards

VRI Ground Sampling Procedures

https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/ground-sample-inventories/vri-audits/standards

Site Tools

https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/field-forms-and-software/software-download

VRI Data Dictionary

https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/data-management-and-access/vri-data-standards

Woodlot for Windows – software and manual

https://www2.gov.bc.ca/gov/content/industry/forestry/forest-tenures/timber-harvesting-rights/woodlot-licence/allowable-annual-cut-calculator-tool