Vegetation Resources Inventory

Photo Interpretation Quality Assurance Procedures and Standards

Prepared by
Ministry of Forests and Range
Forest Analysis and Inventory Branch
for the Terrestrial Ecosystems Vegetation Task Force
Resources Information Standards Committee

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http://ilmbwww.gov.bc.ca/risc/index.htm

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The Resources Information Standards Committee evolved from the Resources Inventory Committee which received funding from the Canada-British Columbia Partnership Agreement of Forest Resource Development (FRDA II), the Corporate Resource Inventory Initiative (CRII) and by Forest Renewal BC (FRBC), and addressed concerns of the 1991 Forest Resources Commission.

For further information about the Resources Information Standards Committee, please access the RISC website at: http://ilmbwww.gov.bc.ca/risc/index.htm.

Table of Contents

1.0 Introduction

1.1 Background

This document contains the Photo Interpretation and Quality Assurance Procedures and Standards for photo interpretation projects undertaken using the British Columbia Vegetation Resources Inventory (VRI) Photo Interpretation Procedures. It is intended to be used by individuals involved in the planning, implementation and quality assurance of VRI photo interpretation projects.

As the use of softcopy technology has become a more common tool for VRI photo interpretation, the procedures documented here primarily reflect the use of that technology. Some of the hardcopy photo interpretation quality assurance process has been moved to Appendix A.

A scoring system has been developed to evaluate the checked polygons, and a passing grade is provided to assist in the evaluation. Some of the standards are not applicable to softcopy technology, as described within the document. If the VRI contractor's score(s) do not meet or exceed the minimums required, remedial action must be taken.

1.2. Objectives of Photo Interpretation Quality Assurance

The objectives of conducting quality assurance for photo interpretation encompass the determination of both consistency and accuracy. Specifically, there are four (4) main objectives including:

1. To improve the quality of photo interpretation through interactive evaluation, feedback and training.
2. To determine the performance of the individual interpreters in relation to measured and interpreted observations.
3. To ensure the maintenance of Ministry of Forests and Range (MFR) photo interpretation standards.
4. To ensure the data is validated and will load to MFR corporate data systems and meet the business needs of government, industry and the general public.

2.0 Photo Interpretation Quality Assurance

2.1. Overview of Photo Interpretation

The work that leads to the production of a vegetation resource inventory data set consists of five major stages:

1. calibration data review and transfer;
2. polygon delineation;
3. field calibration;
4. attribute estimation; and
5. digital capture of attribute and graphic.

Implementation of data source transfer, the first stage of photo interpretation, can be quite different depending on whether softcopy technology or hardcopy photos are being used. Data source transfer consists of preparation of aerial photos or softcopy models and the migration of historical air and ground-based data to the inventory photos or VRI coverage/models from which the new photo interpretation will be made. This source information is useful in photo interpretation calibration. Using softcopy technology, this process can be automated by transferring old digital data source locations from the historic database.

During the polygon delineation stage, boundaries are drawn around areas with uniform vegetated and non-vegetated cover. This process creates vegetation cover polygons.

The field calibration stage is used to further familiarize the photo interpreter with the local vegetation conditions and to provide reference or calibration points to assist in photo interpretation. This familiarization is accomplished by the interpreter selecting representative areas within selected polygons for which they anticipate having difficulty in attribute estimation or where the current inventory requires additional field support. By visiting these land cover types, the photo interpreter builds a mental picture of what attributes should be assigned to stands of similar structure, tone and texture on aerial photographs.

Data collection procedures and quality assurance standards for the collection of field calibration (air and ground calls) data and the quality assurance rating processes and forms are located in the following four documents:

1. Ground Call Data Collection Procedures;
2. Ground Call Quality Assurance Procedures and Standards;
3. Air Call Data Collection Procedures; and
4. Air Call Quality Assurance Procedures and Standards.

For a copy of the current version of these documents, contact the Ministry of Forests and Range or visit the web site: http://www.for.gov.bc.ca/hts/vri/standards/index.html.

The attribute estimation occurs after the field calibration stage. At this stage, the interpreter uses the historical data, their field calibration experience, with calibration point locations transferred to the new data base, and interpretive skills to photo interpret species composition, height, age, density, basal area and other vegetation and ecological attributes for each delineated polygon. VRI attributes are entered directly into a digital format. Initial delineation may be modified into a final format during the attribute estimation stage.

In softcopy, the process for digital capture of the polygon line work is ongoing throughout the VRI project and is essentially complete at the polygon delineation phase. For hardcopy photos, the final stage of the inventory process involves the digital capture of the graphic line work of each polygon which is digitally merged with the attributes that were estimated in the photo estimation phase. The digital capture of the line work is the subject of other documents and is separate from this quality assurance process.

2.2. Process

Quality assurance must be performed by Certified VRI Photo Interpretation personnel that are independent of the primary contractor and sub-contractors undertaking the inventory project. The independent quality assurance staff is referred to as quality assurance personnel in this document.

The VRI Phase I Implementation Process flowchart includes a Quality Assurance section. Please refer to this document on the VRI web site: http://www.for.gov.bc.ca/hts/vri/standards/index.html.

Quality assurance will occur throughout all five (5) stages of the interpretation process. Each stage has products and deliverables that can be evaluated on an individual basis or in combination. As payment is usually based on deliverables of each stage, quality assurance is more appropriately completed on a phase by phase basis. To ensure quality products and timely payment, the primary contractor and the quality assurance personnel should schedule the submission of products in batches at planned points throughout the duration of the contract. The ensuing quality assurance schedule should allow for an appropriate assessment of the contractor's work, time for the contractor to improve the product quality if required, and enable payment to be authorized in a timely and efficient manner.

As the contractor submits each completed set of maps, the quality assurance personnel must obtain samples of the work and check to ensure that Ministry standards are being met. The products produced by the separate stages of the photo interpretation process must be assessed at the start of and throughout each stage, and for the various photo interpretation personnel involved with each stage.

The MFR must receive copies of all quality assurance reports at the time that they are delivered to the licensee/proponent. In addition, by providing these reports to the MFR, government staff is able to track project deliverables and provide a timely final audit function prior to the data being loaded to the corporate data storage systems. If required, the MFR can act as an impartial arbitrator over any disagreements over the quality assurance assessment.

2.2.1. Quality Assurance Records

To facilitate efficient monitoring and create a record of the third-party quality assurance of each map, a "Quality Assurance Record" must be maintained by the quality assurance personnel for the delineation and attribution stage of the photo interpretation process. An updated record must be submitted to the project coordinator and the MFR regional inventory forester with each quality assurance report. See appendix B for an example of a quality assurance record for delineation and attribution stage.

The information to be maintained in the record includes:

- Map sheet reference number;
- Photo interpreter name;
- Submission date;

- Submission Identification Number (SID);
- Date of quality assurance completion;
- Number of polygons attributed per map sheet;
- Number of stereo models or polygons checked per map sheet;
- Rating achieved; and
- Comments.

Each submission of maps for the quality assurance is to be divided by the photo interpreter and numbered in sequential order by a unique submission identification number (SID). In order to identify any delineation or attribution issues early in the project, it is recommended that the first submission of maps be kept to one map sheet equivalent per interpreter. The prime contractor should obtain quality assurance feedback for each photo interpreter prior to letting the photo interpreter begin a new map to ensure project objectives are being achieved.

2.3. Procedures

Quality assurance must be conducted throughout all stages on every map sheet of the VRI photo interpretation process as outlined in this document and as agreed to by the quality assurance personnel, MFR VRI staff and the project proponent.

In order to identify any potential work quality issues early on in the project, quality assurance must be requested by the contractor within three working days after the completion of each interpreter's first full map equivalent in the delineation and attribution stage of the project. The size of each submission of maps submitted for subsequent quality assurance will be determined for each project at the project pre-work meeting.

2.3.1 Systematic Errors

Systematic errors are reproduced inaccuracies that are made consistently over a project, portion of a project, or by a specific interpreter. These may be difficult to determine on a map by map basis.

An example of a systematic error would be where an interpreter is consistently interpreting Aspen as being another species (Birch for example). In this case, the Quality Assurance personnel may have noticed that a crew has misclassified a polygon or two on a map, but it does not affect the overall pass/fail determination for that map. After subsequent maps have been audited, it may become apparent that the mis-classification of these two species is systematic (i.e., consistently being misclassified).

Another example may occur when an interpreter has consistently misunderstood the VRI Photo Interpretation Procedures. If an interpreter is consistently confusing Meso slope with Macro slope, Quality Assurance on any individual map may not determine that there is a problem due to the random selection of polygons, and the number of polygons that may have the correct value *by chance*. Over the course of performing Quality Assurance on several maps, it may become apparent that there has been a consistent misunderstanding of the VRI Photo Interpretation Procedures.

In instances such as this, the recipient will require the contractor to correct polygons in previous maps and, once the maps are fixed, they are subject to further review.

2.4. Data Source Transfer

Traditional photo preparation is not required for a softcopy VRI, other than acquiring the digital imagery and associated model files. Traditional document photos are no longer required as the digital work captured can be digitally draped over the current softcopy imagery being used or any new photos in the future. Quality assurance procedures for photo preparation and data source transfer for traditional hardcopy photo interpretation is described in Appendix A.

2.4.1. Historic Data Source Transfer

Traditional, hardcopy photo, data source transfer of historic reference points (see Appendix A) is not relevant to a softcopy VRI. For all historic inventory field data: air call, ground call, 70mm air call temporary sample plot (TSP) or permanent sample plot (PSP)), the location coordinates, with sample number, year of establishment, etc. were contained on the historic digital forest cover files and have been stripped out of these map files. This data currently exists in an ASCII and mdb file format with data up to about 1999 captured. A "Field Calibration Tile" is under consideration as a permanent storage location for this data.

The location of these historic data points has already been captured (level 14 of FC1) from past inventories and all that is required is to move this data to a new VRI's digital files. The locations along with the corresponding sample point symbology and sample number can be re-established in the new data base and used or not, as the VRI photo interpreter deems necessary.

As the majority of available historical attribute data is not in digital format, the requirement, as specified in the contract, for transfer of the data into a standardized MFR template is determined at the VPIP stage of the project. Transfer of the attribute data into digital format must be completed prior to submission of field calibration plan.

All data sources should be transferred except when a justifiable case can be made to remove them (such as a major disturbance, large stand structure changes, or as defined in the contract document). Softcopy quality assurance involves documenting whether all data source transfer has occurred and the reasons if it has not.

2.4.2. New Data Source Transfer

As a part of the review of attribute estimation, quality assurance personnel must ensure that new inventory data source locations have been captured digitally in the spatial and attribute file. The field data attributes must be made available to the QA personnel by the contractor for review of the final attribute estimations.

2.5. Polygon Delineation

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

The purpose of polygon delineation quality assurance is to determine whether a photo interpreter is using the photo interpretation guidelines for identifying polygon boundaries appropriately. In many cases, polygon boundaries have no sharp, distinguishable boundaries, and each interpreter must use their judgment to determine where the lines are drawn. The lines should, however, follow logical break points such as potential changes in site productivity or changes in species composition and meet project specific delineation

objectives. Quality assurance individuals determine if delineation is "reasonable" and will permit for a logical basis for final attribute estimation.

The end product of polygon delineation is a graphical demarcation of similar vegetated and non-vegetated cover. A quality assurance report will be produced by quality assurance personnel and submitted to the Ministry and the proponent (licensee) with the rating obtained, the pass/fail status based on the standards, and a description of remedial action required if applicable. The Ministry and proponent will determine payment based on this report. Quality assurance will take place on a randomly selected sample of models.

Using softcopy technology and depending on the scale of photography, the number of models per map available for review will vary. To assess delineation, the quality assurance personnel must randomly select at least three model set-ups per map. The number of models assessed in partial mapsheets can be prorated down from 3 based on the percentage full mapsheet equivalent. In the softcopy environment, the quality assurance personnel should review the entire model area and make notes based on the quality assurance criteria outlined below. In the case of line placement, the quality assurance personnel should indicate corrected line work or examples of proper placement of lines to demonstrate to the VRI contractor areas of concern. There is no maximum sample size for quality assurance, and a greater intensity of review may be undertaken as deemed necessary by the QA authority.

2.5.1. Polygon Delineation Evaluation Process

The quality assurance on polygon delineation should proceed as indicated below. Reference to polygon delineation guidelines is provided in the VRI Photo Interpretation Procedures. The VPIP and contract documents must specify any additional requirements such as areas with distinct features below minimum polygon sizes that may be described as valuable aids for navigation, etc.

1. Select models for evaluation
    - Describe the methods for selecting models and if the mapsheet is a partial.
2. Evaluate the following:
    - Accuracy of line placement;
    - Polygon size; may exceed recommended standards as outlined in VPIP and contract documents; and
    - Type separation; consistency and adherence to standards.
3. Record the above evaluation on the Rating Table for Polygon Delineation. See Appendix C for an example of a rating table that must be submitted for each map reviewed.
4. Sign off the quality assurance:
    - Approve the product that achieves a passing score; and
    - Return the batch to the contractor with remedial action instructions regarding items that do not meet standards and that are to be redone.

2.5.2. Polygon Delineation Evaluation

- All polygons must close.

- Polygon size must be consistent with the guidelines set in the Photo Interpretation Procedures. No polygon may be less than 0.5 hectares. The interpreter should try to avoid significant areas where line work is within 40m of other linework.
- General specifications (such as retain outer polygon line or specified internal polygon line requirements) for silvicultural polygons must be outlined in the VRI Photo Interpretation Project Implementation Plan (VPIP) and contract documents.

Table 1 - Polygon Delineation Quality Assurance Standards and Scoring

Within the entire area of each model reviewed, the following criteria will be assessed.

Attribute	Points Possible	Guidelines	Standards
Accuracy of line placement	7 5 0	>90% polygons correct 85 – 90% correct < 85% correct	Subjectively, within +/- 10 meters on the ground for distinct type line breaks and +/- 20 meters within types that are not distinct.
Polygon size	3 1 0	>95% correct 90% to 95% correct <90% correct	Minimum polygon guidelines are adhered to and any additional contract requirements have been met such as significant features for field navigation.
Type separation	7 5 0	>90% polygons correct 85 – 90% correct <85% lines correct	Based on the Photo Interpretation Procedures to guide the process of delineating polygons.
Total Possible	**17**		All scoring is based on the review of an entire model.

A minimum score of 85% per map sheet (as an average of the models that are rated) is required for acceptable completion of work, per map reviewed.

For each stereo model reviewed, the quality assurance reviewer should demonstrate areas of concern by re-digitizing incorrect or unacceptable line work and by adding or deleting polygons to demonstrate quality assurance concerns. The contractor is expected to review/correct any items identified by the quality assurance reviewer.

2.6 Attribute Estimation

Both graphic and attribute data, including the new data source information, will be submitted by the contractor for quality assurance to the quality assurance personnel in a digital format. The contractor must provide the first map completed by each project photo interpreter immediately as it becomes available to the quality assurance personnel. Quality assurance is primarily conducted through photo interpretation checks. The photo interpretation evaluation considers all photo interpreted attributes.

2.6.1. Attribute Evaluation Process

Quality assurance will be undertaken on every map sheet in the project area. The process is as follows:

1. Digital graphics files and attribute listings of delineated polygons on each map must be submitted by the contractor in a format as specified in the contract. The work of each photo interpreter in the project must be clearly identified. Attribute listings that do not contain the interpreter's name for each polygon is unacceptable and must be populated correctly prior to the quality assurance personnel beginning the checks on the attributes.
2. Conduct a data validation of each attribute file prior to polygon selection using MFR validation program. Attribute files that fail the validation process must be returned for correction prior to proceeding with polygon selection.
3. Randomly select a minimum 3% or five polygons, whichever is greater, of the total polygons per map using one of the following two method:

   Method I - using an attribute listing sorted by polygon number, establish a starting random polygon number (random generated number or date of the month is acceptable). Beginning with the starting polygon number, systematically select every 25th consecutive polygon until the target number of polygons is reached.

   Method II - select polygons using another method other than method I that is repeatable, auditable and clearly documented prior to beginning the quality check and that the attribution of all photo interpreters listed in each map is reviewed proportionately.
4. For each sample of polygons, obtain an independent estimate of all attributes as appropriate. The quality assurance personnel must not in any way have prior knowledge of the estimates of the original contractor. The quality assurance personnel must determine a complete polygon description as per the VRI procedures.
5. Compare the estimates of the QA personnel with those of the interpreter for each map and evaluate the difference between the two estimates. Due to the subjective nature of photo interpretation, the quality assurance attributes may be modified at this point with consideration of what is "reasonable". The scoring system provided in Table 3 will be used to conduct the evaluation.
6. Record the scoring result of every attribute by its polygon and corresponding map in a rating table. The rating table in Appendix D must be submitted for each map reviewed.
7. Provide remedial action for any work that does not meet the acceptable minimum rating.
8. Update the Quality Assurance Record.

2.6.2. Attribute Evaluation

- VRI attributes will be estimated for all polygons within a project area.
- Photo estimated attributes must be in an acceptable data structure.
- Photo estimated data must conform to the acceptable specifications.

To ensure an effective attribute evaluation process, each attribute type is assigned to one of three evaluation attribute categories. The three categories are: Critical Attributes, Standard Attributes and Supporting Attributes.

Critical Attributes – attributes must individually achieve an overall minimum score of 85% per map to achieve MFR standards. These attributes are critical to the use of the data in forest management. If the standards are not met for any one of these

attributes, remedial action must be taken and follow-up quality assurance must be carried out.

Standard Attributes - attributes in this category must collectively achieve a score of 85% or greater per map to achieve MFR standards. Although these attributes are important, they are not critical to the use of the data for forest management purposes.

The average score per map for the standard category attributes is calculated independently from the critical and supporting category attributes.

Supporting Attributes - attributes in this category must collectively achieve a score of 70% or greater per map and must individually achieve a score of 50% or greater per map to meet the MFR standard.

The ultimate goal of quality assurance is to ensure high standard of the final photo estimates for the forest inventory. Where it is incidentally discovered that a map holds an unacceptably higher rate of inaccuracy of photo estimates than what the sample of randomly selected polygons revealed, the quality assurance report must identify the attribute(s) in question and provide for recommendations for remedial action established with the project coordinator and contractor to resolve the issue.

Table 2 - Evaluation Attribute Categories

Category 1 Critical Attributes	Category 2 Standard Attributes	Category 3 Supporting Attributes
1. Species Composition	1. Second Species age	1. Ecology
2. Leading species	2. Second species height	2. Shrub height
3. Leading species height	3. Vertical complexity	3. Shrub crown closure
4. Leading species age	4. Estimated site index species	4. Non- vegetated cover type
5. Crown closure	5. Estimated site index	5. Non-vegetated cover percent
6. Basal area	6. Tree Layer	6. Land cover components
	7. Density	7. Tree cover pattern
		8. Snags
		9. Shrub cover pattern
		10. Herb cover percent
		11. Herb cover pattern
		12. Bryoid Cover percent
		13. Non-vegetated cover pattern

The category and score points assigned to each attribute and the minimum standards for attribute estimation are listed in Table 3.

Table 3 - Category, Point and Standards for Attribute Estimation

Category 1 – Critical Attributes

Attribute	Points Possible	Standards	Comments
Species composition	5 2 0	> 80% correct ≥ 70% correct ≤ 70% correct Must include only species codes from the VRI tree species list and must always add up to 100%.	Must be estimated for every tree layer of every polygon.
Leading species	2	Where leading and second species are within 10 %, either is acceptable as the leading species.	
Leading species height	3	Within +/- 3 meters or 15% whichever is greater.	Must be estimated for every tree layer of every polygon.
Leading species age	2	Within 10 years or 15% whichever is greater.	Must be estimated for every tree layer of every polygon.
Crown closure	1	+/- 10 crown closure units	Must be indicated for every tree layer in every polygon.
Basal area	2	Within +/- 10 m^2 or 20% whichever is greater	Must be estimated for every tree layer of every polygon.

**Species Composition Examples:*

Quality Assurance	Contractor	
$S_{40}Pl_{30}Bl_{30}$	$Bl_{40}S_{30}Pl_{30}$	Species composition correct=90%;
$Fd_{50}S_{40}Pl_{10}$	$S_{50}Fd_{40}Pl_{10}$	Species composition correct=90%;
$Pl_{60}Fd_{30}Lw_{10}$	$Fd_{55}Lw_{25}Pl_{20}$	Species composition correct=60%;

Category 2 – Standard Attributes

Attribute	Points Possible	Standards	Comments
Second species age	2	Within 10 years or 15% whichever is greater.	Must be estimated for every tree layer of every polygon where a second species is present.
Second species height	2	Within +/- 3 meters or 15% whichever is greater.	Must be estimated for every tree layer of every polygon where a second species is present.
Vertical complexity	1	Within +/- one unit value.	Must be indicated for every tree layer.
Estimated site index species	1	Must be present for stands under 30 years and stands where calculated site index does not represent actual site.	Must be a species that could occur naturally in the applicable polygon.
Estimated site index	1	+/- 20% of the height at breast height age 50 years. Must be present for stands under 30 years.	Must be accompanied by an Estimated Site Index Species and an Estimated Site Index Source.
Tree layer	-3	A score deduction only (no points awarded) is applied to the total polygon score for a missed layer or unacceptable layers. Attribution is scored independently for each layer.	Polygon with more than one layer must meet the multi-layered criteria outlined in the photo interpretation procedures.
Density (stems/ha)	1	Within 100 stems or 20%, whichever is greater.	Must be estimated for every tree layer of every polygon.

Category 3 – Supporting Attributes

Attribute	Points Possible	Standards	Comments
Ecology	6	SE = same as QA value MP = same as QA value SPM = +/- one unit value. AD = same as QA value SNR= +/- one unit value SMR=+/- one unit value (1 point for each category)	All polygons must have ecological data: Surface expression (SE), Modifying process (MP), Site position meso (SPM), Alpine designation (AD), Soil nutrient regime (SNR), Soil moisture regime (SMR) indicated for all polygons.
Shrub height	2	+/- 0.5 m for shrubs 0.1 m to less than 2 m. +/- 1 m for shrubs 2m to less than 4 m. +/- 2 m for shrubs more than 4 meters.	Must be estimated for every polygon where shrubs are present and observable.
Shrub crown closure	1	+/- 10 crown closure units.	Must be estimated for every polygon where shrubs are present and observable.
Non-vegetated cover type	2	When present must be consistent with the BC Land Cover Classification Scheme code.	Maximum 2 points, if more than 1 land cover component then prorate to a total of 2 points
Non-vegetated cover percent	2	+/- 10 percent units	
Land cover components	1	Each component % must be +/- 10% The sum of all LCC percents must = 100 Where LCC #1 and LCC #2 are 15 % units apart or less, either may be acceptable as LCC #1.	All polygons must have a land cover component identified. Maximum 1 point, if more than 1 land cover component then prorate to a total of 1 point
Tree cover pattern	1	Within +/- one TCP unit value.	Must be indicated for every tree layer in every polygon.
Snags (stems/ha)	1	+/- 20% of the quality assurance value.	Must be estimated for every tree layer in every polygon.
Shrub cover pattern	1	Within +/- one SCP unit value.	
Herb cover type	1	Must be consistent with the BC Land Cover Classification Scheme code.	

Attribute	Points Possible	Standards	Comments
Herb cover percent	1	+/- 10 cover percent units.	
Herb cover pattern	1	Within +/- one HCP unit value.	
Bryoid Cover percent	1	+/- 10 cover percent units.	
Non-vegetated cover pattern	1	Within +/- one N-VCP unit value.	

2.7. Remedial Action Procedures

Where the outcome of the quality assurance identifies a need for re-work, all polygons on the affected map must be re-worked for the identified attributes. The map must be resubmitted for quality assurance when the re-work is complete. A new set of randomly selected polygons will be used to verify the quality of the re-work.

In cases where the results of the quality assurance identify the need for a re-work, it must be specified in the quality assurance report as to which maps and type of attributes that are required to be photo re-interpreted. The follow-up review and rating of the re-work is to be based only on those attributes that did not meet the minimum standard or as otherwise indicated in the quality assurance report.

The quality of the re-work must be verified based on a second set of randomly selected polygons. See Appendix B for an example of a quality assurance record.

2.8. Quality Assurance Report

Each quality assurance report must include the following:

- An up-to-date Quality Assurance Record;
- Tabulated scoring results for delineation or attribution. Examples of delineation and attribution tables are shown in Appendix C, D and Appendix E;
- QA personnel attribute photo estimates;
- If required, a description of the directed remedial action and a report on the compliance with that direction; and
- A report signed off by the QA personnel.

As well as providing immediate feedback to the contractors, MFR and project coordinator, the results of the Quality Assurance process are included as part of the Project Completion Report deliverable.

2.9 Dispute Resolution Process

Where a dispute arises between the photo interpreter and the quality assurance personnel, the recipient is responsible for developing a mechanism to resolve the disagreements. This process must be agreed to in writing and submitted to the MFR for approval.

Appendix A: Hardcopy Photo Preparation and Data Source Transfer

To simplify the quality assurance process, both the photo preparation and data source transfer are combined with the polygon delineation quality assurance. A sample of document photos from a submitted batch is selected for evaluation. The selection is conducted as follows:

1. Determine the number of inventory photos in the map.
2. A minimum of 30 photos (or stereo pairs) or 10% of the submitted stereo pairs is selected for evaluation.
3. Obtain a listing of photo numbers by flight line.
4. Number the photos sequentially by flight line and photo sequence. The numbers should range from 1 to the total number of inventory photo pairs.
5. Use a random number generator to produce as many random numbers as the sample size determined in step 2 above. The random numbers should be constrained to range from 1 to the number of inventory photo pairs. Each random number identifies the photo set to be included in the sample.
6. The sample document photos are evaluated for accuracy of photo preparation, data source transfer and polygon delineation.
7. This quality assurance process should be conducted expeditiously so as not to hamper subsequent photo interpretation processes.

Air photo preparation evaluation

The purpose of the air photo preparation quality assurance is to ensure that the placement of principal point and fiducial marks, the definition of the flight line and the framing of the stereo overlap area, meet the MFR standards. Lack of accuracy in photo preparation results in the production of inaccurate maps. The steps outlined below should be used in evaluating the photo preparation process (if applicable).

1. Evaluate the following:
    - line numbering;
    - north/south orientation;
    - unit boundary transfer on applicable photos;
    - marking of the principal point;
    - accuracy of the transfer of the conjugate points;
    - preparation and marking of the effective photo interpretation; and
    - transfer and extension of polygon boundaries across unit (project boundaries).
2. Record the above evaluation on the Photo Preparation Quality Assurance Rating.
3. Sign off the quality assurance:
    - Approve the product.

- Return the batch to the contractor with instructions regarding items that do not meet standards and that need to be redone.

Table A1 – Air Photo Preparation Quality Assurance Standards

Attribute	Points Possible	Standards
Line numbering	1	Completed properly
North / south orientation	1	Completed properly
Unit boundary transfer	2	Within ± 10 mm
Principle point marking	2	Within ± 2 mm
Conjugate point marking	2	Within ± 5 mm
Mapping effective area	2	Good 2 Fair 1 Poor 0
Transfer of polygon at boundaries	4	Good 4 Fair 2 Poor 1
Total Possible	**14**	

Data source transfer evaluation

Data source transfer primarily involves four types of inventory data, which are:

- air call;
- ground call;
- temporary sample plot (TSP); and
- permanent sample plot (PSP) data.

The existence of any of this information in a delineated polygon is useful for calibration purposes. The assessment of the quality of the data source transfer is completed using a statistically random sample of points. It is suggested that this quality assurance be completed in conjunction with the polygon delineation quality assurance.

1. Evaluate the following:
   - accuracy of data source placement;
   - extent;
   - symbology;
   - completeness of data; and
   - legibility.
2. Record the above evaluation on the Rating Table for Data Source Transfer.
3. Follow up that new placement of older data sources has not changed if older data sources are already in digital format (e.g., FC1).
4. Sign off the quality assurance:
   - Approve the product.

- Return the batch to the contractor with instructions regarding items that do not meet standards and that are to be redone.

Table A2 - Data Source Transfer Quality Assurance Standards

Attribute	Points Possible	Standards
Accuracy of placement	2	Within ± 5 mm
Extent	1	Good 1 Poor 0
Symbology	2	Good 2 Fair 1 Poor 0
Completeness of data	4	Good 4 Fair 2 Poor 1
Legibility	1	Good 1 Poor 0
Total Possible	**10**	

Appendix B: Quality Assurance Records

Delineation Quality Assurance Record

Map	Interpreter	Date Submitted	Date Checked	Number of Photos or Models Checked	Passed or Failed	*Comments*

Attribution Quality Assurance Record

Map	Interpreter	Date Submitted	Date Checked	Number of Polygons		Passed or Failed	Comments
				Attributed	Checked		

Appendix C: Delineation Rating Table

VRI Delineation Rating Table

Project:_____ **QA personnel:**_____

Interpreter:_____

Map	Model / Photo		Line Placement 7	Polygon Size 3	Type Separation 7	Points Obtained	Points Possible 17		Comments

Total % =

Appendix D: Attribution Rating Table for Critical and Standard Category Attributes

Map:		Critical Attributes							Standard Attributes								
Model / Photo	Polygon	Spec. Comp. (5)	Leading Species (2)	Leading Species Age (2)	Leading Species Ht. (3)	BA (2)	CC (1)		*Tree Layer (-3)	Second Species Age (2)	Second Species Ht. (2)	Vertical Complexity (1)	Density (1)	Est. SI Species (1)	Est. SI (1)	Points Obtained	Points Possible
Total Points Obtained									* See tree layer attribute standards in Table 3					Total Points			
Total Points Possible																Percent	
	Percent																

Critical attributes must individually achieve an overall minimum score of 85% per map for acceptable completion of work

Standard attributes must collectively achieve an overall minimum score of 85% per map for acceptable completion of work

Comments:

Interpreter:_____

Date:_____

QA Personnel:_____

Accept:_____
(Yes/No)

Appendix E: Attribution Rating Table for Supporting Category Attributes

Map:		Supporting Attributes															
Model / Photo	Polygon	LCC (1)	Ecology (6)	Tree cover pattern (1)	Snags (1)	Shrub height (2)	Shrub crown closure (1)	Shrub cover pattern (1)	Herb cover type (1)	Herb cover percent (1)	Herb cover pattern (1)	Bryoid cover percent (1)	Non-vegetated cover type (2)	Non-vegetated cover percent (2)	Non-vegetated cover pattern (1)	Total Obtained	Total Points Possible (17)
																0	
																0	
																0	
																0	
																0	
																0	
																0	
	Obtained	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Possible																0
	Percent	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		

% Correct #DIV/0!

Comments:

Interpreter:_____ QA Personnel:_____

Date:_____ Accept:_____
(Yes/No)