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Processing Vascular Plants

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Summary

This document outlines the training, procedures and resource materials used to process and identify vascular plant samples collected by the ABMI. Most vascular plants are identified during surveys at ABMI terrestrial and wetland sites by field technicians. A small proportion of the vascular plants cannot be positively identified by technicians in the field. These specimens are collected and sent to the Sample Processing Centre where they are sorted. Because field technicians may differ in their ability to identify vascular plants in the field, a second attempt at identification by the field technicians with greatest knowledge of vascular plants is made in the lab. By identifying these “easy” specimens, less work is required by experts. Specimens that can not be positively identified in the lab are sent to vascular plant experts for final identification.

Data Management

Transferring Data from the Sample Tracking Log to the Sorting Database

All vascular plant samples received by the Sample Processing Centre (RAM) are tracked using the Sample Tracking Log (Appendix 1). At the conclusion of the field season, sample information that was recorded in the Sample Tracking Log is transferred to the Vascular Plant Sorting Database (Appendix 2). The ABMI lab coordinator checks to ensure that vascular plant information for all ABMI sites is present.

Data Entry During Sorting

The lab technicians responsible for the second attempt at identification enter the required information directly into the Vascular Plant Sorting Database (Appendix 2) for all identified specimens. If more than one species is identified in an individual sample, the lab technician inserts a new row below the original row and fills in the required information for each species present.

Checking and Storing Data During Sorting

A copy of the Vascular Plant Sorting Database is transferred to the ABMI lab coordinator at the end of each day. The lab coordinator checks the database to ensure that all information is recorded accurately and that all data fields are filled in. All copies of the database are stored on a secure computer with a back-up stored in a different building.

Data Entry During Advanced Identification

The ABMI lab coordinator sends an electronic copy of the Vascular Plant Sorting Database to the taxonomic expert. The taxonomic expert fills in the required information (gray columns) as specimens are identified. If more than one species is identified from an individual sample, the expert inserts a new row below the original row and fills in the required information for each species present.

Transferring Data from the Taxonomic Expert to the ABMI Information Centre

Once the advanced ID has been completed, the expert returns the completed electronic copy of the Sorting Database to the lab coordinator. A hard copy is also printed and sent to the lab coordinator along with the identified samples. The lab coordinator checks the database for omissions or errors, stores it on a secure computer with a back-up stored in a different location, sends a copy of the database to the ABMI Information Centre, and records the data transfer in the Sample Tracking Log.

Specimen Management

A few vascular plants are collected during ABMI surveys because they cannot be identified by field technicians. These specimens, and the accompanying data, pass through a variety of facilities during processing. To ensure that samples are not lost, all specimens received by the Sample Processing Centre (RAM) are tracked using the Sample Tracking Log (Appendix 1). All subsequent transfers of specimens, samples and data are recorded in the log.

Specimen Management in the Field

- Vascular plant specimens that cannot be identified by field technicians are collected and given temporary labels: ABMI Site #, Quadrant #, Collection Date, Field Collector Initials, and Vascular Plant Specimen Number (the site number followed by sequential numbers for each specimen collected at that site).
- Specimens are placed in a plant press (separated by sheets of newspaper) either at the ABMI site, or as soon as possible when back at camp.
- If using a plant press in the field, specimens are transferred to a different plant press for storage once back at camp. Specimens from one site are not transported into another.
- Once the specimens have dried for 2-3 days, they may be removed from the press and stored between sheets of newspaper in an aerated plastic box, or left in the storage press if space allows.
- Field data sheets are cross referenced with the specimens in the storage container to ensure that all unidentified specimens are included, organized, and the complete information has been recorded on each temporary label.
- The specimens contained in each storage container are recorded on a Plant Press Log (Appendix 3).
- Specimens are stored in a cool dry location while at the field camp.

Specimen Transfer from the Field to the Sample Processing Centre

- At the end of each shift, plant presses or plastic boxes containing vascular plant specimens are packed in cardboard boxes and shipped via courier to the Sample Processing Centre (see Terrestrial Protocols for Vascular Plants). The number of boxes in the shipment, and the identity of sites within each box are recorded onto the Sample Shipping Checklist (Appendix 4).
- Samples are logged-in when they arrive at the Sample Processing Centre. Each shipment is assigned a lot number, and the contents of each lot are tracked by that number.
- The Sample Tracking Log includes information about the date the lot arrived, the location where the specimens are stored, the ABMI sites where the specimens were collected, and the number of specimens in the lot.
- The ABMI lab coordinator ensures that all specimens listed on the plant press log are present, organized, and recorded in the sample tracking log.
- Vascular plant specimens are inspected to confirm they are dry, pressed, and labeled, and then are stored in a dry, dark place.
- If vascular plant specimens are moved to a different location for temporary storage, the new location and the date of movement are recorded in the log book.

Specimen Transfer from the Sample Processing Centre to the Taxonomic Expert

- Boxes containing vascular plant samples are shipped via courier to the taxonomic expert for advanced identification to the lowest taxonomic level possible.
- The ABMI lab coordinator records the new location and the date of transfer in the sample tracking log.

Specimen Transfer from the Taxonomic Expert to the Sample Processing Centre

- All specimens and materials received from the Sample Processing Centre are returned after species have been identified.
- Samples are packed and shipped in the same manner as listed above.
- The ABMI lab coordinator checks to ensure that all samples have been returned and are properly labelled. Samples are organized and boxed for storage at the Sample Processing Centre.
- The ABMI lab coordinator records the new location and the date of transfer in the sample tracking log.

Long-term Specimen Curation at the RAM

- All specimens collected by the ABMI are gifted to, and where appropriate curated by, RAM.
- RAM retains all ABMI materials for 2 years.
- After 2 years, reference specimens from each species (or taxonomic group if the specimens were not identified to species) and training specimens are retained by the RAM for use by the ABMI. All other ABMI specimens can be loaned, traded, distributed, or disposed as the RAM see fit.
- A policy describing the procedure RAM will use to loan and gift ABMI specimens is under development.

Sample Processing

Identification of “Easy” Specimens

- 1 or 2 field technicians, with the best vascular plant identification skills, are selected by the lab coordinator to:
 - isolate specimens onto separate pages,
 - ensure specimens are clearly labeled,
 - ensure specimens have a unique specimen number,
 - cross reference the unique specimen number to the electronic Vascular Plant Database, and
 - attempt to identify the specimen.
- If a specimen can be identified in less than five minutes, then the technician identifies the specimen and records the species name and other required information (gray columns) in the Vascular Plant Sorting Database (Appendix 2).
- Specimens that have been identified are separated and organized into boxes and the box location of each specimen recorded in the database. These identified specimens are stored at RAM as “Residuals”.
- Specimens that cannot be identified are sorted and organized into a different set of boxes labeled “advanced ID” and the box location of each specimen recorded in the database.

Taxonomic Nomenclature

This section is still under development

Books used to identify vascular plants in the lab include:

Johnson, D., MacKinnon, A., and Kershaw, L.J. 1995. Plants of the Western Boreal Forest and Aspen Parkland. Lonepine Publishing, Edmonton, Alberta, Canada. 392p.

Lahring, H. 2003. Water and Wetland Plants of the Prairie Provinces. Houghton Boston, Saskatoon, Saskatchewan, Canada. 326p.

Advanced Identification of Specimens

Selecting the Expert

- The ABMI will select experts who are known specialists in the field of vascular plant taxonomy. To ensure the highest of standards, and to maintain ABMI's level of credibility, the ABMI will only select experts who can meet at least one of the following criteria:
 1. Expert is endorsed by the Royal Alberta Museum, or an associated museum (e.g., Canadian Museum of Nature), as capable of identifying vascular plants with $\geq 95\%$ accuracy.
 2. Expert is endorsed by 2 members of the scientific community, recognized in the field of vascular plant taxonomy, as capable of identifying vascular plants with $\geq 95\%$ accuracy.

Identifying Vascular Plant Specimens

- All specimens are to be identified to the lowest taxonomic level possible. Species names must be determined based on the Species References/Authorities listed below.
- Whenever possible, specimens are to be identified to species, with the following exceptions;
 - *Salix* specimens containing only juvenile leaves, or that are heavily browsed (vigorous growth) are identified to *Genus* only. Appropriate specimens (good mature branchlets) which lack catkins should be taken to *species* based on leaf morphology, when possible.
 - Small/immature specimens that cannot be identified accurately are recorded to *Genus* only
- RAM maintains the taxonomic keys, and if there is discrepancy between keys determines their order of precedence.
- If during the process of identifying a species additional reference literature is needed, the expert will note this additional literature in the database
- Specimens are examined, identified, and the species name written directly on the original label (or a separate stick-on label) along with the identification date and expert's initials.
- Isolate a voucher specimen for every unique species/taxon identified, and label the new specimen as indicated above with the word "Voucher" on the label. Organize all voucher specimens in separate boxes for return to the Sample Processing Centre.
- Enter all required information in the Vascular Plant Sorting Database (Appendix 2).
- The expert will ship the specimens back to the Sample Processing Centre, via the method above, and e-mail a digital copy of the Vascular Plant Sorting Database to the ABMI lab coordinator.
- The ABMI lab coordinator will add the 7-letter species codes to the electronic database.

Verification Process

- Specimens that have been identified by experts will undergo a verification process by their peers to ensure accuracy.
- For each expert identifying ABMI vascular plants, 10% of the identified specimens (up to a maximum of 200) will be randomly selected for verification. Note that at least one randomly selected specimen from each species (or higher taxonomic group if the specimens are not identified to species) will be included.
- The ABMI lab coordinator will re-label each specimen with a reference number and send the specimens to a second expert that meets the above credibility criteria.
- The second expert will identify the specimens and record the species name beside the matching reference number on a provided data sheet.
- The second expert will ship the specimens back to the ABMI, and email the data sheet to the ABMI lab coordinator.
- The ABMI lab coordinator will compare the data between the two experts.
- Discrepancies are reviewed by both experts (plus additional experts if necessary) to determine the identification based on the most recent literature. If a discrepancy cannot be resolved, the specimen in question will be recorded in the database at the lowest taxonomic level that is agreed upon by the experts.

- If, after all discrepancies have been resolved, there is $\geq 5\%$ error on the part of the initial taxonomic expert, then the genera/species with $\geq 5\%$ mis-identifications are highlighted. All individuals the initial expert identified from the highlighted species are re-identified to confirm their identity.

Specimen Storage

- All vascular plant specimens are stored for 2 years.
- After 2 years, all specimens are given to the Royal Alberta Museum.
- The ABMI will retain vouchers, and enough reference specimens of each species plus additional specimens for training purposes.

Species References/Authorities

This section is still under development – need list of books used by expert

What scientific authority/key was used for species names?

If more than one reference was used, which took precedence?

Appendix 1: Sample Tracking Log

Note: This is a portion of the complete Sample Tracking Log that shows only the columns relevant to the receiving and processing of vascular plant samples.

RAM ACCESSION INFO						ABMI SAMPLE COLLECTION INFO					VASCULAR PLANTS		
Data Series Count	Project	Year	Group	RAM Lot #	Date Received	Sample Type	Site #	Sub-site	Collector	Date Collected	Original Plant Press #	Vascular Plant Specimen Number	Sample ___ of ___ for this Site
1													
2													
3													
4													
5													
6													
7													
8													
9													

SAMPLE DISPOSITION									
Data Transferred to Database	Samples Sent for Sorting	Samples Returned from Sorting	Samples Sent for Advanced ID or Processing	Samples Returned from Advanced ID or Processing	Database Sent to Information Centre	Current Sample Disposition	Current Residual Disposition	Samples Transferred to RAM's TMS	Comments

Appendix 2: Vascular Plant Sorting Database

VASCULAR PLANT SORTING

RAM Lot No.	Original Plant Press #	ABMI Site Number	Sub-site	Collected By	Field Collection Date	Unknown Plant ID Code	Date Sorted	Sorted By	Voucher Location	Residual Box #	Advanced ID Box #	Sample Disposition	Field Crew Comments	Lab Comments

ADVANCED IDENTIFICATION

Identification Date	Identified By	Family	Genus	Species	Species Author	ABMI Species Code	Reference Used	Advanced ID Comments	Verified By	Verification Date

Appendix 4: Sample Shipping Checklist

Sample Shipping Checklist Terrestrial Protocol – Summer

Crew ID: _____ Site Block #: _____ Sites Completed in Block: ___ of ___

Shipping Date: _____ Shipping Method: _____ Waybill #: _____

Type and Total # of Containers: _____

Complete one sheet for each site block in the shipment. Complete one section for each site completed in the block.

You must fill in all fields in each completed section - Record "VNA" for any fields that do not apply.

If shipping by Bus or Courier, save a copy of your waybill for future reference. If dropping off at RAM – enter the date samples are dropped off as the shipping date, enter "Delivered" as the shipping method, and enter the initials of the person dropping it off as the waybill #.

Site # _____ Field Collection Date _____ Prairie Protocol¹ (circle) Y N Field Crew Initials _____

Total Plant Specimens Collected² _____ Plant Press ID³ _____ Collected by: _____

Moss⁴: Collected by: _____ Lichen⁴: Collected by: _____ Tree Cores⁵: Collected by: _____

	NE	NW	SE	SW		NE	NW	SE	SW		NE	NW	SE	SW
Log/stump					Log/stump					1°				
Tree/other					Tree/other					2°				
Wetland					Wetland									
Upland					Upland					1 ha				

Comments: _____

Site # _____ Field Collection Date _____ Prairie Protocol¹ (circle) Y N Field Crew Initials _____

Total Plant Specimens Collected² _____ Plant Press ID³ _____ Collected by: _____

Moss⁴: Collected by: _____ Lichen⁴: Collected by: _____ Tree Cores⁵: Collected by: _____

	NE	NW	SE	SW		NE	NW	SE	SW		NE	NW	SE	SW
Log/stump					Log/stump					1°				
Tree/other					Tree/other					2°				
Wetland					Wetland									
Upland					Upland					1 ha				

Comments: _____

Site # _____ Field Collection Date _____ Prairie Protocol¹ (circle) Y N Field Crew Initials _____

Total Plant Specimens Collected² _____ Plant Press ID³ _____ Collected by: _____

Moss⁴: Collected by: _____ Lichen⁴: Collected by: _____ Tree Cores⁵: Collected by: _____

	NE	NW	SE	SW		NE	NW	SE	SW		NE	NW	SE	SW
Log/stump					Log/stump					1°				
Tree/other					Tree/other					2°				
Wetland					Wetland									
Upland					Upland					1 ha				

Comments: _____

Site # _____ Field Collection Date _____ Prairie Protocol¹ (circle) Y N Field Crew Initials _____

Total Plant Specimens Collected² _____ Plant Press ID³ _____ Collected by: _____

Moss⁴: Collected by: _____ Lichen⁴: Collected by: _____ Tree Cores⁵: Collected by: _____

	NE	NW	SE	SW		NE	NW	SE	SW		NE	NW	SE	SW
Log/stump					Log/stump					1°				
Tree/other					Tree/other					2°				
Wetland					Wetland									
Upland					Upland					1 ha				

Comments: _____

1 – Circle "No" if the site was not sampled using prairie protocols – if yes, circle "Yes" and enter "VNA for Moss and Lichen.
 2 – Record the total number of unknown vascular plant specimens collected from this site. If no unknown plant specimens were collected, indicate "None". List unique specimen ID numbers for all unknown plants collected on the appropriate Plant Press Log.
 3 – Record the Plant Press ID number where the specimens are located.
 4 – For each quadrant, record "C" if a sample was collected, "None" if no specimens were found, or "VNA" if the stratum was not present.
 5 – Indicate species for tree cores or cookies that were collected. Indicate "None" if not collected (include comments indicating why the sample was not collected).