Washington State Department of Ecology

Environmental Assessment Program

Standard Operating Procedures for Litterfall Collection, Processing, and Analysis

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Signatures on File

Please note that the Washington State Department of Ecology's Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical and administrative experts. Their primary purpose is for internal Ecology use, although sampling and administrative SOPs may have a wider utility. Our SOPs do not supplant official published methods. Distribution of these SOPs does not constitute an endorsement of a particular procedure or method.

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Although Ecology follows the SOP in most instances, there may be instances in which Ecology uses an alternative methodology, procedure, or process.

SOP Revision History

Revision Date	Rev number	Summary of changes	Sections	Reviser(s)
02/26/2007	1.1	Litterfall component categories	6.4.3	S. Estrella
08/06/2007	1.2	Stable isotope sample weights	6.5.2	S. Estrella
03/13/2008	2.0	Updated equipment list and summary of procedures; added subsampling section (6.5); added sample datasheets (11.0)	5.0, 6.0, 11.0	S. Estrella

1.0 Purpose and Scope

1.1 This document is for the Environmental Assessment Program Standard Operating Procedure (SOP) for collecting, processing, and analyzing litterfall samples.

1.2 Litterfall sampling uses litterfall traps deployed at specified points in a study area over a specified period of time to collect litter falling from trees and other vegetation. Litterfall sampling may be used to quantify vegetative canopy composition over time or in response to ecosystem disturbances.

2.0 Applicability

2.1 This document was developed as a litterfall collection, processing, and analysis procedure for the Type N Experimental Buffer Treatment (Type N) Study. The procedure may be applicable for other studies assessing litterfall contributions to streams and other habitats.

2.2 Sample processing for stable N and C isotope analysis is a requirement for some of the study basins. This procedure may or may not be useful for other studies.

3.0 Definitions

3.1 Litterfall: organic material consisting of leaves, needles, wood, and other matter that falls from an overhead canopy.

3.2 Type N: perennial and seasonal non fish-bearing streams under Washington State's current stream typing system (WAC 222-16-030).

4.0 Personnel Qualifications/Responsibilities

4.1 Knowledge of the contents of this SOP.

5.0 Equipment, Reagents, and Supplies

5.1 Drill and drill bit
5.2 Large laundry baskets—size determined by user; area sampled by the laundry basket is standardized to one square meter prior to data analysis
5.3 Window screen
5.4 Scissors
5.5 Clothes pins
5.6 Small shovel
5.7 Rebar
5.8 Sledge hammer

5.9 Zipties
5.10 Watch
5.11 Waterproof field datasheets or data book
5.12 Pencil
5.13 Global Positioning System—handheld GPS unit; model determined by the level of accuracy desired
5.14 Flagging tape
5.15 Paint marker
5.16 Garbage bags—large enough to contain the sample; approximately 33 gallons
5.17 Labels
5.18 Permanent marker
5.19 Whisk
5.20 Dustpan
5.21 Stainless steel forceps
5.22 Counting tray or tub
5.23 Lab datasheets
5.24 Teasing needles
5.25 Sieves—different sizes to assist with sorting
5.26 Paper bags
5.27 Drying oven—Thelco GCA/Precision Scientific, VWR gravity convection oven, or equivalent
5.28 Oven thermometer—50 to 300°C (100 to 600°F) range
5.29 Plastic bags—Ziploc bags or equivalent; large enough to contain the sample
5.30 Silica drying agent
5.31 Scale—Mettler or equivalent; 0.l mg resolution
5.32 Crucible
5.33 Weighing dish
5.34 Scoop
5.35 Muffle furnace—Barnstead/Thermolyne or equivalent
5.36 Crucible tongs
5.37 Silicone mat
5.38 Aluminum foil
5.39 Freezer—large enough to contain the samples

6.0 Summary of Procedure

6.1 Equipment Preparation

6.1.1 Drill small holes into the bottom of the laundry basket for drainage (Grady 2001).

6.1.2 Cut a piece of window screen to fit the inside dimensions of the laundry basket.

6.1.3 Assemble the litterfall trap by attaching the screen to the laundry basket with clothes pins.

6.2 Litterfall Trap Installation

6.2.1 Distribute the litterfall traps throughout the study area as dictated by the experimental design. Each litterfall trap station should contain paired traps, with one trap on each bank, and should be located outside of the bankfull channel (Grady 2001). A small shovel may be necessary to construct a level surface.

6.2.2 Secure the litterfall traps to rebar with zipties. Use a sledge hammer to pound the rebar into the ground.

6.2.3 Record the date and time of installation for each litterfall trap station onto a waterproof datasheet or data book using a pencil.

6.2.4 Collect the latitude and longitude location for each litterfall station using a Global Positioning System.

6.2.5 Flag a tree or shrub near each litterfall trap station. Label the flag with the study name, site identifier, and litterfall trap station identifier using a paint marker.

6.3 Sample Collection

6.3.1 Return to the study area six weeks later. Sample design and logistics may necessitate sample collection over a longer or shorter period of time.

6.3.2 Carefully remove the screen containing the litterfall and place into a garbage bag. Label the bag with the study name, site identifier, litterfall trap station identifier, and sample collection date using a permanent marker. Composite the left and right bank samples at each station into one bag.

6.3.3 Record the date of litterfall trap collection onto a waterproof field datasheet or data book using a pencil.

6.3.4 Attach a clean screen to the laundry basket and place the litterfall trap in the same location. Replace laundry basket or flagging if necessary.

6.3.5 Note any disturbance, relocation, replacement, etc.

6.3.6 Air dry the samples until processed.

6.4 Sample Processing

6.4.1 Remove the litterfall from the screen using a whisk and dustpan or forceps. Empty the screen contents onto a tray or tub to avoid losing the sample.

6.4.2 Log the sample onto a lab datasheet (see Litterfall Sorting Form in Section 11.0).

6.4.3 Sort the litterfall sample into deciduous leaves, coniferous needles, woody material (twigs, branches, bark, cones, etc.), and miscellaneous (bud scales, etc.) components on the counting tray using forceps and teasing needles. Different size sieves may be helpful in sorting the components.

6.4.4 Place each component in a paper bag labeled with the study name, site identifier, litterfall trap station identifier, sample collection date, variable (“litterfall”), and component (e.g. “coniferous”).

6.4.5 Dry each component in the paper bag in the drying oven at 55 degrees C for at least 96 hours. Use an oven thermometer to check the oven temperature.

6.4.6 Cool each litterfall component in a dry plastic Ziploc bag or equivalent with a silica drying agent (A. Foster, USFS, personal communication). Label the bag with the study name, site identifier, litterfall trap station identifier, sample collection date, variable ("litterfall"), and component (e.g. "coniferous"). Store the sample in the plastic bag until the sample is weighed and ashed.

6.4.7 Weigh the entire sample on a calibrated scale using a crucible, weighing dish, or other container to hold the sample. Record as dry weight (see Litterfall Sample Processing Form in Section 11.0).

6.4.8 If the entire sample is larger than about one-third to one-half of the capacity of the crucible, it is necessary to subsample the total sample before ashing. To subsample, thoroughly mix the sample in a large container or tub with a scoop. Use forceps or a scoop to remove enough sample to fill about one-third to one-half of the crucible's capacity. Compare the subsample to the rest of the sample to ensure that the subsample is representative of the entire sample.

6.4.9 Weigh the subsampled portion in the crucible prior to ashing and record as subsample dry weight.

6.4.10 Ash each component in a crucible in the muffle furnace at 550 degrees C for at least one hour. Use crucible tongs to add and remove crucibles to and from the furnace.

6.4.11 Cool each litterfall component on a silicone mat.

6.4.12 Weigh each component and record as ashed weight.

6.5 Subsampling and Processing Large Litterfall Samples

6.5.1 Remove the litterfall from the screen using a whisk and dustpan or forceps. Empty the screen contents onto a tray or tub to avoid losing the sample.

6.5.2 Place the litterfall sample in a paper bag labeled with the study name, site identifier, litterfall trap station identifier, sample collection date, and variable ("litterfall").

6.5.3 Dry the entire litterfall sample in a paper bag in the drying oven at 55 degrees C for at least 96 hours. Use an oven thermometer to check the temperature.

6.5.4 Cool the litterfall sample.

6.5.5 Weigh the entire sample on a calibrated scale using a weighing dish or other container to hold the sample. Record as total sample dry weight (see Subsampled Litterfall Sample Processing Form in Section 11.0).

6.5.6 To subsample, thoroughly mix the sample in a large container or tub with a scoop. Use a scoop to remove enough sample that is reasonable to sort within one to two days. Compare the subsample to the rest of the sample to ensure that the subsample is representative of the entire sample.

6.5.7 Weigh the subsampled portion and record as total subsampled dry weight.

6.5.8 Log the sample onto a lab datasheet (see Litterfall Sorting Form in Section 11.0).

6.5.9 Sort the subsampled litterfall sample into deciduous leaves, coniferous needles, woody material (twigs, branches, bark, cones, etc.), and miscellaneous (bud scales, etc.) components on the counting tray using forceps and teasing needles. Different size sieves may be helpful in sorting the components.

6.5.10 Place each component in a paper bag labeled with the study name, site identifier, litterfall trap station identifier, sample collection date, variable ("litterfall"), and component (e.g. "coniferous").

6.5.11 Dry each component in the paper bag in the drying oven at 55 degrees C for at least 96 hours. Use an oven thermometer to check the oven temperature.

6.5.12 Cool each litterfall component in a dry plastic Ziploc bag or equivalent with a silica drying agent (A. Foster, USFS, personal communication). Label the bag with the study name, site identifier, litterfall trap station identifier, sample collection date, variable ("litterfall"), and component (e.g. "coniferous"). Store the sample in the plastic bag until the sample is weighed and ashed.

6.5.13 Weigh the sample on a calibrated scale using a crucible, weighing dish, or other container to hold the sample. Record as component dry weight (see Subsampled Litterfall Sample Processing Form in Section 11.0).

6.5.14 If the sample is larger than about one-third to one-half of the capacity of the crucible, it is necessary to subsample the sample before ashing. To subsample, thoroughly mix the sample in a large container or tub with a scoop. Use forceps or a scoop to remove enough sample to fill about one-third to one-half of the crucible's capacity. Compare the subsample to the rest of the sample to ensure that the subsample is representative of the sample.

6.5.15 Weigh the subsampled portion in the crucible prior to ashing and record as component subsample dry weight.

6.5.16 Ash each component in a crucible in the muffle furnace at 550 degrees C for at least one hour. Use crucible tongs to add and remove crucibles to and from the furnace.

6.5.17 Cool each litterfall component on a silicone mat.

6.5.18 Weigh each component and record as component ashed weight.

6.6 Sample Processing for Stable N and C Isotope Analysis

6.6.1 Thoroughly mix the litterfall sample and remove two to three milligrams dry weight of sample from the total sample. Record the weight removed (see Litterfall Sorting Form in Section 11.0).

6.6.2 Wrap the sample with aluminum foil and bag the sample in a plastic bag (B. Bilby, Weyerhaeuser Company, personal communication).

6.6.3 Label the plastic bags with the study name, site identifier, sample collection date, and variable ("litterfall").

6.6.4 Freeze the samples and ship to the sample processor.

6.6.5 Litterfall samples not used in the stable isotope analysis should be processed according to the procedures outlined in Sections 6.4 or 6.5.

6.7 Sample Analysis

6.7.1 Standardize the sampling area to grams of litterfall per square meter (Grady 2001).

6.7.2 Summarize data as annual means or totals.

7.0 Records Management

7.1 Enter data into an Access database.

8.0 Quality Control and Quality Assurance

8.1 Ensure that datasheets are completely filled out in the field.

8.2 Ensure that sample collection bags are closed and correctly labeled.

8.3 Ensure that all paper bags, plastic bags, and crucibles used in sample processing are correctly labeled.

8.4 Check all data entered into the database for accuracy and completeness.

9.0 Safety

9.1 File a field work plan before commencing field activities.

9.2 Use a CB radio to communicate with other traffic on one-way logging roads.

9.3 Learn how to deal with animals and people encountered in remote areas.

10.0 References

10.1 Grady, Jr., J. 2001. Effects of Buffer Width on Organic Matter Input to Headwater Streams in the Western Cascade Mountains of Washington State. M.S. Thesis, University of Washington, Seattle, WA. 46 pp.