

# **FIELD TECHNICIAN PROCEDURE MANUAL**

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**LTERR Program**

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## Routine Sampling Protocol

### A) Soil Lysimeters



#### 1) Description:

Lysimeters are instruments that sample aqueous "soil solution" from below ground. We have porous-cup tension lysimeters installed at various depths on the Gradient and Riparian Project study sites. These samplers consist of a PVC pipe, usually 3.81 cm diameter (1.5 inches) x 1.0 m long, with a porous ceramic cup (1 bar bubble pressure = 0.1 MPa) cemented to one end and a rubber stopper with two holes for tubing inserted in the other end. Glass tubing extends through the stopper where 0.48 cm inside diameter (3/16 inches) Tygon tubing with plastic closure clamps attaches at the top of the instrument and the same size Tygon tubing extends inside the instrument from one of the glass tubes to the bottom of the porous cup. This extended tube delivers the sample. The other tube attaches to the pump for pressurizing and evacuating the lysimeter and also for creating a vacuum once the sample has been collected. The base of the extraction tube where it enters the rubber stopper is wrapped by colored tape to distinguish it from the pumping tube. When not being sampled, the open ends of the extraction and pumping tubes are connected by glass tubing to prevent contamination of the tubes from soil, insects, fungal growth, etc.

## **2) Gradient Project (Watershed 18 and 27) Lysimeters:**

Lysimeters on the five Gradient plots are installed at 5 random locations along the walkways at two separate soil horizons (5 plots x 5 locations x 2 depths = 50 samplers total). Shallow (AB) horizon samplers are installed at 15 cm depth with an overall length of about 30 cm. Deep (BC) horizon samplers are installed at various depths (average ~80 cm) depending on horizon and have an overall length of about 100 cm. Gradient lysimeters are scheduled to be sampled weekly by the field technician and to be composited and analyzed monthly by the Wet Lab personnel. Water in the lysimeters can freeze, preventing its extraction. Lysimeters should only be sampled when the lysimeters at all plots are not frozen. If you suspect that you may not be able to sample due to frozen lysimeters, start at site 527 because the lysimeters there freeze first. During the winter months (December - March), at least one sample must be collected.

## **3) Riparian Project (Watershed 56) Lysimeters:**

Riparian study lysimeters are located on two transects (control and treatment) at three distances upslope from the stream bank (along walkways) with four replicates at two depths (2 transects x 3 walkways x 4 locations x 2 depths = 48 samplers total). Shallow (AB) horizon samplers are installed at 20-25 cm depth, and deep (BC) horizon samples are installed at 45-50 cm depth. Following Hurricane Opal in October 1995, the third distance upslope lysimeters on the control plot were taken out, leaving two sets of four replicates. Riparian lysimeters are scheduled to be sampled weekly by the field technician and to be composited monthly by the Wet Lab personnel. Beginning with the 1999-2000 dormant season (November through April), the riparian lysimeter collection is discontinued each year for the dormant season.

As of 06 November 2000, analyses of dissolved organic carbon (DOC) on lysimeter samples for the riparian were discontinued. Prior to that, lysimeter samples were collected earlier in the week to allow Wet Lab personnel to subsample DOC on the following day. Monthly DOC subsamples were taken to

the Chemical Analysis Lab in Athens, GA for analysis. DOC samples were to be kept cold at all times during storage and transport.

In addition to lysimeters, three "grab samples" are taken weekly from Watershed 56. The first one is taken slightly downstream from the Coshocton sampler (upstream from the control plot), the second is taken between the control plot and the treatment plot and the third grab sample is taken downstream from the treatment plot bridge. All locations are marked with a long piece of flagging hung from vegetation overhanging the stream. Label the bottle with date and location, remove cap, invert and submerge into water column, turn bottle upright to fill and replace cap. At periods of moderate low water flow, it is necessary to capture the sample by placing part of the bottle in a flowing part of the stream. At periods of extreme low water level, samples can be collected using a 60cc syringe.

Lysimeters should only be sampled when all plots are not frozen. If you suspect some of the lysimeters may be frozen, start with the control plot because the lysimeters freeze first here.

#### **4) Lysimeter Sampling Equipment:**

- a) Vacuum hand pump
- b) Sample bottle holder
- c) Field notebook
- d) Sharpie marker and pencil
- e) Pocket knife
- f) Spare tubing, clamps, and stopper assemblies
- g) Adhesive sealant
- h) 250 ml poly sample bottles (clean, with label)
- i) Crates, backpack or plastic bags for bottles

### 5) Lysimeter Sampling Procedure:

- a) Label sample bottles using P-Touch PC Labeling System. Put the sample bottles for each site (gradient study) or each level (riparian study) in a separate bag.
- b) Locate flag stake next to lysimeter to determine sample identification (ID).
- c) Find correct pre-labeled bottle.
- d) Release clamp on extraction tube. A sucking sound from residual vacuum should be obvious. Sometimes the tubing remains pinched even after the clamp is released and must be manipulated so that the tubing is open. If there is no release of vacuum, make note "NT" (no tension) in field notebook. This often, but not always, indicates a malfunctioning instrument if it occurs repeatedly.
- e) Put sample bottle in bottle holder and hang over sampler; take care to avoid contamination of sample from a variety of sources (soil, precipitation, arthropods, etc.)
- f) Remove any dirt from end of extraction tube and insert in bottle.
- g) Release clamp on pumping tube, firmly insert pump exhaust tube, and begin pumping to pressurize sampler and force sample into bottle.
- h) When all sample has been delivered (if there is more than a bottle of soil solution, pump the rest onto the ground), immediately cap bottle.
- i) Repair any parts as necessary. The tubing needs to be periodically replaced because of fungal/bacterial growth inside the tubing.
- j) Clamp off extraction tube.
- k) Switch pump tube from exhaust port to intake port (brass fitting opposite gauge.)
- l) Evacuate to ~30 centibars soil suction as shown on gauge.
- m) Clamp off pump tube and remove from pump. Connect the extraction and pumping tubes with the glass tubing.

n) After all samples are taken, label crates (with Wet Lab sample forms), record amount of sample collected in each bottle (trace, 1/4, 1/3, 1/2, 2/3, 3/4, or full) and store in appropriate refrigerator in Wet Lab.

o) For the riparian study, the amount in each sample bottle needs to be entered in the "riplys.xls" file.

#### **6) Lysimeter Trouble-shooting:**

A recurring loss of tension usually means that an instrument is malfunctioning.

During very dry conditions, a lysimeter may lose tension due to air intake through the porous cup. If, during normal precipitation periods, a lysimeter loses tension, adding sealant around the stopper assembly and PVC tubing usually corrects the problem. If it does not, the lysimeter must be removed and replaced. If the lysimeter is solid in the ground, the same hole can be used for the new lysimeter.

To replace a lysimeter in the same hole, take ~ 1 liter of deionized water and pour into the hole. Push the new lysimeter firmly into the hole, pushing the water up around it. This "seals" the lysimeter in the ground. Evacuate the lysimeter to ~30 centibars soil suction as usual. Do not use the sample the following week; it will be diluted due to the deionized water. If a "dry hole" seems to be the problem, or the lysimeter is very loose in the ground, the lysimeter will have to be re-installed in a proximal location and depth. This is done by drilling a new hole with a hand auger. The dirt taken out of the hole is sieved through a 2mm soil sieve. Add deionized water to the sieved soil and mix into a slurry. Pour the slurry into the hole and push the lysimeter firmly into the hole. This "seals" the lysimeter in the ground. Evacuate lysimeter to ~30 centibars soil suction as usual. Do not use the sample the following week; it will be diluted due to the deionized water. If a normally producing lysimeter retains tension but does not deliver a sample, the extraction tube may be separated from the glass tube inside the lysimeter. To check this, the stopper assembly must be removed. Reconnect the tubing, rinse off the tubing with deionized water and replace stopper assembly. Pump any water from lysimeter and evacuate lysimeter to ~30 centibars soil suction as

usual. If this problem is not detected in two to three weeks, lysimeter will have to be removed and replaced due to chemical build up in tube. If the sample delivers slowly, the rubber stopper can be removed and the length of the extraction tube can be shortened inside to avoid blockage and collapse. Adhesive seal can be carefully cut through with a pocket knife to remove stopper. Clamps, tubes, and complete stopper assemblies can be replaced in the field. Repair of stopper assemblies and cup seals must be done in the lab. Instrument malfunctions are most common during freezing and drought conditions, which can also prevent sampling.

### **C) Streambed Wells**



#### **1) Description:**

Wells are located between the streambed and lysimeters on Riparian Control and Treatment transects to sample the zone of saturation linking stream and hillslope. These wells consist of a stainless steel pipe outer casing and an acrylic tube insert with sieve holes and screen installed to the depth of saturation. There are two "mini-transects" (A&B) of three wells each (1, 2, 3) on each transect (C&T) for a total of 12 Riparian wells. At the time of this manual rewrite, only wells CW3A and CW3B are functional on the riparian control site. Depth measurements are taken weekly during the growing season (May through October) concurrent with lysimeter sampling, and samples taken biweekly. During the dormant season (November through April) depth measurements are

taken biweekly concurrent with the riparian TDR measurements. Samples are not taken during the dormant season.

**2) Sampling Equipment:**

- a) 12, 250 ml sample bottles
- b) 60 cc plastic syringe with tubing and stopper
- c) 0.635 cm x 1.83 m (1/4 inch x 6 foot) steel welding rod
- d) 1 liter deionized water
- e) Wash bottle
- f) Meter stick
- g) Field notebook

**3) Weekly Measurement Procedure:**

- a) Measure and record distance to ground from top of acrylic tube.
- b) Slowly insert steel rod into tube until it hits bottom.
- c) Slowly remove rod and measure wetted distance from bottom.
- d) Repeat twice and record depth measurement.
- e) The depth and distance from top of tube to the ground measurements need to be entered in the "ripwel.xls" file.

**4) Bi-weekly Sampling Procedure:**

- a) After taking depth readings, clean inside and outside of tube and syringe with deionized water. Then evacuate all wells with syringe/tube assembly.
  - b) Repeat until well is empty or repeat 3 times on upper (3) wells that recharge quickly. Wait about 15 minutes for recharge.
  - c) Thoroughly rinse syringe/tube with DI water.
  - d) Evacuate all water from well into appropriately labeled bottle. Some wells (upper) refill immediately. Repeat evacuation 3 times for these streamwells.
  - e) Thoroughly rinse syringe/tube with DI water between each streamwell.
- The water in some wells contains sediment, which can clog the syringe and prevent sampling. If this occurs, try pulling the plunger of the syringe slowly so as not to suck up excessive sediment. Also, try inserting the tubing so that there is a

small gap between the bottom of the well and the end of the tubing. Most sediment collects at the bottom of the well. A depth measurement of "0" indicates that the well is either clogged or above the current water table. When this occurred at the beginning of the experiment, the acrylic tube was removed and the depth measured. If the rod still read dry, a depth of "0" was recorded. If a substantial (1 cm) length of the rod was wet, this depth was recorded, the screen thoroughly rinsed with DI, the tube replaced, and the depth remeasured in 10 minutes. At the time of this manual rewrite, if the depth measurement is "0", that is recorded and the acrylic tube is not removed, and only wells CW3A and CW3B are functional on the riparian control site. Streamwell samples are taken to the refrigerator in the Wet Lab where they are composited and analyzed.

## D) Microclimate Stations



### 1) Description:

a) IF POWER SUPPLY POLARITY IS REVERSED, CR10 COULD BE CRITICALLY DAMAGED. IF POWER SUPPLY TO CR10 IS INTERRUPTED, DATA, PROGRAMMING, AND CLOCK WILL BE ERASED FROM MEMORY! CR10 dataloggers are powered only from an external 12-volt source. Initially

eight alkaline "C" cells were used, but have been replaced with rechargeable "gel cells", which are trickle-charged by solar modules. This avoids having to change out depleted batteries, which can lead to interruption of power supply.

b) ALWAYS download data BEFORE doing ANYTHING else with datalogger!

Certain commands, including changing program and resetting clock, can erase memory, which is not a problem once data are saved.

c) NEVER let datalogger run too long between downloads. CR10's incorporate a "ring memory" which, when full, automatically overwrites the oldest data. How long the memory takes to fill up varies depending on programming instructions, but dataloggers should be downloaded at least bi-weekly in case a problem has occurred.

d) If downloading of microclimate dataloggers occur at the scheduled biweekly time, one storage module is enough to download all dataloggers. If it has been longer than 21 days, carry at least two storage modules (SM) with cleared data area and memory set to "fill and stop". Insufficient memory in data area will cause incomplete download with fill and stop switch on, and overwriting of new data with fill and stop switch off. A second (or third) storage module can complete sampling when the initial SM becomes full. Avoid splitting data from one station between SM's.

## **2) Sampling Equipment:**

a) Keypad, storage module(s), 2 9-pin cables, soil thermometer, precision screwdrivers, laminated instruction sheet, hard copy of program

b) 10 fresh desiccant packs

c) Ziplock bag with fresh bulk desiccant and ziplock bag for old desiccant

d) Field notebook and pencil

### 3) Sampling Procedure:

- a) Open door to fiberglass enclosure and remove depleted desiccant packs.
- b) Take keypad, storage module, 9-pin cable with 2 9-pin connectors from case; connect cable to CR10, keypad, and storage module.
- c) Keypad display should illuminate with disjunct characters.
- d) Key in \*5, current datalogger time is displayed; record this in the field notebook. Datalogger time is always maintained as Eastern Standard Time with NO observation of Daylight Savings Time. Press A (advance), current datalogger year is displayed. Press A, datalogger Julian date is displayed; record this in the field notebook. Always check the accuracy of time and date; if inaccurate, note in field notebook, proceed with downloading of data and correct after downloading is complete.
- e) Key in \*8; followed by 7 and the address of the storage module; press A.
- f) Display shows memory location at last download (data startdump point); Record this number in field notebook.
- g) Press A to show current memory location (enddump point); Record this number in field notebook.
- h) Advance to display field of "0.000"; enter any number, then A. This will start the downloading process. The display should indicate blocks of data being transferred from start to end points. The numbers should be moving rapidly. If they are moving slowly, you may have forgotten to enter the SM # at the beginning of the \*8 sequence. In this case, the data will not be transferred to the storage module. This can be remedied by redoing the \*8 sequence, remembering to enter the SM #. Enter the startdump and enddump numbers that were recorded in the notebook for channels 2 and 3. Advance to channel 4, enter any number, advance to being downloading data.
- i) Enter \*6 to view data from most recent scan. The data will be displayed as programmed. (At the time of this manual rewrite, the gradient dataloggers are running GRD0399. The measurements to be recorded in the field book include

battery voltage, temperature through 10TCRT, air temperature sensor, soil temperature at 5, 20, and 50cm depths, respectively, and the four soil reflectometer measurements. The riparian dataloggers are running program RIP498. The measurement to be recorded in fieldbook is battery voltage.)

j) Enter \*0 to resume logging; display should read "LOG[program tables]".

k) Disconnect keypad and SM from CR10.

l) Put fresh desiccant packs in housing; unscrew container with bulk desiccant, pour old desiccant into empty ziplock bag, refill container with fresh desiccant and screw back into position; check gasket on door (clean and lubricate if necessary) be sure door is closed and latched tightly.

m) Make Quality Assurance/Quality Control measurements; record values to right-hand page of field notebook, beginning with Max/Min thermometer readings; record maximum and minimum temperature to the nearest 0.5 °C at the bottom of blue index markers, current temperature at mercury level; reset max/min indices using attached magnet to drag markers down to mercury.

n) Take soil thermometer from case and insert into soil near thermocouple ~7 cm deep to measure soil temperature at 5 cm (from center of 5 cm sensitivity length at tip); thermometer may take several minutes to stabilize at correct value; repeat for 20 cm value, inserting ~22 cm into soil (almost all the way). Record to nearest 0.5 °C.

#### **4) Data Retrieval Procedure**

Data are retrieved from storage module to PC via SC532 Interface, using "PC208W" datalogger support software. This program allows interfacing with the storage module or datalogger, writing and compiling datalogger programs, and data processing.

a) Connect SM, SC532, and PC (serial port); be sure Interface has AC power.

Open the Storage Module Software (SMS) application from shortcut screen.

b) From Setup "card", select COM1 and Baud Rate 19200; from Data "card" select Comma Delineated file format and Auto Increment Name. Double click on

file name under File Naming Options, enter the file name as day and month (ex. 08Mar) and program will automatically give each file a number, beginning with 000 in the order that it was downloaded from the CR10 to the storage module; click OK.

c) Select Get New to initiate data retrieval. The files will be stored as .dat files.

d) View the files in Excel to verify the data has been retrieved from the CR10 and storage module correctly. For the Gradient data, graph average air temperature with average soil temperature at 5, 20, and 50 cm to verify a consistency of data/measurements. Compare maximum and minimum air temperature from datalogger to those recorded from the min/max thermometer. Check relative humidity and battery voltage for problems. For the Riparian data, graph each set of soil temperature data to see if any thermocouple sensors have been dislodged; check battery voltage and relative humidity.

e) Rename the file in the PC208W screen according to date and site number.

Example: data from March 8, 2001 site 118 would be 08Mar000.dat in the PC208W screen if 118 was the first site to be downloaded to the storage module; rename to 03-08-01.118

f) Transfer files as ascii files to appropriate directory in sparc account at UGA using WS\_FTP LE program.

g) Go to ONLINE data sets, then ONGOING RESEARCH, choose Terrestrial or Riparian. Choose hourly data and run through steps in Check file to convert to online format (password protected).

h) Append to Coweeta, Data Sets, Ongoing Research website:

Telnet sparc.ecology.uga.edu

User: \*\*\*\*\*

Password: \*\*\*\*\*

type: gradient OR riparian

type: update

## E) TDR Soil Moisture Measurements



**\*\*\* Use of instrument and interpretation of waveforms requires training \*\*\***

### 1) Description:

Time-Domain Reflectometry (TDR) is a technology that was initially developed to allow service personnel to locate damage in buried communication cables. A microwave signal is applied to the coaxial cable and reflected by discontinuities (breaks or shorts) in the cable back to the source, where a video display converts the time delay to distance and graphs a profile of the cable. The apparent distance to the point of damage can be measured and service personnel instructed where to dig. It was found that the apparent distance to the cable break varied from the actual distance depending on the dielectric constant of the surrounding soil, which is directly proportional to soil moisture content.

Soil scientists began using TDR technology in reverse, employing wave guides (broken cables) of known length to deduce soil moisture via several polynomial equations. These wave guides are generally constructed from stainless steel welding rods, which once installed, can be left in place indefinitely. This allows for precise, repetitive, safe, and relatively non-destructive soil moisture measurement at almost any sampling frequency. There are now instruments on the market designed specifically for soil moisture measurement, e.g. Campbell

Scientific CS615 Water Content Reflectometer and Soilmoisture Equipment Corporation (SEC) Trase instrument, which employ automated waveform interpretation, etc. The interpretation of the Tektronix Corporation 1502 series instruments, which were designed for cable testing, requires a certain amount of operator training to minimize subjectivity and maximize comparability of measurements taken by different operators.

**\*\*\* Use of instrument and interpretation of waveforms requires training \*\*\***

## **2) Project Specific Notes:**

There are several methods for the construction and installation of wave guides. Some studies, riparian transect, employ vertically oriented rod pairs, 5 cm apart, to which test leads are attached directly. This method integrates soil moisture content from soil surface to the lower depth of the rods. Before Campbell Scientific CS615 Water Content Reflectometers were installed at the terrestrial gradient plots, TDR rods were oriented parallel to soil horizon and connected to coaxial cable extending above ground. This method, which allowed measurement of discrete soil horizons, required more intensive installation procedures and detailed waveform interpretation. Currently, soil moisture measurements utilizing the TDR technique are made bi-weekly on the Riparian project. Each of the terrestrial gradient plots have four Campbell Scientific CS615 Water Content Reflectometers wired into the datalogger. The reflectometers are installed in sets of two, one set at the top of the plot and one set at the bottom of the plot. Each set is installed with one buried to measure from 30-60cm and one to measure from 0-30cm.

## **3) Sampling Equipment Tektronix 1502 Cable Tester:**

- a) Tektronix 1502 Cable Tester with charged battery pack
- b) Spare battery pack
- c) Coax to twin-lead test cable with balun Test cable construction from Tektronic to TDR rod or buried cable:
  - (1) In-line surge surpressor

(2) RF cable assembly 6 ft., RG-59 BNC, 75 ohm coaxial cable with BNC connectors for general-purpose communications and test instrument applications

(3) TV/RF adapter Adapts male BNC to fit female F-type jack

(4) Indoor/Outdoor matching transformer 75 ohm coax/300 ohm twin lead for connecting 75 ohm downlead to 300 ohm antenna

(5) Two alligator clips

d) Pack with spare test cable and parts

e) Field notebook and pencil

#### **4) Sampling Procedure:**

a) Pull on Power button on lower right hand side of instrument panel.

b) Be certain Vp is set at .99c (2 knobs to left of power button full clockwise).

c) Set distance to meters in setup menu.

d) Noise Filter should be one setting clockwise from "HORIZ".

e) Dist/Div setting should be ~0.5 m.

f) Connect test cable to instrument panel.

g) Move cursor ("<> position" knob) to the right until end-of-cable inflection is on left side of screen.

h) Set zero at end of cable(s); determine end of test cable by shorting lead by touching alligator clips together; when measuring horizontally installed waveguides with buried cable, attach one clip to inner lead of coaxial connector and the other to outer (shielding) lead, determine end of buried cable by change in waveform. Place cursor at end of cable(s) point; turn Noise filter knob one notch clockwise; distance display should now read "0.00m".

i) Attach clips to TDR rods for vertically installed rods.

j) Move cursor to endpoint inflection determined by observing change in waveforms.

k) Read and record apparent distance.

l) Continue with measurements; machine must be reset if turned off.

m) Turn instrument off when driving between sites.

n) Plug in for recharge when finished.

o) For the riparian study, the TDR values need to be entered in the "riptdr.xcl" file.

Data from the TDR measurements are converted to dielectric constant from the square of apparent length divided by actual length of waveguide, then to percent soil moisture via a polynomial equation:

$$\% \text{ H}_2\text{O} = [-5.3 \times 10^{-2}] + [(2.92 \times 10^{-2}) (D)] - [(5.5 \times 10^{-4})(De^2)] + [(4.3 \times 10^{-6})(De^3)]$$

where: D = dielectric constant  
e = exponent

## F) Dendrometer Tree Bands



### 1) Description:

Dendrometers are spring-loaded bands of 1.27 cm (0.5 inch) wide aluminum tape that measure the increase (and decrease) in circumference of trees on which they are permanently installed. The bands have two scales, inches and vernier, which slide past one another to allow measurement of trunk circumference change to the nearest 0.0254 cm (0.01 inch).

## **2) Project Specific Notes:**

Trees with dendrometer bands (or D-bands) are located on the Gap and Gradient study plots. Currently, gradient plots have 15 banded trees on each 20 x 40 m gradient plot. Gap plot trees are located around the gapmaker trees and vary in number. Gap Control trees are dispersed throughout the two study areas outside of proposed gap-affected plots. Gradient trees are marked with pink flagging and are relatively easy to locate, since they are close to walkways. Gap trees were initially marked with red and/or blue flagging, most of which is still remaining. Location of these trees require use of a map in original field book and/or help from someone who knows the tree locations.

## **3) Sampling Equipment:**

- a) Field notebook
- b) Pencil
- c) Replacement flagging

## **4) Sampling Procedure:**

a) To make a dendrometer reading, look closely at the two overlapping scales. The top (rear) scale is divided into 1/10 inch graduations, with a bold hash mark every 0.5 inches. The bottom (front) scale has 11 marks, 0 through 9 to 0, and is the vernier scale, which resolves to 1/100 inch. Carefully read to the tenths place on the top scale at the first 0 on the vernier. Then locate the graduation on the vernier scale that matches up with a hash mark on the top scale. The vernier number is the value for the hundredths place. For example, if the zero mark on the vernier scale is located between 1.7 and 1.8 on the inches scale, and mark number 4 on the vernier scale lines up with a number on the inches scale (exactly which number is unimportant), then the reading is 1.74 inches. Record this value for the appropriate tree ID in the field notebook. Tree ID's are engraved into the band to the right of the measurement scales. Gap tree ID's consist of: plot name, species code, serial number for species. Gradient tree ID's include

only an arbitrary identification number, for which information is located in the main database.

Data files should be entered in Excel using template on Dendrometer Band

Template floppy disk and transferred to appropriate directory on sparcs account at UGA using WS\_FTP LE program.

## G) Leaf Litter Screens



### 1) Description:

Canopy leaves and other litterfall inputs to the forest floor are sampled by litterfall traps, which are installed on study plots and the sample collected at regular intervals. Our litter traps are 0.85 m<sup>2</sup> and are constructed of 2.54 x 15.24 cm (1 x 6 inch) lumber, with insect screen covering the bottom side and beveled edges or sheet metal defining the sample area on top. Traps are usually secured with 2.54 x 5.08 cm (1 x 2 inch) stakes holding the sample area level to earth. Samples are collected at varying intervals depending on season: monthly for winter through summer, bi-weekly during fall, and occasionally weekly during the heaviest litter pulse.

### 2) Sampling Equipment:

- a) Brush and dustpan.
- b) Labeled paper sacks ("elephant" or "stone" grade) that are medium size.
- c) Plier style stapler and extra staples for bags.

d) Staple gun and extra staples for littertrap repair.

### **3) Sampling Procedure:**

a) Bags are pre-labeled with study site, sample type, trap#, and date of collection using P-TOUCH PC labeling system.

b) Samples are collected by putting all litter from traps into the appropriately labeled bag using a small brush and dustpan; Riparian samples are then transferred to the Ecology Annex c/o Dr. Dave Coleman.

c) Gradient study sites have 10 traps each, labeled A-J, located along walkways. Gradient Canopy sites had 6 traps each, labeled 1-6, located under canopy walkways, but this collection was discontinued in 1999.

d) Riparian study sites originally had 5 traps each located at 5m intervals upslope from the stream, and labeled with transect coordinates (e.g. C15-LF); following Hurricane Opal in 1995, only 2 litterfall traps were left on the Control plot.

e) Riparian study sites also included "blowthrough" traps, which sampled downslope litter movement, and resembled small soccer goals. Blowthrough traps were sampled similarly to litterfall by untying mesh and collecting from the rear (downslope) all of the litter that has accumulated behind front opening. Blowthrough traps were labeled similar to litterfall, but with the BT suffix (e.g. C15-BT); following Hurricane Opal in 1995, only 1 blowthrough trap was left on the Control plot. This collection was discontinued in the fall of 2000.

f) Riparian study also included fine particulate organic matter (FPOM) traps which sampled movement of fine organic litter and soil downslope at the soil surface. The FPOM traps were small green plastic garbage cans located just upslope from the stream. There were 3 FPOM traps in the treatment plot and 2, following Hurricane Opal, in the control plot. FPOM samples were placed in plastic ziplock bags. This collection was discontinued in the fall of 2000.

g) Fine Woody Debris (FWD) is collected from the gradient litter traps and from 10 additional traps located at each plot. This includes woody debris less than 1" diameter. The fine woody debris is not necessarily collected on the same day as

the gradient leaf litter. In this case, the FWD is separated out in the gradient leaf litter trap and left until all of the fine woody debris is to be collected.

h) At the riparian site, woody debris should be broken into small pieces and placed in a separate bag; woody debris too big to be broken up should be carried out if possible; if not, it should be sawed into pieces small enough to remove from site. Litter that lies partly in and partly out of trap should be cut or broken along trap edge, with the part inside being sample and the part outside discarded near trap.

i) Litter should not be sampled when extremely wet, snow-covered, or frozen.

j) Litter traps that have been damaged or inundated with atypical debris should be repaired and reset (discard sample).

k) Fold and staple bags from individual traps for transport; put all samples from one study in single bag and label.