LIVE FUEL MOISTURE SAMPLING PROCEDURES

1. Site Selection

Sites are selected with interagency partners so that significantly different fuels and/or geographic variation are sampled. The intent is for area coverage to be obtained through interagency coordination and collection, to prevent duplication of efforts, and minimize travel.

A particular site should be representative of the live fuel complex of concern. The site should be relatively undisturbed, such as by heavy browsing or breakage of shrubs, unless that is highly representative of the fuel complex. The species collected should be the one that carries the fire or the one that is felt to be representative of all the species in a complex. If two species are a concern, they should perhaps both be sampled for the first or several years, to determine if the moisture cycle of one represents both. Because moisture cycles of deciduous leaved shrubs are very different from evergreen leaved shrubs, both in terms of timing of their seasonal moisture cycles and the actual variation in moisture content, both may need to be collected if well represented on site.

The site should be located near a RAWS station or in an area with weather well represented by a nearby automatic or manual weather station. Location of the site near a weather station allows for study of the long-term correlation of fuel moisture cycles to weather.

The collection site should be about 5 acres in size, and relatively homogeneous in terms of species composition, canopy cover, aspect, and slope steepness. It should be fairly easy to travel to, although collection should occur away from roadsides, streams, and ponds. If the shrub canopy makes walking difficult, a path can be cut to allow movement around the site. Clearance along the path should be the minimum necessary to allow access.

Site naming will be important to maintaining the identity of site and foliar moisture data. Include agency, administrative unit, and state names as well as the local name you choose for the sample area.

The site should be described the first year immediately following full greenup. If a site can be linked to other survey/monitoring areas in which vegetation has been characterized, it will simplify description of the area. Basic site information should be noted on the site description form attached. Information should include: GPS location (or latitude and longitude derived from maps), elevation, aspect, percent slope, percent species composition of dominant shrub or tree species, percent canopy cover of dominant species and average ratio of live to dead material in the species being collected. Note the percent coverage of surfaced vegetation type (annual or perennial herbaceous, or deciduous or evergreen woody plant) present and the percent cover of litter and bare mineral soil. An air photo reference should be obtained for the largest scale of coverage available. Note the distance and direction from the nearest RAWS or other representative weather station.

Taking 35mm photographs can enhance site documentation. Establish a photopoint by placing a permanent steel post at a location within the plot.

Photos should be taken at the time of site description preferably on a bright, overcast day to minimize shadows. Plot identification is important. Use a felt tip pen to write the plot name on a full sized sheet of paper and lay it on the ground. Carefully focus and photograph the plot name. This will identify the next series of photos as belonging to that plot. Photos should be taken of the general setting of the site, looking in the four cardinal directions, from your established photopoint post. Inclusion of a brightly colored, vertically placed meter stick or some other visible object will aid as a size reference for the vegetation. Photos looking downwards toward the fuels in four directions will also be useful for characterizing surface vegetation, litter, and the amount of exposed soil. In some types, both the general setting and vegetation character can be captured in the same frame, requiring only four photos. You may wish to take duplicate photos of each, one for your records and one to be sent to a central collection point. Process the film and label each slide with agency, administrative unit, site name and direction of view. The original copy of the form and slides should be maintained at your field office.

2. Timing and Number of Samples

Live fuel moistures should be sampled at least every two weeks. Weekly sampling may be desired through that portion of the season when live fuel moistures are rapidly changing. The starting and ending dates should be established for each state or geographic area. It is important that live fuel moisture is collected well before the fire season begins, and into the fall, if species trends are to be identified. It is best if sampling occurs throughout the entire growing season, recognizing that some evergreen leaved shrubs will not begin to show new growth until well after deciduous vegetation and grasses have begun to green up.

Samples should be collected between 1100 and 1600 hours. A specific site should be visited at about the same time of day, and at about the same day of the week each time it is sampled to maintain consistency. However, if the foliage is wet with dew, rain or snow, do not sample at all, but return as soon as possible once the area has dried.

Twenty samples of new foliage and 20 samples of old foliage (from twenty plants) should be collected each sampling period during the early part of the season. When there is no more than 5% difference, on average, in moisture content of new and old foliage, just collect twenty composite samples containing both. Sampling density the first year will probably be greater than in future years, because we need to learn how much variation there is among individual plants. Then we can estimate how many plants must be sampled to obtain a truly representative fuel moisture sample.

3. Equipment

A. **Containers**: Containers for fuel moisture samples should have tight-fitting lids and be rustproof, permanently numbered, and of a material that can be put directly into a drying oven. The best containers are drawn aluminum soil sample cans, or nalgene

plastic bottles that can tolerate high temperatures. Each has tight fitting lids that prevent evaporation.

“Zip-lock" or self-sealing bags made specifically for fuel moisture sampling are available from commercial forestry suppliers. These bags can be put directly into the oven, although care must be taken that the bags do not tip. These are the ONLY kind of plastic bag that are suitable because moisture can be lost through pores of most plastic materials and other bags may not be able to withstand oven-drying temperatures. Note these bags can only be used one time for sample collection.

Containers should be marked with sequential numbers. Numbers written with permanent marking pens will last about one field season. Numbers can be etched or stamped on metal containers. Each lid and each container pair should be marked with the same number, as container and lid weights may vary.

B. **Clippers**: Good quality pruning shears with two sharp curved blades are the most effective for clipping live fuels. Appropriate sampling for some vegetation types precludes clipping and foliage must be sampled by hand stripping leaves from stems.

C. **Tape**: The lids of metal cans are sealed by placing one strip of 1/2 inch wide drafting tape around the lid. Drafting tape can be easily removed from the container. Masking tape can be used but it frequently leaves a residue that is hard to remove. Cross sections of bicycle tire inner tubes can also be used to seal cans.

D. **Carrying case**: It is most convenient if a carrying case or backpack is used to carry samples and equipment. Insulated plastic coolers with a handle work well, and can keep samples from being heated on hot or sunny days. Between sampling periods, keep all sampling equipment and extra forms in the carrying case.

E. **Drying oven**: An electric, mechanical convection oven with a built-in fan is the best oven for drying fuel moisture samples. The fan circulates the heated air and ventilates the oven, drying fuels more uniformly and rapidly than a gravity convection oven. The oven must be able to maintain a regulated temperature of 80^{o} C and have adequate volume to allow air to circulate freely around the samples. We DO NOT recommend the use of Computrac moisture analyzers. These moisture devices can handle only one very small sample at a time and can require a relatively long time to obtain a moisture measure, preventing timely collection of the number of samples required to adequately characterize live fuel moisture.

F. **Scale**: A top loading electronic scale capable of accurately measuring to the nearest 0.1 gram is adequate. These scales allow rapid weighing and are inexpensive. Battery operated models for field use are available.

4. General Sampling Procedures

On arrival at the sampling site, place the sample carrying case in the shade, and prepare the Live Fuel Moisture data sheet. Record the site number or name, date, time of day, name of observer and note plant phenology.

Do not collect live fuels if water drops from rain or dew are present on leaves because the presence of free surface water will cause large errors in calculated moisture content. Shaking the sample to remove excess water or attempting to dry the sample in any way is ineffective. If the sample is wet with surface water, do not collect until later in the day when leaves have dried naturally or return to the site on another day.

Randomly locate a plant that has not been recently sampled and that is located at least several paces away from the last plant sampled. Your intent is to characterize the live fuel moisture content for your species of interest on the entire site.

Note each container number on the data sheet prior to collecting material for that container.

Place sample loosely in the container, do not compress. Cut long stems or large leaves into pieces because succulent plant material becomes fairly stiff as it dries and may force material out of the container as it dries in the oven.

Each sample should contain about 40 to 80 grams green weight of plant material from one plant. (Dried plant sample should weigh around 20 to 35 grams.) When sampling a vegetation type for which new growth is obviously different from mature, sample each into separate containers, noting on the data form whether the sample is new or old. Sample new and old as pairs from the same plant and enter them on the data sheet sequentially.

Collect from all sides of the plant and from different heights above the ground, but refrain from sampling deep within the interior of the plant because that foliage may represent senescent or ephemeral foliage. Do not collect diseased or damaged stems or leaves. DO NOT include flowers, fruits or dead twigs or leaves. However, if frost has killed living leaves or for some other reason the entire site has damaged leaves, then collect them and note the cause of damage on the data form.

When each container is full, seal it tightly. Check the numbers on lid and container to see they are the same. If aluminum cans are used, seal them with drafting tape or inner tube bands as you collect them.

If you collect samples in plastic bags, weigh these samples in the field as soon as you return to your vehicle. Record the weights and place sample-filled bags together in a larger plastic bag and close tightly. Moisture loss is less likely from sealed aluminum cans or bottles, so they can be weighed when you return to your office or field station. Transport immediately and do not leave samples for extended periods in a closed, heated vehicle.

5. Species Specific Collection Directions

The following directions are for guidance in selecting an appropriate sampling technique based on the type of plant you are collecting. A few plant names are listed as examples. Due to species differences from one region to another and the vast array of growth forms among plants, you may need to use your own judgment in which method is most appropriate. For example, bitterbrush (*Purshia tridentata*) is technically a deciduous-

leaved shrub, but its growth form is most like sagebrush, a "broadleaf" evergreen shrub with tiny leaves. Thus it is most appropriate to sample it in the same way sagebrush is sampled.

A. **Deciduous-leaved trees and shrubs:**

(1) Gambel oak, mountain shrubs, swamp cyrilla, honeycup, etc.:

All leaves are produced newly each year. Collection may begin as soon as leaves begin growing and should be continued until leaf drop. Collect only foliage. Collect one set of 20 samples representing 20 individual plants each sampling period.

(2) Broadleaf evergreen shrubs:

Begin collection prior to initiation of new growth and continue sampling throughout both prescribed burning and wildfire seasons. Sampling may continue year-round if that is appropriate to meeting your fire concerns.

(3) Sagebrush:

Two methods of collection have become established. Note the method chosen on the data form and continue with that method throughout the season and in subsequent years. The sample material you choose to collect will influence results from one sampling period to the next, and from one year to the next.

Technique used at Dinosaur National Monument. For shrubs on which leaves appear on relatively non-woody stems but the current year's growth is not easily distinguishable from the previous year's, collect by clipping both leaves and stems only to the point of stem transition from pliable and green to becoming brown and, lignified. Do not collect any stem material larger than 1/4 inch in diameter. This generally includes only the current year and the previous year's growth. Collect one set of 20 samples representing 20 individual plants each sampling period.

Technique established by the Great Basin Live Fuel Moisture Project. Collect FOLIAGE ONLY by hand stripping leaves from stems. Collect from the outer portion of the plant avoiding reproductive stalks and leaves on old growth material. Collect one set of 20 samples representing 20 individual plants.

(4) California chaparral: chamise-like shrubs:

For shrubs on which leaves appear on relatively non-woody stems, but current years growth is easily distinguishable from previous years, collect both leaves and stem by clipping. Collect 20 samples each of new growth and mature foliage/stem until new growth cannot be distinguished from old in the field or until new and mature moistures are within 5% of each other. Collect one new and one mature sample for each plant and enter as pairs on the data form so identity of the samples as a pair from one plant can be maintained. Later in the season, when new and mature growth are similar, collect 20 samples of the combined foliage/stems.

(5) Arizona oakbrush (Turbinella oak), ceonothus, gallberry, fetterbrush, etc.:

New leaves on these plants appear on new shoots each year that lignify by the end of the season. Mature leaves reside on woody stems. Collect foliage only. Do not clip and collect stems. Collect 20 samples each of new foliage and mature foliage until new foliage cannot be distinguished from old in the field or until foliar moistures are within 5% of each other. Collect one new and one mature foliage sample for each plant and enter as pairs on the data form so identity of the samples as a pair from one plant can be maintained. Later in the season, when new and mature foliage are similar, collect 20 samples of the combined foliage.

B. **Needle-leaved evergreens:**

Prior to onset on new spring growth, collect 20 samples of previous years' growth. Do not include swelling bud in sample. Begin collecting new foliage samples as well once the bud scale covering is lost. Then, collect 20 samples each new and mature growth, one pair per plant, separating current year's growth from that of previous years' throughout the season as these moistures will tend to remain distinguishable. Maintain samples as pairs on the data form. Collect foliage only of long-needled species. Do not collect foliage that dates back more than 2 growing seasons. Short-needled species can be collected either as foliage-only samples or by clipping foliage and foliage covered twigs less than 1/8 inch in diameter, separating current year's growth, once bud scale is lost from new needle growth, from previous years'. Do not collect growth from more than a few years past. It is critical to note on the sample form whether or not twig material is included and it is equally critical that the same method be maintained throughout the season as twig moistures can vary greatly from foliage. Sampling foliage only is preferred.

6. Weighing and Drying

In order to calculate moisture content, you must know the tare (empty) weight of each container. Aluminum and nalgene containers, with their lids, should be weighed and the weight recorded. Reweigh the containers after about every 5 uses. The weight of plastic bags must be determined before sampling as fragments of sample will cling to the inside of the bag after use, changing the weight. Do not attempt to reuse the bags. Fuel moisture sampling bags tend to be quite uniform in weight. Weigh several new empty bags. If the weights are very close, you can use an average weight as the tare. Tare weights can be written on the bag with a permanent marker. Recheck this average weight with each new purchase of bags.

Preheat the drying oven to 80^{o} C. Though water boils at 100^{o} C, studies have shown that moisture is totally removed from plant material at this lower temperature. The lower temperature also limits weight loss do to degradation of other substances in the plant. Samples collected in self-sealing bags and weighed in the field can be opened and placed upright in the oven. Samples collected in cans or bottles must be weighed before drying. Remove any tape or bands from the container. Place the container on the center of the scale platform and record the 'wet" weight to the nearest 0.1 gram. Check to see that the number on the container matches the number on the lid, and if collecting more

than one species, that the species in the container matches that noted on the Live Fuel Moisture data sheet.

Remove the lids from containers and place containers in the drying oven. If the lid fits on the base of the container, place it beneath it in the drying oven. Or, place all lids in sequential order in a convenient place so you can easily replace the matching lid when you remove the dried sample from the oven. Space the containers evenly in the oven so that air can circulate freely around them. Record the date and time that the samples were put into the oven.

Dry the samples for 24 hours at 80^{o} C. Do not put additional samples into the oven while drying a set of samples. If you do, the original samples will absorb moisture from the new samples and the entire set must be dried an additional 24 hours.

When you are to remove the samples from the oven, take a few samples from the oven and quickly replace each lid as the container is removed. If using fuel moisture bags, reseal the bag. Do not leave the oven door open for a long time, particularly if the humidity is high, because the samples can quickly absorb moisture from the air. If any sample material falls from a particular container as you remove it from the oven, throw that sample away, unless you are sure exactly what fell and can replace all of it into the container.

Weigh the sample with its lid on as soon as possible after removing it from the drying oven, and record the dry weight to the nearest 0.1 gram. Check the container number and its contents before you record the weight on the data sheet. After each dried sample is weighed and checked, replace the lid tightly on the container and save the sample until the fuel moisture content is calculated. If an obvious error appears in the calculation, reweighing the sample, or double checking the container contents may reveal the cause of the problem.

7. Calculating Moisture Content

The moisture content is the ratio of the weight of the water in the sample to the dry weight of the sample. This is equal to:

> % Moisture Content = (Wet weight of sample - dry weight of sample) / dry weight of sample * 100

It is most easily computed by the following formula:

> % Moisture Content = (Wet sample weight in container - dry sample weight in container) / (Dry sample weight in container - container tare weight)

Record the calculated moisture contents to the nearest tenth of one percent, one decimal place, rather than rounding to the nearest whole percent. This will decrease the error when you calculate an average of all measured values. Double check numbers entered in the spreadsheet against those recorded on the data sheet. If calculations are performed with a hand calculator, repeat the calculations to ensure that they are correct.

8. Incidental Fire Behavior Observations

The best use of foliar moisture data will be attained as fire behavior observations and foliar moisture observations are compared. Note comments on any prescribed fire or wildfire behavior occurring in the vicinity of sample plots. Place comments on data forms of the appropriate date in remarks box or on a separate, but attached sheet. Helpful comments could include length of burn period, such as "fire continued in shrub crowns only until 1600", or "until late in the evening", or "into the night". Note spread behavior such as spread in crowns only at head, spread at the flanks, or fire backing in crowns. Equally helpful comments include notes on the inability of shrub or tree crowns to carry fire from one crown to the next.

9. Quality Control

Quality control will be the responsibility of the sampling unit. This procedure will take commitment throughout the season and attention to detail by observer and supervisor. The usefulness of foliar moisture data will be highly dependent on the care given to sampling, drying, calculating and reporting.

LIVE FUEL MOISTURE STUDY SITE DESCRIPTION FORM

Instructions: Complete this site description form ONLY after the site has reached full greenup. Take 35 mm slides of the area on the same day the site is described. The best slides are taken on bright overcast days.

1. Enter the date of this observation: month/day/year as mm/dd/yy

2. Enter the observer's name so we have a contact if we have questions.

Enter site identification information including:

3. Agency by code

4. Forest or State by code

5. District or organizational unit by code

6. Site Name descriptive of location (for example Belle Creek) or site number.

7. and 8. Enter latitude and longitude as displayed by GPS or as determined from a map. Please include units such as -105.2425 degrees or -105^{o} 14.55 mins or -105^{o} 14 min 33 sec.

9. Enter the names of the predominant species on the site and the approximate percent canopy cover of each for the following: trees, shrubs, and herbaceous (grasses and forbs). Leave blank if type isn't present. For example, if there are no trees, skip the section on trees. If there are more than four species of a type on site, enter the percent coverage of all the remaining species of that type. Also enter the percent cover of bare soil at this time of year that is soil that is not covered by either live or dead plant material.

10. Enter the color of the soil moist and dry. You do not need to refer to a soil color chart, but may select white, tan, yellow, red, brown or black.

11. Enter the general aspect of the site as N, NW, W, SW, S, SE, E, NE.

12. Enter the average or most common percent slope on the site.

13. Enter the site's elevation in feet.

14. Enter the NFDRS fuel model that best represents the vegetation on the site.

15. Enter the NFDRS or RAWS weather station number associated with the site.

16. Describe the general condition of the vegetation layer that is being sampled for moisture contents: average height in feet, an estimate of the average percent dead material in the plants, the continuity of the plant layer (continuous, patchy, isolated individuals), disturbance in more than 20% of the plants (insects, disease, browsing, wind damage, fire, other). Include any other information about the condition of this layer that may not be obvious in the photos,

17. Note the slide numbers and a brief reference to the scene pictured.

Live Fuel Moisture Study Site Description Form

1. Date _____ 2. Observer _____

3. Agency _____ 4. Forest/State _____

5. District/Unit _____ 6. Site Name or # _____

7. Latitude _____ 8. Longitude _____

9. Major Vegetation:

Tree Species 1 _____ percent cover _____
Tree Species 2 _____ percent cover _____
Tree Species 3 _____ percent cover _____
Tree Species 4 _____ percent cover _____
All other trees percent cover _____

Shrub species 1 _____ percent cover _____
Shrub species 2 _____ percent cover _____
Shrub species 3 _____ percent cover _____
Shrub species 4 _____ percent cover _____
All other shrubs percent cover _____

Grass/forb species 1 _____ percent cover _____
Grass/forb species 2 _____ percent cover _____
Grass/forb species 3 _____ percent cover _____
Grass/forb species 4 _____ percent cover _____
All other grasses/forbs percent cover _____

Bare Ground percent cover _____

10. Predominant soil color: moist _____ dry _____

11. Predominant aspect _____ 12. Predominant % slope _____

13. Elevation (feet) _____ 14. NFDRS fuel model _____

15. Associated NFDRS or RAWS weather station number _____

16. Vegetation condition description of layer chosen for moisture sampling:

Average height (ft) _____ Percent dead _____

Continuity of layer _____ Disturbance _____

Other comments _____
_____

17. Slides numbers and descriptions _____
_____

INSTRUCTIONS FOR LIVE MOISTURE CONTENT SAMPLING DATA SHEET

1. Data Entry

The spreadsheet following these instructions is intended to be used in two ways. Hard copy and data entry into the sheet in excel. An excel version can be downloaded from the same website as this document. The file is named Fuel_Moisture_Sheet.xls. Users will need a hard copy to enter some parts of the data in the field when samples are taken. The excel version will be input in the office during and after oven drying. The excel spreadsheet will do the math for you, however these instructions explain how to do it manually if needed.

The sheet has room to enter 6 samples for 3 different species. It is setup to enter 3 samples of new and 3 samples of old growth for each species. (Deciduous is all new) If you would like to take more samples for each species use the whole sheet for one species and use extra sheets for different species. If you use more than one sheet for the same sampling please enter the page numbers sequentially in the blanks to the upper right.

Enter header information on each sample collection sheet:

- **Agency** code
- **Forest or State** code
- **District or Unit** code
- **Site name or number**.

Enter **Collected Record** header information

- **Date** month/day/year as mm/dd/yy
- **Time** (should be between 1100 and 1600)
- **Person** (your) name

Take a few moments to fill out the **Phenological Stage** section. Mark the appropriate boxes in each of the **Leaf / Stem** and **Flowers / Fruits** columns.

Mark the appropriate **SAMPLE CONTENTS** choice in the box to indicate whether this sample contains foliage only, or is a clipped sample containing both leaves and small diameter stems.

Note anything unusual or of special interest about the site in the **Remarks** box.

Collect your weather observations if that is a part of your previously established sampling program. If weather collection is not a normal part of your sampling routine, just note percent cloud cover.

Enter the can, bag or bottle number as you select each from your pack or box.

If you are collecting only 1 species, note the species in the row under Species heading. If you are sampling more than 3 new and/or 3 old for the one species use the other species sections and enter the same species name under each Species heading. If you are collecting more than one species, note the species in each section. If you are sampling more than 1 species and more than 3 new and/or 3 old samples for the one species, use one sheet for each species and number the sheets sequentially in the blanks to the upper right of the sheet.

Be sure to note the age or condition of each sample you are collecting. They need to be entered in the correct box for each sample as the spreadsheet calculates the math based on which cell the data is entered into. **New** = this year's growth. **Old** = growth from previous year(s). Once current and past years' leaves and/or stems appear the same, **(mix)** just enter the data in the **"old" section and note mix in the can/log # field.**

As you fill each container, double check container number against that entered on the sheet, then seal securely and stow in an insulated cooler or sample box.

When you finish collecting all samples: If you are collecting samples into plastic bags, return to your vehicle and weigh each immediately to the nearest 0.1 gram. Enter this weight in the **(Wet can wt. column)** on your data sheet. Pack the plastic bags carefully into a large plastic bag, seal and store in a cool safe place. If you collect samples in cans or bottles, seal, pack carefully into your box or cooler and place in a secure, shaded location in your vehicle. Return to your office.

2. Oven Drying Procedure

Preheat the drying oven to 80C.

Samples collected in self-sealing bags and weighed in the field can be opened and placed upright in the oven.

Samples collected in cans or bottles must be weighed before drying. Remove any tape or bands from the container. Place container on the center of the scale platform and record the **Gross Wet Weight** to nearest 0.1 gram in the **wet can wt Column**. Check to see that the number on the container matches the number on the lid and the species in the container matches that noted on the data sheet.

Remove lids from containers. Place lid beneath can if it fits and put sample in the drying oven. Place bottle lids in order in a convenient place so you can easily replace the matching lid and place opened bottle in the oven. Space the containers in the oven so air can circulate freely. Record the date and time the samples were put into the oven.

Dry the samples for 24 hours at 80C. Do not put additional samples into the oven while drying a set of samples. If you do, dry the set an additional 24 hours.

Take a few samples from the oven and replace each lid as the container is removed. If using fuel moisture bags, reseal the bag. Do not leave the oven door open. If any

sample material falls from the container, throw the sample away, unless you can replace all of it.

Weigh the sample with its lid on as soon as possible after removing it from the drying oven, and determine the **Gross Dry Weight** to the nearest 0.1 gram. Check the container number and its contents before you record the weight on the data sheet. Enter the weight in the **(dry can wt. Column)**. Replace the lid tightly on the container and save the sample until the fuel moisture content is calculated in case an error requires rechecking the sample contents or weight.

3. Calculating Moisture Content

Enter Tare Weight in the **(tare wt. Column)**. You may have a standard weight to enter if using bags of uniform size. Or enter the weights of the cans or bottles that had been pre-weighed empty from your master tare weight list.

The spreadsheet has the formulas built in and will calculate the rest of the cells for you. **Again, it is important that your data be entered into the correct cells due to this. I.e. The new and old columns, as the final averages are based on the inputs in those rows.**

How this is calculated is as follows:

Water wt column = *Wet can wt*. column - *Dry can wt*. column

Dry plant wt. Column = *Dry can wt*. column - *Tare wt*. column

% Moisture Column = *Water wt* column / *Dry plant wt* column

Average old and *average new* cells = value in *% moisture* cells for the 3 samples of old and new added together and / 3.

If using all of one sheet for one species add the averages and / by 3. Hand enter this number in the cells labeled **Total avg new** and **Total avg old**. If the sample was **Mix** just use, and then hand enter into the cell labeled **Total avg old**.

Live Moisture Sheet

To use as an excel spreadsheet download Live_Moisture_Sheet.xls
You can print this sheet to do the needed field inputs

Agency	Forest	District	Site name or number	Page 1 of ______

	Date	Time	Person
Collected			

CELLS IN GREY ARE TO BE ENTERED BY USER

All weights are in decigrams

Species: ______

can/log #	Needle age / Condition new	old	wet can wt.	dry can wt.	tare wt.	water wt.	dry plant wt.	% moisture	
		x				0	0	#DIV/0!	
		x				0	0	#DIV/0!	
		x				0	0	#DIV/0!	
	x					0	0	#DIV/0!	
	x					0	0	#DIV/0!	
	x					0	0	#DIV/0!	
								avg old	#DIV/0!
								avg new	#DIV/0!

Species: ______

can/log #	Needle age / Condition new	old	wet can wt.	dry can wt.	tare wt.	water wt.	dry plant wt.	% moisture	
		x				0	0	#DIV/0!	
		x				0	0	#DIV/0!	
		x				0	0	#DIV/0!	
	x					0	0	#DIV/0!	
	x					0	0	#DIV/0!	
	x					0	0	#DIV/0!	
								avg old	#DIV/0!
								avg new	#DIV/0!

Species: ______

can/log #	Needle age / Condition new	old	wet can wt.	dry can wt.	tare wt.	water wt.	dry plant wt.	% moisture	
		x				0	0	#DIV/0!	
		x				0	0	#DIV/0!	
		x				0	0	#DIV/0!	
	x					0	0	#DIV/0!	
	x					0	0	#DIV/0!	
	x					0	0	#DIV/0!	
								avg old	#DIV/0!
								avg new	#DIV/0!

* Only used when entire sheet is 1 species

Total avg new	
Total avg old	

Live Plant Phenological Stage
Leaf / Stem Stages

Species			
			Dormant/quiescent
			Buds swelling
			New needle/stem growth
			Needle/stem growth complete
			Oldest needles curing
			Frosted or frozen

Live Plant Phenological Stage
Flowers / Fruits

Species			
			Buds/flowers present
			Seeds/fruits developing
			Seeds/fruits ripe
			Seeds/fruits falling
			None

SAMPLE CONTENTS

Leaf Only	
Leaf & Stem	

Weather

Dry Bulb	
Wet Bulb	
RH	
Cloud Cover	

Comments: ______