PLANT BIOMASS DETERMINATION

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SUPERCEDES: SOP #2034; Revision 0.0; 01/24/92; U.S. EPA Contract EP-W-09-031.

PLANT BIOMASS DETERMINATION

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the method for determining biomass of herbaceous plant tissues. This analysis along with other plant physiological and toxicological techniques will be used to assess the impact of contaminants on primary productivity. This method can be used to normalize analytical data, such as contaminant, protein, or nutrient content. That is, tissue concentrations must be given on a per unit of dry weight basis for valid comparisons. In order to compare the concentration of a specific component in a sample with the concentration of that same component in another sample, a common basis for the comparison must be provided. For instance, if the sample weight is the same for both samples a comparison on this basis might be valid in some situations. However, if one sample is half water and the other is dry, then a calculation would have to be made to account for this difference. The amount of the component in question is therefore often expressed per unit of the dry weight of the sample because dry weight is a substantially uniform standard. This is called "normalizing" for the tested component. Included below are procedures for obtaining representative samples, quality assurance/quality control measures, and proper documentation of sampling activities.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Above ground portions of plants will be collected from a plot using clippers. They will be weighed with a spring scale, in the field if possible (fresh weight), dried for 24-48 hours at 80^{o}C (constant weight), cooled in a desiccator jar, and reweighed (dry weight).

This procedure will be used during the growing season. Samples can also be separated into species and/or organ types to determine partitioning of energy, depending on the goals of the study.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Plants will be placed in resealable plastic bags, kept cool, weighed as soon as possible, and dried following the weighing. If the plants cannot be weighed for fresh weight in the field, they must be transported to the lab or other appropriate facility in plastic bags on wet ice and weighed within 24 hours.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are several potential problems and interferences that may occur when sampling for plant biomass.

1. Site access must be obtained.

2. Additional impacts may occur before and during the sampling period such as drought and other climatic extremes. Other non-contaminant related impacts that can mask the effects of

contaminants may include site disturbance by humans.

3. Microclimatic differences on a site such as shade and moisture, soil factors, nutrients, and topographic variation will affect plant growth and possibly mask the effects of contaminants.

4. This is a destructive method and may be undesirable on some sites.

5. This procedure can only be carried out during the growing season. Also, differences in the times when various species germinate and become dominant within a growing season may bias the results.

6. Results may also be biased if the root portions of plants of different species vary greatly in their proportion of the total biomass. Roots may also be samples but this is a tedious process requiring that all root material be extracted from the soil, and all soil be removed from the roots.

5.0 EQUIPMENT/APPARATUS

Equipment needed for plant population sampling include:

- Stakes
- Clippers
- Plastic bags
- Paper bags
- Aluminum weighing dishes
- Ice chest
- Weighing scale
- Drying oven
- Desiccator jar and desiccant
- Sharpies for labelling bags
- Spring scale
- Documentation supplies (data sheets, sample labels, Chain of Custody records and seals, logbook, pens)

6.0 REAGENTS

A desiccant such as calcium chloride-based pellets will be placed in the desiccator jar to absorb moisture. Reagents may be utilized for decontamination of sampling equipment. Decontamination solutions are specified in ERT/SERAS SOP #2006, Sampling Equipment Decontamination.

7.0 PROCEDURES

7.1 Site Preparation

7.1.1 Plant Population Survey

The site will first be characterized and species of interest chosen according to

ERT/REAC SOP #2037, Terrestrial Plant Community Sampling. Plots will be marked with stakes. Samples to be analyzed will be collected from each randomly selected plot laid out according to the site sampling plan. If woody plants are encountered in a plot, this plot must be eliminated and a new plot selected that contains no woody species.

7.1.2 Sample Collection

The plants will be cut at ground level, weighed as soon as possible after cutting, placed in labelled plastic bags, and kept cool until drying in the laboratory. If wet, the plants must be wiped dry using paper toweling before weighing. Tissue may be separated into species or further to organ groups (stems, leaves, etc.) and weighed separately depending on the goals of the study.

7.2 Laboratory Analysis

7.2.1 Tissue Processing

Plant tissue will be placed in paper bags or aluminum weighing dishes (depending on sample size) in a drying oven set at 80°C. The tissue will be dried for 24 - 48 hours, cooled in a desiccator jar, and reweighed (dry weight). The tissue will be weighed at 4 to 8 hour intervals, replacing the material in the oven between weighings, until no more water weight is lost (i.e., to a constant weight). Care must be taken not to cook or char the material. If oven space is limited, materials can be held refrigerated for no more than one week prior to drying. Less succulent tissues may be left to dry at room temperature in open paper bags before completing the process in the oven. It is important not to allow the samples to decay before drying.

8.0 CALCULATIONS

Water Content = Fresh Weight – Dry Weight

$$\textbf{Standing Biomass} = \frac{\textbf{Dry Weight (of above ground tissues)}}{\textbf{Plot Area}}$$

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following QA/QC procedures apply:

1. All data must be documented on field data sheets or within field/site logbooks.
2. At least one uncontaminated reference site will be sampled for comparison to the contaminated areas.
3. A sample plan, including numbers and sample size, will be diagrammed before sampling.
4. QA Work Plan will be outlined before sampling.
5. All deliverables will receive a peer review prior to release, and 10% of the calculations will be rechecked.
6. All instrumentation must be operated in accordance with operating instruction as supplied by the

manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

10.0 DATA VALIDATION

The data generated will be reviewed according to the Quality Assurance/Quality Control considerations listed in Section 9.0. The data will be statistically analyzed.

11.0 HEALTH AND SAFETY

The preparation of a Health and Safety Plan is required prior to any field activity and must be approved by the SERAS Health and Safety Office or designee. When working with potential hazardous materials, follow U.S. EPA, OSHA, and corporate health and safety procedures.

When sampling on a site known or suspected of contamination, all precautions must be taken to safeguard the samplers.

12.0 REFERENCES

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