UNITED STATES DEPARTMENT OF AGRICULTURE | Forest Service | PNW, Corvallis

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Reply To: 4310 Date: August 19, 1988

Subject: New Procedures for Water Sampling

To: Art McKee, Fred Swanson, Stan Gregory

This memo outlines new procedures for water sampling techniques at the Andrews Experimental Forest. Many years have passed since we have updated our sampling program and several new developments have taken place that will allow us to update our procedures. This will give us more reliable data that is consistent both within our own program and with other programs at Coweeta, Hubbard Brook and other NADP Stations around the world. Wayne Martin, during his visit here, worked with our chemical data and through his recommendations and those of the reviewers of his publications found that our three week sample period is definitely out of sync with the rest of the chemical monitoring world. We are financially unable to analyze our samples on a weekly basis; we can collect on a weekly basis, composite and store samples in our cooler at the Andrews headquarters site. This would raise our credibility.

Wayne also discovered that the Andrews precipitation at present is about the least contaminated of any in the U.S. Our project has already begun monitoring high elevation precipitation and streamflow at the Hi-15 watersheds in documentation of this phenomenon; but we will need to depend on John Moreau's time and expertise to carry out this system.

WATER ANALYSES

The present sample analysis scheme, by group and their cost as follows:

1. NADP SAMPLE (taken weekly at the administrative site. Cost $3,848/yr.)

   ANALYSES PERFORMED ON AN UNFILTERED PORTION OF THE SAMPLE
   pH and conductivity

   ANALYSES PERFORMED ON A FILTERED PORTION OF THE SAMPLE
   CATIONS: Ca, Mg, Na, K
   Sulfate
   Chloride
   Nitrate
   Phosphate
   Ammonium

2. Forest Service Samples Totaling - $13,264.48/yr.

   Watershed 8, 9 samples taken every three weeks. 9 and 10 Rain Collector (RC) and Hi-15 RC samples collected every week.

ANALYSES PERFORMED ON A UNFILTERED PORTION OF THE SAMPLE
Suspended sediment
Total Kjeldahl Nitrogen
Total Phosphorus

ANALYSES PERFORMED ON A FILTERED PORTION OF THE SAMPLE
pH, Alk, Cond
Silica
Cations: Na, K, Ca, Mg
Total Kjeldahl Nitrogen
Total Phosphorus
Nitrate
Ammonium

3. LTER Water Samples Totaling $2,916.69/yr.

WS 2, 10, and Mack Creek

ANALYSES PERFORMED ON A FILTERED PORTION OF THE SAMPLE ONLY
Total Kjeldahl Nitrogen
Total phosphorus
Nitrate
Ammonium
Cations: Na, K, Ca, Mg
Suspended sediment

I recommend that we agree on a standard analyses package and maintain this system for all of our stations. This simplifies both the analyses and the data reduction procedures. It also uncomplicates the thinking about what we have and what we don't have in the way of analyses on each watershed. I suggest the following scheme.

WS 2, 8, 9, 10, Mack Creek, the 9&10 RC and the Hi-15 RC (analyses done at CCAL)
UNFILTERED SAMPLE
pH, Alk, Cond
Suspended sediment
Total Kjeldahl Nitrogen
Total Phosphorus

FILTERED SAMPLE
Total Kjeldahl Nitrogen
Total Phosphorus
Phosphate (Ortho Phosphorus)
Nitrate
Ammonium
Cations: Na, K, Ca, Mg
Silica
Sulfate
Chloride

The Forest Service expense for these analyses would be $16,000.
LTER expense would be $ 5,900.

Water Collection Procedures

The principal objective of the procedure is to match collections at watersheds 2, 9 and 10 with collections at the administrative site and to match the Hi-15 collector with the NADP collector at the administrative site. WS 8 and the Mack Creek water should be collected at the same time that the Hi-15 rain collector is collected; therefor if the NADP collection is made on Tuesday morning, the Hi-15 RC collection should be made on the same day. Times and dates of collections should be written on the streamflow charts, the bottles and the appropriate lab forms. An effort should be made to make collections from the rain collectors and their corresponding watersheds for the same rain event. If collection day turns out to be a day without precipitation, water could be collected from corresponding rain collectors and gaging stations within a 12-hour period. On rainy days the collections should be made within 2 or 3 hours. Collections should not be made during a thunder shower.

FIRST WEEK

At the beginning of each three-week check period, a large (5 gallon) carboy that has been acid washed and distilled water rinsed at the Corvallis lab will be placed at all the proportional samplers. They need to receive a stream water rinse before installation on the sampler system. At the time of this check the stream flow system needs to be checked and serviced and the information compiled on the check sheets and charts. Sampler servicing and checking will also be made at this time (a watershed worker from Corvallis should accompany John or perform this check until John becomes familiar with the procedure). After the check the small (2 1/2 gallon) carboy that will be on the sampler, containing last weeks proportion of the sample, will be taken back to the administrative site cooler and transferred to the appropriately marked carboy stored in the cooler. The small empty carboy must then be rinsed three times with 500 ml of distilled water, allowed to drain thoroughly and stored in a clean, dry location for use the following week.

Water from the Hi-15 rain collector will be removed from the NADP collector in the plastic collection pail. A lid will be placed on the pail and a clean acid washed pail will be placed in the collector for the next week. The Hi-15 precipitation samples will also be stored in the cooler and transported to CCAL with the rest of the stream flow samples.

The sample from the standard NADP collector located at the administrative site will be handled in the standard NADP manner and the sample shipped to the contract lab for analyses.

The auxiliary rain collector for 9 and 10 located at the administrative site will be collected during the same time period as the NADP collector and the 9 and 10 watershed sample and stored in the cooler like the Hi-15 rain collector sample.

SECOND WEEK

The second week collection should consist of a short check of the stream gages and the samplers to assure that all systems are operational and correctly set. Sample information and streamflow data need to be entered on the chart and check sheets. The 5 gallon carboy needs to be replaced with a smaller 2 1/2 gallon carboy that has been distilled water washed and stream rinsed. Batteries and charts should not require replacement at this check; but instrument malfunctions must be corrected and/or reported to receive additional help. Instrument or sampler down time must be held to an absolute minimum especially during winter flows. The 5 gallon carboy is taken back to the headquarters cooler and stored there as a receptacle for the next two samples.

Water from the NADP collector at the Hi-15 and the 9 and 10 collector need to be gathered at this time and moved to the cooler as well. The Hi-15 rainwater and the WS 9 and 10 RC water will remain in separate containers to undergo analyses as a weekly sample.

THIRD WEEK

This check, like the second week, is a mini check to assure that all instruments are functioning properly. Sample information must be written on the charts and the small carboy taken off and replaced with another small, distilled water washed and stream water rinsed carboy. The small carboys are then rinsed with distilled water as before and left to dry. Samples from the NADP collectors are treated as before with the administrative site's sample being shipped to the contract lab and the H9-15 sample covered and set in the cooler for analysis at Corvallis.

FOURTH WEEK

At this point the cycle is complete and the first week check is repeated with a more complete check that will require battery and chart replacement.

OTHER IMPORTANT DETAILS

Contamination is a big problem. Extreme care must be taken to keep the sampling equipment clean and to keep foreign material out of the sample. One finger print can produce a sodium content many times greater than the normal value for that sample.

The sample jugs and pails that are returned to Corvallis on a routine basis will undergo an acid wash after each use. The small carboy used for the second and third collections needs to be returned to Corvallis CCAL for acid washing every 6 months (every April and October).

Bottle washing at Blue River must be done with care to avoid contamination. Handle containers with clean hands and avoid touching the inside of the bottle or the cap with your hands at all. Thorough rinsing of each of the small carboys with 500 ml of distilled water at each of the three rinses must take place after each use. A fresh 25

liter container of distilled water will need to be delivered to the Andrews lab at each first week's check. The stream water rinse must be done with clean stream water only. This may be a problem at low flow on the smaller watersheds. Care should be taken to avoid sucking disturbed water into the sampler during testing at check time.

The sampler system must receive an acid rinse on an annual basis. A .5 normal HCL solution is sucked through the entire system for 5 minutes, then rinsed for 5 more minutes with clean stream water.

QUALITY CONTROL

We will do two quality control checks each year, one in January and one in August. One check would be for deterioration of the composite sample in the gage house during the three week storage period there. The other would be a check for contamination resulting from the flume and sampler system.

During the first check in January and the first one in August, 2-liter grab samples will be taken in each of three places on one watershed. (1) One 2-liter sample will be taken below the turbulence box. (2) Two 2-liter samples will be collected through the sampler; one will be covered and left in the sampler collection house, and the other will be stored with the rest of the samples. (3) The fourth sample will be collected above the flume and away from contact with any gaging device. These three samples will be placed on ice and transported to CCAL for immediate analysis. The fourth sample will remain in the sampler house for one week, then move to the HJA cooler with the normal sample for that station, remain there for two more weeks, and then come to the lab for analysis along with the normal samples.

We will do one station each year starting with WS2 in January 1989 and do WS 8, 9, 10 and Mack Creek in that order in each successive year. Analyses of pH, Alk, Cond, Total N, Total P, Ortho P, Nitrate, Ammonia, Silica, Cations, Sulfate, Chloride will be performed on filtered samples only. The cost of $633 will be assessed to the responsible party.

These data will be processed and added to a quality control section for the Andrews watershed program.

A plot of each element by individual site will be generated at least once a year and scanned for abnormalities by the data management section and then shipped to Wayne Martin for his scrutiny.

WINTER STORMS

Winter access to Mack Creek and the Hi-15 area will likely have to be made by snow cat in order to transport batteries and large volumes of samples from the site. The Forest Service is providing a new cat for the Andrews use; however, strict safety procedures must be followed when traveling by cat, and the machine must be maintained in top shape to provide safe, efficient travel over snow.

A weather watch system must be devised to predict sample overflow time, and extra trips during high rainfall periods may be required to prevent overflow of the water samplers or the NADP collectors. Battery condition at the Hi-15 NADP collector may also be a factor to watch.

SUPPLIES AND MATERIALS REQUIRED

1. Polypropylene bottles for Mack Creek, WS 2, 8, 9, 10 and the 9 and 10 RC stations. Eleven (11) 5-gallon and sixteen (16) 2 1/2-gallon carboys
2. Eight to ten plastic sample pails for the NADP sampler at the Hi-15
3. Two heavy-duty marine type batteries for the NADP collector
4. Additional checks sheets and sample inventory forms located at Blue River
5. Spare sampler and recorder parts for breakdowns
6. Dependable and well-equipped snow cat for winter travel.

DATA PROCESSING

Currently, LTER samples and Forest Service samples are being processed independently. Beginning with WY 1989, both sample sets will be processed as one and packaged together with similar data formats. All past proportional water sample data sets will be reformatted to a single data format and will be made available through the Forest Service Data Bank.

The new sampling program should be implemented at the beginning of the new water year starting October 1, 1988; therefore, any discussion concerning this matter needs to take place before that time. If anyone has strong objections toward this program, please let me know and we can set up a time for discussion. However, if I don't hear any negative feedback concerning this issue, I'll proceed with the initiation of the new program.

AL LEVNO
Supervisor Biologist

cc:
Wayne Martin
John Moreau
Cam Jones
Don Henshaw
Craig Creel
Ross Mersereau