2. What is your research site?

	Response Count
	60
answered question	60
skipped question	3

3. What is your network affiliation, if any? Check all that apply.

	Response Percent	Response Count
LTER	**57.7%**	**30**
Forest Service EFR	25.0%	13
USGS	3.8%	2
NEON	11.5%	6
STREON	5.8%	3
Other	26.9%	14
answered question		**52**
skipped question		**11**

4. Do you generate electronic time series for any of the following in-stream or in-lake environmental measurements? Click all that apply.

	Response Percent	Response Count
Water Level/Flow	**87.8%**	**36**
Water Temperature	82.9%	34
pH	41.5%	17
Specific Conductance	61.0%	25
Ion Specific Electrodes	12.2%	5
Turbidity	41.5%	17
CDOM/FDOM	24.4%	10
Other (list out in next question)	34.1%	14
	answered question	**41**
	skipped question	**22**

5. List additional aquatic measurements, if any.

	Response Count
	22
answered question	**22**
skipped question	**41**

6. Do you generate electronic time series for any of the following terrestrial environmental measurements? Click all that apply.

	Response Percent	Response Count
Soil Temperature	**73.8%**	**31**
Soil Moisture	61.9%	26
Water Table Level	45.2%	19
Phenology	21.4%	9
Acoustics	7.1%	3
Soil Respiration	21.4%	9
Sapflow	9.5%	4
Other (list out in next question)	26.2%	11
	answered question	**42**
	skipped question	**21**

7. List additional terrestrial measurements, if any.

	Response Count
	14
answered question	**14**
skipped question	**49**

8. Do you generate electronic time series for any of the following atmospheric/meteorological measurements? Click all that apply.

	Response Percent	Response Count
Air Temperature	**92.0%**	**46**
Precipiation	88.0%	44
Wind Speed	88.0%	44
Wind Direction	84.0%	42
Barometric Pressure	68.0%	34
Relative Humidity	80.0%	40
Solar Radiation	80.0%	40
Snow Depth	32.0%	16
Snow Water Equivelent	20.0%	10
Eddy Flux	36.0%	18
Atmospheric Chemistry	10.0%	5
Other (list out in next question)	24.0%	12
	answered question	**50**
	skipped question	**13**

9. List additional atmospheric measurements, if any.

	Response Count
	16
answered question	**16**
skipped question	**47**

10. Has your site established sensor networks (spatially distributed autonomous sensors) or wireless communications to distributed data loggers that actively transmit near real-time data to site base station and/or the internet?

	Response Percent	Response Count
Yes	**62.5%**	**35**
No	19.6%	11
In progress	14.3%	8
Planned	17.9%	10
	answered question	**56**
	skipped question	**7**

11. If yes to (10), briefly describe the major components of your sensor array/network and communication system (how are data transmitted?). Please indicate if components are proprietary and do not communicate with open source solutions.

	Response Count
	37
answered question	**37**
skipped question	**26**

12. If yes to (10), briefly describe the tools you use to capture, process, qualify, document, and archive data streams. Please indicate if components are proprietary and do not communicate with open source solutions.

	Response Count
	31
answered question	**31**
skipped question	**32**

13. What factor(s) hinder you from establishing or expanding sensor networks and near real-time access to data streams? Click all that apply.

	Response Percent	Response Count
None. I have a working system that meets my needs.	19.1%	9
Financial - it is too expensive	**51.1%**	**24**
Trained Personnel - don't have trained staff	40.4%	19
Hardware - don't know what hardware to use	25.5%	12
Software - don't know what software to use	27.7%	13
Programming - don't have a programmer	36.2%	17
Other (list out in next question)	38.3%	18
	answered question	**47**
	skipped question	**16**

14. Please elaborate on any challenges to operation and management of your sensor system.

	Response Count
	34
answered question	**34**
skipped question	**29**

15. What science questions are you addressing with your environmental sensors and/or WSNs (briefly)?

	Response Count
	45
answered question	**45**
skipped question	**18**

16. What new science questions or opportunities would you like to address with environmental sensors and/or WSNs (briefly)?

	Response Count
	33
answered question	**33**
skipped question	**30**

17. What new science questions do you dream of addressing with environmental sensors and/or WSN's (briefly)?

	Response Count
	28
answered question	**28**
skipped question	**35**

18. Would you be interested to give a 10 minute oral presentation about your environmental sensor network? Note: Slots are very limited. We strongly encourage poster presentations.

	Response Percent	Response Count
Yes	30.8%	16
No	**69.2%**	**36**
	answered question	**52**
	skipped question	**11**

19. Will your site/forest/experiment bring a poster to the work shop (maximum dimension 3 ft (height) x 4 ft (long)). PLEASE only ONE per site! Space is limited!

	Response Percent	Response Count
Yes	**57.1%**	**28**
No	42.9%	21
	If yes, please specify site name	22
	answered question	**49**
	skipped question	**14**

20. What are your dietary preferences?

	Response Percent	Response Count
Omnivore	**82.1%**	**46**
Vegetarian	16.1%	9
Vegan	1.8%	1
Other (please specify)		2
answered question		**56**
skipped question		**7**

21. Do you have any special needs we should know about?

	Response Percent	Response Count
Yes	3.6%	2
No	**96.4%**	**53**
If yes, please specify		2
answered question		**55**
skipped question		**8**

22. What is your mode of transportation to the workshop (we will do our best to provide shuttles and facilitate ride shares)

	Response Percent	Response Count
air (need shuttle service)	16.1%	9
air and rental car	33.9%	19
car	**53.6%**	**30**
	answered question	**56**
	skipped question	**7**

23. If you are traveling by air, what airport?

	Response Percent	Response Count
Manchester, NH	**51.9%**	**14**
Boston, MA	25.9%	7
Other?	22.2%	6
	answered question	**27**
	skipped question	**36**

24. If traveling by air, what is your arrival time and carrier?

	Response Count
	25
answered question	**25**
skipped question	**38**

25. If traveling by air, what is your departure time and carrier?

	Response Count
	24
answered question	24
skipped question	39

26. What nights do you need lodging?

	Response Percent	Response Count
Monday (October 24)	84.4%	38
Tuesday (October 25)	**100.0%**	**45**
Wednesday (October 26)	88.9%	40
answered question		45
skipped question		18

27. Please let us know if you have further questions!

	Response Count
	11
answered question	11
skipped question	52

Page 2, Q5. List additional aquatic measurements, if any.		
1	D.O.	Oct 17, 2011 10:10 AM
2	Nitrate, Phosphate	Oct 17, 2011 5:11 AM
3	PAR, chlorophyll fluorescence, phycocyanin fluorescence, underwater UV and PAR	Oct 17, 2011 4:45 AM
4	Short-term measurements of pH, conductance, turbidity, CDOM, dissolved O2, dissolved CO2, etc in past.	Oct 14, 2011 11:46 AM
5	Dissolved Oxygen Chlorophyll	Oct 14, 2011 8:53 AM
6	Salinity	Oct 14, 2011 6:18 AM
7	Rainfall	Oct 13, 2011 10:03 AM
8	NA	Oct 13, 2011 5:22 AM
9	water depth, dissolved oxygen, salinity measurements are done in an estuary	Oct 12, 2011 12:32 PM
10	Nitrate	Oct 12, 2011 12:09 PM
11	Solar	Oct 12, 2011 9:11 AM
12	Marine water temperature, conductivity, pressure currently. New bouy will add more measurements. In 2012 will have alkalinity and pCO2 relating to pH. We have no stream or lake data in Moorea.	Oct 11, 2011 3:03 PM
13	groundwater levels; soil moisture; hilllslope runoff	Oct 11, 2011 1:22 PM
14	DO, chlorophyll, conductivity	Oct 11, 2011 7:43 AM
15	nitrate (SUNA), temporarily	Oct 11, 2011 7:41 AM
16	chlorophyll phycocyanin	Oct 11, 2011 6:50 AM
17	Once network is operational; Sites will be co-located with macro-invertebrate and fish biomonitoring stations;	Oct 11, 2011 4:43 AM
18	No but other researchers at our site do.	Oct 10, 2011 8:55 AM
19	In total, we will continuously monitor ~214 "Level 1 Aquatic Data Products" over various time scales at each site.	Oct 10, 2011 6:35 AM
20	SUNA - optical nitrate Cycle P - orthophosphate Chlorophyll Dissolved Oxygen	Oct 9, 2011 5:40 PM
21	Oxygen	Oct 8, 2011 2:12 PM
22	--L. Lacawac: Evaporation & runoff+net seepage (derived from weather measurements and surface Tw); --Crater Lake: Fchl-a in addition to Fcdom and turbidity	Oct 8, 2011 7:37 AM

Page 2, Q7. List additional terrestrial measurements, if any.		
1	Instrumentation is in development in collaboration with Smithsonian. Tower-based VIS/SWIR spectrometer and camera.	Oct 19, 2011 11:52 AM
2	barometric pressure	Oct 18, 2011 9:47 AM
3	Tree sway	Oct 17, 2011 6:51 AM
4	strain gauges on trees	Oct 14, 2011 9:35 AM
5	Soil Chemical Characteristics	Oct 14, 2011 6:18 AM
6	soil water content, leaf wetness	Oct 13, 2011 4:06 PM
7	NA	Oct 13, 2011 5:22 AM
8	DTS distributed temperature sensors (fiber optics) for stream and snow temperature.	Oct 12, 2011 2:06 PM
9	soil heat flux, NDVI from tower radiation measurements	Oct 12, 2011 12:32 PM
10	Nitrate flux	Oct 12, 2011 12:09 PM
11	High resolution images and spectra from tower mounted observatories.	Oct 11, 2011 6:21 AM
12	Other researchers at our site monitor sapflow, respiration, and water table electronically.	Oct 10, 2011 8:55 AM
13	There are 37 continuous "Level 1 Data Products" that will recorded from soil measurements at each site.	Oct 10, 2011 6:35 AM
14	Groundwater conductivity, pH, oxygen	Oct 8, 2011 2:12 PM

Page 2, Q9. List additional atmospheric measurements, if any.		
1	Carbon isotopes	Oct 18, 2011 2:23 PM
2	fast response atmospheric pressure	Oct 17, 2011 6:51 AM
3	ozone dry deposition	Oct 14, 2011 9:35 AM
4	PAR, net radiation	Oct 13, 2011 4:06 PM
5	Snow depth	Oct 13, 2011 11:50 AM
6	aerosols and water vapor through NASA AERONET	Oct 13, 2011 8:16 AM
7	NA	Oct 13, 2011 5:22 AM
8	Dew point temperature, water vapor deficit	Oct 12, 2011 2:06 PM
9	surface temperature	Oct 12, 2011 12:32 PM
10	Energy balance	Oct 12, 2011 7:52 AM
11	CO2, CH4, and isotopic data component radiation (up/down long & shortwave) diffuse radiation net radiation	Oct 11, 2011 12:52 PM
12	Once network is operational	Oct 11, 2011 4:43 AM
13	We will measure 67 additional continuous atmospheric "Level 1 Data Products" over various time scales at each site.	Oct 10, 2011 6:35 AM
14	sensible heat flux	Oct 8, 2011 2:12 PM
15	At L. Lacawac: --Solar UV (305, 320, 340, 380 nm) in addition to PAR incident radiation; --Lake evaporation rate (hourly) calculated from windsp, %RH, Patm, Tsurface; --Snow/ice water equivalent on lake is measured with lake level sensor (0.1mm resolution) when lake is frozen, in combination with near-surface temperature sensors (ultrasonic snow depth sensor and experimental use of TDR soil moisture sensors and capacitance leaf moisture detectors to estimate snow water equivalent within snow will be added later this year).	Oct 8, 2011 7:37 AM
16	Fast response atmospheric pressures. 2-D sway motion of 150 trees.	Oct 8, 2011 3:40 AM

Page 3, Q11. If yes to (10), briefly describe the major components of your sensor array/network and communication system (how are data transmitted?). Please indicate if components are proprietary and do not communicate with open source solutions.		
1	Pointable/zoomable tower-based spectrometer and high resolution camera system. System is in development and not yet deployed. All components are selected to support open source data acquisition and distribution.	Oct 19, 2011 11:52 AM
2	smartBridges wireless ethernet units	Oct 18, 2011 2:24 PM
3	currently manual download in the field	Oct 18, 2011 9:48 AM
4	1 main climate station and 4 remote stations are connected via radio transmitter to a base computer at the office. Campbell data loggers are connected to a FreeWave radio transmitter via antennae. Proprietary. Rain gages and weirs are downloaded manually.	Oct 17, 2011 10:11 AM
5	multidrop array of cambell scientific dataloggers (cr9000, cr1000, cr5000) connected to desktop located in the field. Cellular communications from desktop. Files manipulated via remote desktop software (LogMeIn)	Oct 17, 2011 7:00 AM
6	Nexsens SDL500c datalogger logs data and transmits data daily via cell to server at the University. server uploads data to web server where it is posted online.	Oct 17, 2011 4:48 AM
7	900 mhz radio	Oct 17, 2011 2:34 AM
8	Our weather station has posted data online in near real time for about 10 years. Major components include a wireless network (TCP/IP), Campbell CR10X datalogger with NL100 network adapter, and electronic sensors.	Oct 14, 2011 11:55 AM
9	climate and water discharge data are collected with Campbell dataloggers. Frequency-hopping radios are used to send data to a wireless connection that allows downloading data to a server.	Oct 14, 2011 10:42 AM
10	We have sensors on two through-canopy towers and a series of streams nearby. Data is supposed to be transmitted wirelessly to base, but only from sensors on the towers, and the Campbell software doesn't work well with the wireless communication software.	Oct 14, 2011 9:35 AM
11	Each station transmits data hourly via satellite or cellular modem to a transfer folder in www.hrecos.org. The database retrieves these data hourly, applies automatic quality flags and inserts them into a raw data table. The database was developed by the Stevens Institute and is proprietary.	Oct 14, 2011 9:07 AM
12	Campbell dataloggers connect to terminal servers and are then accessed through the internet. Data is pulled from dataloggers using scheduled downloads using LoggerNet. All components are are open source except for Campbell dataloggers.	Oct 14, 2011 7:20 AM
13	Data are not transmitted yet but uploaded from data loggers in field. Plan to use radio/satellite transmissions in near future	Oct 14, 2011 6:21 AM

Page 3, Q11. If yes to (10), briefly describe the major components of your sensor array/network and communication system (how are data transmitted?). Please indicate if components are proprietary and do not communicate with open source solutions.

14	We have 8 sensor nodes, on 1 or 3m tall tripods. We use Hobo data loggers, and data are sent wirelessly from the sensors, through a router mounted on an eddy covariance tower, to servers at the Jornada. The data are available to researchers via the Hobolink website. Each data logger is powered by a solar panel.	Oct 13, 2011 4:10 PM
15	Real-time streamflow data (USGS) Continuous soil temperature and moisture (recent addition) Continuous stream nitrate concentrations (recent addition, led by Claire Welty at University of Maryland Baltimore County)	Oct 13, 2011 10:04 AM
16	AERONET - optical measurements relayed via GOES DCS	Oct 13, 2011 8:20 AM
17	Campbell Scientific data loggers are radio-equipped and use either 1) a licensed radio frequency at 151 MHz or 2) 900 MHz spread spectrum. The data loggers are connected to wireless modems to transmit data from remote measurement sites (climate stations, gauging stations, cyber watershed), and radio repeater stations are used on ridge tops to relay the signal back to the RF base station at the Andrews Headquarters. All licensed radio frequency data loggers will be replaced with 900 MHz capability, and a tower system connected by 5.8GHz wireless bridges is under construction. The 5.8GHz connectivity will allow extension of the LAN Ethernet into the forest. The towers will eventually be equipped with directional antennae to create "hot spots" for client radio access within the forest. Solar panels are used to power all remote data loggers and tower radios. The base station resides on a LAN at the headquarters and communicates to the university site (Oregon state) using a T1 line (1.5Mbps). Components are proprietary but could communicate with open source solutions.	Oct 12, 2011 2:06 PM
18	In Thailand data is sent via inductive modem to a base station on shore that uses a Campbell data logger to capture the data and convert to serial. Logernet queries the data and we have a parser to read the loggernet file and put into DataTurbine. We add in data from a Davis weather station accessed by Weather Link, and parsed into DataTurbine. We add in video streams (above and underwater) into Data Turbine. The DT server buffers data onsite and mirrors it to a Data Center in Thailand which is then mirrored to other universities in Thailand, UCSD, and AIMs. Off Ramps offload and analyze the data. Our deployment uses a combination of off the shelf production products (Seabird, Campbell, & Davis) working with open source solutions (DT, Esper, Pachube)	Oct 12, 2011 1:30 PM
19	spread spectrum and whf radiotelimetry Campbell Sci. Loggernet software	Oct 12, 2011 12:37 PM
20	Campbell Scientific 900 MHz Spread spectrum to Campbell loggers (met data and eddy flux) WLAN to Campbell loggers and small low power linux computers (eddy flux)	Oct 12, 2011 11:27 AM
21	Campbell RF431, 401	Oct 12, 2011 11:14 AM
22	radiotelemetry network (radios, modems, antennae, base station)	Oct 12, 2011 7:53 AM
23	Our sensors are partially autonomous. Only one is wireless, the new bouy, which	Oct 11, 2011 3:04 PM

Page 3, Q11. If yes to (10), briefly describe the major components of your sensor array/network and communication system (how are data transmitted?). Please indicate if components are proprietary and do not communicate with open source solutions.

	is not yet streaming data. The network is in the testing and prototype stages. We have one moored marine CTD, one bouy with a wide array of marine sensors, and one met station.	
24	tower-based wireless network (802.11b) based on commercial access points with satellite, cable modem, or cellular backhaul. Campbell logger & PC based (at Howland 5 PC's, 2 webcams, and ~12 loggers; at Bartlett 1 PC, 1 camera, 5 loggers)	Oct 11, 2011 1:03 PM
25	Campbell Scientific, Inc. CR1000/CR800 dataloggers transmitting through Freewave FGR115RC radios. Not open source, but posted to web.	Oct 11, 2011 10:44 AM
26	Currently daily updates from a single datalogger/station to a server via cell phone modem. Daily reports sent out to email list from server. Two-way communication allows remote queries at any time. Campell Scientiific datalogger / communication hardware/software; Raven cell phone system (w/Verizon service)	Oct 11, 2011 7:49 AM
27	buoys with sensor, Campbell data loggers, radio to tower at field station, dat files are picked up from the server by an open source DataTurbine server and parsed into a open source MySQL database	Oct 11, 2011 7:48 AM
28	Data is transmitted through telemetry using a provided a plug and play system through YSI EcoNet. Components are proprietary	Oct 11, 2011 7:16 AM
29	Pointed observations that acquire high resolution zoomed images with associated spectra (350nm -1100nm). Observatory can be operated in realtime or pre-programed to acquire data products over seasonal time spans. The observatory has hard wired network connectivity for sites with network (and wireless). For sites w/o network access, data is stored internally for a manual retrieval.	Oct 11, 2011 6:30 AM
30	Soil Climate Analysis Network (SCAN): soil hydraprobes, meteorological tower, snow pillow, transmitted via meteor burst telemetry	Oct 11, 2011 6:14 AM
31	Campbell Loggers and its proprietary radio/software for acquisition and transmission from field sites and then another proprietary package (VistaDataVision) is used to assemble and provide an on-line interface portal for the sensor network administration.	Oct 10, 2011 10:38 AM
32	Data is logged in the field with a Campbell Scientific CR800 logger, transmitted over 900mhz radios to a building with internet, using Campbell's proprietary Loggernet. Data are output to disk as ascii, and then loaded into a DataTurbine server and committed to an SVN repository. We are experimenting with and augmenting ISI's open-source SPAN software running on a gumstix computer, to, among other things, remove loggernet from our stack.	Oct 10, 2011 9:57 AM
33	Eleven CR10X-PB stations on two separate freewave radio networks providing near real time data hourly. Mostly meteorological with soil temperature and	Oct 10, 2011 9:16 AM

Page 3, Q11. If yes to (10), briefly describe the major components of your sensor array/network and communication system (how are data transmitted?). Please indicate if components are proprietary and do not communicate with open source solutions.

	moisture as well.	
34	T1 connection to field station is shared with IP phones. Campbell and Hobo data loggers are deployed to collect data. The Campbell data loggers are connected via 900 MHz radios (spread spectrum) to the field station from weather stations and rain gauges distributed across the research site. Other instrumentation are connected via WiFi and 900 MHz radios and using cell phones. We are planning to increase the bandwidth to the field station using point to point radio hops to deliver up to 70 Mb bandwidth to wireless networks across the field station. Historic rain gauges are being augmented with tipping bucket rain gauges connected to the field station using wireless. The coverage area will also be extended across most of the research area to provide WiFi and 900 MHz radio coverage to most research sites across the Jornada.	Oct 10, 2011 9:11 AM
35	While we are in the process of constructing our sensor network, we have developed a number of data acquisition/communication devices that we will use. They are not proprietary in the sense that they can communicate with any sensor made by any manufacturer, but they are not available for distribution outside of NEON (at least, not yet).	Oct 10, 2011 6:45 AM
36	900 MHz spread spectrum radio modem connectivity to eddy flux tower/weather station from remote field computer, with additional wired/wireless sensor connections planned (e.g. H-ADCP current profiler, moorings)	Oct 8, 2011 2:17 PM
37	--At Lehigh Gap Nature Center: Davis Instruments weather stations and soil stations using long-range radio repeaters across rugged terrain --At L. Lacawac: spread spectrum radios and Campbell Scientific Loggernet software --At Crater Lake, WHOI autonomous profiler using ice-tethered profiler design (satellite uplink).	Oct 8, 2011 7:42 AM

Page 3, Q12. If yes to (10), briefly describe the tools you use to capture, process, qualify, document, and archive data streams. Please indicate if components are proprietary and do not communicate with open source solutions.		
1	LoggerNet software to download data from climate stations. SAS for data QC.	Oct 17, 2011 10:11 AM
2	Loggernet 4.1 - Campbell scientific product. daily email dailybackup2010 which is freeware program that can send email from a via SMTP. Many options to do this.	Oct 17, 2011 7:00 AM
3	Capture: Nexsens SDL 500c dataloggger Process: Matlab Quality: not sure what you mean by this term Document and Archive: online through iChart and WQData (via Nexsens, Inc)	Oct 17, 2011 4:48 AM
4	Data are collected every 15 minutes using Campbell LoggerNet software and parsed, checked, and copied to our web server using a simple in-house program (in Pascal).	Oct 14, 2011 11:55 AM
5	LoggerNet software (proprietary) is used to collect data from dataloggers. Scripts are used to download data to servers, and to process and archive most data streams. STATA scripts are used to process one data streams. Some data streams are processed in spreadsheets. We intend to replace this system with use of the GCE toolbox.	Oct 14, 2011 10:42 AM
6	See above. Campbell CR 1000 data loggers	Oct 14, 2011 9:35 AM
7	The quality flags highlight spiked data, flatlined data, data outside 3 or 4 standard deviations of the seasonal mean, and data outside the range of the instrument. A station manager reviews all the flags and identifies acceptable, suspicious, and rejected data before inserting these final data files into the final table. When a user requests data, it is first drawn from the final then the raw data tables. The database was developed by the Stevens Institute and the specifics of this process are proprietary.	Oct 14, 2011 9:07 AM
8	See comments from Adam Skibbe.	Oct 14, 2011 7:20 AM
9	We use Hobolink for everything at the moment. Data can be downloaded in either a proprietary format or as csv files. Plans are in place to create an R library to manage the data.	Oct 13, 2011 4:10 PM
10	We capture data on dataloggers and post on our WWWsite. USGS processes realtime streamflow data.	Oct 13, 2011 10:04 AM
11	Automated system developed at NASA/Goddard, documented at: http://aeronet.gsfc.nasa.gov/	Oct 13, 2011 8:20 AM
12	Ten dataloggers in WS 1 (cyber watershed), 3 weather station dataloggers, 5 gauging station dataloggers, and 1 snow hydrology station logger are all connected through radio telemetry to the base station and transmit either hourly, twice daily, or daily. Weather stations and stream gauging stations are processed using both Campbell software and Visual Foxpro database applications to produce downloadable provisional data and a one-week running graphic of air temperature, precipitation, snow depth, and stream level on an hourly basis. New applications are underway to schedule daily reading of fixed ASCII Campbell files into SQLServer for initial screening and daily posting of	Oct 12, 2011 2:06 PM

Page 3, Q12. If yes to (10), briefly describe the tools you use to capture, process, qualify, document, and archive data streams. Please indicate if components are proprietary and do not communicate with open source solutions.		
	provisional data to the web. Components are proprietary but could communicate with open source solutions.	
13	For the Thailand deployment, we use ESPER for real time analysis. We use a series of off ramps to archive data into a SQL database and pull portions of data off into CSV files.	Oct 12, 2011 1:30 PM
14	Campbell Sci. Loggernet Software, Edire/Matlab	Oct 12, 2011 12:37 PM
15	Loggernet to Excel For eddy flux: Near sites use customs linux program. Remote sites periodic download of data and then processing.	Oct 12, 2011 11:27 AM
16	Campbell software	Oct 12, 2011 7:53 AM
17	DataTaker DT80; Campbell CR1000 with LoggerNet; SeaBird Electronics SBE39; output to file then input to DataTurbine, then to postgres flat tables. Manually queried to static files for LTER Data Catalog and ClimDB.	Oct 11, 2011 3:04 PM
18	Loggernet & PC208 software (Campbell loggers) Fling & Teamviewer for PC's the webcams have their own ftp servers none of this is proprietary	Oct 11, 2011 1:03 PM
19	Campbell Scientific, Inc. LoggerNet software is used to "pull" data from remote sites, and create graphs, tables, etc. It is then uploaded to a local server and posted to the web. We check data manually in spreadsheets, noting any problems, before archiving to the web.	Oct 11, 2011 10:44 AM
20	Sensor diagnostics built into datalogger program at point of iinitial data capture. Working to bring data directly into USGS National Water Information System (NWIS), which has its own QA/QC and archiving routines.	Oct 11, 2011 7:49 AM
21	EML for documentation, database triggers for range checks and flags, archived in the database	Oct 11, 2011 7:48 AM
22	Data streams are process through YSI EcoNet interface. Components are proprietary	Oct 11, 2011 7:16 AM
23	The Remote Environmental Monitoring Observatory (REMO) is controlled by a on board computer (linux OS). All observatory subsystems (pointing system, camera, optic zoom, and spectrometers are controlled with in-house developed open source software (bash, perl, and C). All acquired telemetry streams are stored in open formats.	Oct 11, 2011 6:30 AM
24	See NRCS SCAN website for more info. All data is archived on this site: http://www.wcc.nrcs.usda.gov/scan/	Oct 11, 2011 6:14 AM
25	The VistaDataVision retains logs of raw data logger downloads and an appended correction file. Its back end is all mySQL which is also independently backed up. Additional electronic documents are kept to log maintenance activity and workflow procedures.	Oct 10, 2011 10:38 AM
26	The project I work on, REAP, is developing an open-source software stack to do	Oct 10, 2011 9:57 AM

Page 3, Q12. If yes to (10), briefly describe the tools you use to capture, process, qualify, document, and archive data streams. Please indicate if components are proprietary and do not communicate with open source solutions.		
	these things. Along with SPAN mentioned above, we utilize DataTurbine as buffer, Kepler for sensor-control, monitoring, data processing, qa/qc, documentation, and archival (into a Metacat).	
27	Dataloggers are polled hourly from a central CPU running LoggerNet software via NL100's and a freewave base radio. After data collection, data is harvested by Vista Data Vision software, run through initial QA/QC, and stored in Vista's database. At this point data is available for viewing on the web through Vista's graphing/web display component. Every 1-3 months data is manually checked using Vista generated graphs and all data anomalies/changes are noted on an excel spreadsheet. At this time data is given the okay to make available for download. Jason Downing can speak to this final process.	Oct 10, 2011 9:16 AM
28	John Anderson and Christine Laney can provide more details about these specifics than I can.	Oct 10, 2011 9:11 AM
29	We have both our Cyberinfrastructure Team and our IT Team working together to address all of the challenges associated with these processes. Currently, data processing and archival is in development and, when completed, should be open source for the community (at least, in large part).	Oct 10, 2011 6:45 AM
30	CSI Loggernet used to manage communications and acquire data from CR3000 to computer; data processed, documented and q/c'd using GCE Data Toolbox for MATLAB software (open source software library for MATLAB system)	Oct 8, 2011 2:17 PM
31	"Dropbox" used for automatically transmitting raw data to Lehigh U; Manual processing, QC and archiving data streams.	Oct 8, 2011 7:42 AM

Page 4, Q14. Please elaborate on any challenges to operation and management of your sensor system.		
1	hardware is sometimes limited because of obstructions and weather	Oct 18, 2011 2:26 PM
2	Topography, power limitations. Some sensors consume a lot of power.. why bother with the trouble of wireless if sensors are only out for a short time period. Or.. why bother with wireless if you have to drive close to intercept the data stream, you might as well just manually download.	Oct 17, 2011 10:12 AM
3	over 2GB of data collected each day cannot be sent via cellular connection. periodic site visits for downloads needed.	Oct 17, 2011 7:00 AM
4	Our current system works well for our research needs, but financials would limit us if we tried to expand the system.	Oct 17, 2011 4:49 AM
5	At our site there are two main challenges: (1) A wireless network is required to reach most field sites. After many years of effort, the network was completed last year. (2) Electrical power is needed for high speed 24/7 wireless. We're working on getting power to additional sites.	Oct 14, 2011 12:01 PM
6	The existing system requires human intervention at many steps and therefore is not suitable for allowing real-time access. We have identified the GCE toolbox as potential replacement software.	Oct 14, 2011 10:44 AM
7	Each station costs roughly $20k per year to operate. We are only willing to add stations to locations where a significant user community exists.	Oct 14, 2011 9:57 AM
8	No time to learn programming and so have to wait until suitable software is available.	Oct 14, 2011 7:20 AM
9	Large remote study area..no cell phone coverage in most of the area..must use satellite.	Oct 14, 2011 6:22 AM
10	Lack of time for personnel to manage the sensors and the data they deliver. Lack of resources to place and work with sensor networks into more remote areas (particularly for our research site in Alaska).	Oct 13, 2011 4:17 PM
11	Access and power	Oct 13, 2011 11:50 AM
12	What are the new scientific questions that I can address with sensors?	Oct 13, 2011 10:04 AM
13	NA	Oct 13, 2011 5:22 AM
14	The site is limited to a T1 line for communication to the university. The cost for a 1Gbps line or equivalent wireless connectivity is cost prohibitive ($2M) - alternate solutions are under consideration. The increase in communication capability on-site has stimulated considerable interest in using new technologies for audio files or web cams, and a more comprehensive information system will likely be required to handle expected use.	Oct 12, 2011 2:12 PM
15	In Thailand the biggest problem is trained staff (both programmers and technicians) to expand the sensor network. They work largely with UCSD for programming and AIMS for equipment support. They are also fiscaly limited from using high precision equipment. The seabird CTD in place is on loan from AIMS. They rely on low precision dataloggers such as HOBO pendants for most of their research. This operational system largely serves as a method to obtain	Oct 12, 2011 1:34 PM

Page 4, Q14. Please elaborate on any challenges to operation and management of your sensor system.		
	future funding to grow their network.	
16	ability to send large data files (eddy flux rawdata)	Oct 12, 2011 12:40 PM
17	amount of data (ca. 3Mb per hour - Eddyflux)	Oct 12, 2011 11:15 AM
18	Hard to sustain funding for trained staff for thorough data management, documentation, and sharing historical and real-time data streams	Oct 12, 2011 7:55 AM
19	Unsure. We have a few programmers involved in the project but we may need some programming and ideally not code custom to our site. The system requires a high level of technical expertise in a variety of hardware and software for maintenance and troubleshooting and I would like to see the system made more robust and manageable but do not know how to accomplish this. Mainly, I dont know what to ask, do not really understand our current system, or what is working as well as can be expected, ie how much reliability to expect.	Oct 11, 2011 3:04 PM
20	institutional opposition to new technologies.	Oct 11, 2011 1:23 PM
21	keeping track of changes (and ip addresses)	Oct 11, 2011 1:03 PM
22	Our research site is remote, and we visit about once a month, which presents maintenance challenges. Data management is also time consuming.	Oct 11, 2011 10:51 AM
23	I rely on collaborators with expertise, and this is well worth the investment to make sure it 'gets done right", but between sensor costs and technical support it gets pricey.	Oct 11, 2011 7:52 AM
24	It's very fragile and many things can go wrong along the way, I.e. it needs a lot of hands on maintenance out in the field as well as the computer and streaming components.	Oct 11, 2011 7:50 AM
25	Suport for displaying data on EPA networks and providing data open to the public.	Oct 11, 2011 7:26 AM
26	Need FY'12 funding to complete network design with TetraTech support;	Oct 11, 2011 4:43 AM
27	General need for additional resources (labor mostly) to maintain and administer these 'automated' systems	Oct 10, 2011 10:40 AM
28	Developing an open-source software stack for controlling and monitoring deployed sensors is made difficult by the wide range of hardware that use different, proprietary, closed-source hardware/software systems. Capturing thorough metadata currently generally requires a lot of manual work, smarter sensors could improve this.	Oct 10, 2011 10:11 AM
29	Challenges exist in dynamically QA/QCing streaming data prior to loading into relational databases. Bandwidth to the field station is another issue. We plan to deploy more web cameras across the research area which will require better bandwidth than our current shared T1 connection can support. As the use of wireless sensors and networks expands, the bandwidth and geographic coverage of the wireless network must also expand. We have detailed specifications and plans to address these obstacles. We plan to hire a full-time professional programmer in our next LTER funding cycle to assist with	Oct 10, 2011 9:25 AM

Page 4, Q14. Please elaborate on any challenges to operation and management of your sensor system.		
	programming efforts related to streaming data and quality assurance as well as to provide timely access to data and its associated metadata from relational databases using web services.	
30	Volume of data is difficult to maintain manually. Keeping up with costs and logistics of calibration and maintenance of sensors. Several sites are in areas difficult to reach with radio/cell communications requiring manual downloads.	Oct 10, 2011 9:19 AM
31	Currently, we are moving forwad with our plans for constructing the NEON sensor network. There will undoubtedly be challenges as we progress through the construction phase and transition to operations but, as of today, we are not experiencing any great hindrance.	Oct 10, 2011 6:48 AM
32	My site is not a LTER site	Oct 10, 2011 6:48 AM
33	Haven't had time to do this yet.	Oct 9, 2011 5:41 PM
34	limited connectivity between field site and field station, and between field station and home institution (UGA), although FSML grant obtained and upgrades are in progress	Oct 8, 2011 2:18 PM

Page 5, Q15. What science questions are you addressing with your environmental sensors and/or WSNs (briefly)?

1	CO2 exchange data for madels	Oct 18, 2011 2:27 PM
2	time-series spatial subsurface ground water level and ground water temperature variation at subject site (site-specifc)	Oct 18, 2011 9:54 AM
3	Coweeta LTER has operates a sensor network measuring below- and above-canopy light environment, and shallow soil moisture measurements, but these are not on a wireless network, and are retrieved manually. We are trying to identify the environmental drivers of spring and fall leaf phenologies, better quantify temperature-dependent models of leaf expansion, assess inter-annual variabilities, and inter-species differences. Growing season length may vary by roughly a month between years, approximately 15% of the total growing season, with concomitant effects on carbon, water, and other cycles, so it is pretty important. Phenology is observed manually during spring leaf-out and fall senescence, and above and below canopy PAR measured every minute and recorded every half-hour. We're also measuring soil moisture at these same sites, to gauge how big an impact soil moisture has on leaf-fall, and to combine with data collected at the gradient plots to eventually develop a better quantitate soil moisture model. In addition, ISCO water samplers, water-level recorders, and Hydrolab sondes are being used to measure various water quality parameters in 12 streams draining areas of various land use. We are interested in how traditional valley development and more recent mountainside development affect water quality. The parameters measured with the sonde are temperature, electrical conductivity, dissolved oxygen concentration, and turbidity. Other parameters are measured from water samples collected with the ISCO sampler. We are particularly interested in water quality changes during storms as this is a very important but often ignored time of chemical and sediment transport. Instrumentation: Terrestrial Gradient Microclimate Data: 5 sites have air temp, soil temp, and soil moisture that are measured every 60 seconds and output every hour. Data have been collected since ~1991 and are manually downloaded monthly using a PDA. An older model CR10 Campbell Data logger, as well as standard soil moisture probes and temp sensors are used to collect the data. Data are used collectively by LTER researchers, including Jim Clark, Paul Bolstad, Jennifer Knoeep, Wayne Swank, and Jim Vose. Data are currently QC'd using Matlab. Continuous Soil Moisture: 4 sites have continuous soil moisture using Campbell Scientific CR10 data loggers. Soil moisture, soil temp, and air temp data are measured every 60 seconds and output as hourly averages since about 2000. In addition, two sites have below-canopy and above canopy PAR sensors that are used in conjunction with spring and fall leaf phenology measurements. Paul Bolstad is the lead PI for this study. Data are currently QC'd using Matlab. Duke Gap Plots: Since 2007, one of the Duke Gap plots (dominant trees in these plots were pulled down to create artificial gaps) has had 9 soil moisture sensors that run off of a Campbell Scientific CR10X data logger. Jim Clark is the PI for this project; he uses the data for his modeling work with forest dynamics. Data are currently QC'd using Matlab. Intensive Hillslope Plots Microclimate Stations: We are in the process of placing soil moisture, soil temp, air temp, and groundwater pressure transducers at 6 sites within Macon County. Each site will have 3 microclimate stations (for a total of 18 stations), with data measured every 60 seconds and output as hourly averages using a Campbell Scientific CR200 data logger. Air temp will be measured with Hobo temp probes (still need to purchase these). Data will be used by multiple scientists as part of an effort to model	Oct 17, 2011 1:37 PM

Page 5, Q15. What science questions are you addressing with your environmental sensors and/or WSNs (briefly)?		
	biogeochemical and hydrologic pathways on mountain slopes under different management regimes. We are in the process of working on a QC process for these data. Intensive Hillslope Plots Weather Stations: A subset of 5 the intensive hillslope plots will have weather stations collecting rainfall, wind speed, wind direction, air temp, barometric pressure, etc. as part of an effort model biogeochemical and hydrologic pathways on mountain slopes under different management regimes. We are in the process of working on a QC process for these data. ISCO Storm Sampling – We used 12 Teledyne ISCO samplers to sample storms for nutrients and TSS. A pressure transducer was connected to the ISCO to measure the stage of the stream. These data were manually collected every 3 weeks or so as an effort to build hysteresis curves for TSS and nutrients. Nine of these units will be moved to smaller headwater streams connected to the Intensive Hillslope study. These data are managed by an LTER tech and graphed/analyzed in Excel and Sigma Plot to troubleshoot the ISCO. Data are used by Jack Webster, Rhett Jackson, David Leigh, and Larry Band. Hach MS5 Hydrolab – We used Hach MS5 Hydrolabs to measure stream water conductivity, temperature, turbidity, and dissolved oxygen at 12 sites in Macon County as part of a study to link streams with land use. Data are output hourly and used in conjunction with the ISCOs. Instruments are calibrated every 3 weeks and data are QC'd in Sigma Plot. Nine of these instruments will be moved to the Intensive Hillslope plots. Data are used by Rhett Jackson, David Leigh, and Jack Webster. Stream Gauges: We are keeping up a subset of Katie Price's stream gauges that record the stage of the stream. Katie developed curves for each of these streams so we can correlate stage with discharge. Data are collected using Odyssey probes. Data are collected every two months and are QC'd using Excel or Matlab. PIs that use these data include Rhett Jackson and Larry Band. Hemlock Plot Soil Temperature Data: As part of the hemlock study at Coweeta, we have 4 Hobo temp sensors at each of 12 hemlock plots. Sensors are buried at 5 cm depth. Data are output as hourly averages. Data are collected about every 6 months.	
4	1. Eddy Flux-- net ecosystem carbon exchange of southern App. deciduous forest. 2. Long term network: long term trends in air temp, precip, streamflow. Effects of aspect, elevation, disturbance, forest management, climate change. Rainfall intensity, amount and duration changes over time, elevation, aspect. 3. RAFES- How do major forest types in eastern US respond to drought. Can we monitor a forest for indications of drought stress? 4. Do fire disturbance, forest management, insect invasion affect fluxes of nutrients at the watershed scale? 5. How do species, height, age of forest trees affect streamflow and ET? Are some species, height, ages more vulnerable to effects of climate change than others? How do species identity and soil moisture affect root distribution, root strength, landslide risk.	Oct 17, 2011 10:12 AM
5	To what extent is nutrient flux in headwater systems affected by land use change? How do storm events influence nutrient flux in these systems?	Oct 17, 2011 8:42 AM
6	How are wind gust structures and the sway motion of trees coupled? How does tree sway feed back turbulence into the atmosphere.	Oct 17, 2011 7:04 AM
7	Ecological response to development impacts	Oct 17, 2011 5:13 AM
8	several and ongoing. These include topics such as: 1. Effects of disturbance	Oct 17, 2011 4:53 AM

Page 5, Q15. What science questions are you addressing with your environmental sensors and/or WSNs (briefly)?		
	events on lake ecosystems 2. Role of physics/mixing in signals 3. Drivers of short-term changes in transparency 4. Ecosystem metabolism	
9	We have electronic sensors, data loggers and/or computers, and wireless network access at many of our experimental sites. Not all projects are interested in streaming data in real time. Too many science questions to list here.	Oct 14, 2011 12:13 PM
10	Changes in stream discharge, water, snow, and temperature.	Oct 14, 2011 11:05 AM
11	We are interested in sediment transport, hydrology, air-water gas exchanges, and the impact of aquatic plants on the Estuary's biochemistry. Other questions include using this technology to monitor water quality concerns, provide accurate forecasts for navigational users, and flood warnings.	Oct 14, 2011 9:57 AM
12	Effects of winds/storms on trees (strain and stem response) and ecosystems, biogeochemical cycling in watersheds, inputs of Saharan dust, climate change	Oct 14, 2011 9:40 AM
13	What is the effect of storm events (heavy precipitation) on lake transparency and DOC levels?	Oct 14, 2011 7:54 AM
14	Productivity and community responses to climate.	Oct 14, 2011 7:26 AM
15	High resolution data help us determine the drivers of ecosystem change and responses over time scales that can capture episodic events as well as long-term trends. Questions include “is it possible to anticipate ecosystem shifts from the variance in high-resolution data”	Oct 14, 2011 6:24 AM
16	How can cyberinfrastructure enhance the capacity of studying land atmosphere interactions in desert ecosystems? What is the temporal variability and what controls of land atmosphere of CO2, water, and energy of a desert shrubland in the Northern Chihuahuan desert? How can biophysical properties (CO2, water vapor, energy) and processes be extrapolated from remote sensing data products (i.e. Landsat, Modis)?	Oct 13, 2011 4:20 PM
17	Climate change, hydrologic cycle, carbon cycling, nutrient fluxes, soil respiration	Oct 13, 2011 11:53 AM
18	We use sensors mostly to collect basic monitoring data on streamflow, soil temperature and moisture and rainfall.	Oct 13, 2011 10:04 AM
19	NA	Oct 13, 2011 5:22 AM
20	Address ecophysiological and ecohydrological questions in mountainous systems at high spatial and temporal resolution including questions about the sources of variability in ecosystem respired delta-13 CO2 and air flow patterns, with the ultimate intention of inverting this monitoring to understand annual patterns on an ecosystem wide scale.	Oct 12, 2011 2:19 PM
21	The Thailand project looks to address the changes in the bay at Racha Yai that is causing an increasing amount of coral bleaching.	Oct 12, 2011 1:46 PM
22	metabolism of marsh and estuary	Oct 12, 2011 12:43 PM
23	Changes in the arctic system at catchment and landscape scales as the product	Oct 12, 2011 11:30 AM

Page 5, Q15. What science questions are you addressing with your environmental sensors and/or WSNs (briefly)?		
	of: (i) Direct effects of climate change on states, processes, and linkages of terrestrial and aquatic ecosystems, and (ii) Indirect effects of climate change on ecosystems through a changing disturbance regime.	
24	How climate is changing, how forest growth is linked to climate, how changes in forest structure and composition alter microclimate	Oct 12, 2011 7:59 AM
25	How do nitrate concentrations vary throughout the day and from day to day	Oct 12, 2011 7:25 AM
26	We are currently doing technology development for a WSN to be used in a marine system: data takers, modems, and middleware. Our current project is to develop middleware and hardware for a Broadcasting Oceanographic Bouy (BOB). Near-real-time streaming data are incorporated into MCR public outreach.	Oct 11, 2011 3:04 PM
27	Depends on particular studies. Mostly hydrologic and biogeochemical responses to enviornmental change.	Oct 11, 2011 1:24 PM
28	How do environmental factors control ecosystem C cycling and trace gas exchange.	Oct 11, 2011 1:04 PM
29	Climate change influence on biogeochemistry of forested watersheds in NE United States.	Oct 11, 2011 10:55 AM
30	How is climate change impacting the hydrology and chemistry of the watershed?	Oct 11, 2011 10:12 AM
31	How does land use effect qualities of streams and their corresponding hillsides?	Oct 11, 2011 9:56 AM
32	What are the short- and long-term dynamics of stream carbon, nitrogen, and mercury dynamics and what controls them?	Oct 11, 2011 8:00 AM
33	the data are used as primary or back ground data for almost all science questions that are asked in NTL and GLEON about lake functioning.	Oct 11, 2011 7:50 AM
34	What are current Water Quality conditions at selected locations and what are phycocyanin (cyanobacteria) levels	Oct 11, 2011 7:36 AM
35	A major hurdle in extending plot level foliar characterization at the canopy level is the lack of detailed knowledge of the spectral variability as a function of seasonal (temporal) and spatial sampling scales. Due to the infrequency and high cost associated in field monitoring campaigns, there currently exists a serious observational gap in the ability to make repeated spectral observations over the same spatial locations to determine the variability in spectral signatures. The ability to reduce uncertainties in determining key global change variables derived from spectral signatures will ultimately depend upon detailed knowledge of the temporal and spatial variability of spectral signatures at the plot level. Our instrumentation (REMO) is specifically attempting to address: o - What is the spectral variability as a function of temporal sampling scales? o - What is the spectral variability within and between species? o - What is the canopy spectral variability as a function of spatial sampling scales? o - How do we translate these variances into reducing estimations of critical vegetative climate parameters? o - How do we monitor small scale changes at the plot level?	Oct 11, 2011 6:45 AM

Page 5, Q15. What science questions are you addressing with your environmental sensors and/or WSNs (briefly)?		
36	Can we identify a climate change signal at reference stream sites from changes in the macro-invertebrate/fish assemblage and water temperature through time;	Oct 11, 2011 4:49 AM
37	The Bonanza Creek Long-Term Ecological Research program (BNZ LTER) focuses on improving our understanding of the long-term consequences of changing climate and disturbance regimes in the Alaskan boreal forest. The central question of our research is: How are boreal ecosystems responding, both gradually and abruptly, to climate warming, and what new landscape patterns are emerging? Our overall objective is to identify factors that buffer systems from radical changes in structure and functioning (resilience) vs. factors that might precipitate changes to alternative states (vulnerability). This requires an extension beyond the assumptions of steady state dynamics to ask under what conditions changes in drivers might trigger a fundamental change in the nature of boreal ecosystems.	Oct 10, 2011 11:29 AM
38	Exploring the impacts of abiotic factors (real-time light, temperature, and rainfall measurements) on the dynamics of plant host populations and their susceptibility to viral pathogens.	Oct 10, 2011 10:16 AM
39	see John Anderson's response	Oct 10, 2011 9:26 AM
40	We have 7 "Grand Challenges" that will address: biogeochemistry, biodiversity, climate change, ecohydrology, infectious disease, land use and invasive species.	Oct 10, 2011 6:58 AM
41	N/A	Oct 10, 2011 6:49 AM
42	How does urbanization impact water quality during storm events, and how do river systems mitigate urban signals across flow condition.	Oct 9, 2011 5:44 PM
43	patterns and quantities of fresh water and nutrients delivered to coastal zone from surface and groundwater flow and atmosphere; atmospheric drivers of estuarine processes; fluxes of heat and CO2 between tidal creeks, marshes and atmosphere that affect carbon and heat balances throughout ecosystem	Oct 8, 2011 2:32 PM
44	Differences in soil CO2 flux among sites with different land uses / land covers (forest, agricultural, suburban).	Oct 8, 2011 8:09 AM
45	--L. Lacawac: hydrologic budget used to study UV attenuation by the water column and carbon dynamics in response to climate change. --Lehigh Gap Nature Center: microclimate measurements are tracking ecosystem recovery from heavy metal pollution after introduction of warm season grasses. --Crater Lake: daily profiles of O2, Fchl, Fcdom, Turbidity are used to explore natural cycles of transparency, food web dynamics, and UVR impact on photosynthesis	Oct 8, 2011 7:57 AM

Page 5, Q16. What new science questions or opportunities would you like to address with environmental sensors and/or WSNs (briefly)?

1	High spectral resolution and temporal resolution visible/near infrared spectra will be collected to support the study of terrestrial ecosystems. This scale of observation fills a gap in efforts to scale from field data collections to remote sensing campaigns. Specific questions involve gaining a better understanding of daily/seasonal variation in vegetation reflectance. Airborne/satellite observations are typically few and far between - understanding the evolution of canopy reflectance at a high temporal frequency will improve our ability to interpret these sparse observations.	Oct 19, 2011 12:00 PM
2	role of bedrock uplands wrt to aquifer recharge an overall water balance	Oct 18, 2011 9:54 AM
3	In general, it would be great to have the data from our instruments come in remotely, be automatically QC'd and flagged, EML automatically generated, and be placed online. It would also be great if we could expand this sensor network to other parts of Coweeta and the surrounding area. In reference to the Hydrolab MS5, It would be great to expand these sensors so that we would have a set in the larger watershed and one nested in a headwater stream that corresponds to a specific land use. One thing that would be particularly helpful would be direct in-line measurement of chemical parameters. Because most chemicals are so low in streams of this area, existing sensors are not sufficiently sensitive. Direct measurement of nitrate would be particularly useful, and we understand the technology is getting better. In answer to question #2, I'd like to see the phenology and soil moisture networks expanded, and made wireless, so that we can better sample the range of variation and better answer the above questions across the environmental gradients at Coweeta, and ease the burden of data retrieval. Additionally, we would hopefully to add above/below canopy phenology at the current micro-met stations. There is a great opportunity to further expand the microclimate, or some components of it, through wireless sensor networks. Predicted increases in temperature and precipitation variability may express themselves differently across the landscape, leading to greater or more frequent ridge-to-cove moisture gradients in dry years, and lower gradients in wet years, mediated by elevation. We can't really follow this at any fine spatial grain through time, but conceivably could with a better, wireless sampling network. This network would allow us to better quantify species, stand, and basin responses to climatic variation, and related soil moisture conditions. We'd be able to better couple the climate-plant-hydrologic system, the basis for primary productivity and stream hydrology in the region, particularly if coupled with a small set of sap flux measurement sites. This would go a long way towards answering questions about plant controls on stream hydrologic response, the spatial and temporal condition under which soil moisture affects plant transpiration.	Oct 17, 2011 1:37 PM
4	Ties into above questions... many of these are on-going questions and new opportunities arise out of these questions	Oct 17, 2011 10:12 AM
5	closer examination of collisions between trees.	Oct 17, 2011 7:04 AM
6	improved experimental design for tracer experiments	Oct 17, 2011 5:13 AM
7	I'd like to be able to address questions that we are asking locally now at a more	Oct 17, 2011 4:53 AM

Page 5, Q16. What new science questions or opportunities would you like to address with environmental sensors and/or WSNs (briefly)?

	regional scale. This includes also asking questions about regional coherence in signals.	
8	We are developing a pumped monitoring station in Poughkeepsie, NY to link the real-time observations with an automated pumping system. Immediately, this will be used to examine environmental hormone levels near a wastewater discharge.	Oct 14, 2011 9:57 AM
9	Better understanding of wind forces in forests (hurricane prone area), differences in biogeochemical cycles in stands of various life zones and successional status	Oct 14, 2011 9:40 AM
10	How will increased precipitation events affect lake transparency in the long-term? Will it be possible to predict long-term changes in DOC or other variables from short-term episodic events?	Oct 14, 2011 7:54 AM
11	C3 and C4 contributions to ecosystem fluxes. Role of precipitation patterns in productivity and community dynamics.	Oct 14, 2011 7:26 AM
12	Questions include “is it possible to anticipate ecosystem shifts from the variance in high-resolution data”.	Oct 14, 2011 6:24 AM
13	I am examining machine-learning approaches to automate the quality control process. I am interested in evaluating the performance of these data-driven QA/QC algorithms using data collected from ecological sensor networks.	Oct 13, 2011 7:15 PM
14	How to optimize automated sensor network packages for desert ecosystems	Oct 13, 2011 4:20 PM
15	Elevational habitat gradients, forest phenology, rain-snow transition zone dynamics, salmon habitat quality	Oct 13, 2011 11:53 AM
16	NA	Oct 13, 2011 5:22 AM
17	Use an energy balance automated weather station (AWS) in Watershed 7 to provide climate data at a site that represents a transition between rain- and snow-dominated winter precipitation.	Oct 12, 2011 2:19 PM
18	An interest is the use of the cameras for automated count of tourists visiting the bay (easy to do since most tourists come in boats wearing orange life vests).	Oct 12, 2011 1:46 PM
19	upscaling regional networking	Oct 12, 2011 12:43 PM
20	Do in-stream measurements provide more accurate results than grab samples	Oct 12, 2011 7:25 AM
21	We would like to do adaptive sampling to detect the influence of internal waves bringing nutrients to the surface. We will be conducting a FOCE experiment with near-real-time data streams.	Oct 11, 2011 3:04 PM
22	1.Can we use in-stream DOC proxy (OM fluorescence) to explain why stream DOC concentrations have bben increasing at most sites over the past two decades? 2. What is the mid- to longer-term prognosis for terrestrial mercury export? C and Hg are strongly linked but DOC is increasing while Hg deposition is decreasing -- how will this play out for Hg?	Oct 11, 2011 8:00 AM

Page 5, Q16. What new science questions or opportunities would you like to address with environmental sensors and/or WSNs (briefly)?		
23	I would like to assess nutrient levels to evaluate BMP stormwater effectiveness	Oct 11, 2011 7:36 AM
24	Implications of climate change for maintaining aquatic ecological integrity.	Oct 11, 2011 4:49 AM
25	?	Oct 10, 2011 11:29 AM
26	N/A - My work is to better enable scientists to do these things.	Oct 10, 2011 10:16 AM
27	see John Anderson's response	Oct 10, 2011 9:26 AM
28	Theoretically, we will enable the realization of continental-scale ecological forecasting. Practically, we will implement all of the necessary cyberinfrastructure, and automated sensors to enable this forecast.	Oct 10, 2011 6:58 AM
29	N/A	Oct 10, 2011 6:49 AM
30	How do multiple land uses interact with river system response to result in the patterns of water quality at the mouth of large watersheds?	Oct 9, 2011 5:44 PM
31	How do long-term climate changes affect the balance of water, heat and productivity (CO2) across the estuarine-marsh complex	Oct 8, 2011 2:32 PM
32	Currently, we are only measuring soil respiration during the growing season. I would like to add winter measurements of CO2 flux through snow packs, which would also include adding measurements of snow depth and wind speed. I would like to use sensors to collect high frequency data of fluxes besides CO2, e.g. N2O, CH4, NH3, VOCs. This would be especially important in managed and human dominated landscapes and could provide very detailed information about the environmental drivers (pulse and press) for these gases. My ideal would be to sample for CO2, N2O, and CH4 year-round	Oct 8, 2011 8:09 AM
33	--L. Lacawac: With autonomous profiling for Fchl, Fcdom, backscatter, UV & PAR Kd, dissolved oxygen, specific conductance, and pH we could dramatically improve models for carbon flux and UV attenuation and lake response to climate change. --L. Lacawac watershed: By monitoring soil moisture and respiration and canopy bulk density we could model forest recovery from overgrazing by deer (experimental logging, exclosures, herbicide treatments in progress). --Crater Lake: would like to monitor runoff into lake with higher resolution lake level sensor and watershed snow/soil moisture sensors.	Oct 8, 2011 7:57 AM

Page 5, Q17. What new science questions do you dream of addressing with environmental sensors and/or WSN's (briefly)?		
1	Few instruments of this type have been developed to date, and through this and other efforts, we hope that expanded deployments will help to improve canopy reflectance characterizations across multiple plant functional types.	Oct 19, 2011 12:00 PM
2	magnitude and frequency of ground water level responses to extreme storm events and long-term climate trends over decades	Oct 18, 2011 9:54 AM
3	Much of the early work at Coweeta focused on spatial variation in precipitation, canopy interception, and basin-scale estimates of plant water use to better understand and predict hydrologic response. The methods were simple, and because labor was inexpensive, the sampling was spatially extensive, but temporally coarse. We have as good an estimate as anyone of canopy interception, but it is at a coarse level, averaged over basins and an annual cycle of storms. It would be nice to know with a given set of antecedent conditions, e.g., soil moisture, depth to saturation, litter moisture, and forest canopy moisture and structure, what is the fate of precipitation? How much is intercepted in the canopy, how much goes to re-wet litter, how does soil respond, and by depth, and how much and how fast is there direct contribution to streams. Unfortunately, we can't really answer these questions at even monthly time scales. We've substituted electronic measurement systems as labor has gotten more expensive, so now many microclimate-dependent studies sample at a high temporal frequency, but a small spatial frequency. With a network, you could perhaps do both. Sensors are still a significant cost, but they are also fixed by power supplies and wiring to a logger. A distributed network of microsensors for temperature, humidity, PAR, soil moisture, and precipitation would improve our estimates of the canopy environment that drives transpiration. A complementary dense network of stream sensors, with depth and cross sections, would allow fine-temporal measurements of depth fluctuation and response. In addition, our experience in sampling storms over the past year has been very frustrating. The best storms always occurred at night, on weekends, and when critical people were on vacation. Even when the storms cooperated, at least one sampler (out of 12) failed. If we had reliable and sensitive direct in-line chemical sensors, we could avoid a lot of effort and problems.	Oct 17, 2011 1:37 PM
4	understand how feedbacks between wind gust structure and forest stand structure vary through the full range of its maturity/development and how deciduous dominated forests may differ in this relationship	Oct 17, 2011 7:04 AM
5	1. How do lakes act as sentinels of whole catchment characteristics? (e.g., does a single point ecosystem metabolism estimate in a lake provide insight into broader landscape level metabolism?) How do terrestrial-aquatic linkages controlled by individual, site-specific characteristics vs. what are the common patterns observed across systems?	Oct 17, 2011 4:53 AM
6	I look forward to an accurate pathogen sensor to assess the impacts of CSO and SSO events and predict conditions for health and safety purposes.	Oct 14, 2011 9:57 AM
7	Acoustical sensor networks to look at population size and dispersal of various endemic bird and frog species. Relationship of bird/frog behavior to climate variables.	Oct 14, 2011 9:40 AM
8	How can sensors be used to forecast future changes from environmental	Oct 14, 2011 7:54 AM

Page 5, Q17. What new science questions do you dream of addressing with environmental sensors and/or WSN's (briefly)?		
	impacts?	
9	Understanding spatial hetergeneity of soil moisture and positive local feedbacks between soil moisture and precipitation	Oct 14, 2011 7:26 AM
10	I hope to learn the degree of spatial and temporal granularity necessary in a sensor network necessary to achieve acceptable performance of our automated QA/QC approach. Moreover, I want to evaluate our methods on networks containing a rich variety of sensor types to see how different phenomenon correlate on a spatial and temporal scale that is captured by the network.	Oct 13, 2011 7:15 PM
11	Forest metabolism, glacial recession	Oct 13, 2011 11:53 AM
12	NA	Oct 13, 2011 5:22 AM
13	Track bird or mammal movement using audio recorders or radio tags within the forest.	Oct 12, 2011 2:19 PM
14	Real-time modeling of ocean currents and circulation patterns.	Oct 11, 2011 3:04 PM
15	Many. Some focused on climates effects on ecosystem processes.	Oct 11, 2011 1:24 PM
16	Lake chemistry monitoring, with a bouy system.	Oct 11, 2011 10:55 AM
17	How can we use in-stream DOC proxy (OM fluorescence) to shed light on terrestrial C cycling and its role in the global C budget?	Oct 11, 2011 8:00 AM
18	Measuring indicator bacteria (E.coli) real-time	Oct 11, 2011 7:36 AM
19	Relevance of climate change to already impaired/degraded stream aquatic ecological integrity;	Oct 11, 2011 4:49 AM
20	?	Oct 10, 2011 11:29 AM
21	N/A - My work is to better enable scientists to do these things.	Oct 10, 2011 10:16 AM
22	see John Anderson's response	Oct 10, 2011 9:26 AM
23	It would be incredible if we could collaborate, not only across the continent, but around the world with other networks to facilitate ecological forecasting on a global scale.	Oct 10, 2011 6:58 AM
24	N/A	Oct 10, 2011 6:49 AM
25	What happens to all the nitrogen people are adding to the landscape? What is the fate of aquatic carbon?	Oct 9, 2011 5:44 PM
26	How do long-term climate changes affect the balance of water, heat and productivity (CO2) across the estuarine-marsh complex in a spatially-explicit manner (i.e. with high spatial resolution)	Oct 8, 2011 2:32 PM
27	I would love to see a network of sites throughout the Northeast doing year-round measurements of soil CO2, N2O, and CH4 flux. We have a reasonable network	Oct 8, 2011 8:09 AM

Page 5, Q17. What new science questions do you dream of addressing with environmental sensors and/or WSN's (briefly)?		
	of eddy covariance towers, but these are focused on measuring CO2. I dream of automated soil respiration systems with the capability to measure multiple species of gases tied into this infrastructure, performing measurements both in winter and during the typical field season. This kind of network could help to address how soil C and N cycles will respond to the changes in winter temperature and precipitation forecasted for this region.	
28	With a multi-lake network of weather stations, high-resolution lake level and stream flow sensors, and autonomous profiling instruments across N. America we seek to measure climate change signals using dynamics of hydraulic residence time, carbon flux, lake metabolism, and plankton processes.	Oct 8, 2011 7:57 AM