

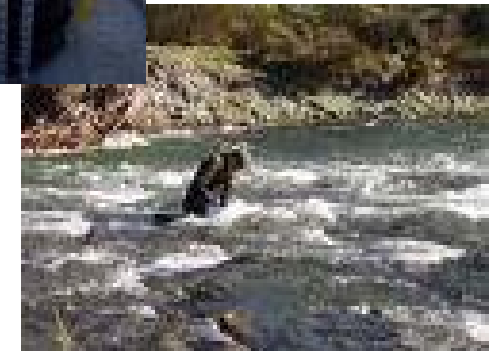
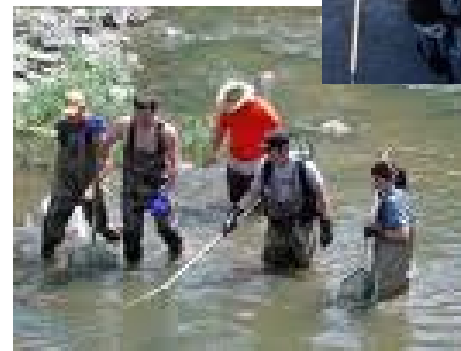
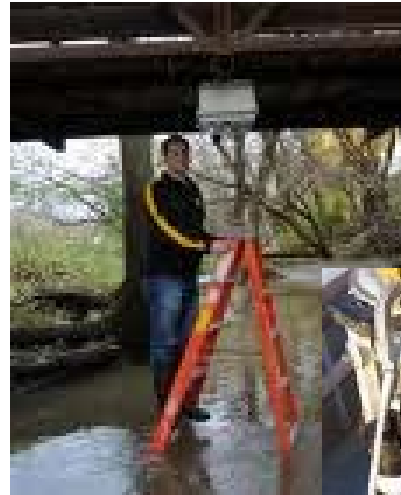
# National Ecological Observatory Network

## Scheduling

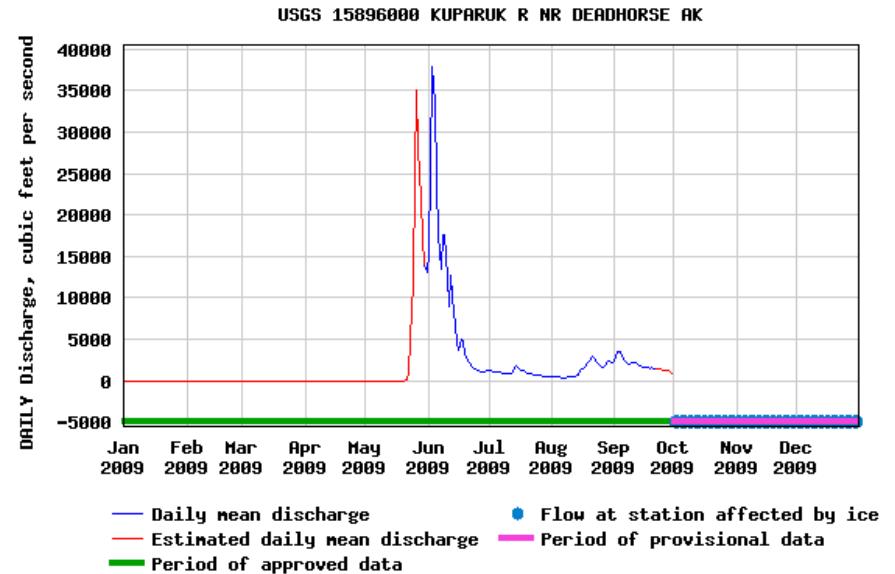
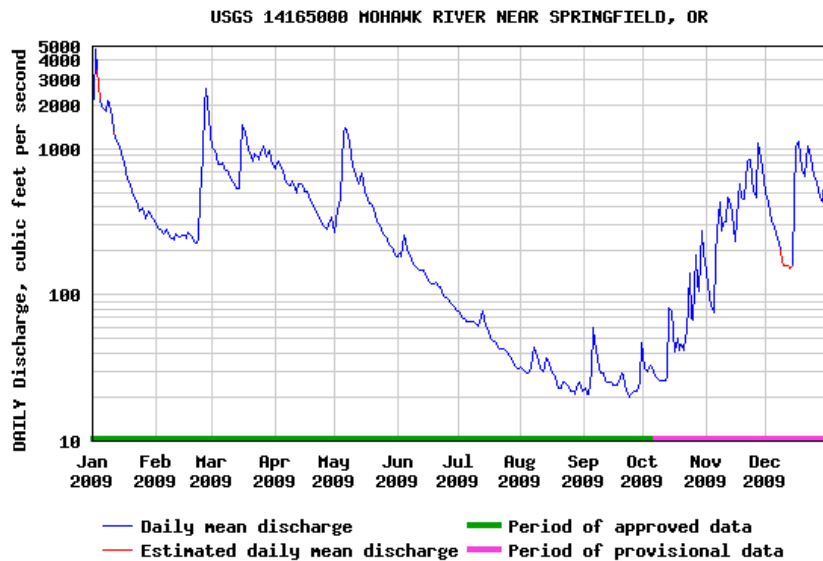
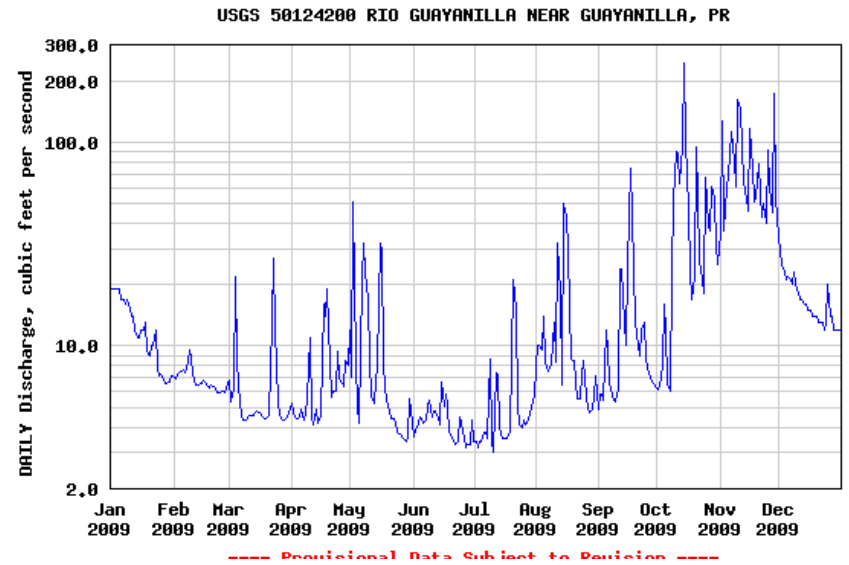
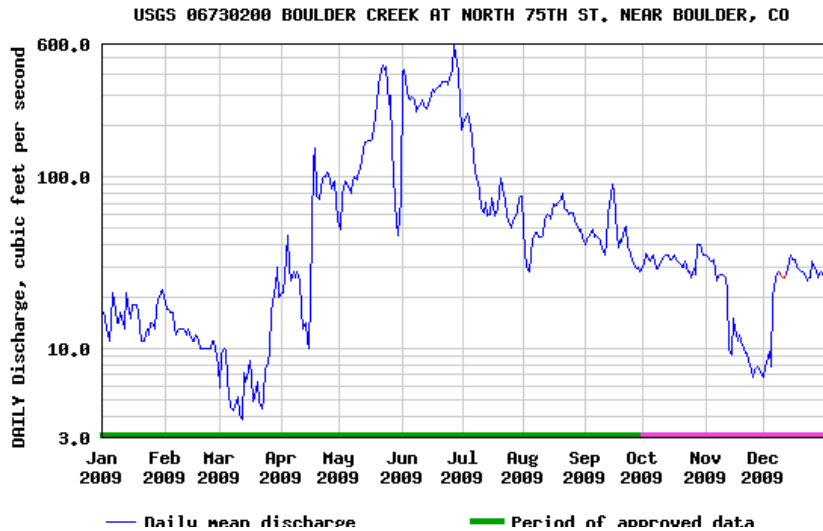
H. Powell / NEON Project Team

# Scheduling Challenge

- Data
  - Maintain sensors
  - Calibrate sensors
  - Verify rating curves
  - Water chemistry
  - Sediment chemistry
  - Algae
  - Aquatic plants
  - Insects
  - Fish
  - Stream morphology



# NEON Scheduling Challenges



# NEON Scheduling Challenges



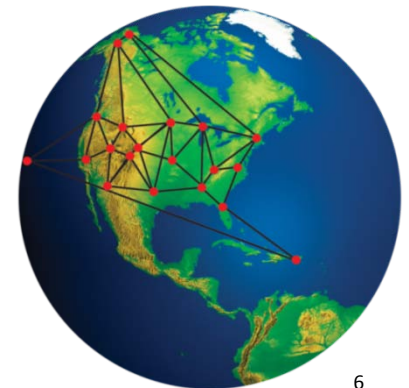
# What is Unique about NEON Scheduling?

- 100 sites distributed across 20 Domains
- Tasks are seasonal
- Seasonality varies by site
  
- Some tasks are people-intensive
- Required skill sets and experience level varies by task
  
- Tasks are dependent site-> on-site lab -> off-site lab

# NEON Goals

Enable understanding and forecasting of climate change, land use change, and invasive species on continental-scale ecology by providing infrastructure to support research in these areas.

- **Information infrastructure:** Consistent, continental, long-term, multi-scaled data-sets and data products that serve as a context for research and education.
- **Physical Infrastructure:** A research platform for investigator-initiated sensors, observations, and experiments providing physical infrastructure, cyberinfrastructure, human resources and expertise, and program management and coordination.



# GRAND CHALLENGES

**Forcing**  
Climate, Land Use  
Invasives



**Responses**  
Biodiversity, Biogeochemical,  
Disease, Ecohydrology

**Lead to focused questions that NEON can address on continental scales...**

What implications do breeding bird phenological shifts have for West Nile Virus disease risk?

How does the changing pattern of land use affect terrestrial productivity at the continental scale?

What is the aquatic biological response to sustained increases in nutrients?

How are the rates of geographic spread and population growth of invasive species affected by land use and climate change?

**That require specific data products to answer the questions...**

Bird diversity; West Nile Virus prevalence in mosquitos

Land cover classification; Ecosystem exchange of carbon

Benthic macro-invertebrate diversity and abundance; Stream metabolism

Invasive species risk maps; Historical Climate Data

**And NEON's infrastructure supports science packages that provide the measurements required to produce the data products**

**FSU**  
Science Reqs  
Tech/Ops Reqs

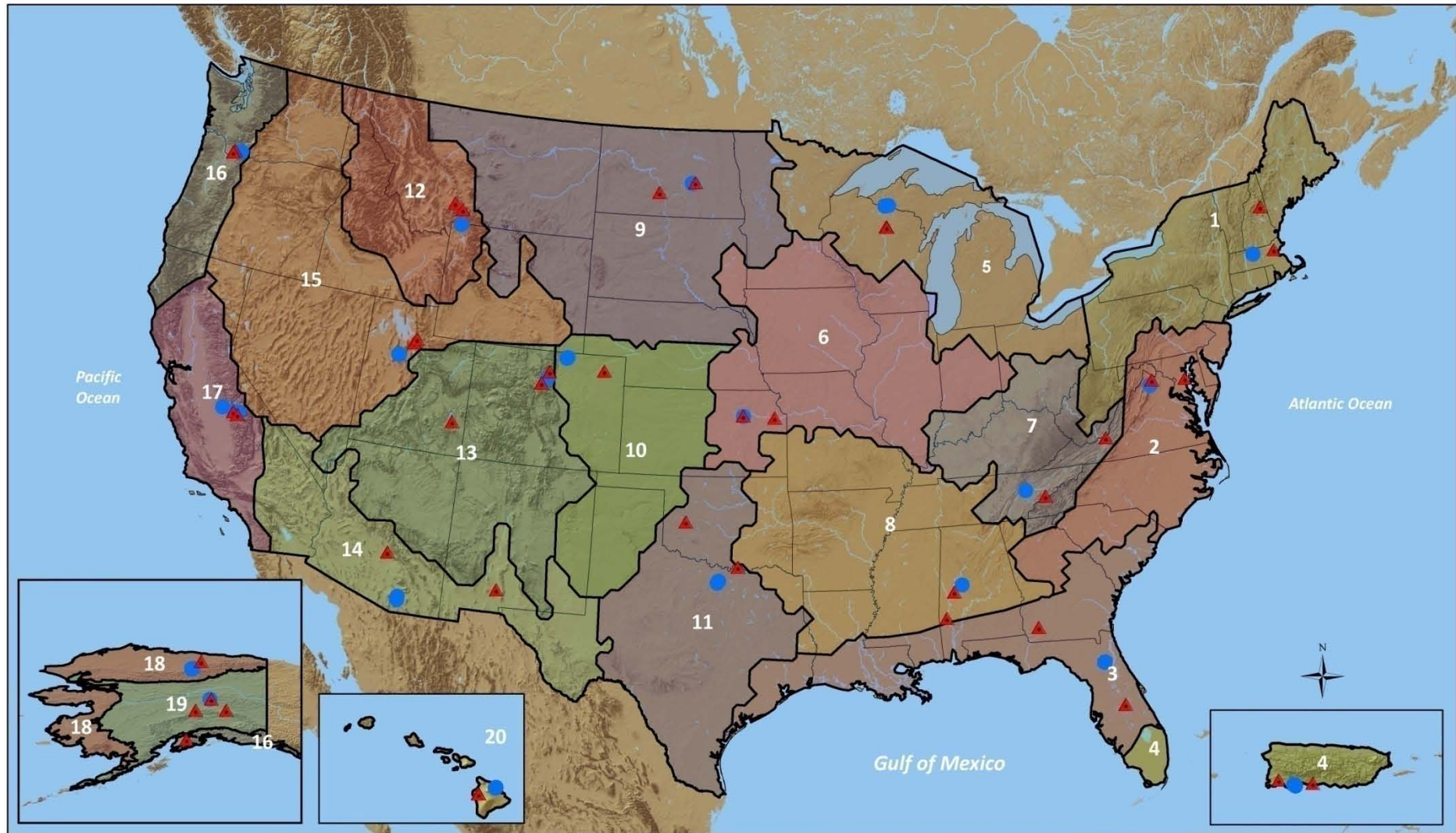
**FIU**  
Science Reqs  
Tech/Ops Reqs

**AOP**  
Science Reqs  
Tech/Ops Reqs

**LUAP**  
Science Reqs  
Tech/Ops Reqs

**STREON**  
Science Reqs  
Tech/Ops Reqs





## NEON Domains

- |                        |                                   |                     |                                      |                      |
|------------------------|-----------------------------------|---------------------|--------------------------------------|----------------------|
| 1 Northeast            | 5 Great Lakes                     | 9 Northern Plains   | 13 Southern Rockies/Colorado Plateau | 17 Pacific Southwest |
| 2 Mid Atlantic         | 6 Prairie Peninsula               | 10 Central Plains   | 14 Desert Southwest                  | 18 Tundra            |
| 3 Southeast            | 7 Appalachians/Cumberland Plateau | 11 Southern Plains  | 15 Great Basin                       | 19 Taiga             |
| 4 Atlantic Neotropical | 8 Ozarks Complex                  | 12 Northern Rockies | 16 Pacific Northwest                 | 20 Pacific Tropical  |



# Level 1 Data Product Deliverables

## (Total = 539)

Science Sub-System	Level 1 Products	Examples
FSU	200	Species ID, number of individuals, Hantavirus presence, tree diameter, leaf N concentration
AQU/STR	194	Algal cell count, macroinvertebrate biovolume, stream discharge
FIU	100	Temperature, humidity, PAR
AOP	4	Spectral reflectance, vertical waveform
LUAP (Level 3)	41	Topography, satellite spectral reflectance, human population density
<b>TOTAL</b>	<b>539</b>	

# Level 4 Data Product Deliverables

## (Total = 118)

Suite	Level 4 Products	Examples
<b>Bioclimate</b>	<b>18</b>	<b>Climate forcings, LAI, fPAR</b>
<b>Biodiversity</b>	<b>31</b>	<b>Abundance, diversity, phenology, demography</b>
<b>Biogeochemistry</b>	<b>30</b>	<b>Ecosystem-atmosphere exchange, nutrient stocks and fluxes</b>
<b>Ecohydrology</b>	<b>10</b>	<b>Soil moisture, water-balance, stream discharge</b>
<b>Infectious Disease</b>	<b>7</b>	<b>Disease prevalence (WNV, Lyme, dengue)</b>
<b>Land Use Change</b>	<b>22</b>	<b>Environmental properties, land cover, land use</b>

# Scheduling Steps

1. Identify tasks
2. Hours required to complete tasks
3. Unique skills or experience requirements
4. Build a schedule
5. Optimize the schedule
6. Repeat for all Domains

# 1. Identify major tasks

- Tower sensor maintenance I, II, III
- Aquatic sensor maintenance I, II
- Sensor calibration I, II
- Soils I, II, III, IV
- Plants I, II, III, IV, V, VI
- Mammals I, II
- Mosquitoes I, II
- Algae
- Insects
- Stream and lake morphology
- STREON I, II, III
- Infrastructure maintenance
- Domain lab maintenance
- General repair and maintenance
- Chemistry
- Birds
- Beetles I, II
- Aquatic chemistry I, II, III
- Aquatic plants I, II
- Fish
- Riparian plants
- Rating curves

**42 major task groups**

# 2. Hours to Complete Tasks

- NEON: bottom-up estimate of required hours for each task

Tower Maintenance I					Team 1		Tower Maintenance III				
Start	End	Start	End	Time	Location	Activity	Start	End	Start	End	Time
0:20	0:20	0:20	0:20	0	Parking Area	Arrive at Location					
					Parking Area	Review work order; prepare equipment & supplies; perform safety briefing.					
0:10	0:30	0:30	0:30	500	In route	Travel to Instrument Hut					
0:15	0:45	0:45	0:45	0		load gas cylinders from Domain HQ (or meet delivery truck at site)					
0:30	1:15	1:15	1:15	0		bring cylinders to hut, secure					
0:30	1:45	1:45	1:45	0	Instr Hut	Replace gas cylinders as necessary.					
0:15	2:00	2:00		0	Instr Hut	assure operation of regulators and pressure transducer					
						Routine maintenance of Instrument Hut equipment (leak repair, service pumps, check damage)					
0:45	2:45	2:45		0	Instr Hut	check and swap samples for the auto analyzer (H2O vapor laser)					
0:30	3:15	3:15		0	Instr Hut	assure 610 operation and calibrate H2O laser w/ 610					
0:45	4:00	4:00			Instr Hut	assure 610 operation and calibrate H2O laser w/ 610					
0:45	4:45	4:45			Instr Hut	calibrate CO2 laser w/ 610					
0:15	5:00	5:00		0	Instr Hut	replace scrubber chemicals					
0:30	5:30	5:30		0	Instr Hut	swap solenoids, pressure test manifold					
0:10	5:40	5:40		0	Instr Hut	Pick up tools and safety equipment for field array					
0:05	5:45	5:45		50	In route	Travel to field array					
0:20	6:05	6:05		0	Field Array	Routine maintenance of field array equipment					
0:05	6:10	6:10	1:50	50	In route	Travel to soil plot #1					
0:15	6:25	6:25		0	Soil #1	Routine maintenance of equipment					
1:15	7:40	7:40		0	Soil #1	minirhizotron pictures					
0:05	7:45	7:45	1:55	50	In route	Travel to soil plot #2					
0:15	8:00	8:00	2:10	0	Soil #2	Routine maintenance of equipment					
1:15	9:15	9:15	3:25	0	Soil #2	minirhizotron pictures					
0:05	9:20	9:20	3:30	50	In route	Travel to soil plot #3					
0:15	9:35	9:35	3:45	0	Soil #3	Routine maintenance of equipment					
1:15	10:50	10:50	5:00	0	Soil #3	minirhizotron pictures					
0:05	10:55	10:55	5:05	50	In route	Travel to soil plot #4					
0:15	11:10	11:10	5:20	0	Soil #4	Routine maintenance of equipment					
1:15	12:25	12:25	6:35	0	Soil #4	minirhizotron pictures					
0:05	12:30	12:30	6:40	50	In route	Travel to soil plot #5					
0:15	12:45	12:45	6:55	0	Soil #5	Routine maintenance of equipment					
1:15	14:00	14:00	8:10	0	Soil #5	minirhizotron pictures					
0:15	14:15	9:30	8:25	0	Instr Hut	Fill out all logs, close out work order, file report.					
0:10	14:25	9:40	8:35	500	In route	Travel to Parking Area					
0:05	14:30	9:45	8:40	0	Parking Area	Stow equipment, secure area, leave.					

## 2., Continued

- Define task hours and dates
  - NEON: differs for each Domain (n=20)
  - Ex: Domain 1, Harvard Forest (1 site)

Task	Hrs/ Date	Dates
Tower sensor maintenance I	12	every 2 weeks, year round
Tower sensor maintenance III	12	every 2 weeks, year round
Soils I	12	3x per year
Plants III	8	every week, April - October
Mosquitoes I	4	every two weeks, March- December
Fish	160	1x per year, late summer or early fall
Aquatic chemistry I	2	every 2 weeks, year round

# 3. Unique Skills or Experience

- Identify which tasks require skills or experience
  - Optimize the use of specialized personnel
  - Tower sensor maintenance I, II, III
  - Aquatic sensor maintenance I, II
  - Sensor calibration I, II
  - Soils I, II, III, IV
  - Plants I, II, III, IV, V, VI
  - Mammals I, II
  - Mosquitoes I, II
  - Algae
  - Insects
  - Stream and lake morphology
  - STREON I, II, III
  - Infrastructure maintenance
  - Domain lab maintenance
  - General repair and maintenance
  - Chemistry
  - Birds
  - Beetles I, II
  - Aquatic chemistry I, II, III
  - Aquatic plants I, II
  - Fish
  - Riparian plants
  - Rating curves

## 4. Build a Schedule

- NEON: each Domain has a unique schedule

### **Identify:**

- Tasks that are flexible or fixed in time
- Dependent tasks
- # bodies required – fulfill hrs, experience level, safety
- Time sensitive tasks (animal protocols; samples to be frozen, shipped, preserved)

### **Account for:**

- Travel time, overnight accommodation
- Overtime
- Holidays, vacation



## 4a. Task Flexibility in Time

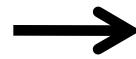
- Identify which tasks are **flexible**, **fixed** or combination
  - Tower sensor maintenance I, II, III
  - Aquatic sensor maintenance I, II
  - **Sensor calibration I, II**
  - Soils **I, II**, III, IV
  - Plants I, II, III, IV, V, VI
  - Mammals I, II
  - **Mosquitoes I, II**
  - Algae
  - Insects
  - **Stream and lake morphology**
  - **STREON I, II, III**
  - **Infrastructure maintenance**
  - **Domain lab maintenance**
  - **General repair and maintenance**
  - **Chemistry**
  - Birds
  - Beetles I, II
  - Aquatic chemistry I, II, III
  - Aquatic plants I, II
  - **Fish**
  - **Riparian plants**
  - Rating curves

# 4b. Task Dependencies

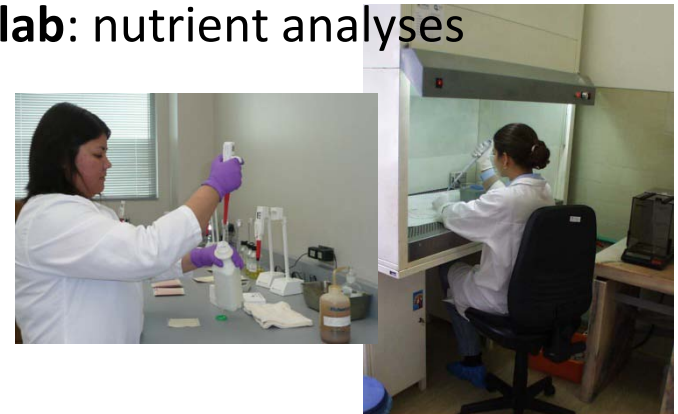
- Some NEON tasks are comprised of a field and lab component
  - Scheduling is coordinated between staff, TL, external labs

**Field:** collecting plants

**Domain lab:** weighing, grinding, labeling



**External lab:** nutrient analyses



# 4c. Identify Staff Requirements

- NEON Domain staff: 1 manager, 1 admin, 4 field and 2 lab technicians

Domain 1 - Northeast, MA											
Location	Description	Task	Staff								
<b>NEON Domain Staff</b>											
Site 1st/Last Frost	4/29to 9/29	Weather Factor		MGR	ADM	FTL	ATL	ST1	ST2	LT1	LT2
<b>Harvard Forest FSU / FIU Core</b>											
Base Station	Athol	Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FIU	Instrument Maintenance - Tower Levels			FTL				
Travel Distance	6.7	Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FIU	Instrument Maintenance - Tower Top			ATL	ST1			
		Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FIU	Instrument Maintenance - Hut / Field			FTL	ST1			
		Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FIU	Instrument Maintenance - Soil / Root Camera				ST1	ST2		
		Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FIU	Sensor Calibration & Other Maintenance							
		Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FSU	FSU Mosquito Phenology Lead							
		Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FSU	FSU Mosquito Phenology A							
		Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FSU	FSU Soil Microbes Lead			FTL				
		Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FSU	FSU Soil Microbes A					ST1		
		Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FSU	FSU Soil Microbes B							
		Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FSU	FSU Plant Phenology Lead			FTL				
		Domain 1 - Northeast, MA - FSU / FIU Core - Harvard Forest	FSU	FSU Plant Phenology A					ST1		
<b>Bartlett Experimental Forest FSU / FIU Relo #1</b>											
Base Station	Athol	Domain 1 - Northeast, MA - FSU / FIU Relo #1 - Bartlett	FIU	Instrument Maintenance - Tower Levels			FTL				
Travel Distance	194	Domain 1 - Northeast, MA - FSU / FIU Relo #1 - Bartlett Exper	FIU	Instrument Maintenance - Tower Top				ATL	ST1		
<b>Harvard Forest AQU Core</b>											
Base Station	Athol	Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Instrument Installation / Removal Lead				ATL		ST2	
Travel Distance	6.4	Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Instrument Installation A							
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Instrument Installation B			FTL				
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Instrument Installation C					ST1		
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Instrument Maintenance Lead				ATL			
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Instrument Maintenance A						ST2	
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Water sample / chemistry				ATL		ST2	
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Subsurface (wells) water sample / chemistry				ATL			
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Subsurface water sample A							
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Morphology Lead				ATL			
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Morphology A							
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Rating curves Lead				ATL			
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Rating curves A						ST2	
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Rating curves B							
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Biology collection Lead				ATL		ST2	
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Biology collection A						ST2	
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Fish sampling Lead				ATL			
		Domain 1 - Northeast, MA - AQU Core - Harvard Forest	AQU - Stream	Fish sampling collection A							
<b>Burlington AQU Relo #1</b>											
Base Station	Athol	Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Biology Collection Sampling 1			AC1				
Travel Distance	69.3	Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Biology Collection Sampling 1				AC2			
		Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Macrophyte Lab Processing			AC1				
		Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Macrophyte Lab Processing				AC2			
		Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Morphology Contractor 1			AC1				
		Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Morphology Contractor 2				AC2			
		Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Rating Curve Contractor 1			AC1				
		Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Rating Curve Contractor 2				AC2			
		Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Rating Curve Contractor 3							
		Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Fish Sampling Contractor 1			AC1				
		Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Fish Sampling Contractor 2				AC2			
		Domain 1 - Northeast, MA - AQU Relo #1 - Burlington	AQU - Contractor	Fish Sampling Contractor 3							

# 4c. Assign Staff Responsibilities

- Assign Domain staff primary responsibilities
  - Increases data quality, staff morale and pride of workmanship

<b>Staff Position</b>	<b>Responsibility</b>
Domain Manager	Manages staff and TL at domain
FIU Lead	Tower sensor maintenance Soil sensor maintenance
AQU Lead	Aquatic sensor maintenance Water chemistry
Technician 1	Assist Leads (tower)
Technician 2	Assist Leads (aquatic)
Lab Technician 1	Process FSU samples
Lab Technician 2	Process FSU samples

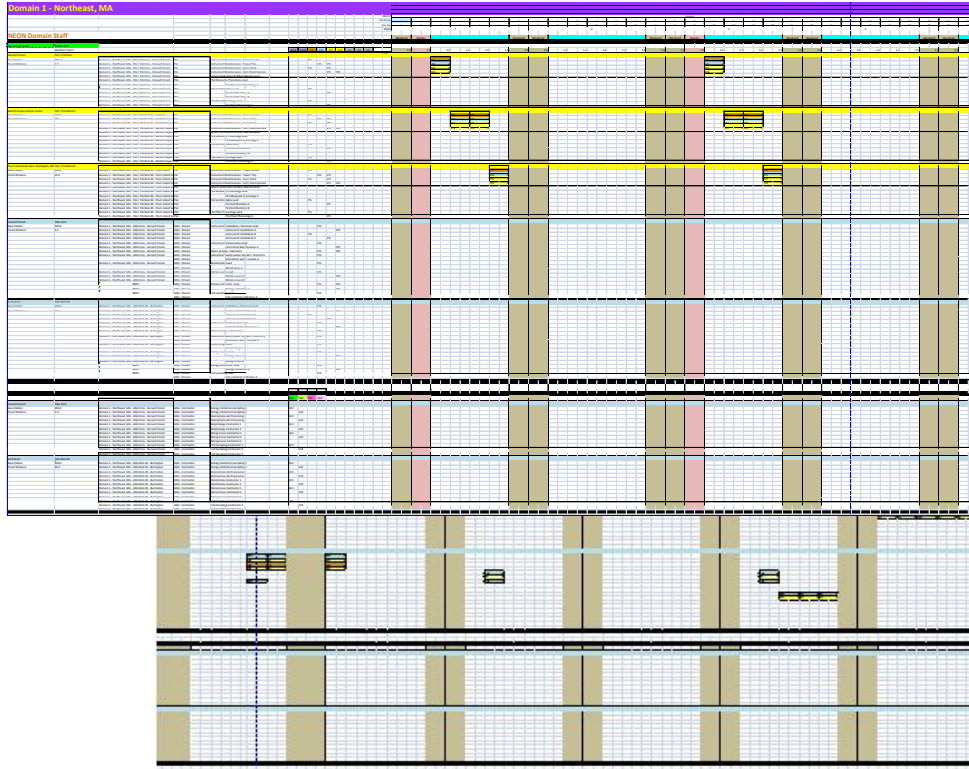
# 4d. Identify Temporary Labor Needs

- Not all tasks can be completed by NEON staff.
  - Ex: Domain 1, Harvard Forest (1 site)

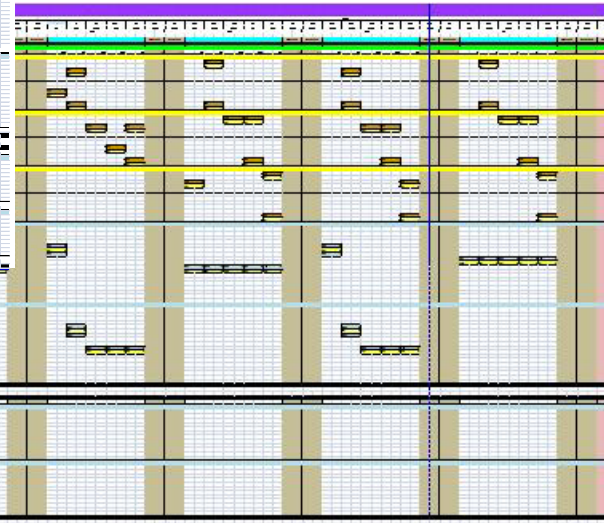
Task	# Bodies Required	
	TL	Staff
Soils I, II, III, IV	2	2
Plants I, II, III, IV, V, VI	15	2
Mammals I, II	3	
Mosquitoes I, II	2	2
Chemistry	2	2
Birds	4	
Beetles I, II	2	2
Algae	2	1
Insects	2	1
Aquatic plants I, II	2	1
Fish	2	2
Riparian plants	2	1
Rating curves	2	1



# 4. Schedule Draft



The domain schedule details each individual performing specific tasks for every day of the year.



Each individual is identified by a different color block.



Brown vertical bars indicate weekends.

Red vertical bars represent holidays.

# 4f. Overtime

- Work, travel and overtime hours are tracked at daily scale for each individual
- Schedule is optimized to reduce overtime and travel time
- Ex: Domain 19, Alaska

	Month	July															
	Day	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
<b>Normal Work Hours</b>		<b>Weekend</b>		<b>Holiday</b>				<b>Weekend</b>	<b>Weekend</b>	<b>Total Hours</b>					<b>Weekend</b>	<b>Weekend</b>	<b>No Work I</b>
MGR		0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ADM		0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FTL		0.0	9.0	8.0	11.6	9.0	11.8	0.0	0.0	0.0	9.0	11.6	9.0	11.8	0.0	0.0	0.0
ATL		0.0	9.0	8.0	9.0	9.0	0.0	10.1	10.1	10.1	10.1	10.1	10.1	10.1	0.0	0.0	0.0
ST1		0.0	9.0	8.0	11.6	9.0	11.8	0.0	0.0	0.0	9.0	11.6	9.0	11.8	0.0	0.0	0.0
ST2		0.0	9.0	8.0	9.0	9.0	0.0	10.1	10.1	10.1	10.1	10.1	10.1	10.1	0.0	0.0	0.0
LT1		5.0	5.0	8.0	0.0	0.0	4.0	6.0	10.0	10.0	7.0	7.0	0.0	8.0	10.0	6.0	6.0
LT2		5.0	5.0	8.0	0.0	0.0	4.0	6.0	10.0	10.0	7.0	7.0	0.0	8.0	10.0	6.0	6.0
<b>Over time hours</b>																	
MGR		0.0	0.0	0.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0
ADM		0.0	0.0	0.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0
FTL		41.3	41.3	50.3	49.3	49.3	49.3	49.3	49.3	49.3	40.4	41.3	41.3	41.3	41.3	41.3	41.3
ATL		27.1	27.1	36.1	35.1	35.1	35.1	35.1	45.2	55.2	56.3	58.3	59.4	60.4	70.5	60.4	50.3
ST1		41.3	41.3	50.3	49.3	49.3	49.3	49.3	49.3	49.3	40.4	41.3	41.3	41.3	41.3	41.3	41.3
ST2		27.1	27.1	36.1	35.1	35.1	35.1	35.1	45.2	55.2	56.3	58.3	59.4	60.4	70.5	60.4	50.3
LT1		9.0	14.0	19.0	27.0	27.0	27.0	27.0	28.0	33.0	38.0	37.0	44.0	44.0	48.0	52.0	48.0
LT2		9.0	14.0	19.0	27.0	27.0	27.0	27.0	28.0	33.0	38.0	37.0	44.0	44.0	48.0	52.0	48.0
<b>Travel time</b>																	
MGR		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ADM		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FTL		0.0	1.0	0.0	3.6	1.0	3.8	0.0	0.0	0.0	1.0	3.6	1.0	3.8	0.0	0.0	0.0
ATL		0.0	1.0	0.0	1.0	1.0	0.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	0.0	0.0	0.0
ST1		0.0	1.0	0.0	3.6	1.0	3.8	0.0	0.0	0.0	1.0	3.6	1.0	3.8	0.0	0.0	0.0
ST2		0.0	1.0	0.0	1.0	1.0	0.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	0.0	0.0	0.0
LT1		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



# 5. Optimize the Schedule

- Which tasks can be performed by Domain staff vs temporary labor?

**Domain 1 - Northeast, MA**

		Weather Factors									
		TEMP	WIND	PREC	RAIN	SLUR	WIND	WIND	WIND		
<b>NEON Domain Staff</b>											
<b>Harvard Forest</b>											
Base Station	Harvard										
Tower Distance	0.7										
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FIU	Instrument Maintenance - Tower Levels								JTL	
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FIU	Instrument Maintenance - Tower Top								JTL	ATL
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FIU	Instrument Maintenance - Hot Fields								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FIU	Instrument Maintenance - Soil / Root Camera								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FIU	Sensor Calibration & O/Rin Maintenance								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FSU	FSU Mosquito Phenology Lead									
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FSU	FSU Mosquito Phenology A									
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FSU	FSU Soil Microbes Lead								JTL	
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FSU	FSU Soil Microbes A									
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FSU	FSU Soil Microbes B								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FSU	FSU Plant Phenology Lead								JTL	
Domain 1 - Northeast, MA, FSU / FIU Core - Harvard Forest	FSU	FSU Plant Phenology A								JTL	STL
<b>Barren Experimental Forest</b>											
Base Station	Harvard										
Tower Distance	0.4										
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FIU	Instrument Maintenance - Tower Levels								JTL	ATL
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FIU	Instrument Maintenance - Tower Top								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FIU	Instrument Maintenance - Hot Fields								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FIU	Instrument Maintenance - Soil / Root Camera								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FIU	Sensor Calibration & O/Rin Maintenance								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FSU	FSU Mosquito Phenology Lead									
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FSU	FSU Mosquito Phenology A									
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FSU	FSU Soil Microbes Lead								JTL	
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FSU	FSU Soil Microbes A									
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FSU	FSU Soil Microbes B								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FSU	FSU Plant Phenology Lead								JTL	
Domain 1 - Northeast, MA, FSU / FIU Ratio #1 - Barren	FSU	FSU Plant Phenology A								JTL	STL
<b>Plum Island Suburban, Burlington, MA FSU / FIU Ratio #2</b>											
Base Station	Harvard										
Tower Distance	05.6										
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FIU	Instrument Maintenance - Tower Levels								JTL	ATL
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FIU	Instrument Maintenance - Tower Top								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FIU	Instrument Maintenance - Hot Fields								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FIU	Instrument Maintenance - Soil / Root Camera								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FIU	Sensor Calibration & O/Rin Maintenance								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FSU	FSU Mosquito Phenology Lead									
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FSU	FSU Mosquito Phenology A									
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FSU	FSU Soil Microbes Lead								JTL	
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FSU	FSU Soil Microbes A									
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FSU	FSU Soil Microbes B								JTL	STL
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FSU	FSU Plant Phenology Lead								JTL	
Domain 1 - Northeast, MA, FSU / FIU Ratio #2 - Plum Island	FSU	FSU Plant Phenology A								JTL	STL
<b>Harvard Forest</b>											
Base Station	Harvard										
Tower Distance	0.4										
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Instrument Installation / Removal Lead									
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Instrument Installation A								JTL	STL
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Instrument Installation B									
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Instrument Installation C								JTL	STL
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Instrument Maintenance Lead									
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Instrument Maintenance A								JTL	STL
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Instrument Maintenance B									
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Substrate (freshly water sample / chemistry)									
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Substrate (stagnant water sample A)									
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Morphology Lead								JTL	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Morphology A									
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Rating curves Lead								JTL	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Rating curves A									
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Rating curves B								JTL	STL
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Biology collection Lead								JTL	STL
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Biology collection A								JTL	STL
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Fish sampling Lead								JTL	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Stream	Fish sampling collection A									
<b>Burlington</b>											
Base Station	Harvard										
Tower Distance	09.3										
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Instrument Installation / Removal Lead									
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Instrument Installation A								JTL	STL
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Instrument Installation B									
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Instrument Installation C								JTL	STL
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Instrument Maintenance Lead									
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Instrument Maintenance A								JTL	STL
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Instrument Maintenance B									
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Substrate (freshly water sample / chemistry)									
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Substrate (stagnant water sample A)									
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Morphology Lead								JTL	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Morphology A									
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Rating curves Lead								JTL	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Rating curves A									
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Rating curves B								JTL	STL
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Biology collection Lead								JTL	STL
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Biology collection A								JTL	STL
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Fish sampling Lead								JTL	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Stream	Fish sampling collection A									
<b>Harvard Forest</b>											
Base Station	Harvard										
Tower Distance	0.4										
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Contractor	Biology Collection Sampling 1								AC1	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Contractor	Biology Collection Sampling 2								AC2	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Contractor	Microphyte Lab Processing								AC1	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Contractor	Microphyte Lab Processing								AC2	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Contractor	Morphology Contractor 1								AC1	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Contractor	Morphology Contractor 2								AC2	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Contractor	Rating Curve Contractor 1								AC1	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Contractor	Rating Curve Contractor 2								AC2	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Contractor	Fish Sampling Contractor 1								AC1	
Domain 1 - Northeast, MA, AQU Core - Harvard Forest	AQU - Contractor	Fish Sampling Contractor 2								AC2	
<b>Burlington</b>											
Base Station	Harvard										
Tower Distance	09.3										
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Contractor	Biology Collection Sampling 1								AC1	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Contractor	Biology Collection Sampling 2								AC2	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Contractor	Microphyte Lab Processing								AC1	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Contractor	Microphyte Lab Processing								AC2	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Contractor	Morphology Contractor 1								AC1	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Contractor	Morphology Contractor 2								AC2	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Contractor	Rating Curve Contractor 1								AC1	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Contractor	Rating Curve Contractor 2								AC2	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Contractor	Fish Sampling Contractor 1								AC1	
Domain 1 - Northeast, MA, AQU Ratio #1 - Burlington	AQU - Contractor	Fish Sampling Contractor 2								AC2	

FIU tasks performed by Domain staff

AQU tasks performed by Domain staff

AQU tasks performed by contractors

Domain 1 has 3 tower and 2 aquatic sites

# 5a. Staff + TL Schedule

	WREF1	WREF1	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Instrument Installation A																
Instrument Installation B																
Instrument Installation C																
Instrument Maintenance Lead																
Instrument Maintenance A																
Sample / chemistry							ST2	2								
Sample (wells) water sample / chemistry																
Subsurface water sample A																
Quality Lead																
Morphology A																
Quality Lead																
Rating curves A																
Rating curves B																
Collection Lead	ATL	8	ATL	8	ATL	8				ATL	8					
Biology collection A						ST2	8	ST2	6							
Quality Lead																
Fish sampling collection A																
Instrument Installation A																
Instrument Installation B																
Instrument Installation C																
Instrument Maintenance Lead																
Instrument Maintenance A																
Sample / chemistry																
Sample (wells) water sample / chemistry																
Subsurface water sample A																
Quality Lead																
Morphology A																
Quality Lead																
Rating curves A																
Rating curves B																
Collection Lead																
Biology collection A																
Quality Lead																
Fish sampling collection A																
Collection Sampling 1	AC1	8.0	AC1	8.0	AC1	8.0	AC1	8.0	AC1	8.0	AC1	8.0	AC1	8.0	AC1	8.0
Collection Sampling 1	AC2	8.0	AC2	8.0	AC2	8.0	AC2	8.0	AC2	8.0	AC2	8.0	AC2	8.0	AC2	8.0
Lab Processing																
Lab Processing																
Contractor 1																
Contractor 2																
Contractor 1																
Contractor 2																
Contractor 3																
Contractor 1																
Contractor 2																
Contractor 3																
Collection Sampling 1																
Collection Sampling 1																
Lab Processing																
Lab Processing																
Contractor 1																
Contractor 2																
Contractor 1																
Contractor 2																
Contractor 3																
Contractor 1																
Contractor 2																
Contractor 3																

# 6. Schedule – 20 Domains

Domain 1 - Northeast

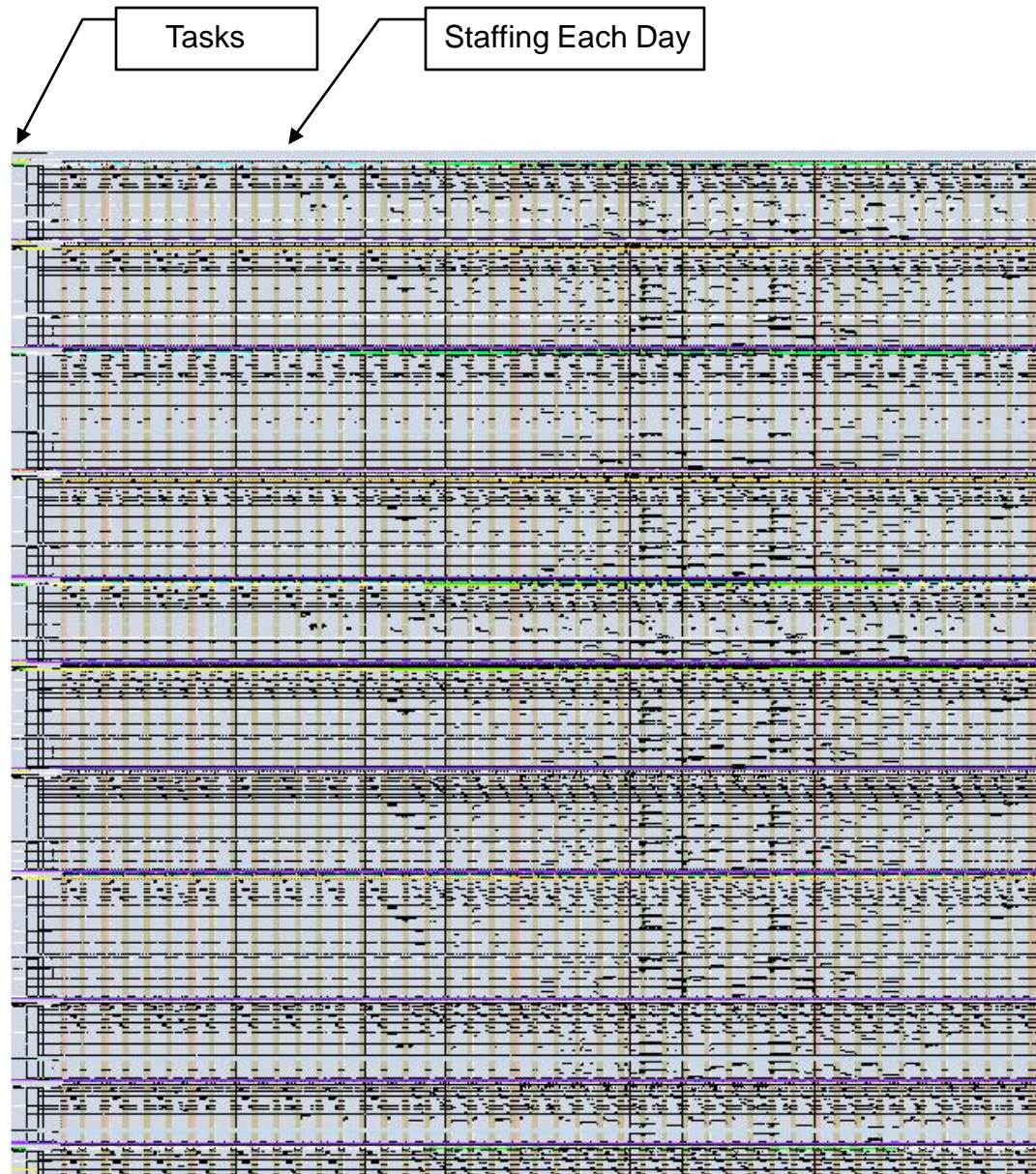
Domain 2 – Mid Atlantic

Domain 3 – Southeast

Domain 4 – Atlantic



Analysis performed to optimize resources, minimize overtime, provide contingency, and ensure all task can be completed.





**NATIONAL ECOLOGICAL OBSERVATORY NETWORK**

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