



| Sunday  | Monday  | Tuesday   | Wednesday   | Thursday   | Friday  | Saturday   |
|---|---|---|---|--|---|--|
| 9/1<br><b>Week 1</b><br>Intro to Ecosystems Science<br><br><b>Noon: Picnic</b><br><b>Welcome &amp; Orientation</b><br><br>14:30 Starr 209 (classroom)<br>Pick up books, lab, field gear | 9/2<br>8:30 Starr 209 Intro to Core Course<br>08:45-10:00 Giblin Earth as an Ecosystem: 4 Billion years of Biogeochemistry<br>10:15-11:00 (Starr 209) Bonnie Kwiatkowski - Computer Orientation & Problem Solving<br>11:30-17:00 Lb 207 Cardon <b>Field Day: Forest Biomass</b> | 9/3<br>8:30-10:00 Melillo How Humans are Altering the Earth as an Ecosystem: The Global Carbon Cycle<br>10:15-noon Elective<br>13:15-14:15 Lb 207 <b>MBL Orientation/Safety</b><br>14:30 17:00 Lb 207 Cardon <b>Lab Forest Biomass Analysis, leaf area measurements, etc.</b>   | 9/4<br>8:30-10:00 Cardon I. The Ecosystems Concept: Energetics and Stoichiometry<br>II. Physical Forcing: Climate, Micro-climate and Energy Balance<br>10:30-17:00 Foreman Lb 207 <b>Field Day; Aquatic Site Characterization &amp; Biomass Lab</b><br><b>By 17:00 Return Field Trip selection form</b> | 9/5<br>8:30 Shaver An Arctic Example of Changing Climate, Disturbance, and Feedbacks that affect ecosystems carbon balances<br>10:15-noon Elective<br>13:30-17:00 Foreman Lb 207 <b>Aquatic Lab Data Workup &amp; Analysis</b> | 9/6<br>8:30-12:00 Cardon Foreman <b>Initial Synthesis: Producer Biomass Problem Set Discussion &amp; wrap up of calculations.</b><br><b>Students introduced to Center staff at Donuts.</b><br>13:30-15:00 <b>Science Journalism (Starr 209)</b><br>15:15-16:00 <b>Library Orientation</b> | 9/7<br><b>WHALE WATCH (SAT OR SUNDAY)</b><br><br>Depart SWOPE 09:00 for Provincetown, noon cruise return for dinner |
| 9/8<br><b>Week 2</b><br>Ecosystem Primary Production  | 9/9<br>08:00 Wk 1 Biomass problem set due<br>08:30 Cardon Photosynthesis, Fates of Energy & Water Cycling.<br>10:30-17:00 Cardon <b>Field Day: Leaf level CO<sub>2</sub> flux measurements at forest sites</b>  | 9/10<br>8:30-10:00 Cardon Photosynthesis and Primary Production on Land<br>10:15-noon Elective<br>13:30-17:00 Cardon <b>Lab: NPP from tree cores; leaf areas and data work up</b>   | 9/11<br>8:30-10:00 Cardon Net Primary Prod. at Regional to Global Scales<br>13:30 McHorney / Foreman <b>Lab Work Pack Wk 1 CN filters Process CN wood / leaf material Wk 1/2</b>  | 9/12<br>8:30-10:00 Foreman Aquatic Primary Production<br>10:15-noon Elective<br>13:30-17:00 Cardon <b>Data work-up; Forest NPP &amp; GPP</b><br><b>Return Wk 1 Prob Set</b>  | 9/13<br>08:30-noon Cardon/Foreman (Starr 209) <b>Student-led Presentations: Terrestrial &amp; Aquatic Primary Producer Biomass</b><br>13:30 SES Class Photo<br><b>DSS 15:00-16:30 Dr. Michael Pace University of Virginia Speck Auditorium</b>  | 9/14   |
| 9/15<br><b>Week 3</b><br>Fate of Organic Matter Produced on Land and Water<br>                       | 9/16<br>08:00-noon Lb 208 Foreman <b>Aquatic Lab / Field Day</b> Primary production. Collect incubate & fix initial water samples Extract Chl a; Run CN filters from Week 1 biomass Lab (Waquoit, Johns Pond, West Falmouth, Siders Pond)                                       | 9/17<br>08:00 Terr.I Primary Prod. Prob. Set due<br>8:30-10:00 Gribble Harmful Algal Blooms & use of Molecular Methods in Phytoplankton Ecology<br>10:15-noon Elective<br>13:30 17:00 Foreman <b>Aquatic Primary Production Lab.</b> Measure ΔO <sub>2</sub> in BOD bottles; Chl a in carboy H <sub>2</sub> O; Start calculations | 9/18<br>8:30 Ruff Microbial Food Webs<br>10:30 – noon <b>Science Journalism</b><br>13:30-17:00 Foreman <b>Primary Production Lab</b> Calculate daily rates of GPP, R, NCP; Scale to pond / bay. Finish data work-up.  | 9/19<br>8:30 Melillo 8:30 Litter Decomposition & Fate of Organic Matter on Land.<br>10:15-noon Elective<br>13:30 Foreman <b>Lab work-up Data:</b> Complete calculations & prepare presentations Aquatic Primary Production     | 9/20<br>8:30-noon Cardon / Foreman (Starr 209) <b>Students present &amp; discuss results of Primary Production Lab, contrast P/B on Land and Water</b><br><br>14:30 Depart Plum Island Estuary (PIE) Field Trip   | 9/21<br><b>PIE KAYAKING FIELD TRIP (OPTIONAL)</b><br><br>Return to MBL Saturday Afternoon  |
| 9/22<br><b>Week 4</b><br>Fate of Organic Matter in Ecosystems & Secondary Production  | 9/23<br>0800 Aquatic Primary Prod. Lab Report due<br>8:30-10:00 Lloret Secondary Production Ecological Efficiency.<br>10:30-17:00 Lloret/Roberson <b>Field Day</b> Trophic / Community Structure in Johns Pond and Waquoit, Bay   | 9/24<br>8:30-10:00 Lloret Use of Isotopes to Study Ecosystems<br>10:15-noon Elective<br>13:30-17:00 Lloret <b>Lab Day</b> Sorting, identifying & counting organisms from Aquatic Sites  | 9/25<br>8:30-10:00 Giblin Decomposition, Aerobic / Anaerobic Respiration, Redox Chemistry.<br>13:30-17:00 Lloret <b>Lab Day</b> Finish sorting, ID and faunal counts; begin calculations.   | 9/26<br>8:30-10:00 Conte Sedimentation and Fate of Organic Matter in the Sea<br>10:15-noon Elective<br>13:30 Lloret <b>Lab</b> Prepare isotope samples, complete trophic pyramids of numbers, biomass & production.            | 9/27<br>8:30-noon Lloret <b>Student-led discussion Secondary Production and Trophic Pyramids.</b> Synthesize food webs data; select samples for Isotope Analysis<br><br><b>DSS 15:00-16:30 Dr. Serita Frey, Univ. New Hampshire Loeb G70</b>  | 9/28   |

## SES PROGRAM CALENDAR – OCTOBER 2019

| Sunday   | Monday  | Tuesday   | Wednesday   | Thursday  | Friday  | Saturday   |
|--|---|---|---|---|---|--|
| 9/29   | 9/30  | 10/1  | 10/2  | 10/3  | 10/4  | 10/5   |
| <b>Week 5</b><br><b>Ecosystem Stoichiometry and Biogeochemistry</b>  | <b>08:00 Lab Report Due Tropic Pyramids</b><br><br><b>8:30-10:00 Tang</b><br>Energy Balance and Soil Respiration in Terrestrial Systems<br><br><b>10:30-17:00 Tang</b><br><b>Terrestrial Field Day</b><br>Soil pits and profiles, soil respiration; begin soil extractions<br><br><b>Distribute Midterm study Questions</b> | <b>8:30-10:00 Giblin</b><br>The Nitrogen Cycle<br><br><b>10:15-noon Elective</b><br><br><b>13:30 McHorney</b><br><b>Introduction to Nutrient Analysis –</b><br>Detection Limit and Standard Curve Exercise  | <b>8:30-10:00 Giblin</b><br>The Phosphorus Cycle<br><br><b>10:30-17:00 Giblin</b><br><b>Aquatic Field Day</b><br>Collect sediment cores Waquoit Bay; Sample & profile water column at Siders Pond & Johns Pond.   | <b>8:30-10:00 Giblin</b><br>Ecosystem Stoichiometry<br><br><b>10:15-noon Elective</b><br><br><b>13:30-17:00 Giblin</b><br><b>Aquatic Lab Day</b><br>Core incubations. Analyze Pond water for DIC, metals, S <sup>2-</sup> , SO <sub>4</sub> /Cl<br><br><b>Foreman C/N analysis:</b> pack leaves, soil, wood | <b>8:30-12:00 Lab McHorney/ Giblin</b><br>Analyze nutrients (NO <sub>3</sub> , NH <sub>4</sub> , PO <sub>4</sub> ) from Waquoit Bay core incubations, Siders & Johns Pond water columns and Crane Forest soil extracts<br><br><b>13:30-14:30 McHorney</b> Complete Nutrient Analysis.<br><br><b>15:00-17:00 faculty</b><br><b>OPTIONAL Q &amp; A</b><br><b>Midterm exam; review</b> |  |
| 10/6   | 10/7  | 10/8  | 10/9  | 10/10   | 10/11   | 10/12  |
| <b>Week 6</b><br><b>Nitrogen and Phosphorus Cycling &amp; Budgets</b><br><br> | <b>08:00-12:00 MID-TERM EXAM</b><br><br><b>15:30 –17:00</b><br><b>Science Journalism</b>  | <b>8:30-10:00 Foreman</b> Coastal Nutrient Loading and Eutrophication<br><br><b>10:15–Noon Elective</b><br><b>13:30-17:00 Tang/ McHorney LAB:</b><br>Calculate soil Respiration; begin elemental analysis of C/N in wood, leaves, soils and sediment. | <b>8:30 10:00 Giblin –</b><br>Acid Deposition, Charge Balance & Ion Exchange<br><br><b>10:30-Noon Foreman, TA's</b><br><i>Discuss project ideas</i><br><br><b>13:30-17:00 Giblin</b><br><b>Calculate</b> core fluxes, water column profiles DO, nutrients, metals, sulfides, etc. | <b>8:30-10:00 Neill</b><br>Deforestation in the Tropics.<br><br><b>10:15–Noon Elective</b><br><b>13:00-17:00 Tang</b><br><b>Calculate N &amp; C</b> stocks in soils, trees & litter and estimate Nitrogen Mineralization  | <b>Noon 1<sup>st</sup> Project</b><br><b>Concept Paper Due</b><br><br><b>DSS 15:00-16:30</b><br>Dr. A.J. Pershing<br>Gulf of Maine<br>Research Institute<br>Lillie Auditorium   |  |
| 10/13  | 10/14   | 10/15   | 10/16   | 10/17   | 10/18   | 10/19  |
| <b>Week 7</b><br><b>Unique Ecosystems</b><br><br><b>Land-Water Interactions Lab</b><br><br><b>Note:</b><br>Meet with project mentors during next two weeks       | <b>8:30-Noon Giblin/ Tang (Starr 209)</b><br>Student-led presentation discussion<br><b>Week 5-6 Ecosystem Stoichiometry &amp; Fate of Organic Matter</b><br><br><b>13:30-15:00</b><br><b>Science Journalism</b>   | <b>08:00 – Report Due</b><br>Soil Respiration & N-mineralization<br><br><b>08:30 Roberson</b><br>Coral Reefs & Global Change<br><br><b>10:15-noon Elective</b><br><br>Afternoon SES Faculty Project Mentor Planning Meetings                          | <b>08:00 Report due</b><br>Stoichiometry / Fate of Organic Matter in Aquatic Ecosystems<br><br><b>08:30-17:00 Lloret/Foreman</b><br><b>Water &amp; Nutrient Budget Lab</b><br>Sample streams & groundwater, MASSTC (Massachusetts Alternative Septic System Test Center)          | <b>8:30 Ruff</b><br>Microbial Ecology of Deep Sea Methane Seeps and Mud Volcanos<br><br><b>10:15-noon Elective</b><br><b>13:30 Foreman / Lloret – Water &amp; Nutrient Budget Lab; FWTP Tour.</b><br>Sampling soil solution water at terrestrial sites.   | <b>8:30-Noon McHorney</b><br><b>Nutrient Analysis</b><br>NO <sub>3</sub> , NH <sub>4</sub> & PO <sub>4</sub> in rainfall, soil solution, groundwater & wastewater<br><br><b>13:30 -17:00</b><br><b>Lloret/McHorney</b><br><b>Calculations and Discussion for Nutrient Analysis</b>  |   |
| 10/20  | 10/21   | 10/22   | 10/23   | 10/24   | 10/25   | 10/26  |
| <b>Week 8</b><br><br><b>How Species affect and are affected by Nutrients</b>   | <b>8:30 Roberson</b><br>What Species do in Ecosystems<br><br><b>13:00-17:00 Hayn/ Lloret</b><br><b>Nutrient H<sub>2</sub>O Budget Lab -</b><br>GIS/Nutrient Loading   | <b>8:30 Deegan</b><br>Nutrient Transport by Animals<br><br><b>10:15-noon- Elective</b><br><br><b>13:30-17:00 Lloret/ Foreman/McHorney</b><br>Nutrient Loading and Budget Calculations   | <b>8:30 Galloway</b><br>Nitrogen Footprints: Sustainability Metric for People, Institutions & Communities<br><br><b>13:30-17:00 Lloret / Foreman/McHorney</b><br><b>Water &amp; Nutrient Budget Lab</b> Applied Science Scenarios & Report Preparation                            | <b>10:15-noon- Elective</b><br><br><b>17:00 –2<sup>nd</sup> Project</b><br><b>Draft Proposal Due</b>  | <b>8:30-noon Lloret / Foreman / McHorney</b><br><b>Water Nutrient Budget Lab</b> Student discussion & presentations.<br><br><b>DSS 15:00-16:30</b><br>Dr. Jennifer Jenkins<br>ENVIVA LP<br>Loeb G70   | <b>Cape Cod Marathon Relay</b><br>Sunday 29th<br>Students, Alumni vs. Faculty<br><br> |

**SES PROGRAM CALENDAR – NOVEMBER/DECEMBER 2019**

| Sunday   | Monday  | Tuesday  | Wednesday   | Thursday   | Friday   | Saturday  |
|--|---|--|---|--|--|---|
| <p align="center">10/27</p> <p><b>Week 9</b><br/>Current Issues in Ecosystems Science</p> <p><i>Cape Cod Marathon Relay / Faculty Challenge Reunion Picnic</i></p>  | <p align="center">10/28</p> <p><b>08:00 Lab Rpt due: Cross-System Flux.</b></p> <p><b>08:30 Giblin</b> Human Alteration of Global Element Cycles</p> <p><b>10:30– Noon Lloret/Otter Food Web Lab</b> Isotope Lab tour / Nitrogen-Footprint calculation</p> <p><b>Noon-17:00 Lloret</b> Isotopes and Food Web Data Work-up</p> | <p align="center">10/29</p> <p><b>08:30 Neill</b> Loss of Ecosystem Services</p> <p><b>10:15-noon Elective</b></p> <p><b>13:30–17:00 Llorett /McHorney Food Web Lab</b> Isotopes and Food Web Data Work-up and Discussion.</p> <p><b>Return Draft Project Proposal Comments.</b></p> | <p align="center">10/30</p> <p><b>08:30 Lloret: Food Web Lab–Discussion</b> Presentation: Food Web / Isotope data</p> <p><b>Distribute Study Question for Final</b></p> <div style="background-color: yellow; border: 1px solid black; padding: 5px; text-align: center;"> <p>Afternoon<br/>SES Faculty<br/>Project Mentor<br/>Planning Meetings</p> </div> | <p align="center">10/31</p>  <p><b>Happy Halloween</b></p> <p><b>10:15-noon Elective</b></p> <p><b>13:30-16:30 Q&amp;A, Final Exam Review (optional)</b></p> | <p align="center">11/1</p> <p><b>8:30-Noon</b> Students present project proposals and preliminary data</p> <p><b>1500:-16:30 – Science Journalism</b></p>      | <p align="center">11/2</p>  |
| <p align="center">11/3</p> <p><b>Week 10</b><br/>Current Issues in Ecosystems Science cont'd.</p> <p>DAYLIGHT SAVINGS TIME ENDS (GAIN HOUR)</p>  | <p align="center">11/4</p> <p><b>8:00-12:30 FINAL EXAM</b></p>  | <p align="center">11/5</p> <p><b>08:30-10:00 Elective</b></p> <p><b>10:30-noon Science Journalism</b></p> <p><b>17:00 Final Written Project Proposal Due</b></p>   | <p align="center">11/6</p> <p><b>Project Work</b></p>   | <p align="center">11/7</p> <p><b>08:30-10:00 Elective</b></p> <p><b>Project Work</b></p>   | <p align="center">11/8</p> <p><b>Project Work</b></p>  | <p align="center">11/9</p> <p><i>Field Trip New England Aquarium / Boston</i></p> |
| <p align="center">11/10</p> <p><b>Week 11</b></p>  | <p align="center">11/11</p> <p><b>Project Work</b></p>  | <p align="center">11/12</p> <p><b>Project Work</b></p>   | <p align="center">11/13</p> <p><b>Project Work</b></p>  | <p align="center">11/14</p> <p><b>Project Work</b></p>   | <p align="center">11/15</p> <p><b>Project Work</b></p> <p><b>15:30-17:00 – Science Journalism</b></p>  | <p align="center">11/16</p>   |
| <p align="center">11/17</p> <p><b>Week 12</b></p>  | <p align="center">11/18</p> <p><b>Project Work</b></p>  | <p align="center">11/19</p> <p><b>Project Work</b></p>   | <p align="center">11/20</p> <p><b>Project Work</b></p>  | <p align="center">11/21</p> <p><b>Project Work</b></p>   | <p align="center">11/22</p> <p><b>Project Work</b></p>   | <p align="center">11/23</p>   |
| <p align="center">11/24</p> <p><b>Week 13</b></p>  | <p align="center">11/25</p> <p><b>Project Work</b></p>  | <p align="center">11/26</p> <p><b>Project Work</b></p> <p><b>15:30-17:00 Science Journalism</b></p>  | <p align="center">11/27</p> <p><b>Project Work</b></p>  | <p align="center">11/28</p>    | <p><b>Thanksgiving Break</b></p>   |   |
| <p align="center">12/1</p> <p><b>Week 14</b></p>   | <p align="center">12/2</p> <p><b>Project Work</b></p> <p><b>15:30-17:00 Science Journalism</b></p>  | <p align="center">12/3</p> <p><b>Project Work</b></p>  | <p align="center">12/4</p> <p><b>Project Work</b></p>   | <p align="center">12/5</p> <p><b>Project Work</b></p>  | <p align="center">12/6</p> <p><b>Project Work</b></p> <p><b>08:30 Project DRAFT Report Due</b></p>   | <p align="center">12/7</p>  |
| <p align="center">12/8</p> <p><b>Week 15</b></p>   | <p align="center">12/9</p> <p><b>Project Work</b></p>   | <p align="center">12/10</p> <p><b>Project Work</b></p>   | <p align="center">12/11</p> <p><b>Project Work</b></p> <p><b>17:00 Draft Project Report Returned</b></p>  | <p align="center">12/12</p> <p><b>Project Work</b></p>   | <p align="center">12/13</p> <div style="background-color: #c8e6c9; padding: 5px;"> <p><b>Student Research SYMPOSIUM</b></p> <p>Oral Project Reports</p> </div> | <p align="center">12/14</p>   |
| <p align="center">12/15</p> <p><b>Week 16</b></p>  | <p align="center">12/16</p> <p><b>Noon - FINAL Project Report Due (written &amp; electronic Word, Powerpoint, Excel)</b></p>  | <p align="center">12/17</p> <p><b>End of Course Check out</b></p>  | <p align="center">12/18</p>    | <p align="center">12/19</p> <p><b>Merry Christmas &amp; Happy Hanukkah</b></p>   | <p align="center">12/20</p>  | <p align="center">12/21</p>   |