### Somerville Schools 2017
**CURRICULUM MAP WITH SCOPE AND SEQUENCE**

<table>
<thead>
<tr>
<th>Course: Environmental Science</th>
<th>Subject Area: Science</th>
<th>Grade Level: 9-12</th>
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<tbody>
<tr>
<td><strong>Enduring Understandings</strong></td>
<td><strong>Unit 1: September-Nov</strong></td>
<td><strong>Unit 2: Nov-Jan</strong></td>
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<td>1. Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HS-LS2-2)</td>
<td>Ecosystems and Water</td>
<td>Weather and Climate</td>
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<td>2. A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical change occurs, it could return to its original status, therefore the ecosystem is resilient. Extreme fluctuations in conditions or size of any population can challenge the functionality of the ecosystem in terms of resources and habitat.</td>
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<td>1. Cyclical changes in the shape of Earth’s orbit around the sun, together with changes in the orientation of the planet’s axis of rotation, both occurring over tens to hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on Earth. These phenomena cause cycles of ice ages and other gradual climate changes. (HS-ESS1.B)</td>
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<td>2. The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun’s energy output or Earth’s orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2.A)</td>
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<td>3. The foundation for Earth’s global climate system is the electromagnetic radiation from the sun as well as its reflection, absorption, storage, and redistribution among the</td>
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### Essential Questions

1. How and why do organisms interact with their environment and what are the effects of these interactions?
2. How can human activity impact ecosystems positively and negatively?
3. How does the flow of energy result in climate change?
4. What are the social and economic impacts of climate change?
5. How has climate changed over time on our planet?

### Content Knowledge

1. Small changes in a variety of environmental components will have a lasting impact on ecosystems (both biotic and abiotic).
2. Relate an account of a small change in an ecosystem that has had grand consequences in the long term.
3. Trace the stage of succession for a local pond.
4. Identify how global patterns of atmospheric movement influence regional weather and climate.
5. Explain how human activities may affect local, regional, and global environments.
6. Analyze data using computational models in order to make valid and reliable scientific claims.
7. Where/ how are fossil fuels extracted for energy use?
8. Which energy types are more sustainable, renewable, nonrenewable?
9. What are the potential uses and limitations of renewable energy uses and/or non-renewable energy uses?
10. How does the extraction of energy sources affect the abundance or scarcity of natural resources (i.e. water)?

### Conclusion

1. All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.
2. When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and...
## Major Skills

1. Students use appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.
2. Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-6)
3. Construct explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
4. Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7)

## Performance Based Assessments

<table>
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<tr>
<th>PBL: Water Filter Challenge</th>
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<td>Weekly Articles: Report on current events impacting the environment/ecology. Can include court cases, natural disasters, international agreements, etc.</td>
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<th>PBL: Hurricane Katrina PBL</th>
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<th>Research Projects: Wind turbine lab, Carbon footprint challenge</th>
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<td>Research Projects: Pond Water - Stages of succession</td>
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<tr>
<td><strong>Digital Platforms</strong></td>
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<tr>
<td>Chromebooks</td>
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<tr>
<td>Web Quests</td>
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<td>Google Applications</td>
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| **Sources: Instructional Materials**                 |                  |
| Chromebuks                                          | Chromebuks       |
| Pens                                                | Pens             |
| Pencils                                             | Pencils          |
| Paper                                               | Paper            |
| Anchor Charts                                       | Anchor Charts    |
| SMARTboard                                          | SMARTboard       |
| Teacher Laptop                                      | Teacher Laptop   |
| **Curriculum Modifications**                        | **Curriculum Modifications** |

| **NJSLS Standards**                                 |                  |
| HS-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. | HS-ESS2-1: Develop a model to illustrate how Earth’s internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. |
| HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. | **HS-ESS2-2**: Analyze geoscience data to make the claim that one change to Earth’s surface can create feedbacks that cause changes to other Earth systems. |
| HS-LS2-6: Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. | HS-ESS2-3: Develop a model based on evidence of Earth’s interior to |
| HS-LS2-7: Design, evaluate and refine a solution for reducing the impacts of human activities on the environment and biodiversity. | |
| HS-ESS2-4: Use a model to describe how variations in the flow of energy into and out of Earth’s systems result in changes in climate. HS-ESS2-4: Construct scientific arguments using data to support claims that spatial and temporal patterns in weather and climate found around the Earth are created by complex global, regional, and local interactions involving sunlight, and all of the Earth’s spheres. HS-ESS3-5: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. HS-ESS2-6: Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere as | |
| HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. | |
**Support Standards (Crosscutting Concepts):**

**HS-LS2-1:** The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.

**HS-LS2-6, HS-LS2-7:** Much of science deals with constructing explanations of how things change and how they remain stable.

**RI.9-10.2:** Determine a central idea of a text and analyze how it is developed and refined by specific details; provide an objective summary of the text.

**NJSLSA.W1:** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

**NJSLSA.W2:** Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

**W.9-10.7:** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

**CRP Standards:**

9.2.12.C.1 Review career goals and determine steps necessary for attainment.

9.2.12.C.3 Identify transferable career skills and design alternate career plans.

9.2.12.C.6 Investigate entrepreneurship it relates to our climate system.

**Support Standards (Crosscutting Concepts):**

**HS-ESS2-4** Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

**HS-ESS3-5** Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

**NJSLS - ELA**

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**HS-ESS2-5** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

**HS-ESS2-6** Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

**HS-ESS2-7** Construct an argument based on evidence about the simultaneous coevolution of Earth’s systems and life on Earth.

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8.1.12.E.1 Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.
8.1.12.E.2 Research and evaluate the impact on society of the unethical use of digital tools and present your research to peers.
CRP1. Act as a responsible and contributing citizen and employee.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP12. Work productively in teams while using cultural global competence.
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Enduring Understandings
1. Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.

Essential Questions
1. How do Earth's surface processes and human activities affect each other?
2. How can human activity impact ecosystems positively and negatively?

Content Knowledge
1. The sustainability of human societies and the biodiversity that supports them requires responsible management of...
1. Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
2. When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.
3. New technologies can have deep impacts on society and the environment, including some that were not anticipated.

Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth’s surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an
increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.

Schoolyard Habitat Project

The Cool School Challenge engages students and teachers in practical strategies to reduce carbon dioxide ($CO_2$) and other greenhouse gas emissions school-wide.

Students challenge individual classrooms to reduce their carbon emissions over a set period of time, and utilize a carbon calculator to evaluate progress.

Cool Schools Challenge Kit

Exit Slip
Teacher Observation

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
<tr>
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<tr>
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<td>Paper</td>
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| NJSLS Standards | HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity  

**HS-ESS3-2:** Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.  
**HS-ESS3-3:** Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.  
**HS-ESS3-4:** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.  
**HS-ESS3-6:** Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.  
**HS-ESS2-2:** Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.  
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Modifications:

**Special Education Students**
- Redirect attention
- Rephrase, repeat directions
- Use visual cues
- Demonstrate the task before proceeding
- Allow additional processing time
- Break down tasks into manageable units
- Simplify directions
- Add time as necessary
- Question student to check for understanding
- Repeat and rephrase explanations as needed
- Differentiate activities/assignments
- Supplement auditory materials with visual aids
- Have students verbalize steps of task before proceeding
- Repetition and review of previously learned material

**At Risk Students**
- Consult with Guidance Counselors and follow all IR&S procedures and action plans.
- Consult with classroom/In class support teacher(s) for specific behavioral interventions.
- Provides rewards and incentives as necessary.
- Use weekly goals as motivating factors
- Assist student in accepting strengths and weaknesses

**Gifted and Talented Students**
- Build on students' intrinsic motivations
- Have student "tutor" another student in the room
- Consult with parents to accommodate students' interests in completing tasks at their level of engagement

**English Language Learners**
- Assign buddy, same language or English speaking
- Allow additional processing time for translation
- Encourage participation but do not force it
- Break down complex tasks into manageable parts
- Promote class discussion