

Course: Environmental Science
Unit #3: Human Population and Land Use

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Stage One - Desired Results

Link(s) to New Jersey Student Learning Standards for this course:

<https://www.state.nj.us/education/cccs/2020/>

- **Unit Standards:**

- **Content Standards**

- HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems.
- HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity in ecosystems.
- HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter (biogeochemical cycles) and flow of energy (food chains/webs).
- HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being moved through an ecosystem.
- HS-LS2-6 Evaluate the 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 with different populations & sizes.
- HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species (invasive species), (2) the emergence of new species over time, and (3) the extinction of other species.
- HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

- 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-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and climate change 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 climate change and other natural systems.
- 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-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-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-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

○ **21st Century Life & Career Standards**

- 9.1.12.CFR.3: Research companies with corporate governance policies supporting the common good and human rights.
- 9.1.12.EG.3: Explain how individuals and businesses influence government policies.
- 9.1.12.EG.5: Relate a country's economic system of production and consumption to building personal wealth, the mindset of social comparison, and achieving societal responsibilities.
- 9.1.12.RM.4: Determine when and why it may be appropriate for the government to provide insurance coverage rather than private industry.
- 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12. CivicsPR.16.a).
- 9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJLSA.W8, Social Studies Practice:

Gathering and Evaluating Sources.

- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
- 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
- 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).
- 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLA.SL5).
- 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5.12acc.C2a, 7.1.IL.IPRET.4).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

○ **English Companion Standards**

- RL.11-12.1. Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
- RI.11-12.1. Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain
- RI.11-12.3. Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.
- RI.11-12.7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
- NJSLA.SL2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
- NJSLA.SL4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
- SL.11-12.4 Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.

- ***Interdisciplinary Content Standards***

- RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
- RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
- RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
- WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- MP.2 Reason abstractly and quantitatively.
- MP.4 Model with mathematics.
- HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
- HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

- ***NJ Statutes:*** NJ State law mandates the inclusion of the following topics in lesson design and instruction as aligned to elementary and secondary curriculum.

Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A. 18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion (N.J.S.A. 18A:35-4.36a) A board of education shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards.

Asian American and Pacific Islanders (AAPI) P.L.2021, c.410 Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLS) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416)

For additional information, see

NJ Amistad Curriculum: <http://www.njamistadcurriculum.net/>

Diversity and Inclusion: <https://www.nj.gov/education/standards/dei/index.shtml>

- (Sample Activities/ Lessons): <https://www.nj.gov/education/standards/dei/samples/index.shtml>

Asian American and Pacific Islanders:

- [Asian American and Pacific Islander Heritage and History in the U.S.](#)

A Teacher's Guide from EDSITEment offering a collection of lessons and resources for K-12 social studies, literature and arts classrooms that center around the experiences, achievements and perspectives of Asian

Americans and Pacific Islanders across U.S. history.

Transfer Goal: Students will be able to independently use their learning to design sustainable practices to improve our relationship with our environment

As aligned with LRHSD Long Term Learning Goal(s):

- design, critique, and carry out experiments in order to investigate scientific questions and/or propose solutions
- collect, interpret, and analyze data in order to solve a defined problem
- apply mathematics to express relationships efficiently and accurately
- draw evidence-based conclusions from data in order to make informed decisions;
- construct, interpret, and refine models (scientific and mathematical) to explain the physical and natural world
- effectively communicate scientific ideas and evidence-based arguments to an appropriate audience through written and oral means
- evaluate the validity of arguments that rely on scientific reasoning presented in the popular press and informational sources

Enduring Understandings

Students will understand that. . .

EU 1

humans alter the environment and that a growing population makes land use planning necessary.

Essential Questions

EU1

- What is the relationship between population growth and environmental impact?
- What societal/cultural changes have influenced the history of human populations growth & its relationship with the environment?
- How do scientists predict the human population will grow in the future?
- How can we use planning to utilize water & land resources more efficiently?

EU 2

mathematical models can be used to represent and predict populations over time.

EU 3

the production of food uses large amounts of resources and land.

EU 4

the lack of land conservation leads to environmental degradation.

EU 5

obstacles need to be considered and overcome in order to use resources and land more sustainably.

EU 2

- How can models be used to represent populations?
- What can the different demographic transition stages tell the public about its population growth?
- How can age structure diagrams be used to describe human populations in the past & make predictions about the future?

EU 3

- What are the important resources necessary to produce food?
- What are the environmental impacts of food production?
- What makes a farming practice sustainable?
- What factors are taken into account when implementing a sustainable irrigation method?
- What traits are considered when genetically modifying organisms to conserve land and water use?

EU 4

- Why do we mine resources and how do different types of mining extractions vary?
- Why do unsustainable farming practices lead to soil degradation?
- What is the role of government in protecting and conserving land and resources?

EU5

- How can we best balance our own interests and needs with the health of the environment?
- Are environmental decisions always ethical and in the public and environment's best interest?

	<ul style="list-style-type: none"> ● How does economic interest affect the effort to protect land and wildlife? ● How can we balance our needs for housing and jobs with the needs of the local and global environment? ● What is the relationship between environmental health and our own health?
<p><u>Knowledge</u> Students will know . . .</p> <p><i>EU 1</i></p> <ul style="list-style-type: none"> ● anthropogenic changes in the environment include habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change, which threaten survival of species. (ESS2.D) (ESS3.A) ● human induced activities such as hunting, fishing, application of fertilizers, and deforestation have contributed to the emergence of new distinct species and extinction to native species due to the population fluctuation under different environmental conditions. (ESS3.A) ● natural hazards and other geologic events have shaped the course of human history, which significantly altered the sizes of human populations and have driven human migrations (ESS3.B) (ETS1.B) ● how biological, chemical, and social factors in the environment affect human health (ESS2.D) (ESS3.A) (ESS3.D) 	<p><u>Skills</u> Students will be able to . . .</p> <p><i>EU 1</i></p> <ul style="list-style-type: none"> ● make “environmentally conscious” decisions (ESS2.D) (ESS3.A) (ESS3.C) (ETS1.B) ● assess (using maps, local planning documents, and historical records) how the natural environment has changed since humans have inhabited the region. (ESS3.A) (ESS3.D) ● recognize the impact of the Agricultural and Industrial Revolution on human population growth (ESS2.D) (ESS3.A) (ETS1.B) ● analyze data in multiple representations, such as visually, numerically, and anecdotally. (ESS3.C) (ESS3.D) ● identify what leading factors, such as technology, has caused population growth to escalate over time (ESS3.A) (ETS1.B) ● compare and contrast the environmental impact of wealthy nations to poorer nations. (ESS3.A) ● identify the impact human activity has on the cycling of matter and energy through ecosystems over time. (ESS2.D) (ESS3.D)

EU 2

- mathematical tools and technology are used to gather, analyze, and communicate trends and results. (ESS3.C) (ESS3.D) (ETS1.B)
- empirical evidence is used to construct and defend arguments when conserving selected land. (ESS3.C) (ESS3.D) (ETS1.B)
- data is collected and organized to differentiate between cause and correlation. (ESS3.D)
- current models predict that although future regional climate changes will be complex and varied, average global temperatures will continue to rise. (ESS2.D) (ESS3.D)
- outcomes predicted by global climate models strongly depend on the amount of human-generated greenhouse gasses generated each year into the atmosphere, ocean, and biosphere. (ESS2.D) (ESS3.A) (ESS3.D)

- investigate and analyze characteristics of a sustainable city. (ESS3.A) (ESS3.C) (ETS1.B)
- identify specific chemical and physical hazards and how to reduce wildlife and human risk from these hazards (ESS3.B) (ESS3.D)

EU 2

- calculate growth rates in different countries around the world by using their birth rate and death rate (ESS3.B) (ESS3.D)
- interpret Age Structure Pyramids to recognize infant mortality rates and life expectancies to see how they vary upon region (ESS3.D)
- use empirical evidence to differentiate between cause and correlation and make claims about specific causes and effects. (ESS3.D) (ETS1.B)
- observe patterns and provide evidence for causality in explanations of phenomena. (ESS3.D) (ETS1.B)
- build, refine, and represent evidence-based models using mathematical, physical, and computational tools. (ESS3.C) (ESS3.D)
- revise predictions and explanations using evidence (ESS3.C) (ESS3.D) (ETS1.B)
- connect explanations/arguments to established scientific knowledge, models, and theories. (ESS3.C) (ESS3.D) (ETS1.B)
- develop quality controls to examine the evidence in data sets as a means of generating and reviewing explanations. (ESS3.C) (ESS3.D) (ETS1.B)

EU 3

- resource availability has guided the development of human society. (ESS3.A) (ESS3.C)
- sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (ESS3.A) (ESS3.C) (ETS1.B)

EU 4

- competition for the environment's limited supply of resources will lead to extinction of biotic necessities all individuals need in order to survive and reproduce (ESS3.A)

- represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. (ESS3.C) (ESS3.D)
- evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations) (ESS3.A) (ESS3.C) (ETS1.B)
- draw conclusions from interpreting data to identify common denominators in trends (ESS3.C) (ESS3.D) (ETS1.B)

EU 3

- populations within low socioeconomic status depend on agriculture, so they will continue to farm heavily, even if it destroys the soil (ESS3.D) (ETS1.B)
- differentiate between land cover and land use, and how humans affect both (ESS3.C)
- identify the rate in which greenhouse gasses are emitted due to food production (ESS2.D) (ESS3.D)
- measure the amount of freshwater withdrawals used for agriculture and livestock (ESS3.D)
- compare the amount of land used around the world for food production and agriculture, versus the amount conserved for trees, grass, and natural habitat (ESS3.C)
- indicate the decrease in biodiversity due to destruction of natural habitat (ESS3.C)

EU 4

- differentiate the motive to conserve land and population control in regions of the pre-industrial, transitional,

EU 5

- when evaluating solutions, it is important to take into account a range of constraints—such as cost, safety, reliability, and aesthetics—while also considering social, cultural, and environmental impacts. (ESS3.A) (ESS3.C) (ETS1.B)
- sanitation, medical technology, and changes in agriculture impacts the growth rate of populations in different cultures (ESS3.A) (ESS3.C) (ETS1.B)

industrial, and post-industrial stage (ESS3.B) (ESS3.C) (ETS1.B)

- formulate explanations with scientific evidence on land overuse in impoverished versus wealthy nations (ESS3.C) (ESS3.D) (ETS1.B)
- explain how poverty may enforce people to engage in environmentally harmful activities just to survive (ESS3.B) (ETS1.B)
- identify the impact of clearing forests to create farmland, land to raise livestock, and deforestation of land to produce paper and timber needs. (ESS2.D) (ESS3.D) (ETS1.B)
- disclose how chemical hazards on land contaminant soil and water, which affects both human and ecosystem health (ESS3.B) (ESS3.D)

EU 5

- investigate past cultural attempts to control population growth, such as, “China’s One-Child Policy.” (ESS3.C) (ETS1.B)
- associate how culture and social norms impact population density (ETS1.B)
- define how the wealth gap refers to the difference in assets and income between individuals in a society or between nations (ETS1.B)
- acknowledge the trend that as certain populations increase in size and wealth, larger demands are placed on natural resources (ESS3.C) (ETS1.B)
- distinguish between the positive and negative impacts of technology (ESS2.D) (ESS3.C) (ESS3.D) (ETS1.B)
- solve through obstacles that could limit urban sprawl and transportation (ESS3.C)

Stage Two - Assessment

Stage Three - Instruction

Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections:** Each learning activity listed must be accompanied by a learning goal of **A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.** The following color codes are used to notate activities that correspond with interdisciplinary connections and 21st Century Life & Career Connections (which involves Technology Literacy): **Red = Interdisciplinary Connection; Purple = 21st Century Life & Career Connection**

PHENOMENON: Google Maps Time Lapse - <https://earthengine.google.com/timelapse/>

Description: The Google Maps Timelapse engine allows you to see the impacts of humans on environments over the last three decades. (EU 1-5)

GOAL: Students will identify that human activity as a result of population growth (urbanization) and land use (mining, agriculture, water diversion, etc.) has a large impact on the environment.

1. Observe an area overtime using google maps time lapse. (EU 1,4,5)
 - a. Go to <https://earthengine.google.com/timelapse/>
 - b. Choose an area.
 - c. Watch the time lapse from 1984-2020 & note any changes. (A)
 - d. Discuss as a class the changes observed, why these changes may have occurred (human activities), and what has or may happen as a result. (M,T)
 - e. Result/Connection to Phenomenon: Humans impact the environment in various ways when they use land & resources. (T)
2. Human Population Speed Jot (EU 1-5)
 - a. Have students predict (without looking it up!) the current world population.
 - b. Place on the board the current world population. <https://www.worldometers.info/world-population/>
 - c. In groups, students will have 1:00 minute using two columns to list as many factors that they can think of that have caused the population to grow to this size, as well as, the factors that limit human carrying capacity on Earth. (A)
 - d. Class will share and discuss (M)
 - e. Result/Connection to Phenomenon: The human population has grown exponentially for various reasons and as the population grows more land will be needed for such activities such as food production & resource acquisition. (T)
3. Human Population and Carrying Capacity Webquest (EU 2)

- a. Have students use various websites to answer the questions on the google doc:
https://docs.google.com/document/d/1Q4aWzxAEINxSVExOB8I5cKzKhga1eJQi_5fzw9xeFcA/edit (A,M)
- b. Complete the calculations to determine and compare population growth rates showing proper work and units. (M/T)
- c. Result/Connection to Phenomenon: 1) Populations grow at different rates and for various reasons. 2) Populations can grow exponentially and this growth takes a major toll on the environment. (T)
**Phenomenon Relation: How does the understanding of carrying capacity raise awareness to the issue of countries on the Google Maps Time Lapse being completely colored in from the dots symbolizing population growth?
4. Nova: The World in Balance - The Population Paradox (EU 2)
 - a. Students will watch various clips from: <https://www.youtube.com/watch?v=5KN7nnvMcxU>
 - b. Students are to compare and contrast age structure diagrams between USA vs China vs Kenya vs India to compare growth rates and make predictions. (A,M)
 - c. Result/Connection to Phenomenon: 1) Populations grow at different rates and for various reasons. 2) Populations can grow exponentially and this growth takes a major toll on the environment. (T)
5. Project: Be A Demographer → “Adopt A Country” (EU 2, 5)
https://docs.google.com/document/d/15pDwicAythDKB1guWJ_Vs0m4viyS8Dm0vpcsIMHTMBE/edit
 - a. Students will “adopt” a country and research the population demographics for that country such as population size, density, birth rate, death rate, immigration rate, emigration rate, infant mortality rate and life expectancy. (A)
 - b. Students will create and analyze a demographic transition graph to identify the different stages and growth rates. (A, M)
 - c. Use this information to create a PSA about the country. (M)
 - d. Result/Connection to Phenomenon: 1) Populations grow at different rates and for various reasons. 2) Populations can grow exponentially and this growth takes a major toll on the environment. (T)
6. Debate: China’s “One Child Policy” (EU 1-5)
 - a. Read the article, “China Fears Lopsided Sex Ratio Could Spark Crisis” (A)
 - i. Article available using online textbook resources.
 - b. Choose a side agreeing or disagreeing with this policy. (M)
 - c. Research facts & evidence both qualitative & quantitative supporting your position.(A)
 - d. In groups present arguments to the class. (M)
 - e. Result/Connection to Phenomenon: Controlling population growth is difficult and comes with benefits and consequences. (T)
7. TED Talk: Dare to Educate Afghan Girls (EU 2 & 5)
 - a. Students will watch the TED Talk: Dare to Educate Afghan Girls <https://www.youtube.com/watch?v=Ka70-Hb1wFE>

b. Students will identify ways to control population growth and the benefits and consequences of these various methods. (A, M)

c. Result/Connection to Phenomenon: Controlling population growth is difficult and comes with benefits and consequences. (T)

**Phenomenon Relation: How do demographics, especially including social and culture normalities, explain the reasoning as to why the countries that had the most population dots on the Google Maps Time Lapse escalated their population growth at the rate in which the map displayed?

8. "I am the Lorax! I Speak for the Trees!" clip (EU 3-5)

a. Students will watch the 25 Min Clip: <https://www.youtube.com/watch?v=P0vwxKyceJ4> (A)

b. Students will take notes while watching on the following sheet.

<https://docs.google.com/document/d/1fdVs25FdVk9mp5j7P6lwQ6H6HoevBGptx7nyjw-ICkQ/edit> (M)

c. Result/Connection to Phenomenon: 1) As the human population grows more land will be needed for such activities such as food production & resource acquisition and these activities come with negative consequences. 2) Not all resources are consumed and replenished at the same rate making some resources more sustainable to depend on than others (T)

9. Food Production Project: *Evaluating Solution to Issues of Modern Industrialized Agriculture* (EU 1,3,4,5)

a. Students will be introduced through a teacher-led discussion the various types of food sources humans consume and the methods used to produce food both in the past and in the present. (A)

b. Students will read the article: "[The Cost of Modern Agriculture](#)" in order to identify the issues and problems with modern industrialized agriculture. (A)

c. Students will choose and research a solution to one of these issues and create a google slide presentation to educate the class. (M)

d. Result/Connection to Phenomenon: The production of food to meet growing population demands and economic profits has many negative consequences on the environment that are difficult to address and solve.

10. Cowspiracy: The Sustainability Secret Documentary - Netflix

<https://docs.google.com/document/d/1IWBp5QJVxPQsnK0t6rbDgYXE1MdhpBzfWoiNuoJdpmc/edit> (EU 3-5)

a. Students will watch Cowspiracy: The Sustainability Secret Documentary. (A)

b. Students will determine the position the creators of this documentary are taking and what evidence they are using to back up this position. (M)

c. Result/Connection to Phenomenon: The production of food to meet growing population demands and economic profits has many negative consequences on the environment that are difficult to address and solve. (T)

****Phenomenon Relation:** On the Google Maps Time Lapse, one could no longer see the original map color once an area reached carrying capacity. If there is no more land on which to build upon, how will earth's natural resources keep up with the pace of human population as it continues to increase? In addition to earth's finite resources, how will this affect human health, society, and government?

11. Activity: Eating at a Lower Trophic Level (EU 1-5)

- a. Students will complete a set of step by step calculations to compare the amount of people and environmental impact of eating food from various trophic levels. (A,M,T)
- b. Result/Connection to Phenomenon: One of the easiest ways to reduce your environmental impact is to eat on a lower trophic level. (T)

12. Activity: Organic or Not (EU 3-5)

- a. Students rotate between different stations with various types of organic & conventional foods but they do not know which is which. (A)
- b. Students make observations such as size, mass, color, taste etc. (A)
- c. Students make predictions for which food is organic or not using data from the activity as evidence to support their argument. (M)
- d. Actual results are revealed & discussed with additional information such as price. (A)
- e. Students read the Dirty Dozen vs. Clean Fifteen Article. (A)
 - i. https://docs.google.com/document/d/1UqtmSzWXqPVC-KD75U9E7Am_JBpILBFy/edit?usp=sharing&oid=111683263640512319633&rtpof=true&sd=true
- f. Students use all this to decide whether switching to organic farming is a sustainable solution to the issues that are associated with modern agricultural practices. (M/T)

13. Soil Labs: https://docs.google.com/document/d/18G_P73UAKb5LI6TQigtXyGYfvOUGgsOp6SUtPLqzgl4/edit (EU 4)

- a. Teacher led discussion about Soil (composition, function/importance, texture, pH, fertility) (A)
- b. Students will complete guided and individual practice problems using the soil texture triangle to determine soil texture. (A,M)
- c. Students perform soil analysis from their yards (texture, permeability, pH, Nutrients) (M)
- d. Explore websites (i.e. LaMott) for different soil nutrients and their function/importance (M)
- e. Students prepare a report based on the soil analysis for amending a collected sample of soil (M/T)
- f. Result/Connection to Phenomena: 1) Soil types have different properties that make soil usable for specific tasks. 2) When soil is used or changed by humans, it can affect its properties and function. (T)

14. Activity: *Cookie Mining* (EU 1-5) <https://docs.google.com/document/d/19fgxC1kpwzEq66wT-Xsf31FPxltu3YyXQCYG-qLPUWE/edit>

- a. The purpose of this activity is to simulate a mining operation. In order to make the simulation economically valid, many of the costs associated with real mining operations will be considered.
- b. A land area will be purchased from the bank.
- c. The land area will be surveyed and quantified.
- d. Mining equipment will be purchased from the bank.
- e. A mining operation will be undertaken, with the cost for each minute of the mining operation included in the total operating costs.
- f. At the conclusion of mining operations, the reclamation of the land area is required, with a fine assessed for any part of the land area that is not successfully reclaimed.
- g. The ore that was mined will be sold back to the bank to offset the start-up costs of the mining operation.

15. Refer back to Phenomenon by leading discussion: If we could go into the future and use google map time lapse to observe the land changes to south jersey from the year you were born to when you turn 100, what changes do you think you would observe and why? How would these changes affect the health of the environment for yourself and other living things? Other than affecting the environment, what other areas might be impacted by this change? (M/T) EU 1-5

Additional suggested ideas:

- GMO Debate using current event articles ([Golden Rice](#)) (M, T)
- Meet (Interview) a Local Farmer (A, M)
- [Soil Cation Exchange Capacity Demonstration](#) (A, M)
- [Movie & Questions - "The Most Dangerous Job"](#) (A, M, T)
- Article & Questions - ["The Real Cost of Batteries"](#) (A, M, T)
- Discussion after reading, "10 Shocking Facts about Plastic in our Ocean" <https://passportocean.com/2018/02/24/facts-plastics-oceans/> (M, T)
- 21st Century Skills - Social Responsibility → "Should BPA be Regulated?" (M, T)
 - a. Social Media PSA Post
 - b. https://docs.google.com/presentation/d/1ixSs8oqUNSIOURkhotAJ9pEx70fqWm9qANTj6W_x5c/edit#slide=id.g119f8dd2baa_0_0
- Data Collection - Environmental Hazards Charts (A)

- a. Use data to create graphs for visual representation / practice graph making
- b. https://docs.google.com/document/d/1gdFUVmoSFcxVX-sSFtb-imqyJ2GXNuhHGjb_d-fJ_8/edit
- Gasland Documentary - (A, M, T)
 - a. Questions while watching: <https://docs.google.com/document/d/1izaEVSy2IIBBO9hWNBet-QMIFG2IX32atCZ-x8RwIX0/edit>
 - b. Debate: Is the use of natural gas a sustainable solution?
<https://docs.google.com/document/d/1C1S2YiCmAkrX7Jd33t4ZP6IKCK4Db24wEB8imCVKNgM/edit>
- Water Quality Lab (A, M)
 - a. Collection of quantitative & qualitative data
 - b. pH, Chlorine, Ammonia, Phosphorus, Nitrate, Hardness
 - c. https://docs.google.com/document/d/1o8NE9V_7Uy5Q4PRvzm56zuPvF0qo51Ck3INjaZcUo58/edit
- Water Footprint Webquest (A/M)) <https://www.watercalculator.org/>

Pacing Guide

Unit #	Title of Unit	Approximate # of teaching days
1	Earth's Systems, Resources and Human Impact	25
2	The Living World	55
3	Human Population and Land Use	55
4	Energy Resources and Sustainability	45

Instructional Materials

A fully equipped Environmental Science Lab including but not limited to the following items:

- Soil testing strips
- Water testing strips
- Chocolate chip cookies
- Tooth picks
- Paper clips
- Graph paper
- Monopoly money

Accommodations

Special Education: The curriculum will be modified as per the Individualized Education Plan (IEP). Students will be accommodated based on specific accommodations listed in the IEP.

Students with 504 Plans: Students will be accommodated based on specific accommodations listed in the 504 Plan.

English Language Learners: Students will be accommodated based on individual need and in consultation with the ELL teacher.

Students at Risk of School Failure: Students will be accommodated based on individual need and provided various structural supports through their school.

Gifted and Talented Students: Students will be challenged to enhance their knowledge and skills through acceleration and additional independent research on the subject matter.