Phoenixville Area School District Understanding by Design (UbD) Science Template

Grade Level &/or HS Subject: Environmental Science Unit Name: Land Use

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="6">Overarching NGSS & PA Standards:

<u>HS-ESS3-3</u>
Create a computational simulation to illustrate the relationship among the management of natural resources, the sustainability of human populations, and biodiversity

<u>HS-ESS3-4</u>
Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

Ask questions and/or define problems
Develop and/or use models
Plan and/or carry out investigations
Analyze and interpret data using computational thinking
Obtain, evaluate, and communicate information (supported by evidence)
Construct explanations and design solutions</td></tr>
<tr><td colspan="2">Meaning-Making</td></tr>
<tr><td>Students will understand that…

Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.

Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impact could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean.</td><td>ESSENTIAL QUESTIONS
Students will keep considering...

How do humans change the planet?</td></tr>
<tr><td colspan="2">Knowledge and Skills Acquisition</td></tr>
<tr><td>UNDERSTANDINGS
Students will know…

ESS3.C: Human Impacts on Earth Systems
-The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
-Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.</td><td>Students will be skilled at…

• Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author</td></tr>
</table>

Which branch(es) of science apply: **LS PS** **E&SS**	ETS1.B: Developing Possible Solutions -When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. KEY VOCABULARY *agriculture* cropland, rangeland, traditional agriculture, monocultures, sustainable agriculture practices, soil, soil profile, topsoil, slash-and-burn, irrigation, compost, land degradation, erosion, desertification, overgrazing, Green Revolution *forestry* deforestation, maximum sustainable yield, clearcutting, island biogeography theory *urban planning* urbanization, suburbs, new urbanism, mass transit, greenways, greenbelts, green buildings, noise pollution, light pollution	makes and to any gaps or inconsistencies in the account. • Evaluate hypothesis, 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. • Reason abstractly and quantitatively. • Model with mathematics. • 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. • Define appropriate quantities for the purpose of descriptive modeling. • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Stage 2 – Evidence		
Evaluative Criteria	***Assessment Evidence***	

Project Rubrics
Labs
Quizzes
Tests
	PERFORMANCE TASK(S):
	
	HS-ESS3-3
	• Students create a computational simulation (using a spreadsheet or a provided multiparameter program) that contains representations of the relevant components, including:
	  o A natural resource in a given ecosystem
	  o The sustainability of human populations in a given ecosystem
	  o Biodiversity in a given ecosystem
	  o The effect of technology on a given ecosystem
	• Students describe* simplified realistic (corresponding to real-world data) relationships between simulation variables to indicate an understanding of the factors (e.g., costs, availability of technologies) that affect the management of natural resources, human sustainability, and biodiversity. *(For example, a relationship could be described that the amount of a natural resource does not affect the sustainability of human populations in a given ecosystem without appropriate technology that makes use of the resource; or a relationship could be described that if a given ecosystem is not able to sustain biodiversity, its ability to sustain a human population is also small.)*
	• Students use scientific information to generate a number of possible refinements to a given technological solution. Students:
	  o Describe the system being impacted and how the human activity is affecting that system
	  o Identify the scientific knowledge and reasoning on which the solution is based
	  o Describe how the technological solution that reduces human impacts on natural systems
	  o Describe that the solution being refined comes from scientists and engineers in the real world who develop technologies to solve problems of environmental degradation
	• Students describe and quantify:
	  o Criteria and constraints for the solutions to the problem
	  o The tradeoffs in the solution, considering priorities and other kinds of research-driven tradeoffs in explaining why this particular solution is or is not needed
		Differentiation Considerations:

	• In their evaluation, students describe how refinement will improve the solution to increase benefits and/or decrease costs or risks to people and the environment.
	• Students evaluate the proposed refinements for:
	  o Their effects on the overall stability of and changes in natural systems
	  o Cost, safety, aesthetics, reliability, as well as cultural and environmental impacts	

Question
Accuracy
Project Rubrics
	OTHER EVIDENCE:
	
	Optional
	• Project
	  o Design a Smart Growth City
	• Labs
	  o Carbon Tree Sequester Lab
	  o Ecological Footprint Lab
	• Unit Test
	  o Agricultural and Forestry Test
	  o Urban Planning Test
		Differentiation Considerations: