

Grades 9-12 Environmental Science Curriculum

Middle Township Public Schools 216 S. Main Street Cape May Court House, NJ 08210

Born On Date: August 2018

SUBJECT: Environmental Science GRADE LEVEL: High School UNIT TITLE: Ecosystems LENGTH OF STUDY: 45 days START OF UNIT: Marking period one END OF UNIT: End of marking period one

Unit Learning Goals

Students will be able to develop and use models.

• Develop a model based on evidence to illustrate the relationships between systems or components of a system. (HS-LS2-5)

Students will be able to use mathematics and computational thinking.

- Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1)
- Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS- LS2-2)
- Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4) Students will be able to construct explanations and design solutions.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS2-3)
- Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations. (HS-LS2-7) Students will be able to engage in argument from evidence.
- Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-6)
- Evaluate the evidence behind currently accepted explanations to determine the merits of arguments. (HS-LS2-8)

Students will be able to ask questions and define problems.

• Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1)

Crosscutting Concepts:

Cause and Effect

• Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2-8)

Scale, Proportion, and Quantity

- The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS- LS2-1)
- Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)

• Systems and System Models

• Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows—within and between systems at different scales. (HS-LS2-5)

Energy and Matter

- Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. (HS-LS2-4)
- Energy drives the cycling of matter within and between systems. (HS-LS2-3)

Stability and Change

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

Suggested Sequence of Lessons Text book Chapters: 1,2,4,5,8,9,10	Instructional Materials	Performance Expectations	Disciplinary Core Ideas	Modification SE/ESL	Assessment
Ecosystems	Text book:	Students who	LS2.A:	Small group	Formative
F 1.4	Holt	demonstrate	Interdependent	instruction,	Assessments
Evolution	Environmental	understanding	Relationships in	graphic	Diagnostic pre-
Diversity of	Science	can:	Ecosystems	organizers,	and post-
living things	K.Arms 2008	HS-LS2-1. Use	• Ecosystems	modified	assessments.
0 0		mathematical	have carrying	worksheets and	
Energy flow in	Power	and/or	capacities, which	tests	Class
ecosystems	points/google	computational	are limits to the		Discussions
The cycling of	slides	representations	numbers of	Structure	Worksheets
Materials	Google	to support	organisms and	lessons around	with teacher
	classroom/Chro	explanations of	populations they	questions that	feedback
How ecosystems	mebook/	factors that	can support.	are authentic,	
chunge	textbooks	affect carrying	These limits result	relate to	Drafts of lab
	Whiteboard or	capacity of	from such factors	students	reports with
Populations:	interactive board,	ecosystems at	as the availability	interests and	teacher
Understanding	ELMO/overhead	different scales.	of living and	community.	feedback.
populations	camera, access to	[Clarification	nonliving	D 11	
	videos	Statement:	resources and	Provide	Summative
The human Bopulation	online/projector,	Emphasis is on	Irom such	students with	Assessments
ropulation	internet care	quantitative	challenges such as	multiple	Quizzes
Biodiversity	internet access,	analysis and	predation,	choices for	Tests
-		the relationships	disease	now they can	1 0515
		among	Organisms would	understandings	Darformanac
		interdependent	have the capacity	understandings	Assessments
		merucpenuem	have the capacity		73963311101113

	factors including	to produce	Provide	/Laboratory
	boundaries,	populations of	opportunities	Investigations
	resources,	great size were it	for students to	Research / Lab
	climate, and	not for the fact	share their	Reports
	competition.	that environments	ideas and to	1
	Examples of	and resources are	encourage	
	mathematical	finite. This	work among	
	comparisons	fundamental	various	
	could include	tension affects the	backgrounds	
	graphs, charts.	abundance	and cultures.	
	histograms, and	(number of		
	population	individuals) of	Use project	
	changes	species in any	based science	
	gathered from	given ecosystem.	learning to	
	simulations or	(HS-LS2-1. HS-	connect	
	historical data	LS2-2)	science to	
	sets.]		observable	
	[Assessment	LS2.B: Cvcles of	phenomenon.	
	Boundary:	Matter and	Presionenom	
	Assessment does	Energy Transfer	Provide ELL	
	not include	in Ecosystems	students with	
	deriving	Photosynthesis	multiple	
	mathematical	and cellular	literacy	
	equations to	respiration	strategies.	
	make	(including	U	
	comparisons.]	anaerobic		
	HS-LS2-2. Use	processes)		
	mathematical	provide most of		
	representations	the energy for life		
	to support and	processes. (HS-		
	revise	LS2-3)		
	explanations	Plants or algae		
	based on	form the lowest		
	evidence about	level of the food		
	factors	web. At each link		
	affecting	upward in a food		
	biodiversity	web, only a small		
	and	fraction of the		
	populations in	matter consumed		
	ecosystems of	at the lower level		
	different scales.	is transferred		
	[Clarification	upward, to		
	Statement:	produce growth		
	Examples of	and release		
	mathematical	energy		
	representations	in cellular		
	include finding	respiration at the		
	the average,	higher level.		

	determining	Given this	
	trends, and	inefficiency, there	
	using graphical	are generally	
	comparisons of	fewer organisms	
	multiple sets of	at higher levels of	
	data 1	a food wob Some	
	[Assessment		
	Boundary:	release energy for	
	Assessment is	life functions,	
	limited to	some matter is	
	provided data.]	stored in newly	
	HS-LS2-3.	made structures,	
	Construct and	and much is	
	revise an	discarded. The	
	explanation	chemical	
	based on	elements that	
	evidence for the	make up the	
	cycling of	molecules of	
	matter and	organisms pass	
	flow of energy	through food	
	in aerobic and	webs and into and	
	anaerobic	out of the	
	conditions.	atmosphere and	
	[Clarification	soil. and they are	
	Statement:	combined and	
	Emphasis is on	recombined in	
	conceptual	different ways. At	
	understanding of	each link in an	
	the role of	ecosystem matter	
	aerobic and	and energy are	
	anaerobic	conserved (HS-	
	respiration in	L S2 4)	
	different	• Photosynthesis	
	anvironmente l	and collular	
	Roundamy	important	
	Assassment do	apportant	
	Assessment does	components of the	
	not include the	carbon cycle, in	
	specific	which carbon is	
	cnemical	exchanged among	
	processes of	the biosphere,	
	either aerobic or	atmosphere,	
	anaerobic	oceans, and	
	respiration.]	geosphere	
	HS-LS2-4. Use	through chemical,	
	mathematical	physical,	
	representations	geological, and	
	to support	biological	

	claims for the	processes (UC	
	evoling of	1 \$2 5)	
	cycling UI mottor and	LS2-5)	
	flow of opener	LS2.C:	
	now of energy	Demonstern	
	among	Dynamics, Eurotioning and	
	organisms in an	Functioning, and	
	ecosystem.	Resilience	
	Clarification	A complex set of	
	Statement:	interactions	
	Emphasis is on	within an	
	using a	ecosystem can	
	mathematical	keep its numbers	
	model of stored	and types of	
	energy in	organisms	
	biomass to	relatively constant	
	transformer	over long periods	
	transfer of	of time under	
	energy from one	stable conditions.	
	trophic level to	If a modest	
	another and that	biological or	
	matter and	physical	
	energy are	disturbance to an	
	conserved as	ecosystem occurs,	
	matter cycles	it may return to its	
	and energy	more or less	
	flows through	original status (i.e	
	ecosystems.	the ecosystem is	
	Emphasis is on	resilient), as	
	atoms and	opposed to	
	molecules such	becoming a very	
	as carbon,	different	
	oxygen,	ecosystem.	
	hydrogen and	Extreme	
	nitrogen being	fluctuations in	
	conserved as	conditions or the	
	they move	size of any	
	through an	population,	
	ecosystem.]	however, can	
	Assessment	challenge the	
	Boundary:	functioning of	
	Assessment is	ecosystems in	
	limited to	terms of resources	
	proportional	and habitat	
	reasoning to	availability. (HS-	
	describe the	LS2-2, HS-LS2-	
	cycling of matter	6)	
	and flow of	Moreover,	
	energy.]	anthropogenic	

		1	
	HS-LS2-5.	changes (induced	
	Develop a	by human	
	model to	activity) in the	
	illustrate the	environment—	
	role of	including habitat	
	photosynthesis	destruction,	
	and cellular	pollution,	
	respiration in	introduction of	
	the cycling of	invasive species,	
	carbon among	overexploitation,	
	the biosphere,	and climate	
	atmosphere,	change—can	
	hydrosphere,	disrupt an	
	and geosphere.	ecosystem and	
	[Clarification	threaten the	
	Statement:	survival of some	
	Examples of	species. (HS-LS2-	
	models could	7)	
	include		
	simulations and	LS2.D: Social	
	mathematical	Interactions and	
	models.]	Group Behavior	
	[Assessment	Group behavior	
	Boundary:	has evolved	
	Assessment does	because	
	not include the	membership can	
	specific	increase the	
	chemical steps	chances of	
	of	survival for	
	photosynthesis	individuals and	
	and respiration.]	their genetic	
	HS-LS2-6.	relatives. (HS-	
	Evaluate the	LS2-8)	
	claims,		
	evidence, and	LS4.D:	
	reasoning that	Biodiversity and	
	the complex	Humans	
	interactions in	Biodiversity is	
	ecosystems	increased by the	
	maintain	formation of new	
	relatively	species	
	consistent	(speciation) and	
	numbers and	decreased by the	
	types of	loss of species	
	organisms in	(extinction).	
	stable	(Secondary to HS-	
	conditions, but	LS2-7)	
	changing	Humans depend	
		in the second research	

conditions may	on the living
result in a new	world for the
ecosystem.	resources and
[Clarification	other benefits
Statement:	provided by
Examples of	biodiversity. But
changes in	human activity is
ecosystem	also having
conditions could	adverse impacts
include modest	on biodiversity
biological or	through
physical	overpopulation,
changes, such as	overexploitation,
moderate	habitat
hunting or a	destruction,
seasonal flood;	pollution,
and extreme	introduction of
changes, such as	invasive species,
volcanic	and climate
eruption or sea	change. Thus
level rise.]	sustaining
HS-LS2-7.	biodiversity so
Design,	that ecosystem
evaluate, and	functioning and
refine a	productivity are
solution for	maintained is
reducing the	essential to
impacts of	supporting and
human	enhancing life on
activities on the	Earth. Sustaining
environment	biodiversity also
and	aids humanity by
biodiversity.*	preserving
[Clarification	landscapes of
Statement:	recreational or
Examples of	inspirational
human activities	value.(Secondary
can include	to HS-LS2-7)
urbanization,	(Note: This
building dams,	Disciplinary Core
and	Idea is also
dissemination of	addressed by HS-
invasive	LS4-6.)
species.]	
HS-LS2-8.	PS3.D: Energy
Evaluate the	in Chemical
evidence for the	Processes
role of group	The main way
	conditions may result in a new ecosystem. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.] HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.] HS-LS2-8. Evaluate the evidence for the role of group

		41	
	benavior on	that solar energy	
	individual and	is captured and	
	species'	stored on Earth 1s	
	chances to	through the	
	survive and	complex chemical	
	reproduce.[Clar	process known as	
	ification	Photosynthesis.	
	Statement:	(Secondary to HS-	
	Emphasis is on:	LS2-5)	
	(1)		
	distinguishing	ETS1.B:	
	between group	Developing	
	and individual	Possible	
	behavior, (2)	Solutions	
	identifying	When evaluating	
	evidence	solutions it is	
	supporting the	important to take	
	outcomes of	into account a	
	group behavior,	range of	
	and (3)	constraints	
	developing	including cost,	
	logical and	safety, reliability	
	reasonable	and aesthetics and	
	arguments based	to consider social,	
	on evidence.	cultural and	
	Examples of	environmental	
	group behaviors	impacts.	
	could include	(Secondary to HS-	
	flocking,	LS2-7)	
	schooling,	,	
	herding, and	ETS1.A:	
	cooperative	Defining and	
	behaviors such	Delimiting	
	as hunting,	Engineering	
	migrating, and	Problems	
	swarming.]	Criteria and	
	HS-ETS1-4.	constraints also	
	Use a computer	include satisfying	
	simulation to	any requirements	
	model the	set by society,	
	impact of	such as taking	
	proposed	issues of risk	
	solutions to a	Mitigation into	
	complex real-	account, and they	
	world problem	should be	
	with numerous	quantified to the	
	criteria and	extent possible	
	constraints on	and stated in such	

	interactions	a way that one	
	within and	can tell if a given	
	between	design meets	
	systems	them. (HS-ETS1-	
	relevant to the	1)	
	problem.	Humanity faces	
		major global	
		challenges today,	
		such as the need	
		for supplies of	
		clean water and	
		food or for energy	
		sources that	
		minimize	
		pollution, which	
		can be addressed	
		through	
		engineering.	
		These global	
		challenges also	
		may have	
		manifestations in	
		local	
		communities.	
		(HS-ETS1-1)	

Materials Needed

Text book Chromebook Lab Materials

Interdisciplinary Connections	21st Century Themes and Skills (Life and Career)
For ELA/Literacy RST.9-10.8 Assess the extent to which the reasoning and ouideness in a text support the outbor's claim or a	9.4.O Science, Technology, Engineering & Mathematics Career Cluster
recommendation for solving a scientific or technical	Communication Skills: All clusters rely on effective
problem. (HS-LS2-6), (HS-LS2-7), (HS-LS2-	oral and written communication strategies for creating,
8) RST.11-12.1 Cite specific textual evidence to	expressing, and interpreting information and ideas that
support analysis of science and technical texts,	incorporate technical terminology and information.
attending to important distinctions the author makes	Problem-Solving and Critical Thinking: Critical and
and to any gaps or inconsistencies in the account. (HS-	creative thinking strategies facilitate innovation and
LS2-1), (HS-LS2-2), (HS-LS2-3), (HS-LS2-6), (HS-	problem-solving independently and in teams.
LS2-8)	Information Technology Applications: Technology is
BST 11-12 7 Integrate and evaluate multiple sources of	used to access manage integrate and disseminate
information presented in diverse formats and media	information.
(e.g., quantitative data, video, multimedia) in order to	Systems:
address a question or solve a problem. (HS-LS2-6),	• Roles within teams, work units, departments,
(HS-LS2-7), (HS-LS2-8)	organizations, inter- organizational systems, and the
RST.11-12.8 Evaluate the hypotheses, data, analysis,	larger environment
and conclusions in a science or technical text, verifying the data when possible and correspondenting or challenging conclusions	 impact business operations. Key organizational systems impact organizational performance and the
with other sources of information. (HS-LS2-6), (HS- LS2-7), (HS-LS2-8)	 Impact organizational performance and the quality of products and services. Understanding the global context of 21st-
WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-	century industries and careers impacts business operations. Safety, Health, and Environment: Implementation of
LS2-1), (HS-LS2-2), (HS-LS2-3)	health, safety, and environmental management systems
WHST.9-12.5 Develop and strengthen writing as	and organizational policies and procedures impacts
trying a new approach, focusing on addressing what is	and continuous improvement.
most significant for a specific purpose and audience.	Leadership and Teamwork:
(HS-LS2-3)WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-	Effective leadership and teamwork strategies foster collaboration and cooperation between business units, business partners, and business associates toward the
generated question) or solve a problem; narrow or	accomplishment of organizational goals.
broaden the inquiry when appropriate; synthesize	Employability and Career Development:
multiple sources on the subject, demonstrating	Employability skills and career and entrepreneurship
understanding of the subject under investigation (US	emportunities build the careerity for successful careers
LS2-7)	in a global economy.
For Mathematics	Academic Foundations:

SUBJECT: Environmental Science GRADE LEVEL: High School UNIT TITLE: Earth's Systems LENGTH OF STUDY: 45 days START OF UNIT: Marking period two END OF UNIT: End of marking period two

Unit Learning Goals

Students will be able to develop and use models.

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS2-1, HS-ESS2-3, HS-ESS2-6)
- Use a model to provide mechanistic accounts of phenomena. (HS-ESS2-4)

Students will be able to plan and carry out investigations.

• Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-ESS2-5)

Students will be able to analyze and interpret data.

• Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HS-ESS2-2)

Students will be able to engage in argument from evidence.

• Construct an oral and written argument or counter-arguments based on data and evidence. (HS-ESS2-7)

Students will be able to investigate the scientific knowledge is based on empirical evidence

Crosscutting Concepts:

Cause and Effect

- •Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS2- 4)
- **Energy and Matter**
 - The total amount of energy and matter in closed systems is conserved. (HS-ESS2-6)
 - Energy drives the cycling of matter within and between systems. (HS-ESS2-3)
 - Structure and Function
 - The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. (HS-ESS2-5)

Stability and Change

• Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS2-7)

- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are Irreversible. (HS-ESS2-1)
- Feedback (negative or positive) can Stabilize or destabilize a system. (HS-ESS2-2)

Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology

• •Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS2-3)

Influence of Engineering, Technology, and Science on Society and the Natural World

• •New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS2-2)

Suggested Sequence of Lessons Text book Chapters: 3,11,12,13,20	Instructional Materials	Performance Expectations	Disciplinary Core Ideas	Modification SE/ESL	Assessment
The Dynamic	Holt	Students who	ESS1.B: Earth	Small group	Formative
Earth	Environmental	demonstrate	and the Solar	instruction,	Assessments
Geosphere	Science	understanding	System	graphic	Diagnostic pre-
Atmosphere	K.Arms 2008	can:	Cyclical	organizers,	and post-
Hydrosphere and	Power	HS-ESS2-1.	changes in the	modified	assessments.
Biosphere	points/google	Develop a	shape of Earth's	worksheets and	Class
	slides	model to	orbit around the	tests	Discussions
Water:	Google	illustrate how	sun, together with		Worksheets
Water resources	classroom/Chro	Earth's	changes in the tilt	Structure	with teacher
Water use and	mebook/	internal and	of the planet's	lessons around	feedback
management	textbooks	surface	axis of rotation,	questions that	Drafts of lab
Water pollution	Whiteboard or	processes	both occurring	are authentic,	reports with
	interactive board,	operate at	over hundreds of	relate to	teacher
Air:	ELMO/overhead	different	thousands of	students	feedback.
Air pollution	camera, access to	spatial and	years, have	interests and	
	videos	temporal scales	altered the	community.	Summative
Acid	online/projector,	to form	intensity and		Assessments
Precipitation	laptop/computer,	continental and	distribution of	Provide	Quizzes
	internet access,	ocean-floor	sunlight falling on	students with	Tests
Atmosphere and		features.	the earth. These	multiple	Performance

Climate change	[Clarification	phenomena cause	choices for	Assessments
Ozone	Statement:	a cycle of ice ages	how they can	/Laboratory
-	Emphasis is on	and other gradual	represent their	Investigations
Global warming	how the	climate	understandings	Research / Lab
0	appearance of	changes.(Seconda	e	Reports
The	land features	rv to HS-ESS2-4)	Provide	I I I III
Environment	(such as	.,	opportunities	
and Human	mountains.	ESS2.A: Earth	for students to	
Health	valleys and	Materials and	share their	
Pollution and	plateaus) and	Systems	ideas and to	
Human Health	sea-floor	Earth's systems.	encourage	
	features (such as	being dynamic	work among	
	trenches, ridges,	and interacting.	various	
	and seamounts)	cause feedback	backgrounds	
	are a result of	effects that can	and cultures.	
	both	increase or		
	constructive	decrease the	Use project	
	forces (such as	original changes.	based science	
	volcanism,	(HS-ESS2-1, HS-	learning to	
	tectonic uplift,	ESS2-2)	connect	
	and orogeny)	Evidence from	science to	
	and destructive	deep probes and	observable	
	mechanisms	seismic waves,	phenomenon.	
	(such as	reconstructions of	-	
	weathering,	historical changes	Provide ELL	
	mass wasting,	in Earth's surface	students with	
	and coastal	and its magnetic	multiple	
	erosion).]	field, and an	literacy	
	[Assessment	understanding of	strategies.	
	Boundary:	physical and		
	Assessment does	chemical		
	not include	processes lead to		
	memorization of	a model of Earth		
	the details of the	with a hot but		
	formation of	solid inner core, a		
	specific	liquid outer core,		
	geographic	a solid mantle and		
	features of	crust. Motions of		
	Earth's	the mantle and its		
	surface.]HS-	plates occur		
	ESS2-2.	primarily through		
	Analyze	thermal		
	geoscience data	convection, which		
	to make the	involves the		
	claim that one	cycling of matter		
	change to	due to		
	Earth's surface	the outward flow		
	can create	of energy from		

feedbacks that	Earth's interior
cause changes	and gravitational
to other Earth	denser meteriels
systems.	toward the
Clarification	interior (US
Statement:	
should include	ESS2-5)
climata	record shows that
feedbacks such	changes to global
as how an	and regional
increase in	climate can be
greenhouse	caused by
gases causes a	interactions
rise in global	among changes in
temperatures	the sun's energy
that melts	output or Earth's
glacial ice	orbit tectonic
which reduces	events, ocean
the amount of	circulation
sunlight	volcanic activity
reflected from	glaciers.
Earth's surface.	vegetation, and
increasing	human activities
surface	These changes
temperatures	can occur on a
and further	variety of time
reducing the	scales from
amount of ice.	sudden (e.g.,
Examples could	volcanic ash
also be taken	clouds) to
from other	intermediate (ice
system	ages) to very
interactions,	long- term
such as how the	tectonic cycles.
loss of ground	(HS-ESS2-4)
vegetation	
causes an	ESS2.B: Plate
increase in water	Tectonics and
runoff and soil	Large-Scale
erosion; how	System
dammed rivers	Interactions
increase	The radioactive
groundwater	decay of unstable
recharge,	isotopes
decrease	continually
sediment	generates new
transport, and	energy within

	increase coastal	Earth's crust and	
	erosion; or how	mantle, providing	
	the loss of	the primary	
	wetlands causes	source of the heat	
	a decrease in	that drives mantle	
	local humidity	convection. Plate	
	that further	tectonics can be	
	reduces the	viewed as the	
	wetland	surface	
	extent.]	expression of	
	HS_FSS2_3	mantle	
	Develop 2	convection (HS-	
	model besed on	ESS2 3)	
	mouer based on	Dista tastanisa is	
	Evidence of	the unifair a	
	Earth's Interior	the unifying	
	to describe the	meory that	
	cycling of	explains the past	
	matter by	and current	
	thermal	movements of the	
	convection.	rocks at Earth's	
	[Clarification	surface and	
	Statement:	provides a	
	Emphasis is on	framework for	
	both a one-	understanding its	
	dimensional	geologic history.	
	model of Earth,	Plate movements	
	with radial	are responsible	
	layers	for most	
	determined by	continental and	
	density, and a	ocean-floor	
	three-	features and for	
	dimensional	the distribution of	
	model, which is	most rocks and	
	controlled by	minerals within	
	mantle	Earth's crust.	
	convection and	(HS-ESS2-1)	
	the resulting	()	
	plate tectonics.	ESS2.C: The	
	Examples of	Roles of Water	
	evidence	in Earth's	
	include mans of	Surface	
	Earth's three-	Processes	
	dimensional	The abundance of	
	structure	liquid water on	
	obtained from	Earth's surface	
	seismic waves	and its unique	
	records of the	combination of	
	rate of change	nhysical and	
	rate of change	physical allu	

of Earth's	chemical
magnetic field	properties are
(as constraints	central to the
on convection	planet's
in the outer	dynamics. These
core), and	properties include
identification of	water's
the composition	exceptional
of Earth's	capacity to
lavers from	absorb, store, and
high-nressure	release large
laboratory	amounts of
experiments]	energy transmit
US ESS2 A	sunlight expand
Ho-Looz-4.	upon freezing
deservibe how	dissolve and
uescribe now	transport
variations in	mansport
the flow of	materials, and
energy into and	lower the
out of Earth's	viscosities and
systems result	melting points of
in changes in	rocks. (HS-ESS2-
climate.	5)
[Clarification	
Statement:	ESS2.D:
Examples of	Weather and
the causes of	Climate
climate change	The foundation
differ by	for Earth's global
timescale over	climate systems is
unicscale, over	childe systems is
1-10 years:	the
1-10 years: large volcanic	the electromagnetic
1-10 years: large volcanic eruption, ocean	the electromagnetic radiation from the
1-10 years: large volcanic eruption, ocean circulation; 10-	the electromagnetic radiation from the sun, as well as its
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years:	the electromagnetic radiation from the sun, as well as its reflection,
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in	the electromagnetic radiation from the sun, as well as its reflection, absorption,
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity.	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity, ocean	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity, ocean circulation.	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity, ocean circulation, solar output:	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere.
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity, ocean circulation, solar output; 10-100s of	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems and this
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Farth's orbit	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re- radiation into
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re- radiation into
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re- radiation into space. (HS-ESS2- 2, HS, ESS2-4)
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re- radiation into space. (HS-ESS2- 2, HS- ESS2-4)
1-10 years: large volcanic eruption, ocean circulation; 10- 100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-	the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re- radiation into space. (HS-ESS2- 2, HS- ESS2-4) Gradual

		_	
	of years: long-	changes were due	
	term changes in	to plants and	
	atmospheric	other organisms	
	composition.]	that captured	
	[Assessment	carbon dioxide	
	Boundary:	and released	
	Assassment of	oxygen (HS-	
	Assessment of		
	ine results of	ЕЗЗ2-0, ПЗ-	
	changes in	ESS2-7)	
	climate is		
	limited to		
	changes in		
	surface		
	temperatures,		
	precipitation		
	patterns, glacial		
	ice volumes sea		
	levels, and		
	hiosphare		
	distribution 1		
	aistribution.]		
	HS-ESS2-6.		
	Develop a		
	quantitative		
	model to		
	describe the		
	cycling of		
	carbon among		
	the		
	hydrosphere		
	atmosphere		
	aunosphere,		
	geosphere, and		
	folorificati		
	Statement:		
	Emphasis is on		
	modeling		
	biogeochemical		
	cycles that		
	include the		
	cycling of		
	carbon through		
	the ocean.		
	atmosphere.		
	soil and		
	hiosnhoro		
	(including		
	(including		
	numans),		
	providing the		

	foundation for		
	living		
	organisms.]		
	HS-ESS2-7.		
	Construct an		
	argument		
	hased on		
	evidence about		
	the		
	simultaneous		
	convolution of		
	Coevolution of		
	and life on		
	and me on Earth [Clarific		
	Earth.[Clarinc		
	Statement:		
	Emphasis is on		
	the dynamic		
	causes, effects,		
	and feedbacks		
	between the		
	biosphere and		
	Earth's other		
	systems,		
	whereby		
	geoscience		
	factors control		
	the evolution of		
	life, which in		
	turn		
	continuously		
	alters Earth's		
	surface.		
	Examples of		
	include how		
	photosynthetic		
	life altered the		
	atmosphere		
	through the		
	production of		
	oxygen, which		
	in turn		
	increased		
	weathering		
	rates and		
	allowed for		
	the evolution of		
	animal life.		
	ammai mv,		

	how microbial		
	life on land		
	increased the		
	formation of		
	soil which in		
	turn allowed		
	turn anowed		
	for the		
	evolution of		
	land		
	plants; or how		
	the evolution of		
	corals created		
	reefs that		
	altered		
	nattorns of		
	patterns of		
	deposition		
	along coastlines		
	and provided		
	habitats		
	for the		
	evolution of		
	new life forms.]		
	[Assessment		
	Boundary:		
	Assessment		
	does not include		
	<i>a</i>		
	u comprehensive		
	comprenensive		
	oj ine		
	Mechanisms of		
	how the		
	biosphere		
	interacts with		
	all of Earth are		
	other systems.]		
	HS-ETS1-3.		
	Evaluate a		
	solution to a		
	complex real-		
	world problem		
	hased on		
	nrioritized		
	priorizeu oritoria and		
	trada offer that		
	trade-ons that		
	account for a		
	range of		

Materials Needed

Text book Chromebook Lab Materials

Interdisciplinary Connections	21st Century Themes and Skills (Life and Career)
	9.4.O Science, Technology, Engineering &
For ELA/Literacy	Mathematics Career Cluster
RST.11-12.1 Cite specific textual evidence to support	
analysis of science and technical texts, attending to	Communication Skills: All clusters rely on effective
important distinctions the author makes and to any gaps	oral and written communication strategies for creating,
or inconsistencies in the account. (HS- ESS2-2), (HS-	expressing, and interpreting information and ideas that
ESS2-3)	incorporate technical terminology and information.
RST.11-12.2 Determine the central ideas or	Problem-Solving and Critical Thinking: Critical and
conclusions of a text; summarize complex concepts,	creative thinking strategies facilitate innovation and
processes, or information presented in	problem-solving independently and in teams.
a text by paraphrasing them in simpler but still accurate	Information Technology Applications: Technology is
terms. (HS-ESS2-2)	used to access, manage, integrate, and disseminate
WHST.9-12.1 Write arguments focused on discipline-	information.
specific content. (HS-ESS2-7)	Systems:
WHST.9-12.7 Conduct short as well as more sustained	• Roles within teams, work units, departments,
research projects to answer a question (including a self-	organizations, inter- organizational systems, and the
generated question) or solve a problem; narrow or	larger environment
broaden the inquiry when appropriate; synthesize	impact business operations.
multiple sources on the subject, demonstrating	Key organizational systems

understanding of the subject under investigation. (HS- ESS2-5) SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-ESS2-1), (HS-ESS2-3), (HS-ESS2-4) For Mathematics MP.2 Reason abstractly and quantitatively. (HS-ESS2- 1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS- ESS2-6) MP4 Model with mathematics. (HS-ESS2-1), (HS- ESS2-3), (HS-ESS2-4), (HS- ESS2-6) 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. (HS-ESS2- 1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS- ESS2-6) HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-1), (HS- ESS2-3), (HS-ESS2-4), (HS- ESS2-6) HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS- ESS2-4), (HS-ESS2-5), (HS-ESS2-6)	 Impact organizational performance and the quality of products and services. Understanding the global context of 21st-century industries and careers impacts business operations. Safety, Health, and Environment: Implementation of health, safety, and environmental management systems and organizational policies and procedures impacts organizational performance, regulatory compliance, and continuous improvement. Leadership and Teamwork: Effective leadership and teamwork strategies foster collaboration and cooperation between business units, business partners, and business associates toward the accomplishment of organizational goals. Employability and Career Development: Employability skills and career and entrepreneurship opportunities build the capacity for successful careers in a global economy. Academic Foundations: Academic concepts lay the foundation for the full range of career and postsecondary education opportunities within the career cluster.
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SUBJECT: Environmental Science GRADE LEVEL: High School UNIT TITLE: Earth and Human Activity LENGTH OF STUDY: 45 days START OF UNIT: Marking period three END OF UNIT: End of Marking period three

Unit Learning Goals

Students will be able to analyze and interpret data.

• Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Students will be able to use mathematics and computational thinking.

- Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3)
- Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Students will be able to construct explanations and design solutions.

- Evaluate a solution to a complex real- world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations. (HS-ETS1-3)
- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1)
- Design or refine a solution to a complex real-world problem, based on scientific knowledge, student- generated sources of evidence, prioritized criteria, and trade off considerations. (HS-ESS3-4)

Students will be able to engage in argument from evidence.

• 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). (HS-ESS3-2)

Students will be able to use a variety of methods to investigate science.

- Science investigations use diverse methods and do not always use the same set of procedures to obtain data. (HS-ESS3-5)
- New technologies advance scientific knowledge. (HS-ESS3-5)

Students will be able to engage in argument from evidence.

• Construct an oral and written argument or counter-arguments based on data and evidence. (HS-ESS2-7)

Crosscutting Concepts:

Cause and Effect

• •Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3- 1)

Systems and System Models

• 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. (HS-ESS3-6)

Stability and Change

- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-3, HS-ESS3-5)
- Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4)
- Connections to Engineering, Technology, and Applications of Science
- Influence of Science, Engineering, and Technology on Society and the Natural World
- • Modern civilization depends on major technological systems. (HS-ESS3-1, HS-ESS3-3)
- Engineers continuously modify these
- Technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS- ESS3-2, HS-ESS3-4)
- New technologies can have deep impacts on society and the environment, including some that were not anticipated. (HS-ESS3-3)
- Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS3-2)
- New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1, HS-ETS1-3)
- ------
- Connections to Nature of Science
- Science is a Human Endeavor
- Science is a result of human endeavors, imagination, and creativity. (HS-ESS3-3)

Science Addresses Questions About the Natural and Material World

- Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (HS-ESS3-2)
- Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. (HS-ESS3-2)
- Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-2)

Suggested Sequence of Lessons Text book Chapters:14,15, 16,17,18,19,20,2 1	Instructional Materials	Performance Expectations	Disciplinary Core Ideas	Modification SE/ESL	Assessment
LandHow we use landWaban land useLandWanagement andConservationRood andAgricultureCrops and soilMining andMineralResourcesMining andMineralResourcesMining andMineralResourcesMineralResourcesMineralResourcesMineralResourcesMineralResourcesMineralResourcesMineralRenewableEnergyRenewableEnergyRenewableEnergy andConservationWasteSolid waste	Environme ntal Science K.Arms 2008 Power points/googl e slides Google classroom/C hromebook/ textbooks Whiteboard or interactive board, ELMO/over head camera, access to videos online/proje ctor, laptop/comp uter, internet access, Lab materials	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. [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of	Weather and Climate • 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. (<i>Secondary to HS-</i> <i>ESS3-6</i>) ESS3.A: Natural Resources Resource availability has guided the development of human society. (HS- ESS3-1) All forms of energy production and other resource extraction have associated economic, social,	instruction, graphic organizers, modified worksheets and tests Structure lessons around questions that are authentic, relate to students interests and community. Provide students with multiple choices for how they can represent their understandings Provide opportunities for students to share their ideas and to encourage work among various backgrounds and cultures. Use project based science learning to connect science to observable phenomenon.	Assessments Diagnostic pre- and post- assessments. Class Discussions Worksheets with teacher feedback Drafts of lab reports with teacher feedback. Summative Assessments Quizzes Tests Performance Assessments /Laboratory Investigations Research / Lab Reports

	temperature and	environmental,	students with	
Reduction Solid	precipitation, and the	and geopolitical	multiple	
waste	types of crops and	costs and risks as	literacy	
	livestock that can be	well as benefits.	strategies.	
The	raised.]	New technologies	U	
Environment	HS-ESS3-2.	and social		
and Human	Evaluate competing	regulations can		
Health	design solutions for	change the		
Pollution and	developing,	balance of these		
Human Health	managing, and	factors. (HS-		
	utilizing energy and	ESS3-2)		
Economics,	mineral resources	ESS3.B: Natural		
Policy and the	based on cost-	Hazards		
Future	benefit	 Natural hazards 		
Economics and	ratios.*	and other		
International	[Clarification	geologic events		
Cooperation	Statement:	have shaped the		
	Emphasis is on the	course of human		
Environmental	conservation,	history; [they]		
Policies in the	recycling, and reuse	have significantly		
US	of resources (such	altered the sizes		
	as minerals and	of		
The Importance	metals) where	human		
of the Individual	possible, and on	populations and		
	minimizing impacts	have driven		
	where it is not.	human		
	Examples include	migrations. (HS-		
	developing best	ESS3-1)		
	practices for	ESS3.C: Human		
	agricultural soil	Impacts on		
	use, mining (for	Earth Systems		
	coal, tar sands, and	The sustainability		
	oil shales), and	of human		
	pumping (for	societies and the		
	petroleum and	biodiversity that		
	natural gas).	supports them		
	science knowledge	requires		
	honnon in noticel	management of		
	systems not what	natural resources		
	systems—not what should happen 1	(HS_FSS3 3)		
	HS_ESS3_3 Croate	Scientists and		
	a computational	engineers can		
	simulation to	make major		
	illustrate the	contributions by		
	relationshins among	developing		
	management of	technologies that		
	natural resources.	produce less		
	the sustainability of	pollution and		
	human populations.	waste and that		
	and biodiversity.	preclude		
	[Clarification	ecosystem		
	Statement:	degradation. (HS-		
	Examples of factors	ESS3-4)		
	that affect the	ESS3.D: Global		

	management of	Climate Change	
	natural resources	Though the	
	include costs of	magnitudes of	
	resource extraction	human impacts	
	and wasta	are greater then	
	and waste	they have even	
	management, per-	they have ever	
	capita consumption,	been, so too are	
	and the	human abilities to	
	development of new	model, predict,	
	technologies.	and manage	
	Examples of factors	current and future	
	that affect human	impacts. (HS-	
	sustainability	ESS3- 5)	
	include agricultural	Through	
	efficiency, levels of	computer	
	conservation and	simulations and	
	urhan nlanning]	other studies	
	[Assessment	important	
	Roundary.	discoveries are	
	Assassment for	still boing made	
	Assessment jor	suit being made	
	computational	about now the	
	simulations is	ocean, the	
	limited to using	atmosphere, and	
	provided multi-	the biosphere	
	parameter programs	interact and are	
	or constructing	modified in	
	simplified	response to	
	spreadsheet	human activities.	
	calculations.]HS-	(HS- ESS3-6)	
	ESS3-4. Evaluate or	ETS1.B:	
	refine a	Developing	
	technological	Possible	
	solution that	Solutions	
	reduces impacts of	• When	
	human activities on	evaluating	
	natural systems.*	solutions, it is	
	[Clarification	important to take	
	Statement:	into account a	
	Examples of data	range of	
	on the impacts of	constraints	
	human activities	including cost	
	could include the	safety reliability	
	quantities and types	and aesthetics	
	of pollutorte	and acouncies,	
	released changes to	to consider social	
	hiomose and masies	cultural and	
	diversity on areal	onvironmentel	
	abangag in land	imposts	
	changes in failu	(Secondaria LC	
	surface use (such as	$(Secondary to \Pi S - ESCONDARY to IS - ESCONDAR$	
	IOF UFDAN	ESSS-2),	
	uevelopment,	(Seconaary HS-	
	agriculture and	ESS3-4)	
	investock, or surface	E151.A:	
	mining). Examples	Defining and	
	tor limiting future	Delimiting	

	impacts could range	Engineering	
	from local efforts	Problems	
	(such as reducing	Criteria and	
	reusing and	constraints also	
	recycling recources)	include satisfying	
	to large coole	any requirements	
	to large-scale	any requirements	
	geoengineering	set by society,	
	design solutions	such as taking	
	(such as altering	issues of risk	
	global temperatures	mitigation into	
	by making large	account, and they	
	changes to the	should be	
	atmosphere or	quantified to the	
	ocean).]	extent possible	
	HS-ESS3-5.	and stated in such	
	Analyze geoscience	a way that one	
	data and the results	can tell if a given	
	from global climate	design meets	
	models to make an	them. (HS-ETS1-	
	evidence-based	1)	
	forecast of the	Humanity faces	
	current rate	major global	
	of global or regional	challenges today	
	olimate change and	such as the need	
	cilliate change and	for sumplies of	
	associated future	for supplies of	
	impacts to Earth	clean water and	
	systems.	food or for energy	
	[Clarification	sources that	
	Statement:	minimize	
	Examples of	pollution, which	
	evidence, for both	can be addressed	
	data and climate	through	
	model outputs, are	engineering.	
	for climate changes	These global	
	(such as	challenges also	
	precipitation and	may have	
	temperature) and	manifestations in	
	their associated	local	
	impacts (such as on	communities.	
	sea level, glacial ice	(HS-ETS1-1)	
	volumes, or		
	atmosphere and		
	ocean		
	composition) 1		
	[Assessment		
	Roundary		
	Assassmant is		
	limited to one		
	arample of a climate		
	example of a climate		
	change and us		
	<i>associatea impacts.</i>]		
	HS-ESS3-6. Use a		
	computational		
	representation to		
	illustrate the		

	relationships among		
	Forth systems and		
	how those		
	now those		
	relationships are		
	being modified due		
	to human activity.		
	[Clarification		
	Statement:		
	Examples of Earth		
	systems to be		
	considered are the		
	hydrosphere		
	atmosphere		
	ervosphere		
	cryosphere,		
	geosphere, and/or		
	biosphere. An		
	example of the far-		
	reaching impacts		
	from a human		
	activity is how an		
	increase in		
	atmospheric carbon		
	dioxide results in an		
	increase in		
	nhotosynthetic		
	biomass on land		
	and an increase in		
	and an increase in		
	with resulting		
	with resulting		
	impacts on sea		
	organism health		
	and marine		
	populations.]		
	[Assessment		
	Boundary:		
	Assessment does not		
	include running		
	computational		
	representations but		
	is limited to using		
	the published results		
	of scientific		
	computational		
	models]		
	HS_FTS1_1		
	Analyza a major		
	alabal aballanga ta		
	giobal challenge to		
	specify quantative		
	and quantitative		
	criteria and		
	constraints for		
	solutions that		
	account for societal		
	needs and wants.		

Materials Needed
Text book
Chromebook
Lab Materials

For ELA/Literacy 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. (HS-ESS3-1), (HS- ESS3-2), (HS-ESS3-4), (HS-ESS3-5) 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. (HS-ESS3-5) 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. (HS-ESS3-5) 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. (HS-ESS3-2), (HS-ESS3-4) WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific remodured corneximute, our chapter deviced processore (HS	For ELA/Literacy 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. (HS-ESS3-1), (HS- ESS3-2), (HS-ESS3-4), (HS-ESS3-5) RST.11-12.2 Determine the central ideas or	
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SUBJECT: Environmental Science GRADE LEVEL: High School UNIT TITLE: The Delaware Bay Estuary LENGTH OF STUDY: 45 days START OF UNIT: Marking period four END OF UNIT: June /End of marking period four

Unit Learning Goals

Students will be able to construct explanations and design solutions.

- Design a solution to a complex real- world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations. (HS-ETS1-2)
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS2-3)

Students will be able to plan and carry out investigations.

• Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design

Students will be able to use mathematics and computational thinking.

• Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4) Students will be able to use scientific knowledge in an effort to revise ideas with new evidence.

• Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or interpretation of existing evidence. (HS-LS2-3)

Suggested Sequence of Lessons Text book Chapters: Online Database and binders from Rutgers "Inservice"	Instructional Materials	Performance Expectations	Disciplinary Core Ideas	Modification SE/ESL	Assessment
Discovering the Delaware Bay estuary mapping watershed modeling watershed life	Power points/google slides Google classroom/Chro mebook/ textbooks Whiteboard or	Students who demonstrate understanding can: HS-LS2-3. Construct and revise an explanation based on evidence for the	LS2.B: Cycles of Matter and Energy Transfer in Ecosystems Photosynthesis and cellular respiration (including anaerobic processes)	Small group instruction, graphic organizers, modified worksheets and tests Structure lessons around	Formative Assessments Diagnostic pre- and post- assessments. Class Discussions Worksheets

bay salinity	interactive board,	cycling of matter and	provide most of the energy for life	questions that are authentic.	with teacher feedback
	ELIVIO/Overneau	flow of energy	processes. (HS-	relate to	Tooubuok
Ovsters as a	camera, access to	in aerobic and	LS2-3)	students	Drafts of lab
Natural	videos	anaerobic	Plants or algae	interests and	reports with
Resource:	online/projector,	conditions.	form the lowest	community.	teacher
History of the	laptop/computer,	[Clarification	level of the food	5	feedback.
5 5	internet access,	Statement:	web. At each link	Provide	
Delaware Bay	Lab materials	Emphasis is on	upward in a food	students with	Summative
		conceptual	web, only a small	multiple	Assessments
Oyster Fishery		understanding of	fraction of the	choices for	Quizzes
oyster harvest		the role of	matter consumed	how they can	-
graphs		aerobic and	at the lower level	represent their	Tests
oyster fishery		anaerobic	is transferred	understandings	
development and		respiration in	upward, to		Performance
decline		different	produce growth	Provide	Assessments
oyster harvest		environments.]	and release	opportunities	/Laboratory
quantities		[Assessment	energy in cellular	for students to	Investigations
		Boundary:	respiration at the	share their	Research / Lab
Oyster Biology		Assessment does	higher level.	ideas and to	Reports
and Ecology		not include the	Given this	encourage	
Morphology and		specific	inefficiency, there	work among	
anatomy of		chemical	are generally	various	
Oysters		processes of	fewer organisms	backgrounds	
		either aerobic or	at higher levels of	and cultures.	
Oysters survival		anaerobic	a food web. Some		
and life cycle		respiration.]HS-	matter reacts to	Use project	
o		LS2-4. Use	release energy for	based science	
Oyster diseases		mathematical	life functions,	learning to	
		representations	some matter is	connect	
Filter feeding		to support	stored in newly	science to	
Oysier reejs/		cialms for the	and much is	phonomonon	
value		cycling of mottor and	discarded The	Provide ELI	
value		flow of energy	chemical	students with	
		among	elements that	multiple	
		organisms in an	make up the	literacy	
		ecosystem.	molecules of	strategies.	
		[Clarification	organisms pass	0	
		Statement:	through food		
		Emphasis is on	webs and into and		
		using a	out of the		
		mathematical	atmosphere and		
		model of stored	soil, and they are		
		energy in	combined and		
		biomass to	recombined in		
		describe the	different ways. At		
		transfer of	each link in an		
		energy from one	ecosystem, matter		
		trophic level to	and energy are		
		another and that	conserved. (HS-		
		matter and	LS2-4)		
		energy are	LS2.C:		
		conserved as	Ecosystem		
		matter cycles	Dynamics,		

	and energy	Functioning, and	
	flows through	Resilience	
	ecosystems	Moreover.	
	Emphasis is on	anthronogenic	
	atoms and	changes(induced	
	moloculos such	hu human	
	molecules such		
	as carbon,	activity) in the	
	oxygen,	environment—	
	hydrogen and	including habitat	
	nitrogen being	destruction,	
	conserved as	pollution,	
	they move	introduction of	
	through an	invasive species,	
	ecosystem.]	overexploitation,	
	[Assessment	and climate	
	Roundary:	change—can	
	Assessment is	disrupt an	
	limited to	ecosystem and	
	proportional	threaten the	
	reasoning to	survival of some	
	describe the	species (HCIC)	
	eveling of matter	species. (115-L52- 7)	
	cycling of maner	/) I SA D.	
	ana jiow oj	Lo4.D. Diadiyaraity and	
	energy.]	Diouiversity and	
	H5-L52-7.	Humans	
	Design,	Biodiversity is	
	evaluate, and	increased by the	
	refine a	formation of new	
	solution for	species	
	reducing the	(speciation) and	
	impacts of	decreased by the	
	human	loss of species	
	activities on the	(extinction).	
	environment	(Secondary to HS-	
	and	LS2-7)	
	biodiversity.*	Humans depend	
	[Clarification	on the living	
	Statement:	world for the	
	Examples of	resources and	
	human activities	other benefits	
	can include	provided by	
	urbanization,	biodiversity. But	
	building dams,	human activity is	
	and	also having	
	dissemination of	adverse impacts	
	invasive	on biodiversity	
	species.]	through	
	HS-ESS2-5.	overpopulation,	
	Plan and	overexploitation,	
	conduct an	habitat	
	investigation of	destruction.	
	the properties	pollution.	
	of water and its	introduction of	
	effects on Earth	invasive species	
	materials and	and climate	
	mater fals allu	und enniate	

	surface	change. Thus	
	processes.[Clari	sustaining	
	fication	biodiversity so	
	Statement:	that ecosystem	
	Emphasis is on	functioning and	
	mechanical and	productivity are	
	chemical	maintained is	
	investigations	essential to	
	with water and a	supporting and	
	variety of solid	enhancing life on	
	materials to	Earth Sustaining	
	materials to	biodiversity also	
	provide the	aida humanitu hu	
	connections	preserving	
	between the	landscapes of	
	nydrologic cycle	recreational or	
	and system	inspirational	
	interactions	value.(Secondary	
	commonly	to HS-LS2-7)	
	known as the	ESS2.C: The	
	rock cycle.	Roles of Water	
	Examples of	in Earth's	
	mechanical	Surface	
	investigations	Processes	
	include stream	The abundance of	
	transportation	liquid water on	
	and deposition	Earth's surface	
	using a stream	and its unique	
	table, erosion	combination of	
	using variations	physical and	
	in soil moisture	chemical	
	content, or frost	properties are	
	wedging by the	central to the	
	expansion of	planet's	
	water as it	dynamics. These	
	freezes.	properties include	
	Examples of	water's	
	chemical	exceptional	
	investigations	capacity to	
	include	absorb, store, and	
	chemical	release large	
	weathering and	amounts of	
	recrystallization	energy, transmit	
	(by testing the	sunlight, expand	
	solubility of	upon freezing,	
	different	dissolve and	
	materials) or	transport	
	melt generation	materials, and	
	(by examining	lower the	
	how water	viscosities and	
	lowers the	melting points of	
	melting	rocks. (HS-ESS2-	
	temperature of	5)	
	most	ETS1.C:	
	solids).]HS-	Optimizing the	
	-	- 0	

ETS1-2. Design a solution to a complex real- world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	Design Solution • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade- offs) may be needed. (HS- ETS1-2) 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	
	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. (Secondary to HS- LS2-7)	

Materials Needed
Text book Chromebook Lab Materials <u>https://billionoysterproject.org/wp-content/uploads/2013/06/curriculum_guide_1-1.pdf</u> Rutgers link to Delaware Bay curriculum -Teachers can use as a guide for informational purposes (activities and data need to be adjusted to NGSS for increased rigor to maintain High School standards and differentiated for students learning needs).

Interdisciplinary Connections	21st Century Themes and Skills (Life and Career)
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