



Santa Rosa City Schools Course Proposal: Living Earth Honors

Proposal Submitted By: Teaching and Learning

Needs Statement: Discuss how this course fits into your Site and/or the District's goals. Attach minutes of meetings where this course was approved at site or district leadership meetings.

This is a course revision and title change to the Biology Honors courses currently offered at our high school sites. The course is being revised to align with the Next Generation Science Standards (NGSS).

Graduation Requirements: Specify which requirement is met. (High School only)

This course will meet the d-level Life Science requirement for graduation.

UC a-g Requirements: Specify which requirement is met. (High School only)

This course will be submitted to the UC for "d" Lab Science.

Explain the rationale for course addition or modification. How does this fit in with district/site goals. Is this course replacing a current course, which course is it replacing and why? Will this course require new sections? Be explicit.

Our Living Earth Honors course offerings are being revised to fully align with the Next Generation Science Standards (NGSS). This will allow all students grades 9-12 access to NGSS High School Performance Expectations (PEs) in Life Science as well as some integrated NGSS Earth Science PEs. In addition, this revised Living Earth Honors course will comprehensively integrate NGSS cross-cutting concepts (CCs) and the NGSS science and engineering practices (SEPs). The NGSS Physical and Earth Science PEs, CCs, and SEPs are thoughtfully aligned to the Common Core State Standards for Literacy in Science and Technical Subjects and the Common Core State Standards in Mathematics. (Next Generation Science Standards Appendix L and M)

Explain the measurable learning outcomes

In Living Earth Honors, students will develop proficient understanding and explain more in-depth the phenomena of the four disciplinary core ideas in life sciences - From Molecules to Organisms: Structures and Processes, Ecosystems: Interactions, Energy and Dynamics, Heredity: Inheritance and Variation of Traits, and Biological Evolution: Unity and Diversity. In Living Earth students will also develop proficient understanding of Earth Science disciplinary core ideas involving Earth's systems and

feedback, coevolution of Earth systems and life, matter and energy cycling, and the relationships between natural resources, hazards, climate, biodiversity of populations and human activity.

Students will also deepen their understanding and application of NGSS cross-cutting concepts which link the different domains of science throughout their K-12 science education. These include patterns, cause and effect, scale/proportion/quantity, systems and system models, energy and matter, structure and function, and stability and change. These cross-cutting concepts will provide an organizational schema for interrelating knowledge from various science fields into a coherent and scientifically based view of the world.

Finally, students will continue growing proficiency in their use of the NGSS science and engineering practices which include 1) Asking Questions and Defining Problems, 2) Developing and Using Models, 3) Planning and Carrying Out Investigations, 4) Analyzing and Interpreting Data, 5) Using Mathematics and Computational Thinking, 6) Constructing Explanations and Designing Solutions and 7) Engaging in Argument from Evidence. These practices are behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems. Strengthening the science and engineering practices of the Next Generation Science Standards will clarify for students the relevance of science, technology, engineering and mathematics (the four STEM fields) to everyday life as well as strengthen their ability to read and write in technical subjects.

As an honors science student, Living Earth Honors students will engage in increasingly advanced levels of analysis and research when studying life and earth science phenomenon. All students in honors science classes will complete semester comprehensive final exams and a year or semester-long project.

Course Description (To be used in the course catalog)

Living Earth Honors is the first course of a three-year Next Generation Science Standards (NGSS) course pathway. In the Living Earth Honors, students will learn about organism structures and processes, ecosystems, inheritance and variation of traits, and biological evolution integrated with earth science core ideas. Living Earth Honors will engage students in increasingly advanced levels of analysis and research when studying life and earth science phenomenon using the NGSS science and engineering practices. All students in honors science classes will complete comprehensive final exams as well as a semester or year-long research project. This course meets 'd' lab science credits for UC/CSU entrance. Prerequisite: highly suggested is a C or better in Math 1 and previous science class.

Detailed Course Design

(Course design should include the objectives, activities, assessments, and standards to be addressed in this course.)

UNIT 1 TITLE: Ecosystem Dynamics

This unit is anchored by an exploration of natural or human caused ecosystem phenomena such as the introduction of an invasive species or changes in predator populations. These

phenomena, defining and modeling stable ecosystems, and the relationships that exist to support them are explored. Evidence is produced and analyzed to support the idea that when one living or non-living factor is changed in an ecosystem, there is often a cascade of changes that follow. The importance of abiotic nutrients as well as their impacts on biodiversity are examined. Additionally, an investigation of the impact of natural geologic changes or events on these ecosystem dynamics is conducted as students investigate how changes on the Earth's surface can affect other systems. This investigation will include past and current movement of tectonic plates and the simultaneous coevolution of Earth's systems and life.

Unit 1 NGSS Life Science Performance Expectations:

LS2-1- Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales

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

***LS2-2** - Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales

***LS2-4** - Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem

Unit 1 NGSS Earth Science Performance Expectations:

***ESS1-5** - Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.

***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.

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

*(*PE also included in another unit)*

UNIT 2 TITLE: Energy Interactions & Matter

This unit is anchored by an exploration of the flow of energy through an ecosystem in all of its forms and the chemical materials that cycle, making up and supporting living organisms within that ecosystem. An exploration of photosynthesis and cellular respiration is fundamental to the energy and matter transformations within ecosystems. These processes are further examined through the study of biosynthesis, food webs, and trophic pyramids. An important focus is the nutrient/chemical cycling of carbon, water, nitrogen, and phosphorus, with a quantitative model and analysis of carbon reservoirs and flows in Earth's systems (geosphere, atmosphere, hydrosphere and biosphere). Students will analyze how human alterations to Earth's systems, such as increasing the combustion of carbon sources, affect these cycles and climate change. They will also evaluate a technological solution to reduce human impact. Throughout this unit, students will begin or deepen thinking about how the Earth's systems and life coevolved. The concepts of universal energy forms (e.g. heat) and entropy are reinforced.

Unit 2 NGSS Life Science Performance Expectations:

***LS1-4** - Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing

and maintaining complex organisms

LS1-5 - Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy

LS1-6 -Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules

LS1-7 - Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy

LS2-3- Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions

***LS2-4**- Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem

***LS2-5** - Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among biosphere, atmosphere, hydrosphere, and geosphere.

Unit 2 NGSS Earth Science Performance Expectations:

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

***ESS1-6** - Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.

***ESS2-4** - Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate

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

***ESS3-4** - Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

*(*PE also included in another unit)*

UNIT 3 TITLE: Structure & Function of Organisms

This unit is anchored by investigations of fundamental life processes such as organism responses to environmental stimuli. These investigations will explore the organization of organisms and any specialized anatomy or physiology that allows for the responses being explored. Students will be able to develop a model that shows the relationship between organism organization and specialization and construct an explanation of the essential functions of life (including the hierarchical organization of cells to specialized body systems in multicellular organisms). Students will also be able to communicate how cell division is an essential component of growth, development, and repair. As part of this exploration, feedback mechanisms are studied as fundamental mechanisms of homeostasis. Multiple responses must be examined to explore the diversity of organismal structure and its correlation to function. The critical relationship of environmental (internal and external) conditions as stimuli to behavioral responses is continually reinforced.

Unit 3 NGSS Life Science Performance Expectations:

LS1-2 - Develop and use a model to illustrate the hierarchical organization of interacting systems that

provide specific functions within multicellular organisms

LS1-3 - Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis

***LS1-4** - Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms

*(*PE also included in another unit)*

UNIT 4 TITLE: Inheritance & Variation of Traits

This unit is anchored by an exploration of the mechanisms and patterns of genetic inheritance in a population. The structural nature of DNA and how it is conducive to its function of encoding genes is explored. Sources of genetic variation including random fertilization, crossing over, independent assortment, mutation, and gene expression are modeled as students attempt explanations for differences and similarities they observe within a population over time. The role of protein synthesis and its fundamental importance are examined in this exploration. Environmental conditions and demands on populations are integrated into student analyses of the variation and distribution of expressed traits in a population.

Unit 4 NGSS Life Science Performance Expectations:

LS1-1 - Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells

LS3-1 - Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring

***LS3-2** - Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors

LS3-3 - Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population

UNIT 5 TITLE: Mechanisms & Evidence for Evolution

This unit is anchored by an exploration of the genetic and morphological changes that occur in a population over time and the multiple lines of evidence that support the nature of these changes. Examples of the evolution of populations by natural selection, genetic drift, and gene flow are investigated. Students continue to demonstrate how Earth processes have shaped the biosphere and how ecosystem environments allow for specific niches to be exploited by populations of organisms. An investigation of the impact of natural geologic changes or events is conducted/revisited as students continue to investigate how changes on the Earth's surface can affect other systems, especially the biosphere. This investigation will include past and current movement of tectonic plates and the simultaneous coevolution of Earth's systems and life. Students also provide physical and molecular evidence that establishes the evolution of these populations. This evidence can simultaneously show the common ancestry and emerging diversity of all organisms, especially closely related populations.

Unit 5 NGSS Life Science Performance Expectations:

***LS2-8** - Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce

***LS3-2** - Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors

LS4-1 - Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence

LS4-2 - Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment

LS4-3 - Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait

LS4-4 - Construct an explanation based on evidence for how natural selection leads to adaptation of populations

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, (2) the emergence of new species over time, and (3) the extinction of other species

Unit 5 NGSS Earth Science Performance Expectations:

***ESS1-5** - Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.

***ESS1-6** - Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.

***ESS 2-7** - Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth

UNIT 6 TITLE: Human Impact on Natural Systems

This unit is anchored by a study of anthropogenic global warming, its effects on biodiversity, and engineering solutions to this problem. The effects of humans on the environment, and the effects of changes in the environment on humans are investigated. The Greenhouse Effect and the implications of trapping heat within the atmosphere are explored. Models, data, and evidence are used to address problems of global warming and to propose and evaluate solutions (including mitigation and adaptation) to reduce human impact. Students will consider human population increase, natural resource management, developing technologies, threats to biodiversity, and rising energy needs, along with human cultural and economic concerns, while weighing risks and benefits and evaluating solutions. Other environmental issues such as availability of water, habitat destruction, and ocean pollution will be examined in a similar manner.,

Unit 6 NGSS Life Science Performance Expectations:

***LS2-2** - Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different

LS2-7 - Design, evaluate, and refine a solution for reducing the impacts of human activities on the

environment and biodiversity

***LS4-4** - Construct an explanation based on evidence for how natural selection leads to adaptation of populations

***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, (2) the emergence of new species over time, and (3) the extinction of other species

***LS2-8** - Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce

LS4-6 - Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity

Unit 6 NGSS Earth Science Performance Expectations:

***ESS2** - Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

***ESS2-4** - Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate

ESS3-1 - Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity

ESS3-3 - Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity

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

***ESS3-4** - Evaluate or refine a technological solution that reduces impacts of human activities on natural systems

ESS3-6 - Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity

Daily Assignments:

- Phenomenon observation and inquiry
- Storytelling (Scientist Biographies)/People to Ponder/Research a Scientist
- Collaborative group work
- Citizen science inquiry and data collection
- Claim-evidence-reasoning (CER) writing
- Formal lab report writing (with particular focus on data analysis and evidence-based writing)
- Close-reading annotations and leveled questioning for science texts
- Direct instruction
- Reflective/strategic note-taking
- Reflective science notebooks
- NGSS Science and Engineering Practices (1) *Asking Questions and Defining Problems*, 2) *Developing and Using Models*, 3) *Planning and Carrying Out Investigations*, 4) *Analyzing and Interpreting Data*, 5) *Using Mathematics and Computational Thinking*, 6) *Constructing Explanations*

and Designing Solutions and 7) Engaging in Argument from Evidence.)

Key Assignments:

Formative and summative assessment will be used throughout involving:

- Quick writes
- Close reading current events
- Science and engineering lab investigations (authentic science and engineering practices opportunities)
- Whiteboard responses
- Pair-share/group share oral and written responses
- Diagrams/graphs/illustrations
- Reading and notetaking annotations and summaries
- Quizzes and other larger assessments
- Computer modeling activities and projects
- Research reports and other projects
- Written lab reports, including writing from evidence and/or design solutions
- Evidence-based writing and explanations
- Presentations

Budget- budget figures must be included even if they are an estimate.

Projected Costs	Start-up	Ongoing
Personnel (Not to include classroom instructor unless a new section is needed)		
Instructional Material Supplies per student (textbooks, software, etc.)	These costs covered in textbook adoption for science. Estimated costs for textbooks and remaining Chromebook carts is approximately 1.5 million.	
Services (training, equipment maintenance, contracts, etc.)		
Capital Outlay (remodeling, technology, etc.)		
Total Projected Costs		

Instructional Materials- must include estimate for new materials even if none have been selected. Place in chart above. **Instructional materials in pilot process.**

Type	Publisher	Title	ISBN	Author	Copyright	# Have/Need

Funding Source(s) for Costs and Instructional Materials

Grants (indicate specific grant and grant timeline)	
Categorical Funds (include related programs)	
Career Technical Education (must be for an approved CTE course)	
Department Funds	
Other (be specific)	

Appendix of Additional Documents



7 – 12 Science Steering Committee Meeting

Agenda and Minutes

Feb. 3, 2020, 3:45 - 5:00 pm

T and L Conference Room

Embrace-Engage-Empower

SRCS Vision Statement: SRCS will send students into the world who are empowered to work together, find purpose, think critically, embrace diversity, adapt to our changing planet, and live healthy and fulfilling lives

SRCS Mission Statement: SRCS ensures equitable access to a transformative educational experience grounded in the assets of our students, staff, and community. We nurture the whole student in an engaging, challenging, and safe environment. We recognize and value each student's individuality and our community's cultural wealth.

SRCS Theory of Action

If we improve the quality of practice **through the** continuous development of leadership capacity to:

- Facilitate the development of a sense of purpose
- Recognize and implement quality instruction
- Lead and guide focused professional learning

- Confront and address issues of equity and access
- Provide and strengthen social and emotional supports
- Engage in problem solving through an inquiry cycle for growth
- Ensure warm, safe, dry schools and facilities
- Utilize data to inform the inquiry cycle for growth
- Target and align resources

Then, we have much work to do as a district. No longer will student outcomes be predicted based on race, disability, socioeconomic status, and/or the language spoken at home.

Members Present: Kyla Bradylong (MCHS), Kelly Mackura (EAHS), Joy Schermer (MCHS), Doug Beneson (MHS), Mark Mantoani (PHS), Elaine Dolcini (SRHS), Dinah Costello (RHS), Rani Goyal (Director)

Members Absent:

Guests: Valerie Jordan (RHS principal), Andrea Correa (VP, SRHS), Amy Weise (VP, MCHS)

Topic	Outcome/Agreements
Welcome and Check in	
<p>What is the best path moving forward for SRCS Science NGSS Implementation?</p> <p>Need to be mindful of two things:</p> <ul style="list-style-type: none"> ● want to provide the opportunity for all students to be exposed to all NGSS standards <p><i>Considering the following:</i></p> <ul style="list-style-type: none"> ○ What pool of core course offerings should we offer at all high schools? <ul style="list-style-type: none"> ■ Science Steering Committee suggested <u>four courses</u>: <i>Earth Science, Living Earth, Chemistry in the Earth, and Physics in the Universe</i> (not offering Life Science and Physical Science) ○ Honors Living Earth for all 9th graders? Other Honors Offerings? (Science Steering Committee suggested offering Honors Living Earth (9/10), Honors Chemistry (10/11), and Honors Physics (11/12) in the Universe at all sites.) ○ What else? 	<p>How do we provide the opportunity for students learning in all NGSS content in Earth Science, Life Science, and Physical Science considering master schedule impact?</p> <p>SRHS:</p> <ul style="list-style-type: none"> ● <i>SRHS ok with reduction of courses from 6 to 4 courses (<u>Four courses</u>: <i>Earth Science, Living Earth, Chemistry in the Earth, and Physics in the Universe</i> (not offering Life Science and Physical Science))</i> <p>MCHS</p> <ul style="list-style-type: none"> ● <i>MCHS ok with reduction of courses from 6 to 4 courses (<u>Four courses</u>: <i>Earth Science, Living Earth, Chemistry in the Earth, and Physics in the Universe</i> (not offering Life Science and Physical Science))</i> <p>RHS</p> <ul style="list-style-type: none"> ● Offering Earth Science and Living Earth <p>MHS</p> <ul style="list-style-type: none"> ● <i>MHS ok with reduction of courses from 6 to 4 courses (<u>Four courses</u>: <i>Earth Science, Living Earth, Chemistry in the Earth, and Physics in the Universe</i> (not offering Life Science and Physical Science))</i> <p>EAHS</p> <ul style="list-style-type: none"> ● <i>EAHS ok with reduction of courses from 6 to 4 courses (<u>Four courses</u>: <i>Earth Science, Living</i></i>

	<p><i>Earth, Chemistry in the Earth, and Physics in the Universe (not offering Life Science and Physical Science)</i></p> <p>PHS)</p> <ul style="list-style-type: none"> • <i>PHS ok with reduction of courses from 6 to 4 courses (Four courses: Earth Science, Living Earth, Chemistry in the Earth, and Physics in the Universe (not offering Life Science and Physical Science))</i> <p>Agreements:</p> <p>Ok with reducing 6-4 courses (not offering physical science or life science), all non AP/IB Life Science offerings will be Living Earth - all sites agree with voice vote</p> <p>Honors Living Earth, accessible to 9th graders, highly recommended concurrently Math 2 - all sites agree with voice vote.</p> <p>Only courses left to write are Physics in the Universe and PU Honors - Kelly setting up first meeting time soon.</p> <p>Please go back to counselors and VPs - Honors Life Science will be Honors Living Earth (Rani will talk to Rand about course number/course title change in Illuminate).</p> <p>Kelly and Rani will get Living Earth Honors course proposal to the board ASAP.</p>
<p>NGSS Region 1 Summit Sharing</p> <ul style="list-style-type: none"> • Resource Folder Link 	<p>Amazing day - review great materials and share with team!</p>

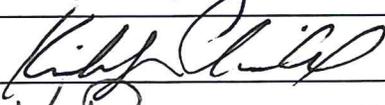
Upcoming meeting dates. All meetings in T and L Conference room from 3:45 - 5 (highlighted meetings are full steering; meetings beyond the four will be compensated)

Feb. 3 - HS only

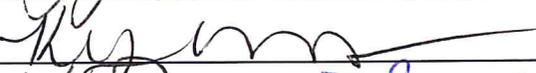
March 9 - MS only

April 13

District Principal Review and Approvals:

Principal's Signatures	Site	Approved / Not Approved
	SRHS	Approved - ^{as a} replacement
	MCMS	Approved.
	RHS	Approved
	PHS	approved
	EAHS	approved
	MHS	Approved

District Department Chair Review and Approvals:

Department Chair Signatures	Site	Approved / Not Approved
	EAHS	Approved
	SRHS	Approved
	MCMS	Approved
	MHS	Approved
	RHS	Approved
	PHS	APPROVED