Horticulture
Grades 9-12

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Born on **Date June 20, 2022**

Horticulture
Midland Park Public Schools

Course Description:

Horticulture is designed to help the student develop an in-depth understanding of the science and art of cultivating and processing plants for human use. Horticultural science encompasses all the pure sciences – physics, chemistry, geology, and biology, as well as related sciences and technologies such as plant pathology, soil science, entomology, and many other scientific disciplines. Students will apply the knowledge, skills, and technologies to produce plants for human food and non-food uses. Students will participate in a variety of in-class and out-of-class learning activities designed to teach them plant propagation, cultivation, improving plant growth, yields, quality, and resistance to insects, diseases, and environmental stresses. Successful horticulture depends on extensive control of the environment, including light, water, temperature, soil structure and fertility, pests, and diseases. The "green industry" is all around you from the food you eat to parks and landscaping. It improves the quality of the environment and your life through plants.

Suggested Course Sequence:

Unit 1: An Overview of Plants

Unit 2: Plant Processes

Unit 3: Seeded Plants and Plant Reproduction

Unit 4: Feeding the World

Unit 5: Productivity, Irrigation, Pests, and Invasive Species

**The number of instructional days is an estimate based on the information*

available at this time. 1 day equals approximately 48 minutes of seat time.

Unit # 1- Overview of Plants	
Content Area: Science	
Unit Title: Overview of Plants	
Grade Level: 9-12	
Core Ideas: Plants have adaptations that enable them to survive in the many environments on Earth.	
Unit # 1- Standards	
Standards (Content and Technology)**:**	
CPI#:	**Statement:**
Performance Expectations (NJSLS)	
HS-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.
HS-LS4-5	valuate 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.
HS-PS2-2	Use mathematical representation of phenomena to describe explanations.
HS-PS1-1	Use a model to predict relationships between systems or between components of systems.
Career Readiness, Life Literacies, and Key Skills	
9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources
9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issue
9.2.12.CAP.4	Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving
Computer Science and Design Thinking	
8.2.12.C.4	Explain and identify interdependent systems and their functions.
8.1.12.E.1	Produce a position statement about a real-world problem by developing a systematic plan

	of investigation with peers and experts synthesizing information from multiple sources.
8.2.12.B.2	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
Study diverse Scientist contributions to forensics	
Recognize the importance of self-confidence in handling daily tasks and challenges (CASEL)	
Understand others' perspectives to effectively interpret their arguments. (Social awareness) (CASEL)	
Companion Standards **ELA/L**	
ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of Science
ELD-LA.9-12 Inform.	Analyzing descriptions and inferences in textual evidence for key attributes, qualities, characteristics, activities, and conceptual relationships

Interpretive	
ELD-LA.9-12 Inform. Expressive	Introduce and define topic and/or entity for audience
ELS-SS.9-12. Explain Interpretive	Determining multiple types of sources, points of view in sources, and potential uses of sources **Companion Standards** **ELA/L** for answering compelling and supporting questions about phenomena or events
ELD-SS.9-12. Explain. Expressive	Develop sound reasoning, sequences with linear and nonlinear relationships, evidence, and details with significant and pertinent information, acknowledging strengths and weaknesses.
Interdisciplinary Connection	
WHST.11-12.1	Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.
WHST.11-12.9	Draw evidence from informational tests to support analysis, reflection, and research.
RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroboration or challenging conclusions with

	other sources of information.
RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
RST.11-12.5	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

Unit Essential Question(s): **What is a plant?** **How is soil classified?** **How do plants grow?** **How do plants adapt and survive?** **Why is composting a beneficial process?**	**Unit Enduring Understandings:** Vascular vs. nonvascular plants. Parts of a plant. Characteristics of soil for growing plants. How to compost.

Evidence of Learning

Formative Assessments:
Lab Reports
Q&A
Worksheets
Exit Slip
Group Problem Solving
Quizzes

Summative/Benchmark Assessment(s): Test
Alternative Assessments: Composting Project

Resources/Materials: **Plant Biology (ISBN 9780-0-07-336944-0)** **Grow Lab (ISBN 0-915873-32-X)** **From Bacteria to Plants (ISBN 978-0-07-88814-8)) Investigating Plants (ISBN 0-941212-21-1)** **Practical Horticulture (ISBN 13: 978-0-13-503866-6**	**Key Vocabulary: Plants, vascular plants, non vascular plants, classification, Monocot, Dicot, Angiosperm, Gymnosperm, composting, seeds, soil**

Suggested Pacing Guide

Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete
Plant Characteristics	Identify characteristics common to all plants.	What is a plant? Types of plants and leaf structure	2 days
Classification of	Classifications of plants	Classification of Plants Dicot vs. Monocot	2 days

Plants		Angiosperm vs. gymnosperm	
Soil	List characteristics used to classify soil	Types of soil	2 days
Plant adaptations	Explain which adaptations make it possible for plants to survive on land.	Adaptations for living on land	2 days
Vascular vs. Nonvascular	Compare and contrast vascular and nonvascular plants.	Vascular vs. Nonvascular Plants	2 days
Plant Care	Plant Care		Continuous
Planting Seeds	Plants from Seeds		Continuous
Composting	Examine the benefits of composting	Why is Composting a Beneficial Process?	3 days

Teacher Notes:

Additional Resources:
https://www.youtube.com/watch?v=OIZukSOqLZQ Plant Parts & their functions
https://study.com/academy/topic/plant-biology-for-high-school-biology-lesson-plans.html https://www.weareteachers.com/plant-life-cycle-activities/

Differentiation/Modification Strategies

Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students
Hands on activity -Cooperative Learning -Peer Tutoring -Extended Time -Reteach in various methods -Rephrase questions, directions, and explanations	**-Hands-on activities -Assess comprehension through demonstration -Give instruction/direc tio ns in writing & oral -Allow errors in speaking -Rephrase questions,**	**-Provide extension activities per student interest -Build on students' intrinsic motivation**	**-Hands on Activity -Cooperative Learning -Reteach in various methods -Consult with guidance counselors, other teachers -Consult with I&RS**	**-Hands on Activity -Cooperative Learning -Reteach in various methods -Extended time -Rephrase questions, directions, and explanations**

-Allow extended time to answer questions	**directions, and explanations -Allow extended time to answer questions Accept participation at any level, even one word**			**-Allow extended time to answer questions**

Unit # 2- Plant Processes	
Content Area: Science	
Unit Title: Plant Processes	
Grade Level: 9-12	
Core Ideas: Photosynthesis and cellular respiration help cycle carbon dioxide and oxygen in the environment. **Plant responses and growth can result from internal and/or external stimuli.**	
Unit # 2- Standards	
Standards (Content and Technology)**:**	
CPI#:	**Statement:**
Performance Expectations (NJSLS)	
HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy in
HS-LS2-4	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
HS-LS3-3	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
HS-LS2-3	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
HS-LS2-5	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.,
Career Readiness, Life Literacies, and Key Skills	
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.

9.4.12.IML.8	Evaluate media sources for point of view, bias, and motivations.
9.4.12.DC.7	Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society.
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.
Computer Science and Design Thinking	
8.2.12.C.4	Explain & Identify interdependent systems and their functions.
8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.
8.2.12.B.2	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.

Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
Develop, implement and model effective problem solving and critical thinking skills (CASEL)	
Study diverse Scientist contributions to Horticulture	
Recognize the importance of self-confidence in handling daily tasks and challenges (CASEL)	
Companion Standards ELA/L	
ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of Science
ELD-SC.9-12.Explain. Interpretive	Defining investigable questions or problems based on observations, information, and/or data about a phenomenon.
ELD-SC.9-12.Explain.Expressive	Develop reasoning to illustrate and/or predict the relationships between variables in a system or between components of a system.
ELD-MA.9-12.Argue. Interpretive	Evaluating relationships among evidence and mathematical principles to create generalizations
ELD-MA.9-12.Argue Expressive	Justify (and refute) conclusions with evidence and mathematical principles
Interdisciplinary Connection	

SL.9-10.4:	"Present information, findings, and supporting evidence clearly, concisely, and logically…"
Sl.11-12.1:	Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task
WHST.11-12.1	Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.
WHST.11-12.9	Draw evidence from informational tests to support analysis, reflection, and research.
RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroboration or challenging conclusions with other sources of information.
RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Evidence of Learning

Formative Assessments:
Lab reports
Article Summary
Worksheets
Group Problem Solving
Quizzes

Summative/Benchmark Assessment(s): Test
Alternative Assessments: School Gardening

Resources/Materials: **Plant Biology (ISBN 9780-0-07-336944-0)** **Grow Lab (ISBN 0-915873-32-X)** **From Bacteria to Plants (ISBN 978-0-07-88814-8)) Investigating Plants (ISBN 0-941212-21-1)** **Practical Horticulture (ISBN 13: 978-0-13-503866-6**	**Key Vocabulary: plants, photosynthesis, cellular respiration, plant responses, plant hormones, photoperiods, leaf**

Suggested Pacing Guidev

Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete

Plant Transpiration	Explain how plants take in and give off gases	Parts of the leaf	2 days
Photosynthe sis & respiration	Compare and contrast photosynthesis and cellular respiration Analyze why photosynthesis and cellular respiration are important	Photosynthesis & Cellular Respiration	3 days
Tropism	Identify the relationship between a stimulus and a tropism in plants.	Plant Responses	2 days
Long-Short Day Plants	Compare and contrast long-day and short-day plants.	Photoperiods	1 day
Plant Hormones	Explain how plant hormones and responses are related.	Plant Hormones	2 days
Plants & Seeds	Lab Activity on Plants	Plants & seeds	5 days

Teacher Notes:

Additional Resources:
https://study.com/academy/topic/plant-biology-for-high-school-biology-lesson-plans.html https://www.youtube.com/watch?v=kOKddw5CVGs Plant Hormones
https://www.youtube.com/watch?v=pCFstSMvAMI
https://www.khanacademy.org/science/biology/plant-biology/plant-responses-to-light-cues/v/phototropism

Differentiation/Modification Strategies

Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students
Hands on activity -Cooperative Learning -Peer Tutoring -Extended Time -Reteach in various methods -Rephrase questions,	**-Hands-on activities -Assess comprehension through demonstration -Give instruction/direc tio ns in writing & oral -Allow errors in speaking**	**-Provide extension activities per student interest -Build on students' intrinsic motivation**	**-Hands on Activity -Cooperative Learning -Reteach in various methods -Consult with guidance counselors, other teachers -Consult with I&RS**	**-Hands on Activity -Cooperative Learning -Reteach in various methods -Extended time -Rephrase questions, directions, and explanations**

directions, and explanations -Allow extended time to answer questions	**-Rephrase questions, directions, and explanations -Allow extended time to answer questions Accept participation at any level, even one word**			**-Allow extended time to answer questions**

Unit # 3- Seeded Plants and Plant Reproduction	
Content Area: Science	
Unit Title: Seeded Plants & Plant Reproduction	
Grade Level: 9-12	
Core Ideas: Seed Plants have adaptations that enable them to live and reproduce in diverse environments.	
Unit # 3- Standards	
Standards (Content and Technology)**:**	
CPI#:	**Statement:**
Performance Expectations (NJSLS)	
HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-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.
HS-LS2-3	Construct and revise an explanation based on evidence for the cycling of matter and flow

	of energy in aerobic and anaerobic conditions.
HS-LS2-5	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
Career Readiness, Life Literacies, and Key Skills	
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.
9.4.12.IML.8	Evaluate media sources for point of view, bias, and motivations.
Computer Science and Design Thinking	
8.2.12.C.4	Explain and identify interdependent systems and their functions.
8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

8.2.12.B.2	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
Develop, implement and model effective problem solving and critical thinking skills (CASEL)	
Study diverse Scientist contributions to forensics	
Recognize the importance of self-confidence in handling daily tasks and challenges (CASEL)	
Companion Standards ELA/L	
ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of science
ELD-SC.9-12.Explain. Interpretive	Defining investigable questions or problems based on observations, information, and/or data about a phenomenon.
ELD-SC.9-12.Explain. Expressive	Develop reasoning to illustrate and/or predict the relationships between variables in a system or between components of a system.
ELD-SI.4-12. Inform	Report on explicit and inferred characteristics, patterns, or behavior
ELD-SI.4-12 Narrate	Identify and raise questions about what might be unexplained, missing or left unsaid
ELD-MA.9-12.Argue. Interpretive	Evaluating relationships among evidence and mathematical principles to create generalizations

ELD-MA.9-12.Argue Expressive	Justify (and refute) conclusions with evidence and mathematical principles
Interdisciplinary Connection	
SL.9-10.4:	"Present information, findings, and supporting evidence clearly, concisely, and logically…"
Sl.11-12.1:	Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research.
WHST.11-12.1	Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.
RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroboration or challenging conclusions with other sources of information.
RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Unit Essential Question(s):	**Unit Enduring Understandings:**
· What are the parts of plants and how do they function?	

· What is the difference between gymnosperms and angiosperms? **· How do plants reproduce?**	· Humans depend on seed plants for food, clothing, and shelter. · Structure and function of plant parts. · Different types of plants and how plants reproduce. · Importance of bees
Evidence of Learning	

Formative Assessments:
Lab reports
Article Summary
Worksheets
Group Problem Solving
Quizzes

Summative/Benchmark Assessment(s): Test

Alternative Assessments: "Where's the Bees" Project Rubric

Resources/Materials:	**Key Vocabulary: plants, roots, stems, leaves, gymnosperms, angiosperms, monocots, dicots, reproduction, flowers**
Plant Biology (ISBN 9780-0-07-336944-0) **Grow Lab (ISBN 0-915873-32-X)** **From Bacteria to Plants (ISBN 978-0-07-88814-8)) Investigating Plants (ISBN 0-941212-21-1)** **Practical Horticulture (ISBN 13: 978-0-13-503866-6**	

Suggested Pacing Guide

Lesson Name/Topic	**Student Learning Objective(s)**	**Suggested Tasks/Activities:**	**Day(s) to Complete**
Characteristics of seed plants	Identify the characteristics of seed plants.	Characteristic of seed plants	3 days
Structure of plants	Explain the structures and functions of roots, stems, and leaves.	Structure & function of roots, stems & leaves	3 days
Gymnosperms	Describe the main characteristics of gymnosperms.	Reproduction in gymnosperms	1 day
Angiosperms	Describe the main characteristics and importance of angiosperms.	Angiosperms & Types of Angiosperms Reproduction of Angiosperms	3 days
Parts of Flowers	Analyze the structure of flowers Distinguish between the two types of plant reproduction.	Lab- Parts of Flowers	2 days
Monocot/ dicot	Compare similarities and differences between monocots and dicots.	What are monocots and dicots	1 day

Bees	Explore the importance of bees and pollinating insects	Pollinating insects	1 day
Construct Poster	Construct a poster on bees	Where are all the Bees? PBL	4 days
Seeded plants	Examine the Importance of Seed Plants	Plant seeds and planting	Continuous

Teacher Notes:

Additional Resources:
https://www.youtube.com/watch?v=f6mJ7e5YmnE
https://www.youtube.com/watch?v=K3oMN1a_pdg
https://www.youtube.com/watch?v=9ePic3dtykk
https://www.pbs.org/video/science-trek-bees/
https://www.smithsonianmag.com/videos/whats-the-waggle-dance-and-why-do-honeybees/ https://www.youtube.com/watch?v=NSDZDY6cNDg

Differentiation/Modification Strategies

Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students
Hands on activity -Cooperative Learning -Peer Tutoring -Extended Time -Reteach in various methods -Rephrase questions, directions, and explanations -Allow extended time to answer questions	**-Hands-on activities -Assess comprehension through demonstration -Give instruction/direction s in writing & oral -Allow errors in speaking -Rephrase questions, directions, and explanations -Allow extended time to answer questions Accept participation at any level, even one word**	**-Provide extension activities per student interest -Build on students' intrinsic motivation**	**-Hands on Activity -Cooperative Learning -Reteach in various methods -Consult with guidance counselors, other teachers -Consult I&RS**	**-Hands on Activity -Cooperative Learning -Reteach in various methods -Extended time -Rephrase questions, directions, and explanations -Allow extended time to answer questions**

Unit #4 – Feed the World	
Content Area: Science	
Unit Title: Feeding the World	
Grade Level: 9-12	
Core Ideas: What technologies may help farmers produce more crops? How GMO's are affecting food production. How are foods mass produced?	
Unit # 4- Standards	
Standards (Content and Technology)**:**	
CPI#:	**Statement:**
Performance Expectations (NJSLS)	
HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-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.
HS-LS4-5	Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
HS-LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-ESS 3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
Career Readiness, Life Literacies, and Key Skills	
9.4.12.IML.8	Evaluate media sources for point of view, bias, and motivations.
9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources
9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issue
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.

Computer Science and Design Thinking	
8.2.12.C.4	Explain and identify interdependent systems and their functions.
8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.
8.2.12.B.3	Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.
8.2.12.B.4	Investigate a technology used in a given period of history and identify their impact and how they may have changed to meet human needs and wants.
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
Develop, implement, and model effective problem solving and critical thinking skills (CASEL)	
Study diverse criminal activity in forensics from different parts of the world.	
Recognize the importance of self-confidence in handling daily tasks and challenges (CASEL)	
Think metacognitively and organize their own thoughts with given information. (CASEL)	
Companion Standards ELA/L	

ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of science
ELD-SC.9-12.Explain. Interpretive	Defining investigable questions or problems based on observations, information, and/or data about a phenomenon.
ELD-SC.9-12.Explain.Expressive	Develop reasoning to illustrate and/or predict the relationships between variables in a system or between components of a system.
ELD-SC.9-12.Argue. Interpretive	Comparing reasoning and claims based on evidence from competing arguments or design solutions
ELD-SC.9-12 Argue. Expressive	Defend or repute a claim based on data and evidence
ELD-MA.9-12.Argue. Interpretive	Evaluating relationships among evidence and mathematical principles to create generalizations

ELD-MA.9-12.Argue Expressive	Justify (and refute) conclusions with evidence and mathematical principles
Interdisciplinary Connection	
HSS-1C.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population
HSS-1C.B.6	Evaluate reports based on data.
MP.4	Model with mathematics
MP.2	Reason abstractly and quantitatively
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
SL.9-10.4:	"Present information, findings, and supporting evidence clearly, concisely, and logically…"
Sl.11-12.1:	Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task
WHST.11-12.9	Draw evidence from informational tests to support analysis, reflection, and research.
RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
RST.11-12.10	By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Unit Essential Question(s): **How can we produce enough food for a rapidly growing population while sustaining our ability to produce it?** **What methods are used to mass produce food? What is sustainability?**	**Unit Enduring Understandings:** Why the world needs more food. Can genetically modified food be used to increase food supply. How the food supply works. How to become sustainable

Evidence of Learning	

Formative Assessments:
Lab reports
Article Summary
Worksheets
Group Problem Solving
Quizzes

Summative/Benchmark Assessment(s): Test
Alternative Assessments: Hydroponic Project and GMO Food Project

Resources/Materials: **Resources/Materials:** **Plant Biology (ISBN 9780-0-07-336944-0)** **Grow Lab (ISBN 0-915873-32-X)** **From Bacteria to Plants (ISBN 978-0-07-88814-8)) Investigating Plants (ISBN 0-941212-21-1)** **Practical Horticulture (ISBN 13: 978-0-13-503866-6**	**Key Vocabulary: Food, agriculture, farming, malnutrition, Genetically Modified Food (GMO), crops, gardening, sustainability**

Suggested Pacing Guide

Lesson Name/Topic	**Student Learning Objective(s)**	**Suggested Tasks/Activities:**	**Day(s) to Complete**
Food Production	Explain why the world needs to grow more food and to grow it sustainably.	Food production, malnutrition, and farming	3 days
Hydroponics	Explore the benefits of hydroponics	Alternative farming	5 days
GMO	Discuss genetically modified food	Do You Eat Genetically Modified Foods?	1 day
GMO Engineering	Identify the benefits of Genetic Engineering in Plants	Engineering better plants	3 days
GMO vs Organic	Compare & Contrast Genetically Modified crops vs. Organic Crops	Compare farm crops Corn the Amazing Grain	4 days
Sustainability	Explore sustainable agriculture	Gardening	10 days

Teacher Notes:

Additional Resources:
https://www.youtube.com/watch?v=wBcnUUkdavE
https://www.youtube.com/watch?v=bWebs3ID6Hw
https://www.youtube.com/watch?v=W3pxln7Itd4
https://www.freshwatersystems.com/blogs/blog/what-are-hydroponic-systems

Differentiation/Modification Strategies				
Students with Disabilities	**English Language Learners**	**Gifted and Talented Students**	**Students at Risk**	**504 Students**
Hands on activity -Cooperative Learning	-Hands-on activities -Assess comprehension	-Provide extension activities per student interest	-Hands on Activity -Cooperative Learning	-Hands on Activity -Cooperative Learning

-Peer Tutoring -Extended Time -Reteach in various methods -Rephrase questions, directions, and explanations -Allow extended time to answer questions	through demonstration -Give instruction/directio ns in writing & oral -Allow errors in speaking -Rephrase questions, directions, and explanations -Allow extended time to answer questions Accept participation at any level, even one word	-Build on students' intrinsic motivation	-Reteach in various methods -Consult with guidance counselors, other teachers	-Reteach in various methods -Extended time -Rephrase questions, directions, and explanations -Allow extended time to answer questions

Unit # 5- Productivity, Irrigation, Pest Control & Invasive Species
Content Area: Science
Unit Title: Productivity, Irrigation, Pest Control & Invasive Species
Grade Level: 9-12
Core Ideas: Farming/Planting practices to increase productivity and sustainability.
Unit # - Standards

Standards (Content and Technology)**:**	
CPI#:	**Statement:**
Performance Expectations (NJSLS)	
HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
HS-ESS 3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
HS-ESS2-2	Obtain and combine information to describe climates in different regions of the world.
HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
Career Readiness, Life Literacies, and Key Skills	
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.
9.4.12.IML.8	Evaluate media sources for point of view, bias, and motivations.
9.4.12.DC.7	Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society.
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.
Computer Science and Design Thinking	
8.2.12.B.3	Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.
8.2.12.C.4	Explain and identify interdependent systems and their functions.

8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.
8.2.12.B.4	Investigate a technology used in a given period of history and identify their impact and how they may have changed to meet human needs and wants.
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
Think metacognitively and organize their own thoughts with given information. (CASEL)	
Develop, implement, and model effective problem solving and critical thinking skills (CASEL)	
Companion Standards ELA/L	
ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of science
ELD-SC.9-12.Explain. Int erpretive	Defining investigable questions or problems based on observations, information, and/or data about a phenomenon.
ELD-SC.9-12.Explain .Ex pressive	Develop reasoning to illustrate and/or predict the relationships between variables in a system or between components of a system.
ELD-SI.4-12. Inform	Report on explicit and inferred characteristics, patterns, or behavior
ELD-SI.4-12 Narrate	Identify and raise questions about what might be unexplained, missing or left unsaid
Interdisciplinary Connection	
SL.9-10.4:	“Present information, findings, and supporting evidence clearly, concisely, and logically…
Sl.11-12.1:	Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task
RI.3.1	Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answer,
MP.2	Reason abstractly and quantitatively

WHST.11-12.9	Draw evidence from informational tests to support analysis, reflection, and research.

HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MP.4	Model with mathematics
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

Unit Essential Question(s): **What is the green revolution?** **How is climate affecting farming?** **How is climate change affecting the world? How does pest affect plants?** **What are invasive species?**	**Unit Enduring Understandings:** **The benefits and risks of agriculture.** **Climate changes effect on farming.** **How to be part of the green revolution.** **How irrigation & pests affect plant growth. Invasive species and effect on environment.**

Evidence of Learning

Formative Assessments:
Lab reports
Article Summary
Worksheets
Group Problem Solving
Quizzes

Summative/Benchmark Assessment(s): Test
Alternative Assessments: Gardening at School

Resources/Materials: **Plant Biology (ISBN 9780-0-07-336944-0)** **Grow Lab (ISBN 0-915873-32-X)** **From Bacteria to Plants (ISBN 978-0-07-88814-8)) Investigating Plants (ISBN 0-941212-21-1)** **Practical Horticulture (ISBN 13: 978-0-13-503866-6**	**Key Vocabulary: green revolution, farming, climate, pest, plants, invasive species, irrigation, agriculture**

Suggested Pacing Guide

Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete
Green Revolution	Explain the importance of industrial agriculture and the green revolution	Agriculture & the green revolution	3 days
Climate change & farming	Explore how climate change is affecting agriculture	Farming and climate change	3 days

Pests	Identify different types of pests and how to control.	Garden Pests	1 day
Irrigation	Describe how irrigation and pesticide use can improve soil productivity in the short term, but they can pollute soil in the long term.	Pests, pesticide, and irrigation	2 days

Invasive Species	Explore invasive species and effect on the environment.	Invasive species	2 days

Teacher Notes:

Additional Resources:
https://www.youtube.com/watch?v=PWvLLGcb96k
https://www.youtube.com/watch?v=q7pI7IYaJLI
https://climatechange.chicago.gov/climate-impacts/climate-impacts-agriculture-and-food-supply https://www.youtube.com/watch?v=-NZIvvhGlR0
https://www.youtube.com/watch?v=Tjr6z1GMDqc
https://www.youtube.com/watch?v=cUpMxLiIyLY
https://www.invasive.org/101/Rancher.cfm
https://www.youtube.com/watch?v=NKh8Lc31rm8
https://www.un.org/en/climatechange/what-is-climate-change
https://www.youtube.com/watch?v=3VGsfEbthEY
https://www.nwf.org/Educational-Resources/Wildlife-Guide/Threats-to-Wildlife/Invasive Species#:~:text=Invasive%20species%20are%20primarily%20spread,carry%20them%20on%20their%20prop ellers.

Differentiation/Modification Strategies

Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students

Hands on activity -Cooperative Learning -Peer Tutoring -Extended Time -Reteach in various methods -Rephrase questions, directions, and explanations -Allow extended time to answer questions	-Hands-on activities -Assess comprehension through demonstration -Give instruction/direc tio ns in writing & oral -Allow errors in speaking -Rephrase questions, directions, and explanations -Allow extended time to answer questions Accept participation at any level, even one word	-Provide extension activities per student interest -Build on students' intrinsic motivation	-Hands on Activity -Cooperative Learning -Reteach in various methods -Consult with guidance counselors, other teachers	-Hands on Activity -Cooperative Learning -Reteach in various methods -Extended time -Rephrase questions, directions, and explanations -Allow extended time to answer questions