



Understanding Ecosystems: Learning and Living in the Carolinas

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This curriculum unit is recommended for:
5th Grade Science

Keywords: ecosystems, *terrestrial, aquatic, estuary, salt marsh, fertile, species, deciduous forest, rainforest, grasslands, oceans, lakes, ponds, continental shelf, shoreline, producers, consumers, decomposers, photosynthesis, interconnected, salinity, community, population, and indigenous*

Teaching Standards: See [Appendix 1](#) for teaching standards addressed in this unit.

Synopsis: This unit serves as collective set of activities to give the students more access to the concepts of ecosystems. Instead of learning about ecosystems, they will become active participants in understanding and conserving the ecosystems around them. The unit is composed of literary elements, vocabulary building strategies, authentic data, rich satellite images, and collaborative activities.

By the end of the unit, students should be able to understand how an ecosystem functions as well as identify local ecosystems and provide ways to be active citizens in protecting valued resources within ecosystems. My goal in designing this curriculum unit is to provide an authentic learning experience that brings the text alive to students and helps them become more conscientious in their interactions with the environment.

I plan to teach this unit during the coming year to 50 students in 5th grade science.

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Kimberly L. Terrell

Content Objectives

The North Carolina Essential Standards Guide provides one overarching standard for ecosystems and three sub – standards, or clarifying objectives, that provide more in – depth expectations on what the students should understand once the standard is covered.

The overall objective of the unit is to assist students in learning to infer the effects that may result from the interconnected relationship of plants and animals to their ecosystem (5.L.2). The specific content standards that will be address include compare the characteristics of several common ecosystems, including estuaries and salt marshes, oceans, lakes and ponds, forests, and grasslands (5.L.2.1); classify the organisms within an ecosystem according to the function they serve: producers, consumers, or decomposers (5.L.2.2); and infer the effects that may result from the interconnected relationship of plants and animals to their ecosystem (5.L.2.3). During the course of the two weeks of the curriculum, the students will learn to know the difference between aquatic and terrestrial ecosystems, know the difference between biotic and abiotic factors as well as know which ones generally exist in aquatic and terrestrial ecosystems, predict the results of certain factors in populations being affected, and evaluate and present data collected from the process of researching the effects of urban development on local ecosystems.

The curriculum unit will integrate a sufficient amount of vocabulary in order the build the students' proficiency in identifying and accurately utilizing scientific language. The keywords for the unit are *terrestrial, aquatic, estuary, salt marsh, fertile, species, deciduous forest, rainforest, grasslands, oceans, lakes, ponds, continental shelf, shoreline, producers, consumers, decomposers, photosynthesis, interconnected, salinity, community, population, and indigenous*.

Rationale

In speaking to the science facilitator at my school, Steele Creek Elementary, when students take the 5th grade End of Grade science test, they score the lowest, across the district, in the area of ecosystems. Students also struggle with the vocabulary, which is also a contributing factor to low test scores during the EOGs. However, there is also a subgroup of advanced students who are stagnant in their learning due to lack of rigor and enrichment. I used this insight to determine the direction of the curriculum.

One of the major ways to get students to connect with any learning material is to make it meaningful. And to make something meaningful, it must relate to the students

personally. If I show the students that the science of ecosystems is not just in a textbook or on the internet, but right in their backyards and day – to – day lives, they will most likely form a lasting connection to the concepts of, and within, ecosystems that will evolve as they matriculate through higher learning. In addition to providing examples of real – life, nearby ecosystems, I will also blend in elements of literature, social studies, and math to show students how ideas can connect across the curriculum. The curriculum must be vocabulary – rich and allow the students to interact with the vocabulary on a consistent basis.¹

The students have access to Chromebooks in the classroom, so I will include the use of technology and group learning to incorporate 21st century skills and expectations. Steele Creek is adopting the STEAM (Science, Technology, Engineering, Arts, and Mathematics) learning model for the 2015 – 2016 school year, which will give me the opportunity to bring in engineering and arts into the classroom. I will use the Explore and Elaborate portions of the 5E model (Engage, Explore, Explain, Elaborate, and Evaluate) the most by giving the students a challenge to research the data of a local ecosystem that has been affected by urban development and present the information along with a proposed solution to preserve the remaining ecosystems or increase the populations, which will be a major part of the culminating activity in the curriculum. The lessons are based on the minimum time allotted to teach science in Charlotte Mecklenburg Schools, which is 3 days a week, 45 minutes a class. At Steele Creek, the fifth grade math and science teachers get 5 days a week, 30 minutes a day. The lessons are easily modified to address the time constraints of each class.

Overall, the unit will engage the learners by combining elements that will address and validate all learning styles and expose the students to the ecosystems around them while also exploring other ecosystems that exist.

Teaching Strategies

In an effort to incorporate the strategies learned during the Integrating Concepts in the Life Sciences, I wanted to choose a topic within ecosystems that would allow the students to intentionally interact with authentic data. I merged that search with my original idea to introduce the students to local ecosystems which led to my finding the research conducted by American Forests. American Forests used the process of Urban Ecosystem Analysis (UEA) of Charlotte Mecklenburg to assess the health and benefits of urban ecosystems. The study used satellite imagery to analyze land cover of Mecklenburg County – Charlotte, Davidson, Cornelius, Huntersville, Matthews, Mint Hill, and Pineville – from 1985 to 2008.² The study also utilized high resolution data from 2002 to compare tree canopy changes from 2008. The analysis collected from American Forests became the springboard for my curriculum unit.

In order to fully engage the students, the majority of the learning will be facilitated by the instructor but led by the students. Students will work in cooperative learning teams in

order to complete most of the class assignments. Cooperative learning teams, groups no larger than four, allow students from different academic levels to collaborate which will also encourage them to use their strengths to contribute information while their growth areas develop as they gather ideas from each other.

Assess Prior Knowledge

Before teaching the curriculum unit, the students will have already had some background information on ecosystems. The unit will be a cumulative review of the major concepts while introducing the methods of interpreting data and incorporating local demographics. The teaching strategies chosen to establish prior knowledge will maximize engagement, time, and assessment of learning.

Ecosystems A – Z

The instructor will give each cooperative learning team a sheet of chart paper and a box of markers. The teams will have fifteen minutes to brainstorm a list of key words and phrases about ecosystems, except the list has to be in alphabetical order. The instructor will advise the teams of the time limit and advise them to write their letters from A to Z in a list form.³ In order to keep the teams on task, the instructor may post an online timer on the Smart Board as well as continuously circulate around the room to observe the teams at work and clear up any misconceptions that may come up during team discussions. At the end of the fifteen minutes, the teacher will have each student post their charts around the room and allow the students to do a gallery walk for five minutes. During a gallery walk, students may circulate the room looking at the charts from the other teams. Instructors may choose to play some classical music to create the setting of being in an actual art gallery as well as control the beginning and ending of the gallery walk. Students may add any words to each other's charts which will further develop the list of concepts for each team.

Vocabulary Crossword Puzzles

In order to reinforce unit vocabulary, the instructor will provide a crossword puzzle which includes the definitions of the key words. To modify the crossword for students with learning disabilities, the instructor can provide a copy of the crossword puzzle that contains a word bank. To increase rigor, the instructor can provide a copy of the word bank and have the students create the puzzle itself. This activity will allow students to review vocabulary material in an unconventional way while giving every student the opportunity to be successful. The instructor can use this as a class assignment or homework assignment. Students may work individually or in pairs. The instructor should provide an answer key to partners with completed puzzles to check for accuracy.

Teaching the Lessons

Place Vocabulary in the Beginning, Middle, and End of the Unit

If the instructor places the vocabulary throughout the unit, the students will have multiple interactions with the language and become more familiar with the terms.¹ There are several ways to achieve this including awarding a positive point or shouting words of affirmation to students who use the words during class discussions, placing stars above the words as they appear in the students' writing, and challenging students to create mini posters that contain the words, definitions, and examples of the unit key words.

Data-Driven Instruction

While teaching the curriculum unit, it is very important to incorporate the use of data. Understanding data is a skill that combines mathematical and literacy skills, and the use of data will engage the students in using higher order critical thinking. The data will be presented in the form of various graphs, charts, and images relevant to the same topic. The variety of data will assist the students in understanding that there are different ways to present information on related topics.⁴

The data will be presented within articles about the topic of land cover trends in Mecklenburg County. Although the articles are written above the fifth grade reading levels, the instructor will be able to use excerpts to unpack the information and have the students model in drawings what they understand from the readings and the accompanying data. Once the students model their thinking individually, teacher will lead the students in creating a model as a whole group. During this time, students will have the opportunity to explain their thinking, listen to the ideas of others, and engage in a discussion with the instructor who will ask leading, open ended questions to determine comprehension and provoke deeper thinking.

Relevant Reading Passages

When covering the subject of ecosystems, in addition to having the students read excerpts of the studies published on the Urban Ecosystem Analysis, the students will read assigned short passages from ReadWorks.Org related to the subject. The students will begin with the on level text *The Ecosystem of the Forest* which is a nonfiction text and contains many of the key words and is mostly related to the topic of tree cover. The students will also read *All the Pieces Matter*, which is a passage above grade level and written in narrative form and closes with the idea of the human element of changing the balance of ecosystems.

Using the two passages throughout the unit, along with the articles about tree coverage in Mecklenburg County, will provide students with content-rich literacy. The passages even contain paired texts in case reteaching or enrichment is necessary. The passages are attached to ten questions that are on different levels of the thinking spectrum, from basic

knowledge to comprehension and higher order critical thinking. The students will get the advantage of being exposed to a variety of texts and situations and the opportunity to synthesize their thoughts with the unit activities and assessments.

Reading through Passages using Literacy Techniques

As the students read through the passages, it will be very important to empower them with literacy strategies that will make learning more concrete. There are several strategies that have been proven to be beneficial to assisting students in literary comprehension: close reading, chunking, highlighting, talking to the text, modeling, and rereading.⁵ If students have not been exposed to these strategies, it is best to model for them and then practice with them.

Close reading occurs when the students are introduced to a text, and they use text structures to predict the content of the passage. This strategy gets the students brains in gear about what they are about to read and will further enhance any connections the students will have with the text. The students get the opportunity to interact with the text several times and in different ways every time. They pre-read, reread, and read again while questioning the text, the author, and themselves.

Chunking the text is a great strategy for longer passages. The best way to cover the findings of the Urban Ecosystem Analysis will be to chunk the text which means, break up the text into different sections and assign those sections to certain students or teams. Everyone should receive a “chunk” of the text to read. After chunking the text, the students or teams can share out what they read in order of the text. The instructor can also choose to have student teams create posters of their reading in order for every student to benefit from the entire text and revisit the information when necessary.

Highlighting is a great strategy for students who have difficulty focusing on key words and phrases in the text. Modeling this strategy is very important. If students have never gone through and highlighted a text before, one thing an instructor can do is to have words and phrases displayed for students to highlight once they find them. If the students are already familiar with this strategy, the instructor should encourage them to highlight key words and any information they believe is important in comprehending the text.

Talking to the text is a vital strategy in assisting students in comprehending the text. Students may either write in the margins of the text or write on sticky notes and place them on the passage. This strategy provides an opportunity for students to jot down notes about elements that stand out to them as well as write any questions they may have about words or phrases in the passage.

Modeling, or illustrating, the text is great for helping the students visualize printed text or data. The instructor will provide students with a specific amount of time to read over

the passage, create a model about the text, and then bring the class together to create one complete model of what the text is attempting to convey. Students can illustrate on the passage or a separate sheet of paper. They may work as individuals or in partners to achieve their models. The most important aspect of the modeling is when the instructor composes the picture with the whole class with everyone providing input on what they visualized when they read the passage.

Rereading is a strategy that can be used alone or along with the modeling strategy. It is important that the students interact with a singular text as often as possible for reinforced comprehension. The strategy can work when the students are given the passage in advance of the class session for homework and then after given time to read it in class, the students can have the chance to read it again independently to gather their thoughts and bring the ideas together.

Differentiation for Students

With all of the reading the strategies, the instructor must make sure to make appropriate modifications and accommodations for students with learning difficulties so that all students have access to the information.⁵ The majority of the strategies mentioned will assist all students in their learning; however, there are a few additional tools the instructor can provide for maximum learning. For students who are English Language Learners, allow them to use Google Translate to type in any words or phrases that students cannot grasp or pronounce. Also ask questions as they are interacting with the text to check for understanding. Chunking the text will work best for students with learning disabilities. Allowing them to read smaller parts of the text will prevent them from being overwhelmed and allow them to digest small amounts at a time. The highlighting will also help students who have difficulty focusing by assisting them in looking for only what is important. When necessary, pull a paired selection or text with a lower level of complexity.

Place Students in Heterogeneous Study Teams

An important strategy for grouping students to do the necessary work is to place the students in learning teams with a variety of strengths and abilities. One way to accomplish this task is by knowing the students and grouping them in advance of the curriculum unit. Another way is by counting the students off according to the number of groups in the classroom. It is a very random way to select groups and keeps the students involved in the process. Once the instructor sees how the students are dispersed, they may make any adjustments necessary. Before allowing the students to work in their groups, the instructor should also discuss norms and responsibilities, modeling and discussing examples of the do's and don'ts with the class to ensure everyone understands what the expected behaviors look like. As long as the students are in groups that are supportive and cooperative, high levels of learning can take place.

Engage Students Using Videos and Technology

When introducing a new topic, grabbing the students' attention is really important. With fifth graders, they love the use of technology and videos. Since most fifth graders have access to Chrome books, instructors can either watch content appropriate videos with the whole group using the Smart Board or assign the videos to the students and allow them to watch them in their own space. There are several videos on ecosystems available on Scholastic Study Jams, Bill Nye the Science Guy, You Tube, and Brain Pop. These videos assist the students in visualizing the concepts and help them make connections with the content. Engaging the students appropriately sets the tone for the remainder of the curriculum unit.

The instructor must make sure to choose the videos appropriate for the students' interests and learning styles. Out of the videos available, watch them thoroughly and develop a list of high quality questions that will engage students after watching them to check for understanding and probe their brains for deeper levels of thinking. For students with difficulty following videos, watching videos in advance can also provide the chance for the instructor to create an outline for students to fill in as they watch the videos or after they finish watching the videos.

Gallery Walks for Peer Assessment

One of the best ways for students to become more proficient in producing their work is through authentic assessment and feedback. Teaching the students to appropriately assess and provide feedback will also put them in a better position to assess themselves, especially if they know their peers will be viewing their work. Gallery walks are an excellent way for students to view each others work without being overly concerned about how their work is being viewed. Depending on the work products, students can either provide feedback directly on the work or write the feedback on sticky notes and place it on the work. This strategy also teaches appropriate social skills as well as gives the students the chance to move around keeping their brains further stimulated.

Student Choice for Final Presentation

The culminating activity for the curriculum unit will be research and assessment of the data along with a proposal on how to preserve or extend the local ecosystems. With this challenge comes the chance for students to exercise their power to choose. The instructor should allow the students to present their findings in a way that best fits their learning style and interests.

Some options available to the students will be to present by creating a poster, PowerPoint, Prezi, video, skit, or song. With presenting the choices, the instructor must also create a rubric that shows the students how they will be assessed on their presentation. Providing these choices will give the students avenues to be creative and

express themselves in the way that works best for them. If they choose an option that seems more challenging, it will help build their capacity to stretch themselves academically and creatively.

Utilize End of Grade – Style Assessment Questions for Summative Assessment

In order to maximize learning and synthesize the assessment process for the students, using questions that are in similar format throughout their learning process will assist the students in being more confident and comfortable with summative assessments.

Fifth grade is the first grade that students are expected to complete the Science End of Grade Assessment. Often, teachers and facilitators have noted that students tend to perform below grade level due to the vocabulary and question formatting on the EOG. With creating high level assessments that allow students to see vocabulary and formatting consistent throughout their learning experience, they are more likely to perform at a more advanced level and avoid test anxiety. They will be familiar with how to pace themselves and what will be expected of them in completing their assessments.

Classroom Activities

Lesson 1: Engage

To engage the students in learning about ecosystems, the students will participate in constructing an Ecosystem A – Z brainstorm to compose a list of all of the words they can think of that begin with each letter of the alphabet and is related to ecosystems. The students may work in teams of 2 – 3 or as individuals for more of a challenge. Give the students 5 – 10 minutes to complete the activity. After filling in as much of the list as possible within the time allowed, the students will do a Gallery Walk to observe their classmates' ideas. They will then get a couple minutes to go back to their lists and add any words they observed. If using science notebooks, the instructor can print the list and have the students glue the list into their notebooks. If using binders or folders to keep the information organized, the instructors can print and hole punch the following list to hand out to each student:

Ecosystems A – Z

Directions: Write as many words/terms as possible that begin with the letter at the beginning of each line. The words/terms must be related to ecosystems. Return to the list any time during the unit to add more words.

A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

Figure 1

After completing the Ecosystems A – Z Brainstorm, the students will watch the Scholastic Study Jam titled *Ecosystems* found at <http://studyjams.scholastic.com/studyjams/jams/science/ecosystems/ecosystems.htm> The teacher will have the students pair up with someone next to them or across from them to share the following:

- What did I hear that I already knew?
- What information was new to me?
- What information did I find interesting?

As the students listen to each others’ thoughts, they will jot down their partners thoughts on a small sheet of paper that can serve as an exit slip for a quick formative assessment. After collecting the exit slips, the teacher can lead the students in a brief discussion to allow several students to share out what they heard from their partner or said themselves. I encourage the use of fidelity sticks to select students who share out.

Example of Exit Slip:

Student (speaker):	Partner (writer):
What did I hear that I already knew?	
What information was new to me?	
What information did I find interesting?	

Figure 2

Lesson 2: Engage/Explore

Review the previous day’s lesson by having students form an Inside – Outside circle. Start of by counting off each student as one or two. The ones will form the outer circle, and the twos will form the inner circle facing the person on the outer circle. Give each student the task to share what they remember from the previous day’s lesson with the person standing in front of them. Then, instruct one of the circles to shift to the left or right, you can also say clockwise or counterclockwise, so the students will be paired up with a different person. After having them share with three different people, instruct them to return to their seats. Instruct the students to log in to their Chromebooks and watch the Study Jam on Ecosystems again. After watching the video, instruct the students to take

the quiz to check for their understanding. Give the students five to ten minutes to complete the task.

Gather the students around the carpet and present the vocabulary cards from the first set of words: *ecosystem, community, population, abiotic, biotic, niche, ecology, and habitat*. Pronounce each word, and ask the students the following questions:

- Have you seen this word before? If so, where?
- Are there any prefixes or suffixes, beginning or ending parts, which give a clue to the word's meaning?
- What do you think this word means?

Using fidelity sticks, choose three students at a time to answer out loud. Next, inform the students that they will work in pairs to complete the vocabulary chart to better understand the main terms. In order to complete the task, the students need to find the definition of each term, illustrate the terms or use them in a sentence which puts them in context, and write a key word or phrase related to the term. They are allowed to use the dictionary, science textbook, or their Discovery Education Techbooks as resources. Give the students fifteen to twenty minutes to complete the task.

After the students complete their vocabulary chart, which can be glued into their science notebooks, inform the students that they will watch one more Study Jam that will be directly related to the unit and will be important to their tasks. As a whole group, the students will watch the following Scholastic Study Jam:

<http://studyjams.scholastic.com/studyjams/jams/science/ecosystems/changes-ecosystems.htm>

Inform the students that at the end of the unit, they will be required to develop a plan to conserve the remaining ecosystems in the midst of urban development. The lessons leading up to the final project will give them insight into a current, local issue in Mecklenburg County and challenge them to create a plan to preserve what remains.

Ecosystems Vocabulary Chart

Term	Definition	Keyword / Phrase	Sentence or Illustration
<i>ecosystem</i>			
<i>community</i>			
<i>population</i>			
<i>abiotic</i>			
<i>biotic</i>			
<i>niche</i>			
<i>ecology</i>			
<i>habitat</i>			

Figure 3

Lesson 3: Explore

Begin the lesson by passing out the passage *The Ecosystem of the Forest*. Explain to the students that they will do a close read of the passage. The first time they read the passage; they are just introducing themselves to the text and noticing any information that stands out. The second time they read the passage, they need to highlight any key words and phrases and make notes of any words that seem unfamiliar. The third time they read the passage, they need to ask themselves how the information relates to them and summarize the information. For each read, give the students five minutes. They may work as individuals or in pairs. The passage introduces the terms *producers, consumers, and decomposers* and reinforces the theme of the interconnectedness between living and nonliving things. For homework, assign the questions that accompany the passage. To modify the assignment for students with learning disabilities, eliminate some of the choices on the multiple choice questions and give them the option to choose one open ended question to answer.

One option for students with learning disabilities and ELLs is to provide them with the following chart while leading them in a small group:

Close Reading - <i>The Ecosystem of the Forest</i>	
First Read... List two or more things that stood out to you.	
Second Read... Highlight any key words and phrases. Underline or circle any words that seem unfamiliar.	
Third Read... How can you relate to the passage? Summarize what you have learned.	

Figure 4

After the reading, inform the students that the class is going to take a nature walk to observe the local forests in the surrounding area. If the school does not have access to any forests or green areas, create a slideshow of local forests and greenery, but take them outdoors anyway to observe the landscaping of the area. Noticing the lack of green spaces is just as valuable as noticing the green spaces for this unit. The students should take their notebooks with them to record any observations of the area around them. The walk should take ten to twenty minutes depending on the amount of nature and the engagement of the students. Allow the students to record their observations while outdoors. Encourage the students to illustrate their observations as well as write them. When you return to the classroom, give the students a moment to have a five minute, educated social, which is just a forum for them to walk around and share their observations with each other. Circulate the room to observe the discussions as well as keep the students on task. Display a countdown timer on the interactive whiteboard so the students can keep track of their time.

Lesson 4: Explain

In this lesson, begin the session by reviewing the answers to the passage (*The Ecosystem of the Forest*) questions with the students. If done as a whole group, this should take no more than ten minutes.

After reviewing the answers to the questions, introduce the text, *All the Pieces Matter*. Lead the students in selecting partners to read the passage. The students will partner read the passage and answer the questions. Give the students twenty minutes to complete the task. After the time is up, gather the students to the carpet to lead them in a discussion about the reading. The big ideas:

- Everything in an ecosystem plays a part (niche).
- If one element goes missing, the ecosystem will adjust over time to make up for the loss.
- Even as humans, we play a major role in the survival of our ecosystems.

Introduce the report from American Forests, Urban Ecosystem Analysis Mecklenburg County and the City of Charlotte, North Carolina. Although the students will only see excerpts of the report, post the entire report on the interactive whiteboard and flip through it while introducing the information. Let the students know that they will have the opportunity to utilize the data and graphs to understand important information about the ecosystems in their own backyards.

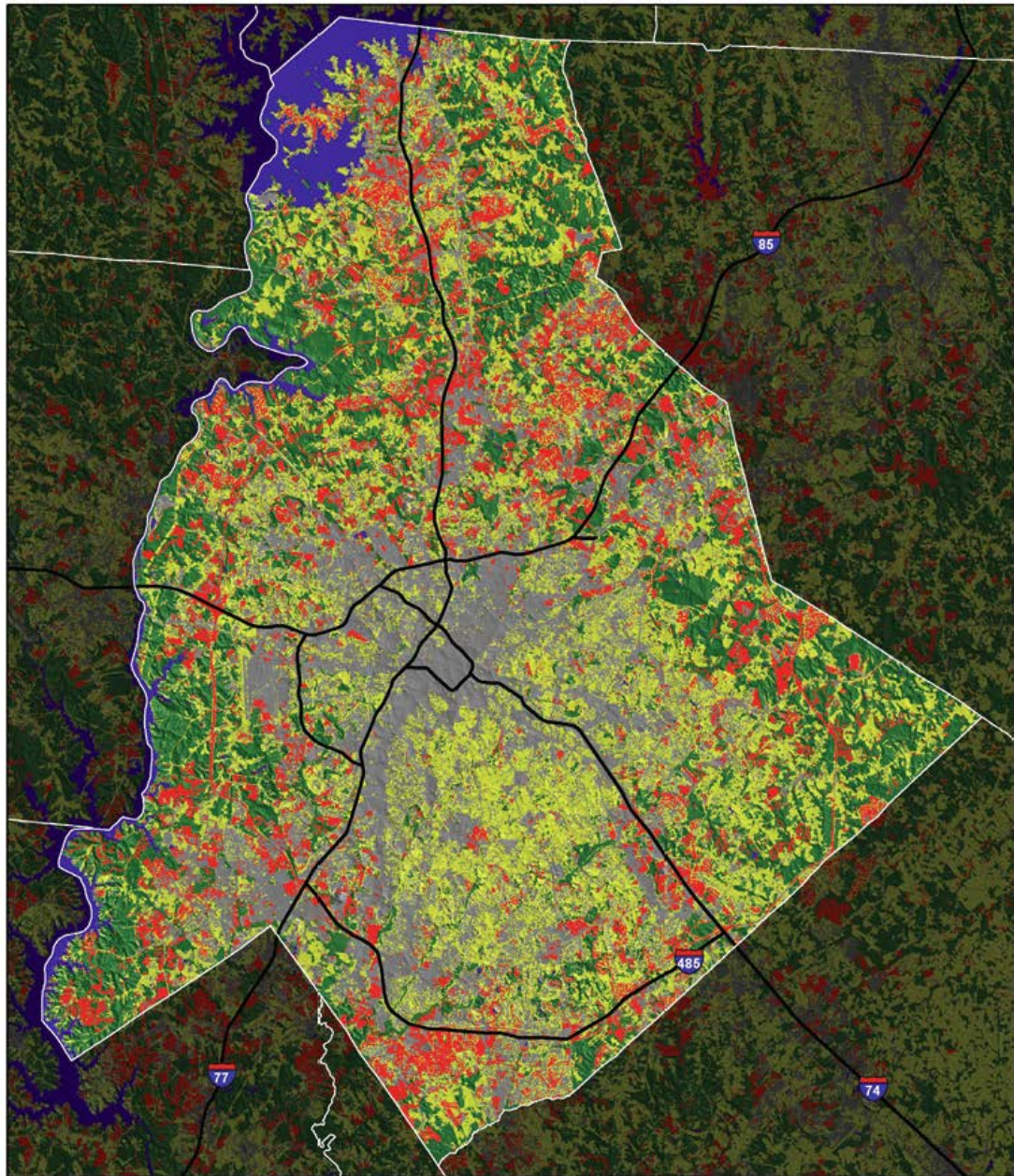
Lesson 5: Elaborate

Begin this lesson by handing out a packet of the main information for the lesson (pp. 2 – 5, 8 – 9). Guide the introduction of the report using the following questions or questions similar:

- What is the name of the county in which we live?
- Name some of the elements of our ecosystem.
- What are some objects you remember observing during our nature walk?
- Do you believe that trees are an important natural resource? If yes, why? If no, why not?

Display the first satellite data (Figure 5) of *Mecklenburg County Tree Loss 1985 – 2008* on the Smart Board. Give the students two to three minutes to look at the image, and then lead them in a discussion about the image and make predictions on the information given based on what they see. Make sure the students can identify all of the features including the following:

- Reference Title: Mecklenburg County Tree Loss 1985 - 2008
- Image Title: Urban Ecosystem Analysis Tree Loss 1985 – 2008, Mecklenburg County, North Carolina
- Legend: Tree Loss (Red), Trees (Green), Urban (Gray), Open space (Yellow), Water (Blue)
- Scale
- Sources



URBAN ECOSYSTEM ANALYSIS
TREE LOSS 1985-2008
 MECKLENBURG COUNTY, NORTH CAROLINA

LEGEND

- TREE LOSS
- TREES
- URBAN
- OPEN SPACE
- WATER

SOURCES: MECKLENBURG COUNTY
 AMERICAN FORESTS
 VERSION 1.02

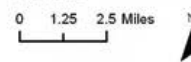


Figure 5

After discussing the satellite the image, explain to the students that they will do a jigsaw of the report. Since the report is lengthy and a complex text, the jigsaw will help them navigate the report with some assistance. Either assign the groups according to their seats/counting them off one through six or have them place themselves in a group with a number of students proportionate to the passages, which should not exceed 5 students. Explain and display the directions to the class:

Directions: Your group is responsible for helping the other students in the class understand the important part of your text.

- Read the selected text with your assigned group.
- Use the chart paper and markers to summarize the information from the text. Include the title and page number of your selected text on your chart.
- The information must be clear, concise, and presented neatly.
 - Feel free to include illustrations related to the text.
- Be prepared to present your information to the class.

Selected Texts

- Major Findings Summary (pp. 2 – 3)
- Land Cover Change Trends: Landsat 1985 – 2008 (p.4)
- Land Cover Change Trends: Landsat 1985 – 2008 (p.5a)
- High Resolution Analysis 2008 and Ecosystem Benefits (pp. 5b - 7)
- 2002 and 2008 High Resolution Comparison and Stormwater Benefits (p. 8)
- Water Quality Benefits and Air Quality Benefits (p. 9)

Give the students fifteen minutes to read their texts and create their posters. During this time, circulate the classroom to observe discussions and facilitate discussions for groups having difficulty getting started. Have the groups briefly present their information in order of the appearance in the report. Encourage students to take notes onto the report or in their science notebooks.

Lesson 6: Elaborate

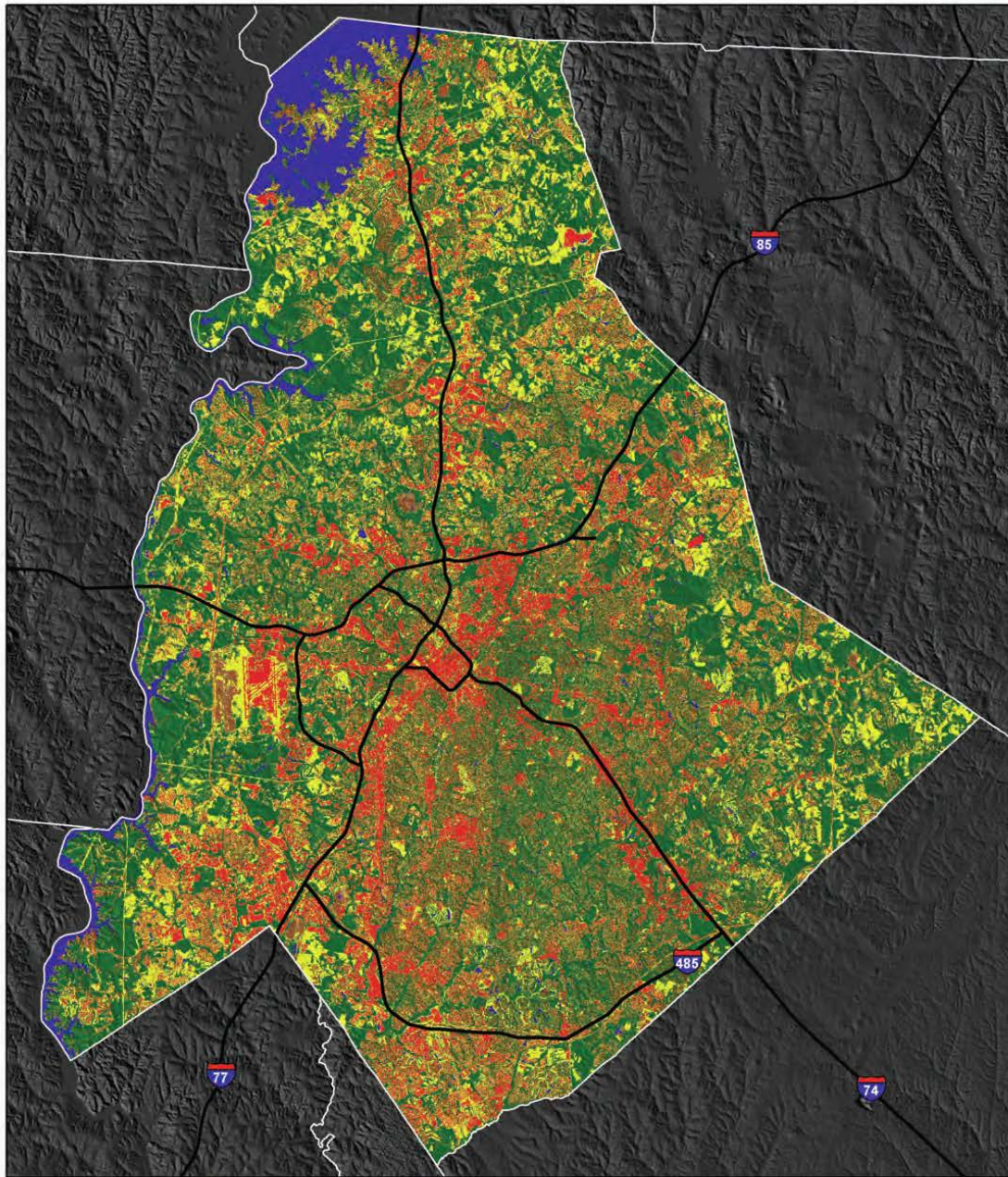
Before the class begins, make a half class set of color copies of the satellite images on pages six and seven of the UEA report. For instance, if there are thirty students in the class, make fifteen copies of the image on page six “Mecklenburg County Landcover” (Figure 6) and fifteen of the image on page seven “Charlotte Landcover” (Figure 7). Have the students stand up, pair up, and sit facing each other once they find a place. Hand out a copy of page six to one of the partners in each pair and a copy of page seven to the other partner. They will engage in an activity called Same and Different. Without allowing their partners to see their image, they must ask questions to determine what their images have in common and what is different. On a separate sheet of lined paper, the students need to create a T-chart. On one side of the chart, they need to write “same” and write “different” on the other. As they discover the features, they will write the features in the appropriate column. Give the students five minutes for this activity. At the end of the five minutes, instruct the students to show each other their images to observe any features they missed.

Engage students in a brief discussion about what they observe about each image in regards to the tree coverage and urban development. Ask the students the following questions:

- What do you think is the significance of maintaining landcover?
- How do you think trees contribute to the environment?
- How do you think the air quality from 1995 differs from the air quality in 2008? Why?

Give the students four minutes to think, pair, and share their thoughts about the questions. After that time, select a few students to share out what they discussed. Engage the entire class by having students give a thumbs up to statements with which they agreed, thumbs down if they disagreed, and a thumb to the side if they are not sure.

Next, have students look at page eight of their report. Give the students three to five minutes to read the section ***2002 and 2008 High Resolution Comparison*** and make notes on the corresponding line graph ***Actual and Projected Tree Canopy Decline in Charlotte Mecklenburg***. After that time, bring everyone together to create a class illustration about the reading and chart. As the students describe what they illustrated, recreate it on the board. After the class illustration is complete, have students compare it to their own and use their thumbs for whole group feedback. Since the graph includes a projected value for 2015, facilitate a discussion about whether the students think the projection is accurate and relevant.



URBAN ECOSYSTEM ANALYSIS
2008 HIGH-RESOLUTION CLASSIFICATION
 MECKLENBURG COUNTY, NORTH CAROLINA

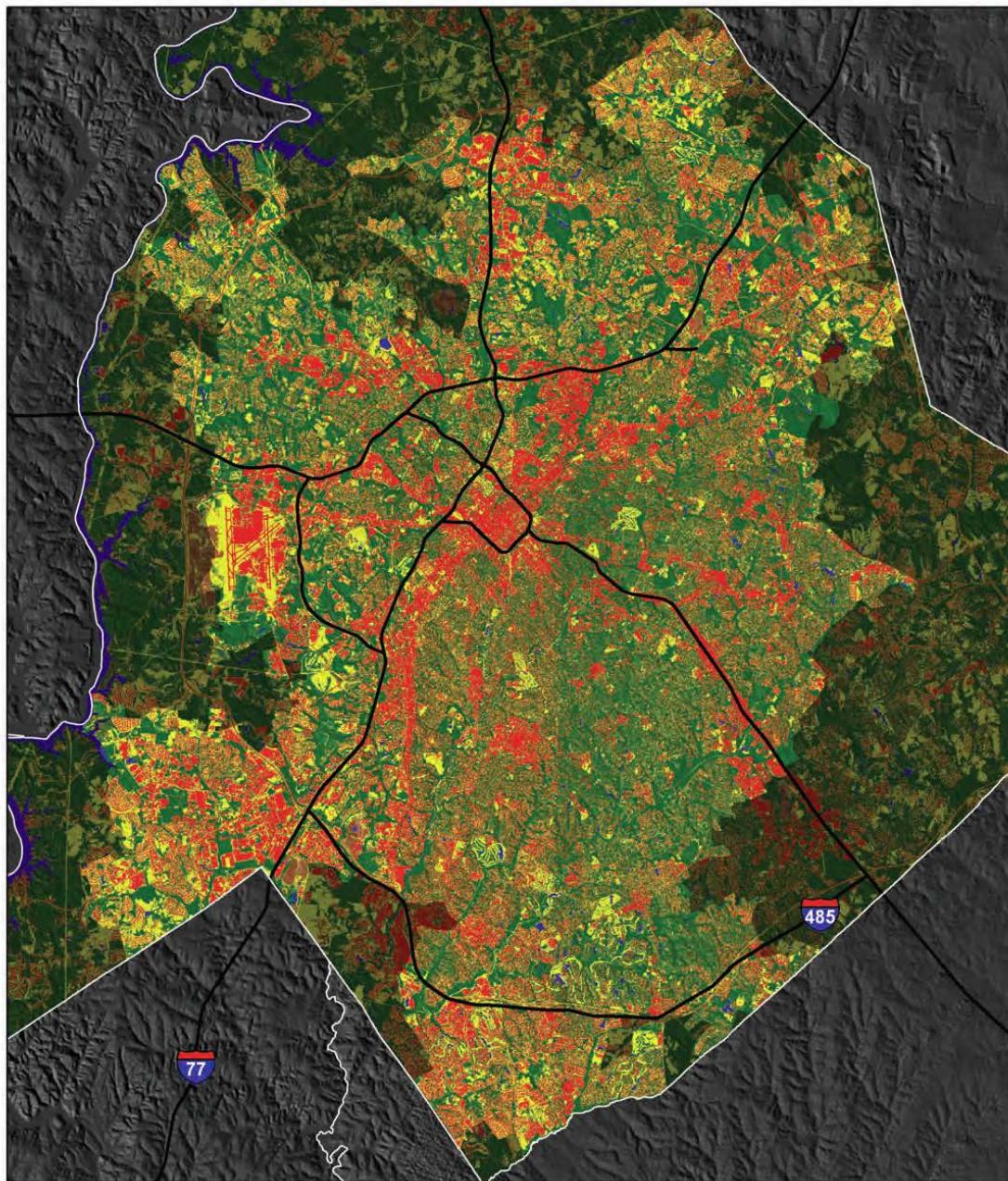
LEGEND		Acres (Percent of Total)
■	URBAN	91,230 (26%)
■	TREES	175,395 (50%)
■	OPEN SPACE	66,401 (19%)
■	WATER	15,654 (4%)
■	BARE	2,827 (<1%)

SOURCES: MECKLENBURG COUNTY
 AMERICAN FORESTS
 VERSION 1.02

0 1 2 Miles

N

Figure 6



URBAN ECOSYSTEM ANALYSIS
2008 HIGH-RESOLUTION CLASSIFICATION
 CITY OF CHARLOTTE, NORTH CAROLINA

LEGEND	Acres (Percent of Total)
URBAN	48,866 (27%)
TREES	84,943 (46%)
OPEN SPACE	47,625 (26%)
WATER	1,051 (<1%)
BARE	1,078 (<1%)

SOURCES: MECKLENBURG COUNTY
 AMERICAN FORESTS
 VERSION 1.02

0 1 2 Miles

AMERICAN FORESTS

Figure 7

Lesson 7: Elaborate

Have the students look at the information on page nine of the UEA report, which discusses air and water quality benefits and displays bar graphs that show the measurements of percent change in contaminants. Give the students ten minutes to read and illustrate the information. The students may read in partners due to the complexity of the text. Lead the students in a discussion about the text and their models. Create a class illustration of the text.

Next, lead the students in a discussion comparing and contrasting the two bar graphs. Ask questions that will engage the students in looking at the visual data and make deeper connections with the numbers in how they related to each other. This activity introduces a mathematical aspect to the lesson and allows the students to see that literacy, science, and mathematics are all a significant aspect of learning. The students should utilize the chart to see the importance of landcover. The trees absorb the water pollutants of the chemicals and keep them from reaching the water sources.

City of Charlotte Water Pollutants As Measured In Percent Change in Contaminant Loading

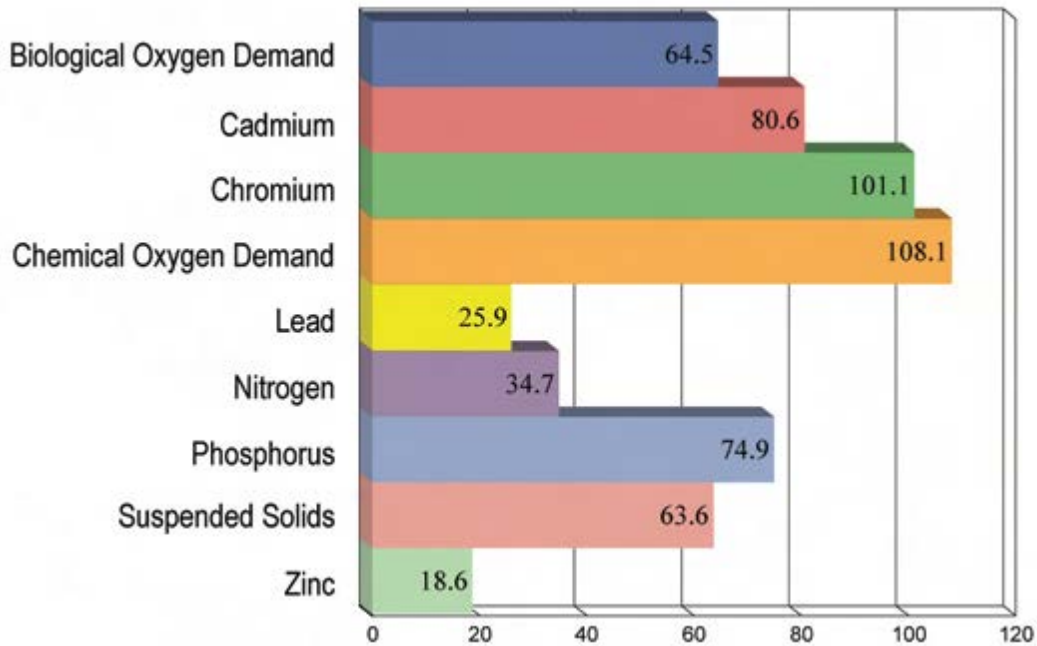


Figure 8

Mecklenburg County Water Pollutants As Measured In Percent Change in Contaminant Loading

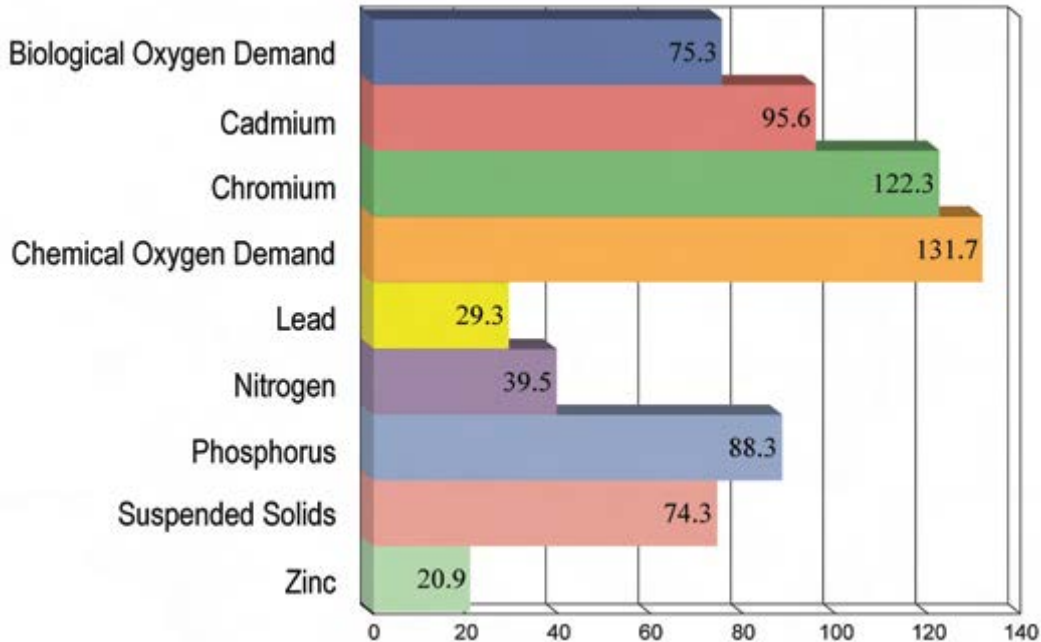


Figure 9

Lesson 8: Evaluate

For the final project and unit assessment, the students must break up into teams and develop a proposal to reduce the amount of urban land development or reduce the number of pollutants entering the air and water in the event of future urban development. Present the task to the students in the following way:

- You are going to research and design a solution to the problem of urban land development and water and air pollutants. You must present your plan to the Mecklenburg County Commission. Your plan should include the following:
 - A statement of the problem
 - Researched information related to the problem
 - A strategic solution
 - A creative presentation that includes the elements mentioned above
- Presentation options: PowerPoint, Google Slides, Prezi, Skit (Role Play), Song

The students may use the information obtained in the UEA report and any other relevant information acquired during their research. Give the students the current and next two class sessions to create, evaluate, and refine their presentations. Give the students a copy of the following rubric to communicate your expectations:

Elements of Presentation	20	15	10	5
Neatness and Organization	Handwriting or typing is neat, content is organized in an easy to follow format	Most of the handwriting or typing is neat, content is organized in an easy to follow format	Some of the handwriting or typing is neat, content is somewhat organized in an easy to follow format	The handwriting or typing is not neat, and the content is not in an easy to follow format
Content Accuracy	Written responses demonstrate an understanding of science concepts and proper vocabulary use	Written responses demonstrate an understanding of some science concepts and proper vocabulary use	Written responses demonstrate a limited understanding of science concepts and proper vocabulary use	Written responses demonstrate an inaccurate understanding of science concepts and proper vocabulary use
Creativity	The presentation is thoughtful, colorful, and/or unique.	Most of the presentation is thoughtful, colorful, and/or unique.	Some of the presentation is thoughtful, colorful, and/or unique.	The presentation lacks thought, color, and/or uniqueness.
Illustrations and Diagrams	Illustrations and diagrams are clear, accurate, and labeled	Illustrations and diagrams are usually clear, accurate, and labeled	Some illustrations and diagrams are clear, accurate, and labeled with some missing	Illustrations and diagrams are sloppy/unclear or missing

Use the final class session to allow the students to present their proposal. For added authenticity, reach out to a local commission or city council member, city official, or parks and recreations member to sit in on the class to evaluate the proposals.

Appendix 1: Implementing Teaching Standards

Science

5.L.2 Understand the interdependence of plants and animals with their ecosystem.

- The students will achieve this standard by reading and interacting with the nonfiction texts within the unit as well as through quality questioning and nature walks.

5.L.2.1 Compare the characteristics of several common ecosystems, including estuaries and salt marshes, oceans, lakes and ponds, forests, and grasslands.

- The students will master a portion of this standard by making observations during nature walks and comparing observations with each other.

5.L.2.2 Classify the organisms within an ecosystem according to the function they serve: producers, consumers, or decomposers (biotic factors).

- The students will participate in lessons that will allow students to use their observations and resources to classify organisms within their observed ecosystem.

5.L.2.3 Infer the effects that may result from the interconnected relationship of plants and animals to their ecosystem.

- The culminating activity of the unit will assist the students in observing and understanding interconnected relationships in their observed and researched ecosystems.

ELA

RI.5.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.

- Throughout the unit, students are expected to use several pieces of informational text to explain relationships in ecosystems.

RI.5.7

Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.

- For the final assessment, the students are expected to compile all of the information apprehended and create a solution to the scientific problem of preserving ecosystems.

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Campbell, A. Malcolm, Laurie J. Heyer, and Chris Paradise. *Integrating Concepts in Biology*. [Http://www.trinity.net/ICB-examcopy/](http://www.trinity.net/ICB-examcopy/), 2014. This online textbook contains information rich with data and is divided up into short chapters that narrate factual situations that occur in biology and have larger implications for how organisms behave in nature.

Carey, Benedict. *How We Learn: The Surprising Truth about When, Where, and Why It Happens*. New York: Random House, 2014. Carey uses this book as a platform to share case studies and information regarding brain research. The book also serves as a reference on how to study and instruct in order to best stimulate brain activity.

Gonick, Larry, and Alice B. Outwater. *The Cartoon Guide to the Environment*. New York: HarperCollins Publishers, 1996. The guide puts what could be seen as complex scientific concepts into more reader friendly illustrations and information outlined in comic strips.

Heacox, Diane. *Differentiating Instruction in the Regular Classroom: How to Reach and Teach All Learners, Grades 3-12*. Minneapolis, MN: Free Spirit Pub., 2002. This book provides information on the value of differentiating instruction for all students and provides resources such as interest inventories and rubrics to support differentiating instruction in the regular classroom.

Kagan, Miguel, and Spencer Kagan. *Multiple Intelligences: The Complete MI Book*. San Clemente, CA: Kagan, 1998. The information given on multiple intelligences within this book addresses the importance of meeting all learning styles in the classroom. The book also provides strategies on keeping all students engaged and accountable in the classroom.

Kagan, S. *Kagan Structures: A Miracle of Active Engagement*. San Clemente, CA: Kagan Publishing. *Kagan Online Magazine*, Fall/Winter 2009. The article highlights several specific strategies that would accompany the strategies provided in the *Multiple Intelligences* book. The strategies are key in whole group engagement during class discussions.

Tate, Marcia L. *Worksheets Don't Grow Dendrites: 20 Instructional Strategies That Engage the Brain*. 2nd ed. Thousand Oaks, Calif.: Corwin Press, 2010. In this workbook, Marcia Tate provides information on adding rigor to every area of classroom instruction, specifically in the area of classwork. The author also provides examples of student-friendly activities which support building connections in the brain for long term retention of information.

"Urban Ecosystem Analysis Mecklenburg County and the City of Charlotte, North Carolina."

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[http://charmeck.org/city/charlotte/epm/services/landdevelopment/documents/charlotte mecklenburg uea_lowres final2.pdf](http://charmeck.org/city/charlotte/epm/services/landdevelopment/documents/charlotte%20mecklenburg%20uea_lowres%20final2.pdf). The report, conducted and released by the American Forests organization, a nonprofit citizen conservation organization, provides the main sources of the illustrations and data for the curriculum unit. The organization conducted an Urban Ecosystem Analysis on Charlotte and Mecklenburg County and published its findings making the reports available for download.

Notes

¹ Tate, Marcia L. *Worksheets Don't Grow Dendrites: 20 Instructional Strategies That Engage the Brain*. 2nd ed. Thousand Oaks, Calif.: Corwin Press, 2010.

² "Urban Ecosystem Analysis Mecklenburg County and the City of Charlotte, North Carolina."
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