

## **Food and Food Systems-Is there enough *room* at the table for everyone?**

***Conchita L Austin***

There is a lot of discussion today about what seems to be the new buzzword- sustainability. What is sustainability? Can we achieve sustainability? How can we maintain sustainability? Charles, who wrote *What are the ingredients of a sustainable food system?* offers "...a good definition of sustainability (is) enough for everyone forever." (1) Ensuring that there will always be enough food resources for everyone seems to be our *simple* task as the stewards and dependants of Mother Earth. One aspect of sustainability, that is near and dear to our hearts and stomachs, is the ability to achieve an equitable and sustaining food system-locally and globally. With human populations steadily increasing and the ever broadening gap between those who have access to an adequate food supply and those who don't, we must not only raise the awareness of those who have more than enough, but also attempt to find immediate and plausible solutions for those suffering from malnutrition and hunger.

The endeavor of obtaining an equitable and sustaining food system is going to require the input and cooperation of individuals from every aspect of our human society. Kloppenburg relates, "...People from many backgrounds and social locations are participating in initiatives and movements for food system sustainability. It is through honoring and understanding the multiple dimensions of motivation and intent that people bring to the transformative project that it can actually be brought to fruition" (2) The purpose of this curriculum unit is to bring awareness to my students, the next generation on this planet, as well as incite within them a call to action by participating in discussions and debates to generate some possible solutions and equitable improvements in our food systems, which could lead to food sustainability locally and globally.

### **Student Background**

This is my eleventh year as a high school science teacher. I received an undergraduate degree in Biology and worked in food laboratories in quality control and research and development for over 10 years; then I went back to school, earned a master's degree in education and became a science teacher. I have taught at my current assignment for 8 years. My school has a population of about 1,800 students, approximately 54% on free and reduced lunch. The student population is 25% Caucasian, 49% African American, 5% Asian, 16% Hispanic, <1% American Indian, and 4% Multiracial students. We have a large population of EC (exceptional child) students, an IB (International Baccalaureate) program, and offer Honor's and AP (Advanced Placement) programs. We are a diverse school population, which I think makes our school a good atmosphere for preparing them

for real world experiences. These factors will provide for a variety of opinions and perspectives as I teach this unit on food and food system sustainability.

One of my most rewarding teaching experiences has been working with my ESL (English as a Second Language) students in the Sheltered Instructional Observation Protocol (SIOP) Program. This program is designed for students that have limited English language proficiency and have recently come to the United States from their native country or are living in households where their primary language is not English. One of the main focuses of SIOP is to provide the ESL students with a “sheltered” environment as they transition into American culture from their native country. I try to achieve an atmosphere of safety and inclusion by establishing early on that each member of the classroom has the right to learn and express his or her own opinions and we must be respectful of each others pacing and style of learning. SIOP stresses the effectiveness of differential instruction, cooperative learning, and the use of multiple intelligences. These students are creative and have rich experiences to contribute to the class, but they tend to be shy when reading aloud or speaking in front of their classmates. My English Language learners, more than any of my other students, will be able to better appreciate the need for global concerns as they relate to our food systems because of the past experiences in their native countries. They will be invaluable in describing the food systems from their native own countries.

Another group of students is my Honor’s Biology Class. This class consists of 31 students ranging in grades from 9-12 and age’s 14-18. These students are ethnically diverse: Multi-racial, White, Black, Asian, and Hispanic. Most of the students are selected for this class based on previous math and other test scores as well as teacher recommendations based on their status as AG (academically gifted) and/or participation in the IB (International Baccalaureate) Program. This class is vocal and social, so they enjoy having discussions and sharing their opinions. These students benefit from any additional rigor and challenge incorporated into the standard curriculum, which will provoke them to think, reason, and make connections with what they are going to be learning. The curriculum in this unit will be beneficial for this group because it will encourage them to use inquiry as they make associations between the environment and the impact of human actions. This will open up room for continued higher level thinking as they research and offer proposals for possible sustainability solutions.

My third group of students consists of my inclusion and gateway students. My inclusion class will consist of students who are classified as EC (Exceptional Child) who have been identified with some form of learning disability and a selected group of regular education students. The purpose of combining EC and regular education students is to provide an opportunity for students with varying ability levels to interact and collaborate with each other, reduce distractions, and hopefully increase passing rates on the End of Course Test in Biology. My other sub-group of students is those considered gateway-they had passed the Biology course, but still haven’t achieved a passing score on the End of

Course Exam. These students will all benefit from this unit because it utilizes hands-on activities and calls upon their prior knowledge of food. Students that need to move around more frequently or have difficulty with reading will be able to participate in the activities with minimum difficulty.

## **Rationale**

I don't feel that it is an exaggeration to say that most students, or adults for that matter, have no idea where their foods come from. When I initially pose this question to my students in class they usually reply, "The (grocery) store," or "McDonalds" (or some other fast-food restaurant). Many of them are unaware how interconnected they are with the environment as a result of being food consumers. When teaching the unit on Ecology, I present as a theme-"We are all connected." I want my students to realize how we impact the same environment that we depend on to nourish and sustain us. The purpose and focus of writing this unit is to not only raise the students' awareness about themselves and the world around them, but encourage them to take meaningful roles in being proactive about an issue that is relevant to them and their future generations.

There are several benefits for my students as a result of teaching this unit. One benefit is that this whole unit consists of hands-on activities that are or should be personally relevant. We all eat and food seems to be a topic of interest even to students in grades 9-12. Secondly, this unit will allow students to research and determine what goes into obtaining their food and some possible options to achieve sustainability. Thirdly, students will be able to participate in the planning and implementation of a school garden. Many students I teach have never planted a seed or been exposed to the cultivating of a garden. This unit will provide an opportunity for students to get back to nature and hopefully appreciate their connectedness to the environment and the need for responsible stewardship.

## **Background Information**

What is a food system?

Not so long ago, most humans obtained most of the food they ate locally by either raising or growing it themselves or at least purchasing it within their community. At the risk of exposing my age, I can remember my mother and grandmother loading up my brother, sister, and myself to go to the cannery at the end of the summer. None of my students know what a cannery is and I don't know if any exist now or not. My mother and grandmother would bring that summer's harvest- tomatoes, green beans, corn, lima beans, or whatever else came into the garden to preserve for the winter. Now it is much easier to go to Super Wal-Mart or Super Target and purchase these items on sale at two cans for a dollar even though it doesn't taste nearly as good as what I remember. Today

much of our food has been shipped in from around the world and is heavily processed before it reaches the dinner table; many times it is unrecognizable from its original state. What are we truly paying for this convenience? We are so far removed from the actual source of our nourishment that we fail to realize the toll our convenience places on what can now be considered our way of life on the environment not to mention our health and well being.

Michael Pollan shares in his book, *The Omnivore's Dilemma*, that a food system can be defined as anything that pertains to food. It relates to how food is grown, harvested, transported, processed, consumed, and properly disposed of.(3) The article *Food Systems* by UC Santa Cruz's Kent Bailey offers, "One subtle challenge of the food system is the way it distances 'eaters' from the social and environmental impacts of production. Nationally and globally, human food systems represent a substantial impact on soil, water, and biodiversity. The ways humans interact with nutrient and cycles, local ecosystems, and global climate to procure daily bread together comprises one of the greatest impacts on human health through air pollution, compromised drinking water, and exposure to pesticides and other chemicals."(4) The ultimate goal of any food system is to provide physical nourishment; however, food has a much deeper and more complicated role in the lives of us as humans.

Kloppenborg discusses these various dimensions in which we view our food as it relates to food systems and sustainability in *Tasting Food, Tasting Sustainability: Defining the Attributes of an Alternative Food System with Competent, Ordinary People*.(5) The first dimension discussed by Kloppenborg is that of Ecological Sustainability. This dimension covers the need to raise awareness as it relates to food systems and the environment. We must not only focus on the costs and effects on the environment locally, but global systems as well. There is a diversity of food systems on this planet as it relates to the various cultures and geographic locations. This factor needs to be respected and taken into consideration as we address the need for specific rules and guidelines in order to encourage sustainable practices.

Other dimensions presented by Kloppenborg are of Economic Sustainability and Value-oriented (Associative) Economics. Economical Sustainability maintains that since businesses are out for profit, then we need to establish a system in which sustainability proves to be profitable. Likewise, Value-oriented (Associative) Economics acknowledges the fact that money and profit are always a significant and motivating element in any world system. This dimension suggests as well that an economic value or benefit must be associated with sustainability in order for the world systems to feel the merit of investing in sustainability. (6)

One perhaps overlooked or underrated dimension presented in this article is the human, relational factor as it relates to food and sustainability. Everyone needs to work toward a common goal in order to achieve sustainability including farmers, consumers,

industry, small business, politicians, and world systems. This is especially true in the dimension of food and food systems, which ought to be culturally nourishing. We as citizens of this earth may be culturally diverse, but we each hold a special affinity for certain foods and value the very act of sharing these foods as much as sharing our unique cultures. Most cultures view food as not only nourishing to the physical body, but to the mind and spirit as well. Therefore, every individual needs to contribute toward the cause of the whole in promoting food sustainability.

Why should we be concerned about the sustainability of our food system?

Something as simple as the meal on our plate presents huge implications of local and global impact and many of us are painfully unaware of the total picture of ensuring sustainability in our food systems. Walter Dodds in *Humanity's Footprint* relates, "Behavioral constraints channel aggregate behavior to such a degree that it will be extremely difficult to use our resources wisely as a global society. Strong measures are required to reverse the path we are taking. Pessimism may be counter productive, but realism is mandatory if we are to confront human nature and problems associated with sustaining a comfortable existence on our globe." (7) Lester Brown in Plan B 4.0 calls food (or our food system) the weak link and adds, "From time to time I go back and read about earlier civilizations that declined and collapsed, trying to understand the reasons for their demise. More often than not shrinking food supplies were responsible... Our continuing failure to reverse the environmental trends that are undermining the world food economy forces me to conclude that if we continue with business as usual such a collapse is not only possible but likely." (8)

The article, *Projected Food, Energy Demands Seen To Outpace Production* published in Science Daily in June 2009, reveals "With the caloric needs of the planet expected to soar by 50 percent in the next 40 years, planning and investment in global agriculture will become critically important. By 2050, world population is expected to exceed 9 billion people, up from 6.5 billion today. A gap is emerging between agricultural production and demand, and the disconnect is expected to be amplified by climate change, increasing demand for biofuels, and a growing scarcity of water." (9) It is imperative that we come up with some effective solutions in order to combat the ever-increasing demand caused by our growing population and our lapse of proper stewardship. After awareness of the problem, we must begin looking for viable and sustainable solutions

What are some effective options toward achieving the sustainability of our food systems?

The difficult part of broaching the concept of sustainability is that when researching and discussing the state of our planet and the dire need for sustainability, it seems so dismal and overwhelming. Many of my students ask, "If we are all going to run out of food and die, why even bother to try?" There seems to be much "gloom," "doom," and reprimand

surrounding this whole discussion of the sustainability of food systems. As Dodds and Brown have expressed, there is an obvious problem which requires a degree of urgency, but there also should be a message going out that something can be done individually and collectively that will make a difference, reminiscent of the Oncler's charge to the young man in Dr. Seuss' *The Lorax* to do likewise.

In addition to being made aware of what food sustainability is and why it is crucial for our continued survival, I feel an obligation to present to my students some positive and effective solutions that are being implemented in order to make food sustainability an obtainable goal during their lifetime. There are no easy solutions or quick fixes in regards to effective options toward achieving the sustainability of our food systems. Hassanein discusses this dilemma in her article, *Practicing food democracy: a pragmatic politics of transformation*,

“A sustainable agro-food system (is) one that equitably balances concerns for environmental soundness, economic viability, and social justice among all sectors of society.” Hassanein continues to point out that even though this is a functional definition the very simplistic nature of its content raises an issue to its practicality. She goes on to state, “politics is the arena in which we deal with disagreements over values. Such conflict is not something to shy away from; conflict leads to change. Change means movement. Movement means friction. Only in the frictionless vacuum of a nonexistent abstract world can movement or change occur without that abrasive friction of conflict. The best hope for finding workable solutions to conflicts about the character and the direction of the agro-food system is through active participation of the citizenry (in the broad sense of the word) and political engagement to work out our differences. Food citizenship suggests both belonging and participating at all levels of relationship from the intimacy of breastfeeding to the discussions at the World Trade Organization.”(10)

As previously stated, there are no easy solutions, but I want my students to be aware of what is currently being done by others and what they, themselves can do to make some positive changes toward food sustainability. It is easy to approach this whole topic with a sense of hopelessness, that there is nothing that can be done. Students need to be reassured that anything they do on the smallest of scales can make a positive contribution toward a possible solution. This unit will be viewed a success if my students know that whatever efforts they make toward sustainability will collectively contribute to the achievement of this crucial goal.

There are several programs and projects currently being implemented which are outlined on such websites as [Globalstewards.org](http://Globalstewards.org). Legislatively and globally, there are the Millennium Development Goals (MDG) which consists of 8 goals, the first being that all 191 members of the United Nations have agreed to work toward eradicating extreme hunger and poverty by 2015. Another initiative also sponsored by the UN is the Organic

Agriculture Outperforming Conventional in Developing Countries, which studies suggest that in many developing countries, organic agriculture outperforms conventional and traditional systems in terms of yields, cost effectiveness, and diversity (11).

One participant in the goal of working toward food sustainability is Industry. The website Globalstewards.org introduces an organized movement on the behalf of industry called Fair Trade Food Products which promotes equitable standards for international labor, environmentalism, and social policy in areas as related to the production of labeled and unlabeled goods. Another industrial concept featured on this same website is called Holistic Management. “Holistic Management (is) a systems thinking approach to managing land resources that builds biodiversity, improves production, generates financial strength, and improves the quality of life” (12).

Farmers are also key players in promoting food sustainability. One concept being explored to assist farmers in doing their part is Agroecology. “Agroecology is the study that integrates ecological concepts and principles to the design, development, and management of sustainable agriculture systems” (13) Another branch of science that has emerged is called Biodynamics. Biodynamics promotes sustainable farming through sound ecological practices focusing on organic farming in order to reduce the burdens on the land and environment typically caused by conventional and traditional practices. The ideas of encouraging farmers to plan perennial crops as well as no-till farming are also being viewed as viable options toward sustainability.

The final, but not least essential component toward promoting food sustainability is the individual consumers. As consumers, we can opt to purchase or food locally through avenues such as food coops or from local farmer’s markets. We can also grow our own gardens or support local community gardens. As consumers, we can choose to support legislature, industry, and farmers that promote organic foods and sustainable practices by our votes and purchasing habits. In the documentary, *Food, Inc.*, the narrator concludes by stating that we as consumers cast a vote for what we support with each item that is scanned at the checkout. What we purchase and support does have an effect upon legislature, industry, farmers, and ultimately our environment.

## **Student Activities**

### **Activity 1- Where does food come from?**

As an introduction to this unit on food sustainability, I want to show my students two documentaries: *Food, Inc* and National Geographic *Human Footprint*. The video questions can be found in Appendix A. Both of these videos are really visual and excellent demonstrations of where our food comes from and how we as consumers impact our environment, which is one of our goals from the biology curriculum in North

Carolina. Another video which is good to show students as it relates to where food comes from is the HBO movie, *Temple Grandin*. *Temple Grandin* is a biography of a woman who is autistic and is able to not only overcome obstacles related to this condition, but use her ticks to her advantage in designing humane treatment of animals in slaughter houses. Due to time constraints, I realize that I may not be able to show all three videos during one lesson, I would show Food, Inc. first and as time permits will work in the other two perhaps throughout the semester as we are to continue teaching human impact on the environment throughout the course. *Temple Grandin* can also be shown during our discussion on animal behavior.

Another good link I found on the web is from Sustainable Table.org called *The Meatrix*. *The Meatrix* is a trilogy of video clips based on the movie *The Matrix* which is animated to demonstrate what happens to animals that are slaughtered as a result of factory farming. This site includes activities and discussion questions for the students after watching the video clips. This activity would also be a good substitute if time is a factor and you are not able to show the full-length videos above.

#### Activity 2- What is Hunger?

After discussing with my class where their food comes from, I would like to discuss with them the national and global effects of hunger. My students will go to the website [WWW.Worldhunger.org/learn.htm](http://WWW.Worldhunger.org/learn.htm) where we are going to participate in several activities and quizzes as they relate to hunger worldwide and in the United States. On this website, I want them to browse the link *Hunger Fact Sheets* and *Hunger Quizzes*. One article found through this link details one man's experiment to understand what it is like to be truly hungry. I anticipate that this will generate classroom discussion and make my students more aware of the necessity for our planet of becoming food sustainable. The purpose of this activity is to assist my students in coming to better terms with the significance of hunger as it relates to the need for equitable and sustainable food systems. Most of my students have no prior knowledge or concept of what is like to be hungry or without an adequate food supply. In the United States, we have tend to have an overabundance of food and foodstuffs even though , we will learn that even here we suffer from pockets of "food deserts" where there are those without access to nourishing, non-processed food items.

#### Activity 3 – "Eagle Spirit" Garden

The most involved and committed activity for this unit will be the planning and implementation of the school garden. This garden is going to be a shared project with two other teachers who are also writing curriculum units in this course on sustainability. Each teacher has a specific focus for the garden: one teacher will focus on conservation and composting, the other teacher will focus on water and water quality, while I will be focusing on the actual growing of food. Upon doing my research on planning school



gardens, I came across the idea of Victory Gardens (13). Victory Gardens were originally created during World Wars I & II as an effort to supplement food rations during scarcity of food during war time. Individuals would maintain gardens, not matter how small, in order to do their part for the greater cause. Today the concept of Victory Gardens has resurfaced in order to meet the demand for fresh, wholesome foods especially in “Urban Deserts” where there is a significant need for fresh, unprocessed food options (14). In this current economy, food banks are being stressed as families are struggling to feed their families. Maintaining individual and/or community gardens could prove to be a start toward finding a solution toward food sustainability. Most of my students have not had experience in taking care of any type of plant, let alone maintaining a garden. This activity will hopefully instill within them an interest for growing herbs and/or vegetables and develop an appreciation for local farmers and unprocessed foods. Our school mascot is the eagle so I decided to name the garden Eagle Spirit to personalize the project for my students. The students are going to decide what they want to plant and be assigned sections of the garden that will be their responsibility to weed and maintained. We will also monitor and share the projects that the other two teachers’ classes will be working on during the course of the semester. This project will hopefully be an ongoing activity during successive semesters.

## **Conclusion**

The title of this unit asks- Is there enough room at the table? Food is much more than fuel for or mortal bodies. Pollan relates this well, “ food revels itself for what it is: no mere *thing* but a web of relationships among a great many living beings... each of them dependent on the other and all of the ultimately rooted in the soil and nourished by sunlight.” (15) We value food as sacred to our spiritual belief system and culture. It is suggested by experts that there is enough food for everyone, but there is also equity, or shall we say inequity, issue. There is a vast gap between those who have more than enough and those who clearly don’t. There, likewise, seems to be a false sense of security that those who have will continue to do so. Unless we start working toward sustainable practices, we too may become those have-nots. Obtaining a state of food sustainability is crucial for all of us as citizens on this planet as well as our obligation of being stewards of our environment. It is my desire to share this message with my students as my part of becoming part of the solution and encourage them to do the same as well. Students need to know what the issues are and how they become part of the solution through political activity and personal commitment toward sustainability. Dodds in *Human Footprint* states, “Even if many individuals make all these changes, it might not have an effect. But an attempt to leave the world’s environment better is positive action and far superior to ignoring or exacerbating a global crisis. The earth is our only home. As far as current scientific knowledge is concerned, this may be the only planet that can support life.” (16) It is our obligations as citizens of this planet to not only become good stewards, but to pass this value on to our students- the future generation.

## Notes

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<http://sustainableindustries.com/print/8030>.
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consumers, farmers, and industry]

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### ***Appendix A-Video Questions***

#### *1. Food, Inc*

*(modified from newyorkscienceteachers.com)*

Name \_\_\_\_\_ Block \_\_\_\_\_

1. How many products are found in the average US supermarket?
2. What ripens conventional green tomatoes before you buy them?
3. How did the McDonald brothers revolutionize the fast food industry?
4. How many companies control the majority of meat available for purchase?
5. After the decline of tobacco what did farmers switch to?
6. How many days did it used to take to 'grow' a chicken? How many now?
7. Why do they pick up chickens at night?
8. How much does a typical chicken farmer with 2 \$500,000 houses make a year?
9. What is the majority of food made from?

10. How much corn used to be harvested per acre? How much currently?
11. 90% of products contain either or
12. How much meat does the average person eat per year?
13. Why are grass-eating cows being fed corn?
14. How many FDA food safety inspections were conducted in 1972? 2006?
15. State two reasons they do less food safety inspections?
16. Can the USDA shut down a plant that has repeated *E.coli* and *Salmonella* positive tests?
17. How many days does it take giving a cow grass instead of corn for the cow to shed 80% of *E. coli*?
18. What cleanses most of the bacteria out of production line hamburger filler?
19. Why are 'bad' (unhealthy) calories cheaper?
20. One in \_\_\_\_\_ Americans born after 2000 will have type 2 diabetes.
21. At Smithfield in Tarheel, NC, how many pigs are killed per day?
22. What president took on the beef trust?
23. What is one of the most dangerous jobs in the US?
24. What industry invites illegal Mexican immigrants to the US?
25. What happens to these immigrants?
26. How much of food is grown organically annually?
27. What is the #3 yogurt brand in America? Why is this important?

28. How many soybeans grown in 2008 contained the round-up ready genes?
29. What happens to a farmer who tries to save his own seeds?
30. How many seed cleaner machines are left in the US?
31. How many public seeds are still produced by universities/the government?
32. What Supreme Court Justice was a former Monsanto employee that wrote the majority decision for seed patents?
33. What kind of meat does not need to be labeled before being sold?
34. What percent of food in the supermarket is genetically modified?
35. Who sued Oprah for saying she didn't want to eat a burger? Who won?
36. How many gallons of diesel fuel are used by farmers annually?
37. How much oil does it take to raise a steer to slaughter?
38. Individual consumers can change (list one thing)
39. If YOU demand more wholesome foods, what will farmers do?
40. What is one thing you want to do after viewing this movie?

2. National Geographic Human Footprint questions  
(modified from newyorkscienceteachers.org)

Human Footprint  
Video Questions

Name \_\_\_\_\_  
Block: \_\_\_\_\_

1. How many people are currently on the planet?
2. What did the Wildlife Conservation Society call the impact that humans have on the planet?
3. How much of the world's land surface is unaffected by humans?
4. How many diapers will we go through in our first  $2\frac{1}{2}$  years of life?
5. How many trees are needed to make the padding in a diaper for 1 child over  $2\frac{1}{2}$  years?
6. How many diapers are thrown away in the U.S. every year?
7. How long could it take for those diapers to biodegrade?
8. How much milk can one cow produce each day?
9. How many pints of milk does an average human consume in a year?
10. How many calories do we need to consume daily?
11. How many chickens will we consume in a lifetime?
12. How many eggs will we eat in a year?
13. How many potatoes does an average person eat in a lifetime?
14. How big is the area that America devotes to wheat fields?
15. How many loaves of bread does a person eat in a lifetime?
16. As a nation, how many hot dogs do we eat on the 4<sup>th</sup> of July?
17. How many pounds of candy do we consume each year?
18. How many pounds of sugar are found in a lifetime supply of candy bars?
19. What is the natural color of a cocktail cherry before it is bleached and re-colored?



20. Number of bananas in a lifetime supply: \_\_\_\_\_  
Number of oranges peeled in a lifetime: \_\_\_\_\_
21. How many cans of soda will the average American consume in a lifetime?
22. How many gallons of water does a lifetime of showers use?
23. In a lifetime, you will use:  
\_\_\_\_\_ tubes of toothpaste  
\_\_\_\_\_ bars of soap  
\_\_\_\_\_ bottles of shampoo
24. How many gallons of water will the average person use in a lifetime?
25. \_\_\_\_\_ gallons of sewage are sent through the sewage system each day.  
\_\_\_\_\_ gallons of sewage are produced in a lifetime.
26. As a nation, how many tons of waste do we generate each year?
27. How many pounds of laundry does the average American generate annually?
28. To build an average home you need:  
More than \_\_\_\_\_ trees to supply the wood framing  
\_\_\_\_\_ sq. feet of siding  
\_\_\_\_\_ tons of concrete  
\_\_\_\_\_ pounds of copper piping  
\_\_\_\_\_ gallons of paint
29. How much coal will you burn through in a lifetime just by blow drying your hair?
30. What does coal release into the atmosphere when it's burned?
31. How many tons of carbon dioxide emissions does the average American create per year?  
What is the worldwide average of CO<sub>2</sub> emissions?
32. How many pounds of fossil fuels does it take to create a desktop computer?
33. What length of time will you spend watching TV over a lifetime?
34. What can 22,000 kilowatts of electricity do?
35. How much CO<sub>2</sub> is released into the atmosphere from cutting down trees to make newspapers?

36. How many Christmas trees do we cut down each year?
37. On average, how many miles do we drive in a year? In a lifetime?
38. What types of modern transport contribute to the carbon footprint?
39. How much carbon do we each generate over a lifetime?
40. How many endangered/threatened animals are there in the U.S.? Why?

### ***Appendix B-Teacher Resources***

1. Food Inc. DVD. Directed by Robert Kenner. Los Angeles: Magnolia Home Entertainment, 2009. Good video to demonstrate how our food is processed and the politics related to food processing
2. Temple Grandin DVD. Directed by Mick Jackson. null: HBO Home Video, 2010. Video discusses the life of a woman with autism who uses her abilities to relate to animals in order to design and develop more humane methods in slaughter houses.
3. National Geographic: Human Footprint DVD. Directed by Clive Maltby. Los Angeles: Nat'l Geographic, 2008. Video illustrates in detail how much we as humans consume from birth and throughout the rest of our lives.
4. The Meatrix- <http://www.themeatrix.com/> an interactive site that discusses how meat is processed. Site has a trilogy of videos (based on the format of the Matrix) as well interactive activities for students.
5. "World Hunger Notes--You Can...Learn More About Hunger." World Hunger Notes Homepage. <http://www.worldhunger.org/learn.htm>. Site provides quizzes, articles and activities that allow students to relate to what hunger is and how people are affected by hunger throughout the globe.
6. 10 tips for Starting a Victory Garden-  
[http://www.wral.com/lifestyles/house\\_and\\_home/story/2071313](http://www.wral.com/lifestyles/house_and_home/story/2071313)
7. The Victory Garden Revisited -  
[http://www.startnow.org/victory\\_garden\\_revisited.htm](http://www.startnow.org/victory_garden_revisited.htm)

## ***Appendix C- North Carolina Course of Study Standards for this unit***

### **Goal**

The biology curriculum is designed to continue student investigations and deepen student understanding of the biological sciences. High school instruction should include concepts introduced in grades K-8 at a more abstract level. In-depth study of the following concepts is included: the cell, the molecular basis of heredity, biological evolution, the interdependence of organisms, matter, energy and organization in living systems, and the adaptive responses of organisms. For instruction, the program strands and unifying concepts should be woven through the content goals and objectives of the course. The following explanation introduces teachers to the program strands and unifying concepts. Supplemental materials, providing a more detailed explanation of the goals, objectives, unifying concepts and program strands, with specific recommendations for classroom and/or laboratory implementation, are available through the Department of Public Instruction's Publications Section.

### **Personal and Social Perspectives**

This strand is designed to help students formulate basic understanding and implied actions for many issues facing our society. The fundamental concepts that form the basis for this strand include:

#### **Personal and Community Health**

Biology is an excellent context for investigating the factors that affect the health of organisms in general and humans in specific. Persuading adolescents to adopt personal habits that contribute to long-term health is not always easy. Looking at issues such as nutrition, exercise, rest, and substance abuse from the perspective of an organism's needs and responses provides a less emotional atmosphere for considering health issues relevant to teenagers.

#### **Population Growth**

Biology students should develop the ability to assess the carrying capacity of a given environment and its implied limits on population growth, as well as how technology allows environmental modifications to adjust its carrying capacity.

#### **Environmental Quality**

The role of biological sciences is particularly relevant to areas where humans affect and are affected by other organisms and the non-living environment. The curriculum offers opportunities for students to make decisions based on evidence in the areas of environmental stewardship and economic realities.

#### **Science and Technology in Local, National, and Global Challenges**

This part of the science in personal and social perspectives strand examines the involvement of human decisions in the use of scientific and technological knowledge. "Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various science and technology-related challenges. Students should understand the causes and extent of

science-related challenges. They should become familiar with the advances and improvements that proper application of scientific principles and products has brought to environmental enhancement, wise energy use, reduced vehicle emissions, and improved human health.

**Competency Goal 5: The learner will develop an understanding of the ecological relationships among organisms.**

**Objectives**

5.01 Investigate and analyze the interrelationships among organisms, populations, communities, and ecosystems.

- Techniques of field ecology.
- Carrying capacity.

5.03 Assess human population and its impact on local ecosystems and global environments:

- Historic and potential changes in population.
- Factors associated with those changes.
- Climate change.
- Resource use.
- Sustainable practices/stewardship.