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GOING GREEN WITH AGRICULTURAL EDUCATION

Agricultural Education is Green

by Harry N. Boone, Jr.

Since their inception in the 19th century, high school agriculture education programs have been advocates for innovative agriculture practices. These innovations were usually based on the long-term sustainability of agriculture and the family farm. Agriculture education curriculums have always stressed the concepts of saving energy, renewable energy, water conservation, soil conservation, recycling, reusing, composting, and overall conservation. To borrow (and modify slightly) the words from a 1980s county song, agriculture education was green (when green wasn't cool) (Kye Fleming and Dennis Morgan: *I Was Country When Country Wasn't Cool*).

> Agriculture education is a leader in developing and promoting green agriculture practices.

In this issue of *The Agricultural Education Magazine* you will learn how a number of agriculture teachers are incorporating green principles, including sustainability, into their high school curriculums. Joe Green, a teacher at Pope High School, Marietta, Georgia, shares his lesson plan for Earth Awareness Week. Students inquire into topics such as GMO foods, carbon footprint, community supported agriculture (CSA), organic foods, fair trade, and water recycling to name a few.

Drs. Alston and English highlight the green initiatives of five high schools in North Carolina. Their efforts have included the manufacture of biodiesel; development of a an aquaculture/hydroponics unit; recycling aluminum, paper, and plastic; development and maintenance of a school garden, and raising rainbow trout. Many of these initiatives received grant funding to support their efforts.

As teachers we all take advantage of paper and copy machines. I will be the first to admit that I make my share of copies to distribute to my students. Tiffany Morey, an agriculture teacher at Essex County Vocational Technical School (NJ) discusses her efforts to eliminate "paper" from her program. She has accomplished this by utilizing various technologies into her classroom and curriculum.

Going "green" also involves protecting our natural resources. Matt Lenhardt and Don Rainey discuss ways to protect waterways and drinking water in Florida. They discuss Florida's Green Industries Best Management Practices (GI-BMP) curriculum and its certification process. The curriculum focuses on proper landscape fertilization and management practices.

Dr. Clardy and Brian Copeland approach the "green" initiative through sustainable school gardens and green education. They discuss their efforts with several middle and secondary schools in the Nashville, Tennessee area to implement sustainable school gardens.

In addition to the articles previously highlighted, we have information on learning landscapes/natural playgrounds (Dr. George Smith), alternative fuels (Dr. Cliff Ricketts), using technology (Liza Goetz), green animal management techniques (Anthea Saez, Lori Unruh Snyder and John Patterson), and a critique of a documentary on low-input verses traditional-input farm commodity production (Dale Gruis).

In an October 5, 2009 speech, President Obama stated, "*..... the Federal Government can and should lead by example when it comes to creating innovative ways to reduce greenhouse gas emissions, increase energy efficiency, conserve water, reduce waste, and use environmentally responsible products and technologies.*"

I would argue that we should substitute the words "agriculture education" for "the Federal Government." Agriculture education can and will be a leader in developing and promoting green practices in the agriculture industry.

Dr. Harry N. Boone, Jr., is an Associate Professor at West Virginia University and Editor of ***The Agricultural Education Magazine.***

CONTENTS

Theme: Going Green with Agricultural Education

Editorial:

Agricultural Education is Green.....2
by Harry N. Boone, Jr., Editor

Theme Editor Comments:

Going Green in Agricultural Education.....4
by John Ricketts

Theme Articles:

The Pioneering a Service-Learning Project in Costa Rican Communities to Promote "Greener" Animal Management through Agriscience..... 5
by Anthea Saez, Lori Unruh Snyder and John Patterson

Going Green in Agricultural Education..... 7
by Joe Green

Preparing Future Green Professionals Through Tarheel Agricultural Education..... 9
by Antoine J. Alston and Chastity Warren English

Going Green Beyond the Greenhouse.....11
by Tiffany Morey

American Meat: Food for Thought..... 13
by Dale Gruis

Applying the Green Industries Best Management Practices Training to Secondary Agricultural Education 15
by Matt Lenhardt and Don Rainey

Technology: It's Not As Scary As You Think..... 18
by Liza Goetz

Sustainable School Gardens and Green Education: Familiar Lessons through a New Lens 20
by Arvazena E. Clardy and Brian Copeland

Environmental Education + Learning Landscapes..... 22
by George R. Smith

Alternative Fuels: A Relevant Avenue to Integrate STEM in the Agricultural Education Curriculum..... 24
by Cliff Ricketts

Cover Photo: A natural playground (see full article on page 22). Photo courtesy of George R. Smith.

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Articles and photographs should be submitted to the Editor or Theme Editor. Items to be considered for publication should be submitted at least 90 days prior to the publication date of the intended issue. All submissions will be acknowledged by the Theme Editor and/or the Editor. No items are returned unless accompanied by a written request. Articles should be approximately four double spaced pages in length (1500 words). Information about the author(s) should be included at the end of the article. Photos and/or drawings appropriate for the "theme issue" are welcomed. Photos/drawings should be submitted in an electronic format (jpg or tiff format preferred – minimum 300 dpi). Do not imbed photos/drawings in the Word document. A recent photograph (jpg or tiff format preferred– minimum 300 dpi) of all authors should accompany the article unless photographs are on file with the Editor. Articles in the *Magazine* may be reproduced without permission but should be acknowledged.

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Going Green in Agricultural Education

by John C. Ricketts

Welcome to this issue of *The Agricultural Education Magazine*, "Going Green in Agricultural Education." It seems everyone wants to "Go Green!" What does it actually mean to change you, or your organization, to a nice calming color the shade of Kermit the Frog? Well, going green is simply a catchall pair of buzzwords describing a variety of activities conducted by a variety of people all with the ONE goal of sustainable agriculture. Without sustainable agriculture no one would have any other problems because they wouldn't last very long anyway given a grave limited food resource problem.

So, when you first read the theme, "Going Green with Agricultural Education" you may have thought this issue will be about interesting ways to involve your chapter in the popular and growing GREEN MOVEMENT that seems to have come to agricultural education over the years, and you are right. There are many excellent, recipe-oriented articles and several great examples herein to introduce your students to Going Green. However, I hope you see each article and the excellent educational opportunities discussed in this issue as a launching point for your students. I hope you and your students can see these or other related green activities you may already engage in as key tools and implements necessary for sustainable agriculture

> We are being green to be sustainable and this sustainability is purposed for our very survival.

The University of California (UC) Sustainable Agriculture Research and Education Program explains that sustainable agriculture focuses on three primary goals - environmental health, economic profitability, and social and economic equity. These goals are addressed in a way that allows us to meet our current needs without compromising our children's ability to meet their own needs in the years to come. This is a tall order; given studies suggesting that the world will need 70 to 100% more food by 2050 (Godfray et al., 2010). This need only keeps the global society at current hunger status quo, which is frightening as it is.

achievement. Each of these activities are important strategies helping the realization of the environmental, social, and economic sustainability goals. Sustainability goals and activities, including the "Going Green…" suggestions in this issue are usually grouped around some familiar areas of concern for those of us in agricultural education: Farming and Natural Resources (water, energy, air, soil), Plant Production Practices (selection, diversity, soil management, efficient use of inputs, farmer considerations), Animal Production Practices (management planning, selection, nutrition, reproduction, herd health, grazing management, confined livestock production), and The Economic, Social, and Political Context (food and agricultural policy, land use, labor, rural community development, consumers) (Feenstra, n.d.). So, as we GO GREEN in agricultural education let us remember that we are not just being "green to be seen" (not an original though I wish it were). We are being green to be sustainable, and this sustainability is purposed for our very survival. Going green is our opportunity, as agricultural educators to engage our students in global problem solving that will have to make a difference.

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Pioneering a Service-Learning Project in Costa Rican Communities to Promote "Greener" Animal Management through Agriscience

by Anthea Saez, Lori Unruh Snyder and John Patterson

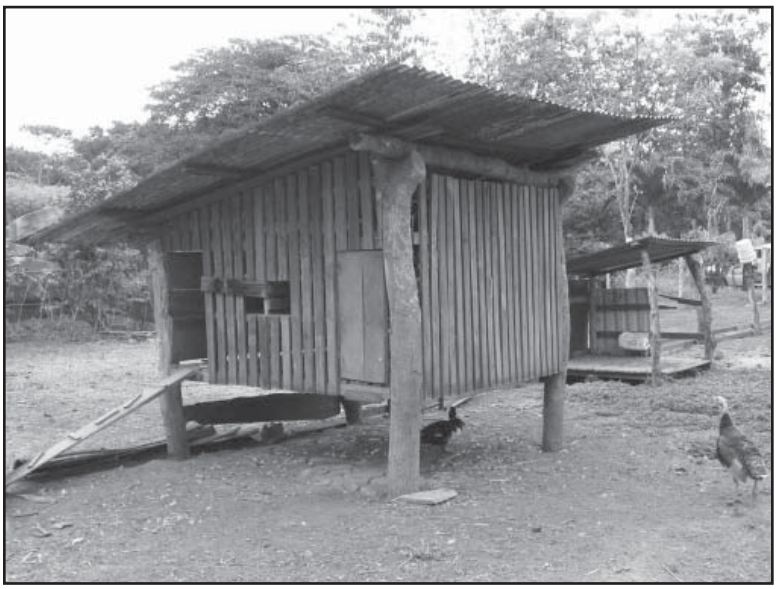
During a short-term study abroad course, we provided a new service-learning opportunity for students to work within local Costa Rican communities, where students were introduced to "green" or more eco-friendly techniques to help reduce the incidences of potential transfer of harmful bacteria within farm settings, as well as, sanitation issues. In this context, we visited a number of farms to explore the microbial issues where students saw first-hand the problems faced with animal agriculture systems and how sanitation challenges present themselves in the farmers' day-to-day lives and practices. Before departing to the farms we introduced the basic science of microbiology, asking the students to reflect on how science is related to the basic life skills needed for human and animal health. We wanted the students to apply science in a setting outside of the classroom to allow for authentic learning experiences that relate to real-world settings (Elliot, 2007). These experiences engaged the students' to think critically while directly interacting in the problem-like situation. The overall goal was to sample the local communities' livestock for S*almonella spp.*, an indicator organism, to demonstrate the risk from contaminated livestock to potential hazards to human health.

In order to encourage other agricultural education educators to replicate this study, the materials necessary are easy to use and to purchase. First, the module met the criteria for the American Society of Microbiology (ASM, 2011). We used aseptic techniques to enrich and isolate microorganisms under field conditions along with using media-based methods to identify samples potentially contaminated with Salmonella following the manufacturer's directions of the EnteroScreen 4 Diagnostic Kit (L225, Harder Diagnostics, Santa Maria, CA). Although we did not have access to laboratory facilities (autoclave, hoods, incubators, etc.), we adapted to the best of our ability given our limited resources for teaching abroad. The test samples were incubated overnight at ambient temperatures. Media was boiled on a kitchen oven-stove top, poured into appropriate sterile plastic centrifuge tubes and used within two hours. We diluted samples ten-fold in a peptone broth, which we brought from the USA (VWR International Inc., Batavia, IL). We homogenized by vigorous shaking of tubes by hand, transferred 10 % of the medium into Rappaport Vassiliadis (RV) medium broth selective for *Salmonella spp (*Acudmedia Manufactors, Inc.). We enriched each sample overnight in RV medium at ambient temperatures. We used sterile disposable loops to stab inoculate with Enterotubes (Hardy Diagnostics, Santa Monica, CA), which were then incubated overnight at ambient temperatures. The Enterotube 4 test kit was designed to be used with pure cultures of bacteria. However, prior to leaving for Costa Rica, we tested a number of pure *Salmonella* cultures and fecal samples spiked with *Salmonella.* Only samples containing Salmonella gave a positive color change indicative of *Salmonella*. Cultures that gave the appropriate color change for Salmonella were presumptively identified as *Salmonella*. No further tests were conducted to definitively identify the presumptive *Salmonella* cultures. All contaminated materials were sterilized using 10% Clorox bleach.

The desired impact on teaching and learning was to display the true-life realities of challenges faced with sanitation issues within communities to the students. We wanted to provide suggestions to the communities on how to make slight modifications to help "green up" their livestock technologies to improve management of livestock that could minimize health risks. The teaching and sampling

Collection techniques shown by student collecting fecal samples at a local pig farm in Costa Rica.

methods were student driven and the students divided themselves into teams. The first team provided a brief background history of the communities to all other students before visiting the farms. The second team was responsible for taking pictures of the animals on the farm, households and sanitary conditions of each farm. The third group of students gathered fecal samples from chickens, cattle (dairy) and pigs from two different lower income communities. The Pangola community was located near a primary rainforest north of San Miguel. The La Esperanza community was surrounded by tropical rainforest adjacent to EARTH University.



A poultry house in Costa Rica: one of the locations sampled by the students.

The students collected the samples in duplicate from at least four animal sites at six different poultry (chicken) and dairy/cattle farms for a total of 48 samples. Fecal samples were gathered from individual animals or the floor (swabbed if feces was not available). In addition, pictures of the animals feeding and sleeping conditions were recorded. All the students were taught to process the samples and analyze the data.

The results of the microbiology module were discussed with the students and the members of the local communities. The risks of working with livestock and proper sanitation were mentioned along with proper hand-washing was emphasized. All of the fecal samples from all species tested were positive for *Salmonella*. Given that we did not have the time or facilities to do extensive and specific studies on *Salmonella*, we felt that the Enterotube 4 kit gave an adequate indication of the presumptive presence of *Salmonella*. As part of the project, we had a reflection session where the students comments were as follows: (R1) "*Even though the conditions were poor, it was interesting to see the different management methods amongst the farms. One farm used the manure of the cows to fertilize the crops that were used to feed the household that ran the farm*"; (R2) "*Instead of feeding their pigs animal feed or forage they fed plantains and plantain leaves, which actually made the pigs feces a bright green color, but the feces odor was less unpleasant.*" The students' reflections were very insightful and critically reflected their true experiences.

The students recommendations for a more eco-friendly management for the poultry farms was to house the poultry away from the home and public foot traffic in order to lessen the occurrence of disease and transfer of pathogens to humans. It would be easier to determine the source of contamination (individual, flock, people etc) if the animals could be restricted to one area; then they can be either excluded or determined as a source of contamination. Housing the poultry in a fenced in area allows for easier management of each individual or flock along with cleanup and proper disposal of fecal matter; since it would be all in one designated area. The second recommendation

continued on page 26

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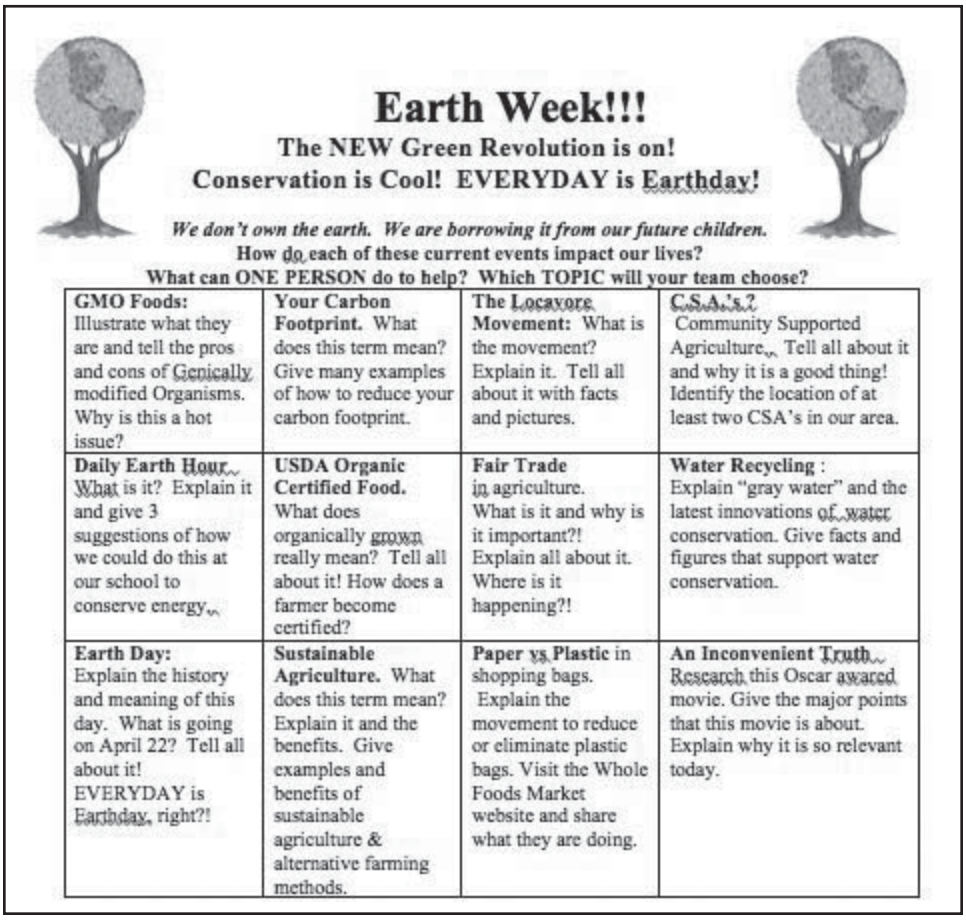
Going Green in Agricultural Education

by Joe Green

So Mr. Green, what's this thing called Earth Day? I know it's been around for 42 years, but shouldn't everyday be Earth Day?" That's the question that was posed to me by one of my more perceptive students recently. The more I thought about it, I realized he was right. As agricultural educators, we, more than any other subject area, should bear the responsibility of "going green with agricultural education" every single day in our classroom. If we truly practiced what we preach in this area, we would demonstrate principles of environmental stewardship that would help set the wheels in motion for this and future generations.

Ag teachers have so much on their plates already that some teachers may think adding a whole new unit on "Going Green" seems like a tall order. It may take a little research on your part, but you could begin by integrating just a small amount of these principles into every agricultural lesson you teach. By adding a little more "green" with each lesson, we can set the stage to break the paradigm of unsustainable environmental practices. Conventional agriculture may be feeding the world for now, but unless we teach our future farmers and future consumers the long term effects of careless environmental practices, we are leading them down an uncertain and unsustainable path for the future.

The thing I tell my students is that "living green" is not just a fad that we do one day of the year, or even one week of the year, in order to check the box for Earth Day. We are at the point where it must become a daily way of life so that every purchase, every meal, and pretty much every decision we make in agriculture is like a vote for the environment. Live it, breathe it, believe it. That's basically the definition of sustainability I tell them… making sound ecological decisions that do not degrade our planet or our resources for our future generations. It is an ongoing process similar to feeding the soil. It is not a quick fix like only feeding the plant with no regard for the future of the soil in which it grew. We have to ask ourselves what are we leaving behind? Are we preparing our planet for future generations or are we depleting our resources with little regard for the next generation?



Earth Week!!!

The NEW Green Revolution is on!

Conservation is Cool! EVERYDAY is Earthday!

We don't own the earth. We are borrowing it from our future children.

How do each of these current events impact our lives?

What can ONE PERSON do to help? Which TOPIC will your team choose?

GMO Foods: Illustrate what they are and tell the pros and cons of Genically modified Organisms. Why is this a hot issue?	**Your Carbon Footprint.** What does this term mean? Give many examples of how to reduce your carbon footprint.	**The Locavore Movement:** What is the movement? Explain it. Tell all about it with facts and pictures.	**C.S.A.'s?** Community Supported Agriculture,, Tell all about it and why it is a good thing! Identify the location of at least two CSA's in our area.
Daily Earth Hour What is it? Explain it and give 3 suggestions of how we could do this at our school to conserve energy,,	**USDA Organic Certified Food.** What does organically grown really mean? Tell all about it! How does a farmer become certified?	**Fair Trade** in agriculture. What is it and why is it important?! Explain all about it. Where is it happening?!	**Water Recycling** : Explain "gray water" and the latest innovations of water conservation. Give facts and figures that support water conservation.
Earth Day: Explain the history and meaning of this day. What is going on April 22? Tell all about it! EVERYDAY is Earthday, right?!	**Sustainable Agriculture.** What does this term mean? Explain it and the benefits. Give examples and benefits of sustainable agriculture & alternative farming methods.	**Paper vs Plastic** in shopping bags. Explain the movement to reduce or eliminate plastic bags. Visit the Whole Foods Market website and share what they are doing.	**An Inconvenient Truth** Research this Oscar awared movie. Give the major points that this movie is about. Explain why it is so relevant today.

Soon after that student's question about Earth Day, I developed a lesson plan to address the topic. The more I prepared the lesson, the more I realized that this topic of *Going Green in Agriculture* could be an entire course in itself. While most of my students had a thumbnail understanding, and a real curiosity, of hot topics like going green, global warming, recycling, and carbon footprints; very few of them could really give you accurate detail about those topics. Any good Ag teacher knows that when opportunity meets curiosity you have fertile ground for teaching a lesson that will engage students. Enter Mr. Green's Earth Awareness Week assignment. I will give a brief summary here of how this project worked for me in hopes that you will consider making this April 2012, Earth Month for your agriculture students.

I began by identifying 12 green topic areas that seem to be in the news and that represent good prac-

tices upon which any student could personally act. (see chart of topics). Like any new project that you introduce to students, half the battle to get them engaged is in how you present, or sell, the idea to them. Your personal enthusiasm is first priority to make it work. "Kids, I have a fantastic SURPRISE for you today!" Next, I give them the benefit of choice. Using PowerPoint, I post a grid of all 12 topics on the big screen. I explain that only one team will be allowed to research each topic and once that topic is chosen, you will have to select a different one. I choose to make it a team project. You can let them rush to your desk to sign up for the topic of their choice, first come first serve. Or you can throw them a curve ball with the blindfold method. By this method, I blindfold a student representing his team. I spin him around 3 times and then hand him a laser pointer. His team mates have 30 seconds to verbally "guide" him on the big screen to the topic they would like. Sometimes I allow teams to barter or trade topics too. Once you've got them primed and pumped for their topic, you review the grading guidelines and the project pretty much teaches itself from there. We use the computer lab to begin our research. The grading guidelines are as follows:

Two visual aids will be required to present the topic: a PowerPoint and a banner.

- Research your topic and come up with 20 accurate facts about the topic.
- Create the coolest PowerPoint ever.
- You must include an opening and closing slide that includes the topic title and all team members' names.
- Each fact must be presented on a separate slide, and must include either a photo, illustration, or video imbedded.
- Each team member must contribute at least 5 slides to the presentation.
- Banner: These will be displayed in the school, and should clearly explain the topic using text, photos, and artwork. Encourage the use of bold lettering, multiple colors, and illustrations. Create the banner as if you were explaining the topic to someone who knows absolutely nothing about the topic.
- Presentation: Each team will present their Earth Awareness project in class for a grade.
- **BONUS POINTS**: Any team that presents <u>10 additional methods</u> to help "save the planet" will be awarded bonus points. However, these additional facts must come directly from *The Green Book* by Elizabeth Rogers and Thomas Kostigen (available at bookstores or the web for $12.95). This is a great little book where students really enjoy discovering everyday practical methods for saving the planet one step at a time.

The Green Book for extra credit.

I find that my students become excited about this project and are especially proud to present their banners in the hallways of the school. Team photos with the banners are a nice touch as well. On the day we present the PowerPoints, I invite my principal down. I am amazed at how savvy some of the presentations are as students incorporate music, video, and photos into their show. I allow a full week to complete this project and constantly encourage their creativity. I spend most of the week strolling through the teams and giving positive comments as a formative assessment. A suggested rubric for the assignment is as follows:

- 25 points – Does the PowerPoint have at least 20 relevant and accurate facts represented?
- 25 points – Does each slide have a photo, illustration, or video imbedded?
- 10 points – Does the PowerPoint have an opening and closing slide?

continued on page 26

Joe Green is the Agriculture Teacher at Pope High School, Marietta, GA.

Preparing Future Green Professionals Through Tarheel Agricultural Education

by Antoine J. Alston and Chastity Warren English

The great 19th century poet and philosopher Henry David Thoreau once wrote, "What's the use of a fine house if you haven't got a tolerable planet to put it on?" This statement holds many implications for agricultural education as a whole. When one considers the deep connection between the environment and agriculture, and the demands placed upon the environment by agricultural practices, it is imperative that agricultural education promotes agricultural literacy in order to ensure that society, both consumers and producers, make informed decisions about the wise use of the earth's natural resources. Given the emphasis placed upon "green" initiatives and healthy living today, 21st century agricultural education must have an increased emphasis upon the "green" side of the agricultural sciences in the curricula.

The agricultural industry is the nation's largest employer, accounting for more than 24 million individuals employed in various phases such as food and fiber production, agriscience research, environmental conservation, and agricultural retail (American Farm Bureau, 2008). North Carolina's agricultural industry, including food, fiber, and forestry, contributes $70 billion annually to the State's economy, accounts for 18% of the State's income, and employs over 18% of the work force serving as the state's largest industry (North Carolina Department of Agriculture and Consumer Services, 2011). Given the importance of green initiatives to 21st Century Agriculture, how are North Carolina's secondary agricultural education programs preparing the next generation of "green" agricultural leaders?

At Brevard High School, in Brevard, North Carolina, the agriculture program has taken several steps to address going green. Over the past several years they have worked in partnership with the AP Chemistry classes to demonstrate the process of making biodiesel from waste vegetable oil (WVO) in the agriculture mechanics shop. Their students have collected waste oil from area restaurants and individuals, prepared test batches, titrated samples, and completed large batch conversions of biodiesel. This project has been mainly used for research and demonstration instead of large scale production, but has inspired many students to further research and investigate the potential agriculture holds in the future of alternative fuels.

> Agricultural education must have an increased emphasis on the "green" side of agricultural science.

The Alexander Central High School Agricultural Education program, located in Taylorsville, North Carolina, recently received a Lowes Home Improvement Grant for $3300.00 to install an aquaculture facility to furnish a safe food supply and provide an alternative to harvesting fish from natural waters. Students also learn how to convert fish waste to usable plant food. Students enrolled in the environmental and natural resource course, work throughout the county to recycle aluminum and plastic containers and have collected over 1500 pounds of recyclable metals. Agriscience and horticulture students have a vermiculture and organic waste compost pile, which uses night crawlers and natural microorganisms to break down organic waste. This chapter was cited as a "Going Green" chapter in North Carolina.

The FFA Academy of Agriculture and Natural Sciences located at Cape Fear High School in Fayetteville, North Carolina, initiated and began a recycling program six years ago, the first year the academy was established there. The program initiated a community service project named "Let's Get Green" that was adopted by all the departments in the school. Throughout the school colored bins are located to collect items for recycling such as cardboard, newspapers, magazines, glass, batteries, electronic equipment, tin cans, and books. In addition the program has instructional projects, which involve solar technology, composting, and the restoration of the school's nature trail. The efforts of the program have trickled down to their middle school as well. They now have recycling bins identical to the ones at the high school. This is a great recruitment tool for the program, since the students come into

the high school already accustomed to recycling from the middle school. Cape Fear High School was designated a "green high school" by Cumberland County last year, the first high school in the county to receive this designation, as well as being designated as a Going Green Chapter by the North Carolina FFA Association.

Students within the Smithfield Selma High School Agricultural Education program developed and have maintained a school garden for the last several years. It has been done in cooperation with Horticulture I and II students working with the Life Skills class at the school. The students grow tomatoes, cucumbers, squash, and peppers successfully. Students are in charge of preparing the soil, planting the seeds, weeding, and harvesting the produce. Students see where their food comes from and also have the opportunity to work with the special needs students at the school. The overall project has been deemed to be a rewarding experience for everyone involved. The program was also recognized two years ago as one of North Carolina's "Going Green" chapters.

The Ledford High School Agricultural Education program in Thomasville, North Carolina, another "Going Green" chapter, has initiated several green initiatives in the curriculum. The chapter members teamed up with several earth science classes at their high school to start a recycling program. They collect paper, aluminum cans, and plastic bottles. They purchased and placed recycling bins in each classroom. Each week they collect these materials and place the recyclables in specialized bins for transportation to a nearby recycling center. The chapter also created a trifold brochure full of energy conservation tips and techniques which was displayed at the local county fair. The chapter also secured grant monies to buy equipment to make biofuels. Their biotechnology classes investigate the fermentation process and the energy released by the combustion of ethanol and kerosene. Students also measure and compare two by-products of the two fuels – CO2 and particulate matter. They then compare results and discuss the trade-offs of biofuels and fossil fuels as sources of energy. The chapter also partnered with the local Trout Unlimited Chapter to raise rainbow trout in the classroom. The trout were then released in Stone Mountain Park. The chapter performed stream clean ups on two occasions with the Trout Unlimited Chapter and performed studies of water quality and macro invertebrates.

Green initiatives within agriculture will play a major role in the global economy of the future. By 2030 there will be 1.7 billion more mouths to feed, with the ratio of arable land to populations declining by 40-50%. Over 1.8 billion people will be living with absolute water scarcity by 2025 (Crop Life International, 2009). Projections for the future have growth at nearly 9 billion by 2050. The United Nations Environment Programme (2009) predicts that the global demand for food will increase by at least 2.5 times the current amount by 2050. All of these factors, coupled with a decreasing farm labor pool are seriously stretching limited resources, which speaks to the need to produce future agricultural leaders.

The National Academy of Science (2009) indicated that the agricultural workforce of today must respond to changes in the physical, economic, and social environment surrounding agriculture. Professionals in the field of agriculture must constantly stay abreast of continuing changes with respect of health and nutrition issues, consumer preferences, national security concerns, environmental impacts, and many other factors. In June 2008, former Senator Barack Obama indicated that "A green, renewable energy economy isn't some pie-in-the-sky, far-off future – it is now. It is creating jobs – now. It is providing cheap alternatives to $140-per-barrel oil – now. And it can create millions of additional jobs, an entire new industry, if we act – now." President J. F. Kennedy once stated that, "Change is the law of life. And those who look only to the past or present are certain to miss the future." Given the aforementioned statements how will secondary agricultural education prepare the 21st Century "Green" Agricultural Workforce? Only time will answer this question and the many other challenges facing earth's precious natural resources.

continued on page 27

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Dr. Chastity Warren English is an Assistant Professor at North Carolina Agricultural and Technical State University

Going Green Beyond the Greenhouse

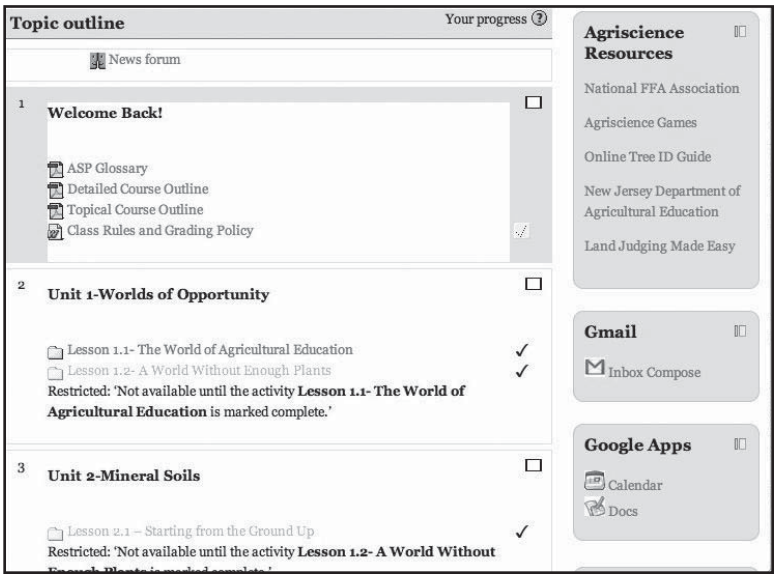
by Tiffany Morey

The world today is hooked on the idea of "going green." From installing solar panels on homes and businesses to driving hybrid cars, the efforts to be more environmentally friendly are becoming more and more visible. As a very ecofriendly person in my personal life, I decided to challenge myself to adopt a similar attitude when it comes to my agricultural science teaching practices.

I will be the first to admit that up until this school year, I had a very close relationship with my school's copy machine and was a regular tree killer with the amount of paper used for my agricultural science classes. As a CASE instructor, it seemed as if I was constantly making copies of the activities that would eventually fill students' extremely large CASE binders. My desk was usually covered in stacks of activity sheets, and the grading bins were overflowing with the assignments students turned in on a daily basis. I realized how much paper was being wasted, and decided to see if there were ways to expand the "green" in my program beyond the school greenhouse and into the classroom.

Last year, my school district was awarded a grant that allowed for the purchase of technology items for my school. A school Google server called Moodle was launched and all staff and students received their own e-mail account with all of the features of a regular Gmail account, including GoogleDocs. Brand new MacBook Pro laptops were purchased for use in the classroom through computer carts that could be signed out, and a plan to outfit everyone in the building with their own laptop was put into place. Teachers received their laptops throughout the spring, and on the first day of school this past September, our school officially went to a 1:1 laptop program for the students.

This massive influx of technology provided a host of new ways to go "green" in my agricultural science classroom. With the launch of Moodle, I started having students collaborate on CASE assignments using their laptops and GoogleDocs. This allowed them to have instant access to information and data from their labs and to work together to make sure that their work was complete and correct. In addition, they were able to submit these assignments electronically instead of on paper, which led me to wonder if it would be possible to do this for all their CASE activities.



The answer came quickly. Part of the Moodle server included a section where teachers were able to set up their own course websites. Over the summer I began experimenting with setting up a site for the CASE Plant Science course that I would be teaching when the new school year started. The CASE curriculum is entirely on the computer and organized by unit and subunit with all activities, assessments, and PowerPoints available as downloadable files that are printed for student use. I decided to set up my course page in a similar format and uploaded links to all the activity files for each unit and subunit. Sections were also included for class rules and procedures, FFA resources, and links to websites the students would be using on a regular basis. By the time school started, the Moodle CASE Plant Science page was ready to go and I couldn't wait to try it out with my students.

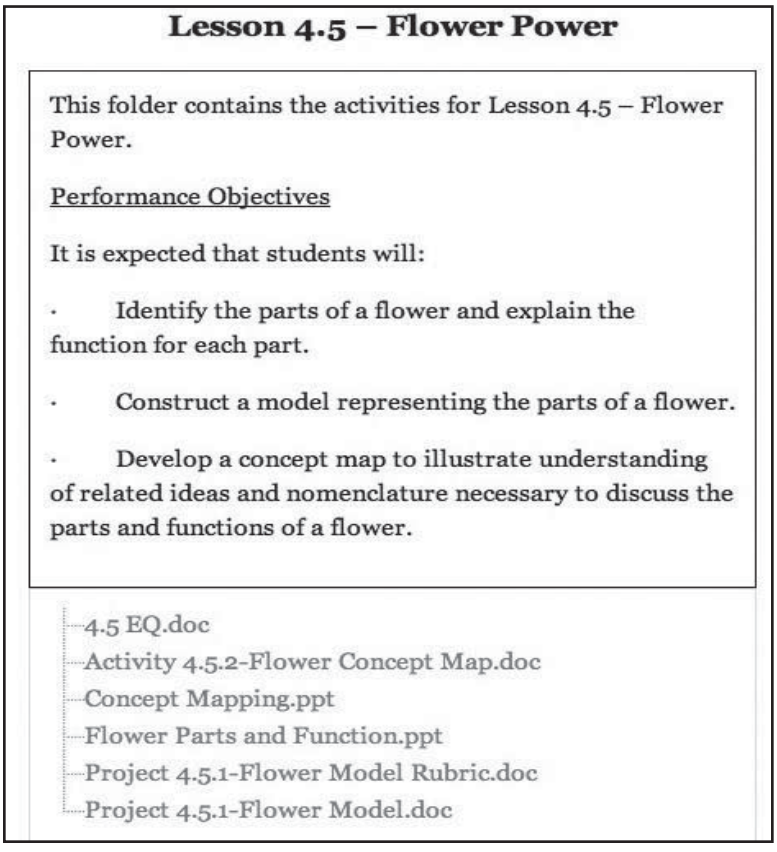
Initially, the students struggled a bit to grasp the format of the online CASE course. They were quite surprised to find that their assignments would not be done on paper as they had been done in the past, but would instead be done on the computer and submitted electronically. After we went over each CASE PowerPoint in class, it was uploaded to the site for students to use as a study tool. When it came time for assessments, those files were uploaded as well and students would submit them via e-mail. Students saved their CASE assignments on their computers and soon had a growing electronic portfolio of their work. They were no longer struggling to keep their paper assignments organized and their CASE

binders up to date and began to get more and more comfortable with the technology available to them with their laptops.

The use of this technology has made it so that my CASE Plant Science course is indeed "green" in more ways than just the plants that are being grown in the greenhouse. With the exception of a few activities that require students to sketch their observations or show their mathematical calculations, it is an entirely paperless course. Students have even started making their CASE poster projects online using Glogster, and have become quite proficient in creating interactive and eye-catching Glogs to display the information they have researched on our school's digital bulletin boards. The students have really come to love the format of the online course site and I plan to try it in future years with other courses.

Plans are also in the works for each CASE curriculum to include a student version so that students will also have access to CASE documents on the computer. According to CASE Project Director Dan Jansen "Both ASA and ASP will have a student version available for fall 2012. Student versions will include all activity, project, and problem worksheets so students can complete the assignments on Word® and submit them electronically for grading. Students will have access to PowerPoints and other materials for remedial studies and reference later in the class. Students will also have access to an Agriscience notebook component to record class notes and store all assignments. The notebook projects will have a research component that students must complete throughout the school year."

For those ag teachers whose schools do not have a Moodle server, you can create a similar online course site for your agricultural education classes using Edmodo. Like Moodle, students log in with a user name and password and you have the option to upload assignments which students view as a "library" of their work. You can even create discussion forums to interact with students in small groups and as a place for them to ask questions and talk about assignments with one another. You also have the option to create a drop box where students can submit assignments and then view feedback once you have graded them. Edmodo is free and is already being used by many ag teachers who want the convenience of an online course site but don't have access to Moodle.


Lesson 4.5 – Flower Power

This folder contains the activities for Lesson 4.5 – Flower Power.

Performance Objectives

It is expected that students will:

- Identify the parts of a flower and explain the function for each part.
- Construct a model representing the parts of a flower.
- Develop a concept map to illustrate understanding of related ideas and nomenclature necessary to discuss the parts and functions of a flower.

4.5 EQ.doc
Activity 4.5.2-Flower Concept Map.doc
Concept Mapping.ppt
Flower Parts and Function.ppt
Project 4.5.1-Flower Model Rubric.doc
Project 4.5.1-Flower Model.doc

In addition to the CASE course website, I have also started to incorporate iPads into my agricultural science classroom. My school purchased a cart of 30 iPads earlier this year and I have found a lot of great apps to use with my students. When I am teaching a unit on soils, I have students perform their analysis of the soil profile and then compare them to the SoilWeb app data for the soil in our area. For plant identification, students practice with the online dichotomous key and the textbook and then use the Leafsnap app to take a picture of the plants they are identifying and upload it to the app's database to see if they were correct in their identification. CellsAlive! is an interactive app that allows students to view 3D models of the cell and GrowItKnowIt serves as a way for them to test their knowledge of where their food comes from. CEV has some great apps out there to prepare students for the Environmental Science and Floriculture CDEs, and there are even apps that

continued on page 27

Tiffany Morey is a Teacher of Agriscience, Essex County Vocational Technical Schools, West Caldwell, NJ.

American Meat: Food for Thought

by Dale Gruis

I couldn't help but feel deeply skeptical when a young man I'd never met approached me at the Iowa State Fair last August and asked whether I'd like to attend his documentary film, "American Meat," later that evening.

"Is this a PETA or Humane Society thing?" I asked, not wanting to be duped into seeing another anti-meat film. He replied, "No, in fact we will have a question and answer panel after the documentary. Several Iowa farmers are in the documentary, and I know I need to connect with FFA members. "

Still not wanting to be duped, I asked, "The question and answer panel, what names would I recognize?" He reeled off several, but sold me with the executive director of the Iowa Pork Producers Association, whom I knew I could trust.

That was my introduction to Graham Meriwether, a 32-year-old New York City filmmaker who has spent the past five years crisscrossing the country chronicling the story of America's meat farmers and whose film has been seen by thousands of Iowa FFA students.

In my role as Iowa's FFA Advisor, I've been honored to help Meriwether connect with chapters across the state. I couldn't be happier at the kind of critical thinking the film has evoked among our students and community members about the nature of what we do, the respect and care we have for the environment, and what it truly means to "Go Green."

It's reminded me afresh of the principles I've lived as a high school ag teacher and as an FFA Advisor. Some educators utilize the BQLTN approach (Be Quiet Listen Take Notes). I am proud that the Ag Ed Model has de-emphasized memorization in favor of promoting understanding through application. (i.e., Learning to Do, Doing to Learn, Earning to Live, Living to Serve).

My greatest joys as an Ag teacher have been to encourage students to question traditional thinking, not because traditions are bad but because doing something we've always done isn't always wise, particularly in today's fast-changing world.

> It raises questions about producing food as cheaply and quickly as possible.

Without taking sides, '*American Meat*' raises questions about the traditional thinking of producing food as cheaply and quickly as possible, and asks whether there aren't alternatives. Rather than organic vs. non-organic, the documentary addresses low-input vs. traditional-input approaches toward production. Ag Ed is not just about farming, but some traditional farming approaches are becoming too expensive for many students to pursue. In the Midwest, many shrinking rural economies reflect the significant reduction of manual labor in agriculture. The documentary gives me hope that alternative forms of livestock production may increase the demand for labor in agriculture and increase some rural populations and economies. (Manual labor that some cubicle-dwellers would appreciate.)

Will increased manual labor increase the cost to produce a product? Yes, but niche, or grass-fed, markets exist for consumers who are willing to pay more for organic production. Does the average consumer know the people who produced their food? No, but niche markets exist to serve consumers who want more of a personal connection to farmers who produce their food.

In a nutshell, the movie features conversations with both traditional and grass-based livestock producers. For me, the movie also made me reminisce about stories my dad had told about his life growing up on a farm. When he was a kid everything on the farm was organic. Everything was green until it turned brown. The film also reminded me that fossil fuels are a finite resource. As more and more people utilize this finite resource, a time may come when fossil fuels are too valuable to be utilized to ship food around the world as we do today.

At the lively give-and-take after the film I saw in Des Moines that August night, I was surprised and delighted by all the questions, comments, and 'out-of-the-box' thinking I heard among traditional and niche farmers alike, among young and old. So were three of my fellow FFA colleagues I'd persuaded to leave the fairgrounds to see the movie. I thought immediately: "How can I get

more educators involved."

When I learned Meriwether was bringing the film back to Iowa in October, I reached out to FFA advisors across the state. A dozen of them, most from the heart of traditional farming areas, seized the opportunity immediately. What followed was gratifying. More than 600 students and community members saw the film and held question-and-answer discussions that were excellent critical-thinking exercises.

Listen to what two Ag Ed students, aspiring young farmers, said about '*American Meat.*'

"The film gave me a different view of where farming could be in the future," said Josh.

"It opened my eyes to a greater variety of agriculture. I hadn't seen the niche farms, the grass-based farms, from the perspective of an actual person involved in it. It gave me a perspective of how an actual farmer feels and does his own work."

Peyton, another Ag Ed student, said: "The panel discussion [after the film] was really great. Everybody walked away having learned something. Some of the farmers in the community were a little put off but that always happens. What Graham [Meriwether, the filmmaker] did was great, he said, 'First of all, thank you for what you do.' He wasn't trying to put down what they [commodity farmers in audience] do. He was just trying to present an alternative."

Their Ag Ed teacher, Juston Lamb of Pekin High School, was delighted with what the movie, and the discussion, prompted from everyone who came to the screening. "It was a chance for kids to think and, to me, that was the attraction -- it makes students think. Our debate is where our kids really got their eyes opened."

Lamb also thought the film served another purpose. "FFA chapters sometimes get so busy we miss out on the opportunity to educate our consumer. And that's exactly what this film does. It's a perfect opportunity to bring information to our students, our community, and let them think about it, and digest it. It's an opportunity to educate beyond the classroom."

I hadn't seen the niche farms from the perspective of an actual person involved in it.

In a survey I conducted with the 12 FFA chapters who saw the film, 98 percent of the participants said they'd recommend the film to another student or another FFA chapter; 93 percent said the panel discussion with community members and the filmmaker was very valuable.

The success of the October screenings, which were funded by Sustainability Research Institute (SRI) of Fairfield, IA and Applegate Natural and Organic Meats of New Jersey, prompted Meriwether to return to Iowa in February where he's scheduled more than 35 screenings at FFA chapters and at least four college campuses.

The success of the film reminded me again of a truism about teaching young people about farming and other subjects. The question mark may be an educator's most powerful tool. Do future agriculturalists need to understand the power of the question mark? Does agriculture society need critical-thinkers who never fail, or critical-thinkers who learn from failure? I come down on the side of those who learn from failure, or as the industrialist Henry Ford put it so well: "Failure is simply the opportunity to begin again, this time more intelligently."

I encourage agricultural educators (secondary and postsecondary) to consider viewing *American Meat* with your students. In terms of "Going Green," this documentary can help students and educators ask important questions.

To obtain a DVD of *American Meat* or schedule a screening, contact:

- Graham Meriwether, producer, graham@leaveitbetter.com or 917 514-2028;
- Heath Meriwether, media & development coordinator, heath@leaveitbetter.com or 860 806-3073

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Applying the Green Industries Best Management Practices Training to Secondary Agricultural Education

by Matt Lenhardt and Don Rainey

Protecting our waterways and drinking water is an important challenge facing the state of Florida. For the many industry professionals that are in the golf course, agricultural, nursery, landscape, and grounds maintenance industries, fertilization and pest control applications are a routine and essential service to their farm or clientele. Unfortunately, improper fertilization and maintenance techniques on turf and ornamentals can cause leaching of nitrates, phosphorous, and other pollutants into Florida's unique waterways and aquifers. As a result, specific Ag and Non-Ag Best Management Practices have been put in place to reduce the level of nutrients and pesticides leached.

The University of Florida Institute of Food and Agriculture Sciences (IFAS) Extension, Florida-Friendly Landscaping™ program addresses the educational needs for the 'Green Industry' professional via the Florida Friendly Best Management Practices for Protection of Water Resources by the Green Industries (GI-BMP). The GI-BMP program incorporates the Florida Friendly-Landscaping™ Principles. Florida-Friendly Landscaping™ (FFL) means using low-maintenance plants and environmentally sustainable practices based on proper design and landscape maintenance, while at the same time saving time, energy and money. For example, 'Right Plant, Right Place is one of the guiding principles taught in the GI-BMP program.

Several industry specific best management practices exist with different educational material. For example, the golf course and agricultural industries have their own specific best management guidelines. The Green Industries Best Management Practices (GI-BMP) were developed in cooperation with the Florida Department of Environmental Protection, the University of Florida, and other industry leaders, and are targeted specifically for landscape professionals, or anyone who applies fertilizer on a "for hire" basis, emphasizing a comprehensive approach to lawn care.

> Protecting waterways and drinking water is an important challenge.

According to the Florida Department of Environmental Protection, the GI-BMPs are a science-based program and "provide information and guidance on turfgrass and landscape management practices to minimize nonpoint source pollution in order to conserve and protect Florida's water resources." It is also "intended to enhance the professional knowledge and judgment of turfgrass and landscape workers." While this certification is currently voluntary in Florida unless mandated by specific counties, beginning in 2014, a GI-BMP certification and license will be required of all green industry professionals that apply fertilizer on a commercial basis. This is an individual license, meaning that *anyone* on the job that applies fertilizer must have this license, not just the owner of the company or crew leader.

The purpose of the trainings, which are administered primarily by Extension agents and certified industry instructors, is to emphasize why proper landscape fertilization and management practices are an important component of preserving water quality for humans and wildlife. Details of the overview include understanding how ground and surface water move from residential lawns, percolate through the soil, and eventually make it to our rivers and aquifers.

The GI-BMPs give landscape professionals information on proper irrigation, design and installation, fertilizer application, pesticide application and storage, proper cultural maintenance practices, as well as an overview emphasizing the important role that Florida's unique waterways play in our daily lives and why it is so important to protect them. Attendees will also learn about the advantages of using slow release nitrogen versus quick release nitrogen, as well as figuring the correct amount of fertilizer to apply and proper spreader calibration. Once a participant has attended the training, they are then required to pass a post-test to receive the GI-BMP certification.

There are five modules, plus introductions, testing, etc. Module 2 is 80 minutes, the others are 50 minutes each.

1. Overview of nonpoint source pollution, laws, effects on water quality; effects on business, economy, and quality of life; and best management practices as both good business and environmental benefit.

2. Florida turfgrass species, landscape plants and characteristics, and BMPs for cultural practices including: fertilizer requirements and the effects of landscape design, mowing, pruning, irrigation, shade, wear, pest, disease, cold and heat stresses on fertilizer materials, amounts and timing; and conversely, the effects of fertilization on these cultural aspects in addition to direct effects on water quality, including nutrient pollution, erosion and sedimentation, and water usage rates.

3. Irrigation systems and the effects of irrigation on volatilization, leaching, runoff, water conservation and water quality issues; effects of over or under irrigation on plants and fertilizer needs; effects of irrigation water quality and reclaimed water issues; recognizing of irrigation problems; and importance of proper repair to maintain distribution uniformity to prevent spot leaching and runoff of fertilizers, which may result in more fertilizer use and more pollution.

4. Fertilizer characteristics and selection, including physical and chemical properties; soil type, pH, temperature, and moisture effects on release rates; calculation of application rates; spreader calibration; materials handling, and spills.

5. Pesticide licensing law, including fertilizer-pesticide mixtures; integrated pest management, environmental effects, and safety; effects of fertilizer application on pesticide use; and effects of some pesticides on fertilization requirements.

While it is too early to assess changes to water quality in response to this educational program, it is clear that the industry has noted the importance of complying with the GIBMPs in 2011. According to GI-training exit evaluations, 3002 (98%) out of the 3112 participants responded they will use or already use the recommended fertilization rates and methods of application as presented in the training materials. In addition, 3007 (98%) responded positively when asked if their knowledge of the Green Industries BMPs and how they affect the lawn care industry has increased because of the program. Following initial reluctance on the part of some to embrace the concepts or promote the program, the regulatory events that have unfolded at both local and state levels have led to more widespread acceptance of the practices and the program in general. Additionally, as public awareness of the program has grown, "GIBMP Certified" has become a marketing tool. According to the training evaluation, 2966 (98%) participants responded favorably to informing clients of the recommendations contained in the BMP manual that apply to their situation.

Support of the program from industry leaders statewide has helped to enhance participation and compliance among the industries. According to Pete Snyder, Executive Director of the Florida Turgrass Association stated *"…industry's challenge: to make sure that all involved in the turfgrass industry are doing the right by adhering to the BMPs that have been substantiated by peer-reviewed science. We need to encourage them to follow the BMPs and to take classes."* Paul Mitola, Environmental Specialist III, Florida Department of Agriculture and Consumer Sciences states, *"Your best defense is training"* when it comes to preserving industry and (your) job.

In terms of changing industry behavior, there are numerous indicators that participants have incorporated BMPs that may have a direct impact on water quality into their work practices. The Florida-Friendly Landscaping™ GI-BMP statewide office collects data annually to measure change. A follow-up training survey was sent out to approximately 4000 individuals statewide with 525 responding, representing 41 counties. The survey consisted of 29 questions, regarding ways in which their practices have changed since taking the training. Questions were based on before/after questions, select value, and yes/no. Some of these that directly impact water quality include as reported **after** taking the training:

- Combined 84% reported often and always decreased fertilizer application prior to heavy rainfall
- Combined 85.5% reported often and always increased use of non-fertilized buffer zones around water bodies
- Combined 78% reported often and always increased use of deflector shields on spreaders
- Combined 60% reported often and always increased soil testing, particularly for soil P
- Combined 82% reported often and always proper calibration of fertilizer and pesticide applica-

tion equipment

Personal communication with numerous attendees and written comments from class evaluation and follow-up surveys over the years indicated that the majority of the program attendees welcomed the information provided and that many were previously unaware of many of the potential implications of their activities on quality of ground and surface waters. Many attendees indicated that they had not considered the watershed concept in correlation with their activities. The majority was willing to be seen as positive environmental forces and to make needed changes in practices to be in compliance.

In conclusion, The GI-BMP program is a common sense approach to sustaining landscapes and enhancing professional knowledge. According to the GI-BMP manual "…Simply put, only you, the people working every day, mowing, pruning, planting, weeding, fertilizing, watering, taking care of pest problems, and teaching your customers how to properly care for their lawn, can make a difference in the effects our landscapes have on our natural resources. Governments can regulate and educators can teach, but only the individual working in the yard can actually make a difference."

Citrus County Extension links the public with the University of Florida/ IFAS' knowledge, research, and resources to address youth, family, community, and agricultural needs. All programs and related activities sponsored for, or assisted by, the Institute of Food and Agricultural Sciences are open to all persons without discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations, genetic information and veteran status as protected under the Vietnam Era Veterans' Readjustment Assistance Act.

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Florida-Friendly FAQs for FDEP, FDACS, and UF-IFAS on 2009 legislative bills SB494 and SB2080 (2009)

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Upcoming Themes

July - August

Using Interactive Technologies in Agricultural Education

Facebook, Twitter, personal response clickers, texting, gaming technologies…. The list of interactive technologies goes on. How are agricultural education teachers taking advantage of interactive technologies to enhance their educational activities?

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September - October

The CASE Initiative

The Curriculum for Agricultural Science Education™ (CASE™) project has developed a structured sequence of agriculture courses and serves as a model for elevating the rigor and relevance of agricultural education. This issue will explore the successes of the CASE™ curriculum in agricultural education.

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Technology: It's Not As Scary As You Think

by Liza Goetz

Technology. The mere mention of the word brings mixed emotion. To some technology is a blessing; others find it to be intimidating. Fortunately as ag teachers we are used to wearing many hats and are flexible in our instruction methods. My name is Liza Goetz and I am fortunate to work at Kent County High School in the rural Eastern Shore area of Maryland. Some may say being a small school can be hard, but I wholeheartedly disagree. I think it has given us the flexibility to focus on things with our students that others may not always have the opportunity to access such as technology integration.

We are a school that has technology as a focus for our students. While not every class is structured this way, instead of a textbook I use Moodle for assignments and communication. We use very little paper and utilize computers almost everyday. Are their times when the kids sometimes get distracted by games? Yes. Do I redirect and work really hard to keep them on task? Everyday. It takes more work, more monitoring and more communication of expectations for a classroom like this to work. Once routines are established the class practically runs itself. Kids have more interest because it is communicating to them on a level they are familiar with. Tell a student they need to answer five conclusion questions about a lab and they may groan. Tell them to text you the answers and they are quick to respond and eager to participate. Lets face it, computers are here to stay. We have to figure out ways we can engage our students and make sure they are ready for their next phase in life.

Whether students choose to attend college or move directly into a career they need to learn how to use technology wisely. School is a great training ground for this. When students make decisions about the use of technology in a way that is not education based such as trying to text a friend on a cell phone for instance, I often will tell talk to them as if I were their boss asking them if that type of communication will help them get a raise or make a bonus. When you put it in real world context it changes the perspective from being the "mean teacher who doesn't let them have any fun" to a person who cares about them and their future.

Students today are immersed in technology. When I was a student we had computers that had terms like *tower* or *hard drive*; you couldn't pick up and move them anywhere. They were huge! There was no Internet. How times have changed! How many of us have struggled to explain to students a concept they will see only under the microscope? How many of us have had students confused by a cellular concept? Then they say oh I see it only to find out what they were looking at was the pointer in the microscope, not a cell or a nematode like they were supposed to find? Technology has bridged this gap for us nicely. Instead of telling students what they should see, today all we have to do is attach the USB cable to the Microscope Eyepiece and project right on the board an example of what they should find. We are not giving the students the answers, but allowing students to be more successful and understand the concept at hand.

In the CASE program we are constantly using technology and showing students not only how, but why this is such an important resource by using real time tools. One of my favorite lessons is when I show them the math involved in calculating growing degree days and then comparing the rates of growth for a plant grown in two different climates. Students often groan and complain about how much work this is and how hard it is to do the same task over and over. I let them work it out for the first section until I see they understand how to work the problem. Once they are working the problems easily and smoothly I ask them if they think there is an easier way to do this? We talk about what programs could calculate this for them, such as Excel spreadsheets, weather information applications and a variety of other applications. We

then look for the app that calculates this for them. As we look at this app we then talk about other weather related applications such as weather bug and how this app also helps with more detailed information on weather specific for the region.

Once we look at the information about the weather we again "springboard" for another application moment – we talk about Google Earth and how satellite placement has changed agriculture. I challenge the students to find their home, then a local attraction of their choice and then we look at multiple other points around the globe; the pyramids in Egypt, the Eiffel tower, Stonehenge, just to name a few. We then talk about how a farmer who is involved in production agriculture uses similar technology to make sure they are applying chemicals correctly – no overlap in the spray translates into so many benefits for consumers as well as less cost for the farmer, and less environmental impacts. Living close to the Chesapeake Bay many of the students are very aware of the impacts farming can have on the local watershed and ways to make sure the farmer is not the "bad guy" because of chemicals.

A question often debated is whether you should have an ag teacher teaching biology or a biology teacher teaching ag. Who teaches the real world science application? I believe it is the ag teacher!! So many of our concepts obviously overlap. Concepts like pH, cells and genetics are just a few examples and technology use is critical to better understanding all of them. Some of the technologies we use in the classroom are the Vernier products. Vernier products allow you to plug in multiple sensors to the unit and they give you readings based on the sensor used in real time data collection. Graphs are formed, information is calculated and then students can assess the information various ways. The nice part is the many departments; physics department, the chemistry department, the math department – can share the basic handheld units and then use various sensors that they would need for their specific activities. I have the privilege of being able to use this technology in the classroom with multiple sensors such as temperature, pH, CO2, dissolved oxygen and GPS just to name a few. One of the best labs we have used this data collection device for was comparing various everyday substances with pH sensors. The litmus paper is a thing of the past! We test a variety of substances that students are in contact with everyday such as coke, vinegar, milk, crushed tums, and orange juice. Students can see first hand how acidic that soda is they are drinking with the numbers displayed right in front of them. It certainly makes for a great discussion!

I firmly believe that students should apply what they are learning in the classroom to real situations so we always take a field trip to our local Outdoor Environmental Educational Center. We were able to apply first hand in the field the use of these sensors. We kayaked up a variety of estuaries and took samples of the water, recorded the data, and charts were instantly displayed of the various CO2 levels in the water. Temperature data was collected then displayed at various points displaying the graph right next to the CO2 levels so students were able to see first hand the direct relationship between the two levels. Besides taking the students in the field, launching a canoe, checking for water clarity and turbidity levels, studying native species and just taking time to <u>listen</u> to the outside world around them without the use of their I-pods, they were able to see technology used in a whole different way. The otter in the creek was a nice addition! Once we had returned to shore there were a few students who were arguing about a type of bird species they were hearing. How did they solve the debate? They researched it on their I-pods! They found an app that lists the type of bird, where they are found, and what they sound like. Technology is an amazing thing.

The culminating activity for the field trip was a report but again with a technological spin. They had to create a two minute I-movie on their experience. Each student focused on what had the biggest impact on them personally, downloaded and included their data collected in the field, then made statements about how this relates to what we learned in the classroom and presented this to their fellow students. No two were alike, there was no way to copy any information from each other and they enjoyed the process by adding their own music and personal touch to the movie.

Technology is not something to be wary of, on the contrary I see it as a way to connect, engage and stretch my students. I love my job and teaching is a fun way to spend my day with my students but add technology and you have the best classes ever!

Liza Goetz is an Agriculture Teacher at Kent County High School, Worton, MD.

Sustainable School Gardens and Green Education: Familiar Lessons through a New Lens

by Arvazena E. Clardy and Brian Copeland

As a former secondary educator, I (Clardy) think back over countless class lectures, which could have greatly benefited if I had the opportunity to incorporate a sustainable school garden in my agriscience education program. In fact, this article presents basic lessons that I taught, and which you teach on a daily basis. However, we challenge you to consider implementing a sustainable school garden as a way to cement learning for your students and perhaps even the community in which you teach.

Presently, we work with several middle and secondary schools implementing a sustainable school garden for their campus in Nashville, Tennessee areas. With just a little bit of workable land, seeds, tools and eager students, you can implement a successful sustainable school garden program at your school. Many inner city students are growing up in areas where food deserts are prevailing, meaning these students have not had the opportunity to taste fresh fruits and vegetables, let alone experience growing them. Numerous inner city students who have seen fruits and vegetables think they come from magical place in the local grocery store! This type of ignorance leads to several problems, one of which is childhood obesity. You may be wondering if implementing a sustainable school garden is feasible for your situation, but most school principals are receptive to the idea of implementing a sustainable school garden on their school campus, especially nowadays.

There are many resources you can take advantage of as you plan and implement a sustainable school garden. For example, land grant universities in the United States have Extension programs where you can access localized research and information about certain crops, weather patterns, etc…. You can also pick up the phone and simply call experienced horticulturists to ask about information helpful to implementing a successful sustainable school garden program. In the paragraphs that follow we introduce (or re-introduce to most of you) specific activities for **Green Experiment Lessons**. Granted, most of us have been "green" since we started teaching agriscience, but what was once unpopular in some schools is now the king of cool!

You may start a sustainable school garden program with almost any size plot, but we suggest at least a 20' X 20' plot for your teaching. Successful hands-on sustainable school garden teaching plot sizes will depend on the number of classes, class sizes, and if you are having individual or group garden projects. When in doubt, it is best to start small and expand at a future date! Once you have located your sustainable school garden spot, have your landscaping or plant science/horticulture classes plan the location of the plot by measuring and staking it so that the position of the plots will allow plants to receive optimum sunlight. If you have agricultural mechanics classes they can till the soil until it is equally graded and uniformed in texture (no clodding or clumps). The same class or additional classes can layout the rows for planting.

Plant and/or soil science classes can test the soil for NPK (nitrogen, phosphorus and potassium) using standard test kits that can be bought from various companies such as Carolina Biological or Hummerts International. Kits range from $30 to $60 (or cheaper) and are good for large groups and several classes. When using these kits, it is important to make sure students have plastic gloves. Although there are no harsh or toxic chemicals in these kits, safety is always important. You can supplement the soil lesson by sending samples to the local extension service for analysis and then comparing their analysis to the analysis done in your own class. This is another great way to get students thinking, and the cost of soil and/or plant analysis is only $15 to $20.

Depending on the time of school

year, you can have the students decide what fruits and vegetables to plant (appropriate for your region of the country) so students can observe growth and development and harvest of a crop. You might wish to use either seedlings or pre-start seeds, and then have the class perform a seed germination lab. It is good to let students germinate both monocot and dicot seeds to observe the differences in plant structure. If you live in an area with short growing seasons, consider growing in containers or purchase the Carolina "fast track kits," where you can grow from seeds to beans within 45 days. Once seeds/seedlings are planted have students record plant heights, flower numbers, and observe overall plant growth and development by using various fertilizer types and rates.

We suggest having students start a journal to record all experiments from start to finish of the school garden project. To change it up and to account for different learning styles, you can have students do everything from chart findings to encouraging them to simply draw their findings. A student's journal can assist you as the teacher to get an understanding of student's observation skills and level of understanding. Journals are also great if you plan on evaluating students' knowledge over the course of the sustainable school garden project.

Another lesson to be learned when working with sustainable school gardens focuses on various methods of plant propagation through asexual means. You can take cuttings from existing plants and start regeneration using rooting hormone. This could involve grafting (although because of using a very sharp knife, you might want to demonstrate) or leaf cuttings (African Violet's work well with this lesson and plant material is inexpensive and easy to find) or various other techniques that drive home many science concepts in a very visual and practical manner. Spider plants/airplane plants are excellent for asexual propagation demonstration because of the offshoot plantlets.

Depending on your school and school regulations you might have a plant sale with plant materials propagated from seeds to fund your activities during the year. This activity not only drives home the science learned in the sustainable school garden, but it gives students experience planning and operating a business and ultimately a sense of ownership and pride in the learning in which they have engaged. This is also a great place to introduce the community to the garden project if you have not done so already.

All of the basic, beneficial, and green lessons learned through your sustainable school garden can be taught to all types of learners as long as modifications are made. Students with learning disabilities can be paired with other students on projects such as transplanting seedlings or annual plugs or even making a terrarium. Physically disabled students need a safe, trouble-free environment (i.e. wheelchair accessibility to comfortably reach work areas), and if this is in place they too can flourish via lessons in the sustainable school garden. During the senior author's five years of high school agriculture teaching, she found these green educational lessons very rewarding for all, herself included. You will see friendships develop and the barriers and stereotypes dissolved about working with students with disabilities.

We sincerely hope this article will inspire you to implement a sustainable school garden and improve your green education program at your school; students, other teachers and your school system will gladly support your efforts. The green experiment lessons will allow you to take your secondary agriscience education program to the next level by using a sustainable school garden as an additional teaching tool. And as always, "Happy Gardening".

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Environmental Education + Learning Landscapes

by George R. Smith

Tennessee State University (TSU) is located in Nashville Tennessee and is an 1890 Historically Black College and University (HBCU). TSU turns 100 this year and is aging very well! Transformation is happening at the College of Agriculture, Human and Natural Sciences (CAHNS). CAHNS has expanded its agriculture programs to include development and delivery of unique environmental education, information and training content focused on current and emerging issues that impact both agriculture and the broader topic of environmental sustainability. New 'green' education programs are currently being developed and implemented. These courses include green energy, biofuels, environmental design, and sustainable landscape design.

The Bureau of Labor Statistics projected significant growth in green jobs for the period 2008 to 2018. Occupational Program Supply and Occupational Demand Projections for Tennessee (University of Tennessee, Knoxville, 2008) for the period 2008 to 2018 indicate that Environmental Service Systems pathways for academic programs in Tennessee will not produce enough graduates during the next 10 years to match the pace of green job creation because there are not enough academic program offerings related to green infrastructure and green technology.

CAHNS and other colleges like it across the United States are commitment to meet this demand for green jobs education by introducing new environmental education opportunities. A recently submitted proposal at TSU for a BS in Environmental Science offers concentrations in Environmental Design, Biofuels, and Green Energy, and courses are now being developed for the Environmental Design Concentration. Indeed education opportunities at TSU and across the United States are stepping up to the challenges and opportunities available in the green industry.

> Natural playgrounds involve students, parents, and community in the design and construction and building a natural playground can be a low cost, high impact event.

Learning Landscapes

Green infrastructure includes water harvesting, rain gardens, bio-swales, constructed wetlands, and biofiltration techniques. Environmental design includes Low Impact Development, plant remediation, wetland reconstruction, sustainable grading, and Leadership in Energy and Environmental Design (LEED) compliance. At TSU we are developing these programs for delivery in flexible and innovative ways, including in-class, on-line, workshop, and seminar delivery that will target existing and potential students and public individuals seeking certificates and courses in green infrastructure. Perhaps the most innovative delivery method will be through learning landscapes.

Learning landscapes offer a unique approach to hands-on education. The concept of 'learning landscapes' is related to experiential learning. Specific locations or sites are designed to replicate natural or managed landscapes, and demonstrate natural processes. The exciting thing about learning landscape is that they don't require a big investment to start. For example, secondary education and college of agriculture programs can start small with simple projects that take on a life of their own.

Try this. Take a vacant piece of campus or community landscape and develop a learning landscape 'timescape.' Get the students involved. Divide the land into 3 or more equal sections. One section is mowed as usual, which establishes a benchmark to compare and contrast other sections. Section 2 is mowed 2 times a growing season. Section 3 is left fallow to regenerate naturally. It's a low cost, big return project that will provide many opportunities for study. At TSU we are proposing the design of an on-campus site that will include rain gardens, bioswales, and constructed wetland demonstrations as well as biomass, plantings for carbon sequestering, and water harvesting technology. That's the

big goal but we will start small in a similar way as suggested above.

Natural Playgrounds

Natural playgrounds have recently gained wide attention and interest related to their reported benefits as outdoor learning facilities. They are unique educational facilities for young children. Natural playgrounds have grown significantly in popularity among educators, parents and kids across the nation, and are quickly replacing more traditional playgrounds, which have minimal recreational value (see cover photo).

Natural playgrounds have many benefits. The consensus among researchers and proponents of nature-based learning is that children who have access to natural environments can potentially receive significant educational benefits from their outdoor experiences. Dr Sara-Ann Munoz (2009) states that a greater engagement with the outdoors throughout the curriculum (not just in play or organized sports activities) for primary and secondary school aged children can bring benefits associated with a greater connection with nature. Harrington and Beach (2007) conclude "consistent contact with the outdoors improves children's cognitive development by improving awareness, curiosity, observational skills, and reasoning". They add that contact with natural environments can reduce children's stress levels and promote positive social intelligence and positive social interactions.

The great thing about natural playgrounds is… actually there are two great things. First, the students, parents, and community can and should be invited to get involved with your natural playground's design and construction. Hold a meeting. Ask their opinion. Ask for their help. Second, building a natural playground can be a low cost, high impact event. Here is a simple way to start a natural playground construction project. Invite the students, parents and community to a natural playground start-up day. Tell them to bring pails, shovels, and rakes. For minimal cost a group of motivated participants can build the first phase of a local natural playground in a day by installing a few flower beds, planting some blackberry and blueberry shrubs, and making a simple pathway with crushed stone. Add a few plant identification tags, and from that point the natural playground will take on a life of its own!

Learning landscapes have many benefits. They 'green' and beautify the campus environment creating a healthier physical context. They also provide effective and innovative educational opportunities for teachers, students, and the community beyond the campus. In a big way it's about saving the environment but that's a big job, which won't be finished overnight. However, we believe that our efforts at greening the CAHNS curriculum represent a big step in the right direction.

If you want to learn more on learning landscapes, *Learning With Nature Idea Book: Creating Nurturing Outdoor Spaces for Children* book (Arbor Day Foundation, 2007) is a good starting point. Harrington and Beach's (2007) *Research, Practice, and Trends in Child Care Centre Design for Outdoor Play* has some good ideas as well. In 2005 Richard Louv published *Last Child in the Woods: Saving our children from natural deficit disorder*. In 2008 Robin Moore & Marcus Cooper collaborated on *Healthy planet, healthy children: Designing nature into the daily spaces of childhood,* which is a comprehensive overview of nature-based learning.

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Alternative Fuels: A Relevant Avenue to Integrate STEM in the Agricultural Education Curriculum

by Cliff Ricketts

The author has been doing alternative research at Middle Tennessee State University (MTSU) for over 32 years. Besides the implications for a cleaner environment and an improved economy, it is an excellent way to STEM into the agricultural education curriculum.

Interestingly, the following described work on alternative fuel began at MTSU in 1979. The work was spurred by the fact that the Iranians had taken hostages, and OPEC was attempting to control the world's fuel (petroleum) supply. Out of frustration, the author and his students started a conquest for the American farmer to be energy independent in that time of global crisis. Several alternative fuel sources were researched as to their potential and viability.

Running an engine off corn (ethanol) was the first challenge. Although many other persons or groups were doing similar research making ethanol, it was the persistence of the MTSU team that eventually led to the building and running of an ethanol-powered truck that ran over 25,000 miles on pure ethanol. Presentations were made at the 1982 World's Fair and the Tennessee Valley Authority's (TVA) 50th Anniversary Barge Tours.

Having succeeded in building an ethanol-powered vehicle, the next challenge was to run an engine off cow manure (methane). Once hydrogen sulfide and carbon dioxide are removed, the gas that remains is CH_4 (natural gas). Natural gas engines were fairly common, and several engines were reviewed that were powered by methane. It was found that methane production was viable and methane digesters were available in selected large dairy farms.

The knowledge gained in the study of methane production lead to the ultimate challenge of hydrogen powered engines from water. On October 14, 1987, the MTSU team ran an engine for eight seconds off of hydrogen from water. The next day they ran the eight horsepower engine for two minutes. Since that time, the author and his students have powered tractors, cars, trucks, and stationary engines from hydrogen. The MTSU team was invited to the world's first hydrogen race at the 1991 Bonneville Speed Trials at the Great Salt Flats in Wendover, Utah, where they set the world's land speed record (timed only) for a hydrogen vehicle. Researchers at MTSU proceeded to build another engine to run from pure hydrogen. The MTSU team entered the vehicle in the Southern California Timing Association (SCTA) World Finals on October 18, 1992, at the Bonneville Salt Flats in Wendover, Utah, and set a new world land speed record for pure hydrogen-fueled vehicles. The record stood for several years.

The next fuel to be tested was soybean oil. An Allis-Chambers diesel tractor engine was placed in a 1975 Corvette. The author and his agriculture students placed fourth of 40, behind two entries by NASA and one from American Honda, in an alternative fuel road rally sponsored by the Florida Solar Energy Commission and others. The rally started at Cape Canaveral and ended at Disney World. A clogged fuel line resulted from the decomposition of soybean oil. Soybean oil breaks down after six months.

The lifetime goal of the MTSU research is to run engines from sun and water (hydrogen from water). An electric/hydrogen hybrid vehicle was developed. The following explains how the vehicle works. A 10-kilowatt solar unit was installed. Through the Green Power Switch program with the TVA, the electricity produced by the solar array goes into the Murfreesboro (TN) Electric Grid Lines within TVA. With the aid of automatic computer readings and calculations, all the electricity produced is monitored. Since the 10-kilowatt solar unit was started March 9, 2004, over 92,000 kilowatts have been produced.

The system works analogously to the banking system. The energy is stored in the "bank" for use at any time--day or night, sunny or cloudy. When the electric component (plug-in) of the vehicle is charged, the kilowatts used are counted through another meter. In other words, the electricity is taken from the bank and an immediate balance is also available by comparing the difference in the input meter and output meter.

A similar procedure occurs when the hydrogen is produced. The kilowatts needed to power the 40 cubic foot per hour electrolysis unit are metered. The unit is a Proton 40 electrolysis unit. The banked electricity powers the electrolysis unit that separates the hydrogen and oxygen from the water. The hydrogen is then temporarily stored in two 500-gallon tanks at 200 psi. Another system compresses the hydrogen to fill the K cylinders at 6,500 psi. Using

a cascading system, a 5,000 psi (4.2 kilogram) hydrogen tank is filled onboard the hydrogen vehicle

By using the system just described, vehicles are being driven with the only power sources being sun and water. Please note that both the electric component of the truck and the hydrogen component of the truck could be powered directly from the solar unit. However, approximately 90 percent of the electricity produced would be lost. By banking the electricity through the grid, the solar unit is working and saving any time the sun is shining and somewhat when it is cloudy.

Presently, we have five vehicles that are powered by sun and hydrogen from water using the above process. Last year the author and his students drove from Bristol, Virginia to West Memphis, Arkansas in one day off of sun and hydrogen from water in a 1994 Toyota Tercel (approximately 550 miles). Other goals within the next year include driving coast to coast on less than ten gallons of gasoline in a flex-fuel vehicle than runs off of a combination of fuels: solar electric, hydrogen and ethanol blended with a small amount of gas to meet standards. The other goal is to drive coast to coast in a vehicle powered only by sun and hydrogen from water.

Ideas to Bring Into your Agricultural Laboratory

You may be wondering how this applies to you and your agriculture program. Students really get motivated when they can see the results of their work. I fully realize that most high schools cannot afford full size vehicles or full-scale models to produce the fuels mentioned above. However, you can build scale models to produce the fuels. Likewise, you could start small with something like go-karts to burn the fuel. Space does not permit to explain exactly how to do each, but I challenge you to surf the Internet for ideas, including "You Tube". Nearly all of the students that assisted the author with the aforementioned research came from secondary agriscience programs just like yours! So consider the following, very feasible ideas:

Ethanol: Kits and small-scale models are available on the Internet. Be aware of any state regulations. The author had a student of his build a system for the agricultural laboratory, but it was large enough that permits had to be secured. We started with corn and ended with 188 proof ethanol. The ethanol has to be 80 per cent ethanol (160 proof) to run in an engine. Once the ethanol is produced, run it in a small gas engine. To really get the students motivated, build or mount the engine on a "go kart". Efficiency of the fuel could also be tested against standard fuels as an agriscience fair project.

Methane: Besides the large scales model methane digester used on dairy farms and feedlots, which use the methane from the cow manure, you could create a simple demonstration system by putting cow manure in a 55-gallon drum. Again, scan the Internet for details. The challenge is capturing the gas. Again, run it in a go-kart. Since methane and natural gas are practically the same, you make want to produce the methane, but use a natural gas system on the go-kart.

Biodiesel: Biodiesel can be made from several vegetable oils, but the easiest thing to do is to get used cooking oil from a local restaurant. It must be clean. You want the cooking oil from the deep fryer where the French fries, etc. are cooked. There are commercial systems available to convert it into biodiesel. Again, do extensive research before doing this. Remember, biodiesel is used in diesel engines. By using the engineering and mechanical skills of selected students, I would suggest getting a small diesel engine and installing it on another go-kart.

Solar/Electric: We are now switching to electric engines. For this go-kart, have a team of students install a small DC electric motor on a go-kart powered by a deep cell battery such as a tow motor/forklift battery. The battery is then charged by a solar panel. Don't forget the research to find similar models.

Now, let us really have fun. Pending the school administration's approval, have a 25-lap race or whatever works best, and invite the school to watch. Charge admission to help offset the cost of the alternative fuel engines and go-karts.

Of course, these are simply ideas and you can alter them as you wish. You may wish to add other alternative to the above list. The idea is bring the classroom alive and make it relevant to the students. By doing such activities, you can integrate STEM into your program and make it a model for others to follow.

Dr. Cliff Ricketts is a Professor of Agricultural Education at Middle Tennessee State University.

Pioneering a Service-Learning Project... *(continued from page 6)*

was for the other community of La Esperanza to try to avoid injuries to animals that can become entry points for pathogens or insects (transfer disease, pathogens, and parasites). One major concern was the burial of deceased cattle near grazing areas and water sources. If the animal died due to a pathogen or any other contaminate, then it would be easily transferred to other live animals, local communities, or other farms vial soil, water, grass, etc. Recommendations suggested by the students for the cattle farms included understanding and practicing natural pest control or farm management practices that help to reduce the occurrence of pathogen contamination via insects, human traffic, water, feed, etc.

Overall, we would have liked to involve the community by demonstrating more about the importance of sanitation rather than just giving recommendations, but our short-time period in each community made this unfeasible. However, we utilized the time resources available, which made for a creative problem-solving learning experience from the students' perspectives. We believe we accomplished our objectives because the students and community members gained a deeper appreciation of the link between animal health and food safety. The students also understood that very simple changes could make a greater impact on the environment by making it more eco-friendly. This includes green management animal care techniques as they relate to human health as well animal welfare. The replication of this activity is very inexpensive and the authors are willing to share the protocols in which it was implemented.

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Going Green in Agricultural Education... *(continued from page 8)*

- 20 point – Does the banner have colors, photos, text, and a clear explanation of the topic?
- 20 points - Does each team member speak during the presentation?
- BONUS POINTS – Did students use *The Green Book* for additional facts about the topic?

Conclusion

After all the banners are posted, photos taken, power points given, and the principal sees what you created, I like to close with a final reflection about the project. I give each student a post card to address to themselves. Next, I ask them to write down at least 4 *Action Goals* they will personally make to better our environment within the next 6 months. At the end of that 6 month period, I mail the post cards to their home address in hopes they will reflect on the project and evaluate how they met the goals they set. Any teacher who would like to receive the full handouts and instructions electronically for this lesson may email me at joe.green@cobbk12.org

Before our lesson on Earth Awareness Week, many students had no idea what a C.S.A. was what a Fair Trade agreement was, much less the strict farm requirements mandated to label food crops as USDA Certified Organic. And a carbon foot print? No, it's not something you look for in the woods while deer hunting. And just what is a Locavore? My class took that topic a step further and recorded a 5 minute music video called *The Locavore Song*. You can search that title on YouTube or Teacher Tube and see some fired up students really and truly *Going Green In Agriculture*. But don't stop there. Think before you present the same old lesson. How can YOU effectively integrate sustainable environmental practices into all your lessons? Just get started small and the rest will follow… because the longest journey in the world begins with one small step.

Preparing Future Green Professionals... ***(continued from page 10)***

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Going Green Beyond the Greenhouse... ***(continued from page 12)***

allow students to dissect frogs and pigs right on their iPad. No matter what area of agricultural science you might teach, there is definitely an app for that!

In addition to fun apps, the iPads also serve as great ways to collect program data. At our district's annual school recruitment fair, I dispatched two of my students with iPads to collect information from prospective students using forms that were created using GoogleDocs. One collected contact information from students interested in learning more about the district, and another surveyed students to see which areas of agricultural science they would be interested in studying. The information and data collected were compiled and submitted to the district's administrators. Not only did they have an organized list of contact information for prospective students, but the student interest survey results convinced my district to add CASE Animal Science to the agricultural science course offerings for next year.

Thanks to technology, my goal of becoming a more ecofriendly agricultural science teacher has been accomplished. The amount of paper used by my classes has been significantly reduced, and I have found innovative and fun ways to incorporate technology into my CASE courses. With some creativity and the willingness to experiment with technology, you too can take the "green" of your ag classes beyond the greenhouse!

Back Cover (clockwise from top left):

Photo 1: Dr. Cliff Ricketts with a hybrid prototype vehicle. Photo courtesy of Dr. Cliff Ricketts.

Photo 2: Student using a microscope for agriculture science research. Photo courtesy of Liza Goetz.

Photo 3: Student using 'green" principles in the greenhouse. Photo courtesy of Liza Goetz.

Photo 4: Student applying classroom knowledge to real settings in the greenhouse. Photo courtesy of Liza Goetz.