2007 Mississippi Curriculum Framework

Secondary Agriscience

(Program CIP: 01.0000 – Agriculture, General)

Direct inquiries to

Program Coordinator, Agricultural Education
Office of Vocational Education and Workforce Development
Mississippi Department of Education
P.O. Box 771
Jackson, MS 39205
(601) 359-3940
wchancellor@mde.k12.ms.us

Stephanie King, Ph.D.
Instructional Design Specialist
Research and Curriculum Unit
P.O. Drawer DX
Mississippi State, MS 39762
(662) 325-2510
sbk2@ra.msstate.edu

Additional copies

Research and Curriculum Unit for Workforce Development
Vocational and Technical Education
Attention: Reference Room and Media Center Coordinator
P.O. Drawer DX
Mississippi State, MS 39762
http://cia.rcu.msstate.edu/curriculum/download.asp
(662) 325-2510

Published by

Office of Vocational Education and Workforce Development
Mississippi Department of Education
Jackson, MS 39205

Research and Curriculum Unit for Workforce Development
Vocational and Technical Education
Mississippi State University
Mississippi State, MS 39762

Acknowledgments

Writing Team	Steve Cantrell, Hatley High School, Amory, MS Scott Conway, Petal Schools, Petal, MS Linda Jack, Millsaps Career and Technical Center, Starkville, MS Dan Stuckey, Lawrence County Technology and Career Center, Monticello, MS
RCU Staff	Stephanie King – Instructional Design Specialist Rodney Beasley – Instructional Design Specialist
MDE Staff	Wilbur Chancellor – Agricultural Education Program Coordinator
Professional Curriculum Advisory Team	Hinds Community College Agriculture Advisory Committee

Standards in this document are based on information from the following organizations:

Agriculture, Food, and Natural Resources Standards	Adapted from the publication, Career Cluster Resources for Agriculture, Food, and Natural Resources, National Association of State Directors of Career and Technical Education. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf
Academic Standards	Mississippi Department of Education Subject Area Testing Program
21st Century Skills	Reproduced with permission of the Partnership for 21st Century Skills. Further information may be found at www.21stcenturyskills.org

Preface

Secondary Agriscience Research Synopsis

Articles, books, Web sites, and other materials listed at the end of each unit were considered during the revision process. *Career Cluster Resources for Agriculture, Food, and Natural Resources, Successful Farming, Progressive Farmer,* and *Journal of Agricultural Education* were especially useful in providing insight into trends and issues in the field. These references are suggested for use by instructors and students during the study of the topics outlined.

Industry advisory team members from schools throughout the state were asked to give input related to changes to be made to the curriculum framework. Specific comments related to soft skills needed in this program included punctuality, motivation, communication, leadership, and positive attitude. Occupation-specific skills stated included mechanical reasoning, math, general computer, and welding. Safety practices emphasized included general farm safety.

Instructors from schools throughout the state were also asked to give input on changes to be made to the curriculum framework. Changes suggested for the curriculum included more specificity and less repetition in competencies and objectives, less time spent on the scientific method since students have studied the concepts since elementary school, introduction to weather and chemistry, combining some of the introductory units, introduction of environmental science in the first year, and providing a specific unit for safety taught early in the year.

Curriculum

The following state/national standards were referenced in each course of the curriculum:

- *Mississippi Department of Education Subject Area Testing Program Academic Standards*
- *21st Century Skills*
- *Agriculture, Food, and Natural Resources Standards*

Industry and instructor comments, along with current research, were considered by the curriculum revision team during the revision process; and changes were made as needed and appropriate. Many of the skills and topics noted in the research were already included in the curriculum framework. Specific changes made to the curriculum at the March 6-8, 2006, curriculum revision meeting included:

- Competencies and objectives were reviewed to ensure accuracy and appropriateness. Some were rewritten to provide broader competencies and more specific, measurable objectives. Where appropriate, competencies were combined to ensure clarity and minimize repetition.
- Suggested teaching and assessment strategies were added that incorporate preassessment, introductory and closure material, varied projects, mastery learning, and the use of various forms of technology. The integration of workplace and academic skills including math, science, English, and history was also documented.
- The units Introduction to Agriscience and Opportunities in Agriscience in the first year were combined into an introductory unit including information about careers and appropriate soft skills.
- A separate unit on safety and the scientific method was developed for the first year.

- The unit Natural Resources in the first year was expanded to include environmental resources and renamed Environmental and Natural Resources. An Advanced Environmental and Natural Resources unit was added to the second year.
- The Recommended Tools and Equipment list was updated.

Assessment
Students will be assessed with the *Secondary Agriscience MS-CPAS2 Test*.

Professional Learning
It is suggested that instructors participate in professional learning related to the following concepts:

- Demonstration of varied teaching and assessment strategies by other agriculture teachers
- Biotechnology and laboratory technique (including lab specimen production) demonstrations by other agriculture teachers and scientific supply company representatives
- Availability of postsecondary educational programs and employment opportunities for students
- Use of the program Blackboard® site
- Differentiated instruction – To learn more about differentiated instruction, please go to http://www.paec.org/teacher2teacher/additional_subjects.html and click on Differentiated Instruction. Work through this online course and review the additional resources.

Foreword

Secondary vocational-technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act III, 1998; and No Child Left Behind Act of 2001).

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task - An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75-80 percent of the time in the course.
- Competencies and Suggested Objectives
  - A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies.
  - The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.
- Suggested Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies which reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.
- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.

- Integrated Academic Topics, Workplace Skills, Technology Standards, and Occupational Standards - This section identifies related academic topics as required in the Subject Area Assessment Program (SATP) in Algebra I, Biology I, English II, and U. S. History from 1877, which are integrated into the content of the unit. It also identifies the 21st Century Skills, which were developed by the Partnership for 21st Century Skills, a group of business and education organizations concerned about the gap between the knowledge and skills learned in school and those needed in communities and the workplace. A portion of the 21st Century Skills addresses learning skills needed in the 21st century, including information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills. The need for these types of skills has been recognized for some time and the 21st Century Skills are adapted in part from the 1991 report from the U.S. Secretary of Labor's Commission on Achieving Necessary Skills (SCANS). Another important aspect of learning and working in the 21st century involves technology skills, and the International Society for Technology in Education, developers of the National Educational Technology Standards (NETS), were strategic partners in the Partnership for 21st Century Skills.
- References - A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

Table of Contents

Program Description

Agriscience provides a study of selected areas of agricultural science. Students will investigate agricultural science topics including biotechnology, animal science, mechanical technology, food science, fiber science, plant science, soil science, environmental and natural resources, and entomology. These concepts are taught through classroom and laboratory instruction and applications such as the Supervised Agricultural Experience Program (SAE) and FFA Career Development Activities. This program will utilize the problem solving method of instruction and will rely upon the agricultural information systems, including the Internet. Leadership, citizenship, and cooperation skills are taught through participation in FFA activities. The FFA is an intra-curricular vocational student organization designed to provide a learning laboratory for the implementation of this curriculum. Graduates may be employed at the entry level or pursue careers through agriculture, agribusiness, or natural resources education in postsecondary or higher education.

Agriscience is intended to be a two-year course of study. Students completing the first year of the program will receive one Carnegie unit in science (seniors of school year 2007-2008). Students completing the two-course sequence will receive two Carnegie units in science (seniors of school year 2008-2009 and later). Students completing the Supervised Agricultural Experience (SAE) may receive an additional 0.5 Carnegie units for each year.

Industry standards referenced are from the *Career Cluster Resources for Agriculture, Food, and Natural Resources*, National Association of State Directors of Career and Technical Education.

Course Outline

Agriscience I
Course CIP Code: 02.9991

Course Description: Students in Agriscience I will gain foundation competencies related to careers and opportunities in agriscience, application of safety and the scientific method in agriscience, human relations/leadership/FFA activities, developing a supervised agricultural experience program in agriscience, biotechnology, animal science, mechanical science, principles of fiber science, plant science, soil science, environmental science and natural resources, and entomology. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Agriscience Introduction, Opportunities, and Careers	20
2	Agriscience Lab Safety and the Scientific Method	10
3	Human Relations/Leadership/FFA Activities	15
4	Developing a Supervised Agricultural Experience (SAE) in Agriscience	15
5	Biotechnology	20
6	Animal Science	20
7	Mechanical Science	15
8	Principles of Fiber Science	10
9	Plant Science	20
10	Soil Science	20
11	Environmental Science and Natural Resources	20
12	Entomology	20

Agriscience II
Course CIP Code: 02.9992

Course Description: Agriscience II is the advanced level course of the secondary Agriscience program. Students in Agriscience II will gain foundation competencies related to communication and career skills, developing a supervised agricultural experience program in agriscience, advanced biotechnology, food science, advanced plant science, advanced soil science, advanced environmental science and natural resources, aquaculture, and advanced animal science. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Communication and Career Skills	10
2	Supervised Agricultural Experience (SAE) in Agriscience (Review)	15
3	Advanced Biotechnology	30
4	Food Science	20
5	Advanced Plant Science	25
6	Advanced Soil Science	25
7	Advanced Environmental Science and Natural Resources	30
8	Aquaculture	25
9	Advanced Animal Science	30

Agriscience I
Unit 1: Agriscience Introduction, Opportunities, and Careers (20 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Introduce concepts and terms associated with agriculture, science, and agriscience.	**Teaching:** • Introduce the career field, and discuss job requirements (e.g., certifications and education) and occupation-specific and soft skills needed. Lead students in a discussion about what they know about the field, the types of jobs available, and the salaries of those jobs. • Outline the units of the program and how they relate to various jobs in the field. • Use a multiple learning styles inventory to determine students' learning styles and interests. Share with the students their styles and the impact they have. Throughout the year, provide varied projects to meet the learning styles. • Work with the Special Populations instructor to assess the reading, writing, and math skills of each student and to provide materials that are appropriate for each student. Plan to reassess students at the end of the year. • Divide students into groups based on learning styles, and have them use the Internet or textbooks to research the development of the field, origination of terms, and the terms used in different countries throughout the world. Have students present their findings by developing a dictionary, writing and conducting a mock training session for new employees, or making a videotape or tape recording. **Assessment:** • Monitor student participation in discussions using the Group Participation Assessment Rubric located in Appendix D. • Evaluate each group's project and presentation for content, clarity, and length.
2. Investigate the major areas of agriculture. a. Examine major areas of agriculture:	**Teaching:** • Use information from the U.S. Department

agricultural processing, agricultural production, agricultural mechanics, agribusiness/supplies and services, forestry, natural resources, horticulture, entomology, aquaculture, animal science, and plant science. b. Describe the importance of the areas in society. c. Discuss the economic impact of the areas in local, state, national, and global economies.	of Labor to describe the major areas of agriculture, related occupations and their expected growth, and salaries of a variety of jobs in the field. • Divide students into groups, and have each group construct a presentation such as a poster, collage, role play, or multimedia presentation outlining assigned area(s). Have each group present their information for peer review. • Have each student develop at least one question for each group based on their presentation. **Assessment:** • Evaluate the presentation using the Group Presentation Assessment Rubric located in Appendix D. • Assess that each student asks questions to the groups.
3. Connect major sciences supporting agriscience. a. Examine concepts of biology, chemistry, biochemistry, physical sciences, and biotechnology. b. Relate the use of concepts of pure science to the use of concepts of agriscience.	**Teaching:** • Introduce the students to the different areas of pure science such as biology, chemistry, and physics. Ask students to describe the concepts taught in pure sciences based on knowledge acquired in their academic courses. • Describe to the students the different areas of applied sciences in agriculture such as genetics, crop science, soil science, animal science, and biotechnology. Discuss how these applied sciences relate to the pure sciences. • Have students interview people working in various fields of agriculture to determine which high school and college courses (especially sciences) were most useful to them in their work today and why. • Have each student summarize the interview and prepare a poster or other visual product. Combine all products to form a collage. **Assessment:** • Evaluate the interview activity for conduct and information gathered. • Evaluate the poster or other product for content and neatness using the Poster

	Assessment Rubric in Appendix D.
4. Investigate current trends occurring in agriscience. a. Investigate precision agriculture. b. Investigate niche farming, such as organic farming and alternative animal agriculture. c. Investigate animal tracking. d. Investigate country of origin labeling.	**Teaching:** • Discuss new and emerging technologies, practices, trends, and issues associated with the field, using videos and a multimedia presentation if available. Ask students how developments throughout history have impacted how people live and work. • Take students on a field trip to a local industry to observe the use of various types of technology. • Have students work in groups based on their learning styles and use the Internet and current publications to research one new and emerging technology, practice, trend, or issue. • Have students use the research to develop an idea for a new product, prepare, and deliver a presentation according to the preferred learning styles in order to sell the idea to a company (the class). Students may use technology to prepare brochures, posters, or handouts to distribute during a multimedia presentation; create a commercial and act it out; or develop a newspaper advertisement. • Have the class self-evaluate their own work and peer evaluate their classmates' work. • Have each student select the one product that he or she thinks is most likely to be successful in the market and prepare a brief report justifying the product chosen and explaining the expected impact of the product on the field. **Assessment:** • Assess field trip participation using the Field Trip Participation Checklist located in Appendix D. • Monitor group work to ensure that each member participates in research, idea development, and presentation preparation. • Evaluate each group's project for content, clarity, presentation, and length. • Evaluate each student's report using the

	Written Report Assessment Rubric in Appendix D.
5. Examine the opportunities for careers in agriscience.	**Teaching:** • Lead students in a discussion about various careers in the field and how they differ throughout the world. Discuss salaries, educational requirements, working conditions, and other topics for people working in various locations (e.g., China, Iraq, South America, and Europe). Also discuss the proportion of each gender currently working in the field. • Explain educational and career opportunities that will be available to students after they complete the program. Have students make a list of skills they think will be required and how the program will help them to obtain those skills. • Have each student select a career in a field related to the course and use the Occupational Outlook Handbook (book or Web site), Internet, and other resources to research job titles, educational and skill requirements, expected job growth, and entry-level salaries. Have each student report the findings by writing a news report, making a learning center, or creating a job announcement. • Lead students in a discussion about the relationship of agriscience opportunities to the Supervised Agricultural Experience program. **Assessment:** • Monitor discussion and group work activities throughout the unit to ensure that each member participates. • Evaluate the list of skills to determine misconceptions students have. • Assess career product for content and appearance.
6. Demonstrate job seeking skills. a. Conduct an Internet search for employment in a selected agricultural occupation. b. Develop a resume.	**Teaching:** • Use technology to show students examples of good and bad resumes and cover letters. Have students identify errors in the examples.

c. Prepare a job application and cover letter. d. Participate in a role-play interview.	• Have each student use the Internet or newspapers to choose a job for which they are qualified and prepare a resume and cover letter that can be used to apply for the selected job. • Discuss appropriate interview techniques and have the students participate in mock interviews with local personnel working in administrative positions. Have students send thank you notes to mock interviewers. • To provide closure to each unit throughout the year, have students summarize what they have learned about the topic covered and place the summaries in a notebook. Review the notebooks at the end of each unit and reteach as appropriate to ensure mastery. **Assessment:** • Evaluate the resume, cover letter, and mock interview using the Resume Rubric and Interview Rubric located in Appendix D. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives.
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives.
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Bridges Transitions. (2005). *Choices 2005* [Computer software]. Oroville, WA: Author.

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Albany, NY: Delmar. (ISBN: 1-4018-9644-8)

Journal of Agricultural Education. (n.d.). Stillwater, OK: American Association for Agricultural Education. Retrieved March 10, 2006, from http://pubs.aged.tamu.edu/jae/

The Progressive Farmer. (n.d.). Birmingham, AL: The Progressive Farmer. Retrieved March 10, 2006, from http://www.progressivefarmer.com/farmer/

Successful Farming. (n.d.). Des Moines, IA: Meredith. Retrieved March 10, 2006, from http://www.agriculture.com

Agriscience I
Unit 2: Agriscience Lab Safety and the Scientific Method (10 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Analyze the basic rules of safety in the agriscience laboratory. a. Discuss safe and proper use of chemicals, heat and fire, laboratory equipment, specimens and animals, and electrical equipment. b. Utilize procedures for reporting an accident. c. Examine the "Hazardous Communications Acts" and the "Worker Protection Act" as applied to agricultural occupations. d. Illustrate the use of a Materials Safety Data Sheet (MSDS).	**Teaching:** • Show students videos demonstrating examples of accidents in the workplace. Pre-assess knowledge of safety by having each student write a summary of the safety violations present in the videos. • Have an industry speaker present to the class general safety procedures, the necessity of safety in the work environment, and his or her company's safety policy, or invite a representative from Farm Bureau to present their safety program. • Lead the class in developing safety policies for the classroom based on industry policies. Discuss and demonstrate terms, rules, and procedures related to laboratory and industry safety, including chemical safety, heat and fire safety, laboratory equipment safety, working safely with specimens and animals, electrical equipment safety, and reporting accidents. • Divide students into groups based on learning styles, and assign each group a guideline for personal and laboratory safety (i.e., chemicals, fire, equipment, animals, and electrical) or general laboratory conduct. Have each group role-play, create a multimedia presentation or a rap song, or write a story to discuss the proper and improper procedures related to the guideline. • Have each student read and summarize the "Hazardous Communications Acts" and "Worker Protection Act." • Describe the components of a MSDS sheet. • Have each student prepare a MSDS sheet for a chemical whose description you provide.

	Assessment: • Evaluate the pre-assessment for accuracy. • Have students self-evaluate and peer evaluate guideline project. • Evaluate the summary of the safety acts. • Review the MSDS sheet completion for accuracy and neatness.
2. Demonstrate all safety equipment in the agriscience laboratory.	**Teaching:** • Identify all safety equipment in the agriscience laboratory and demonstrate proper use. • Describe key school and program policies and safety procedures to the class based on industry standards and requirements (may use the school handbook and any program specific information). Introduce workplace skills (SCANS) and how they will be used to relate the classroom work to meet industry requirements. • Have students work in groups to develop an advertisement for an assigned piece of safety equipment and present the advertisement to the class. Have each student peer review the advertisements. **Assessment:** • Evaluate the advertisement for creativity, neatness, and accuracy.
3. Practice safety concepts in laboratory activities. a. Use appropriate precautions when working with electrical applications, fire, poisons, and gas. b. Protect hands and eyes. c. Wear proper clothing for protection. d. Safely work with animals and plants. e. Take steps to prevent explosion danger.	**Teaching:** • Lead the students on a tour of the facilities. Discuss and demonstrate general safety procedures for the facilities. • Lead a class discussion and demonstration on electrical, hand, poison, eye, fire, gas, animal, and plant safety as well as clothing protection and the prevention of explosions. Have the students answer questions on proper procedures for each area. • Emphasize the importance of safety, and explain that the use of safe practices will be assessed throughout the program. **Assessment:** • Observe student participation in class discussions using the Group Participation Assessment Rubric located in Appendix D. • Evaluate students' demonstration of proper

	procedures in each area of safety.
4. Examine terms and concepts associated with the scientific method.	**Teaching:** • Present an interactive lecture on the terms associated with the scientific method, and have students take notes. • Lead students in a discussion of the importance of the scientific method as it relates to agriculture. • Place students in cooperative learning groups and have them list at least three agriculture problems that can be solved using the scientific method. They may relate these problems to historical problems by using the Internet to search past problems. Have students present their findings to the class. **Assessment:** • Assess student presentations using the Group Presentation Assessment Rubric located in Appendix D.
5. Describe each step of the scientific method. a. Identify the problem. b. Gather data. c. Formulate possible solutions. d. Implement the preferred solutions. e. Evaluate the results.	**Teaching:** • Give students a laboratory report outlining an actual scientific experiment. Have students identify the steps of the scientific method in order to preassess their knowledge. • Based on student knowledge, present information about the steps of the scientific method as applied to an agriculture problem. • Divide students into groups and have them use the Internet and other resources to research the history of the scientific method. Have each group develop a diagram, report, or bulletin board based on their findings. • Have each student identify a problem in agriculture today that he or she could study and outline the steps needed to investigate the problem. **Assessment:** • Assess student identification of steps for accuracy. • Evaluate history products for content and appearance. • Assess problem and steps outlined for

	accuracy.
6. Apply the scientific method. a. Identify the problem or question to be answered. b. Gather data related to the problem or question. c. Formulate possible solutions. d. Implement one or a combination of several solutions. e. Evaluate the results and pursue further research as needed.	**Teaching:** • Discuss with students people, materials, and other resources available to them for solving a scientific problem. • Have each student investigate the problem he or she outlined and determine a possible solution. Have each student present their problem, steps, and solution to the class. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Evaluate the presentation using the Presentation Checklist located in Appendix D. • Review notes and summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives.
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives.
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
ANM2 Recognize animal behaviors to facilitate working with animals safely.
TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR2 Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
ENV3 Apply scientific principles to environmental services.

Academic Standards

B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Farm Bureau Mississippi Safety Programs. (n.d.). Retrieved March 10, 2006, from http://www.msfb.com/programs/safety.html

Herren, R. V. (2004). *The science of agriculture: A biological approach* (2nd ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1673-7)

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Albany, NY: Delmar. (ISBN: 1-4018-9644-8)

Agriscience I
Unit 3: Human Relations/Leadership/FFA Activities (15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Discuss concepts related to leadership. a. Describe leadership. b. Describe traits of a good leader such as integrity, knowledge, courage, tactfulness, enthusiasm, unselfishness, and loyalty. c. Practice acceptable manners in appropriate places, including introductions, greetings, table manners, and telephone manners.	**Teaching:** • Define the traits of a good leader, including ethics and etiquette as well as related terms, and discuss their importance in the workplace. Include integrity, knowledge, courage, tactfulness, enthusiasm, unselfishness, and loyalty. • Have a local business owner speak to the class about qualities that an employer looks for in an applicant. • Have each student score himself or herself on a list of personal leadership characteristics as described by the guest speaker or other sources. • Demonstrate proper greeting of a guest, introductions, table manners, and telephone manners. • Have students role play improper manners. • Have each student identify the improper manners shown and write a summary about how using those manners could affect both the person using improper manners and the person interacting with them. **Assessment:** • Review the student list of traits to ensure comprehension. • Assess student participation in role-play using the Role-Play Rubric in Appendix D. • Evaluate summaries for content and grammar.
2. Investigate the FFA organization. a. Describe the history of FFA. b. Contrast degrees of membership. c. State the creed. d. Demonstrate official dress. e. Investigate the emblem and its symbols.	**Teaching:** • Describe FFA, and provide an overview of opportunities to participate in leadership activities, community service projects, and competitive events. • Have students work in pairs to explore the FFA website and develop a slide presentation, brochure, or display that includes the motto, creed, emblem, colors, theme, and history of the organization. Also have students research which famous

	or successful people were part of the organization. • Discuss with students the election process used in the FFA; compare and contrast this process with the processes used for local, state, and national elections. Emphasize the importance of participating in elections as a part of good citizenship. • Have students participate in local officer elections modeled after the election process. Have officers campaign and prepare posters and a speech. Have members vote by secret ballot. **Assessment:** • Evaluate the FFA presentation using the Visual Presentation Checklist in Appendix D. • Appraise student participation in activities.
3. Explain opportunities for leadership development through the FFA. a. Describe contests and awards programs, including proficiency awards and state and American degrees. b. Participate in personal development seminars. c. Participate in leadership activities and/or leadership conferences and conventions. d. Describe national and international exchange programs. e. Plan for education experience with industry. f. Determine opportunities for participation in personal and community development programs.	**Teaching:** • Have students use the FFA Manual, Student Handbook, PowerPoint presentation, FFA organization Web site, Local Program Success Guide, and LifeKnowledge lesson handouts and worksheets to identify and describe the different FFA events, programs, and degrees; explore how each contributes to career advancement and individual achievement. • Have each student select one or more FFA activities to participate in the coming year(s). Have students keep an ongoing journal of preparation for FFA activities. **Assessment:** • Evaluate the student journal using the Sample Rubric on a Student Journal in Appendix D.
4. Participate in parliamentary procedure. a. Define parliamentary terms. b. Introduce a motion. c. Debate amendments. d. Utilize different methods of voting. e. Discuss taps of the gavel.	**Teaching:** • Discuss with the students the origin of parliamentary procedure, its purpose in society today, and associated terms. • Using a chart, electronic presentation, or video, identify and describe the use of the different methods of voting, the procedure for receiving and disposing of a main motion, debating amendments, and taps of

	the gavel. • Have students demonstrate by taking turns in receiving and disposing of a main motion using the different methods for voting. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Evaluate the demonstration of parliamentary procedure skill using the Sample Scorecard for Parliamentary Procedure Demonstration in Appendix D. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives.
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives.
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.

Academic Standards

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.

E6 Explore cultural contributions to the history of the English language and its literature.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

National FFA Organization. (n.d.). Retrieved March 10, 2006, from http://www.ffa.org

National FFA Organization. (2003). *Career development events handbook 2001-2005*. Retrieved June 20, 2005, from http://www.ffa.org/programs/cde/documents/cde_handbook.pdf

National FFA Organization. (2005). *FFA proficiency award and degree* [Computer software]. Indianapolis, IN: Author.

National FFA Organization. (2005). Lesson HS.128: Managing my journey. In *LifeKnowledge-Real lessons for real life* [Computer software]. Indianapolis, IN: Author.

National FFA Organization. (2005). Lesson HS.129: Adjusting your journey. In *LifeKnowledge-Real lessons for real life* [Computer software]. Indianapolis, IN: Author.

National FFA Organization. (2005). *FFA manual*. Indianapolis, IN: Author.

National FFA Organization. (2005). *FFA student handbook*. Indianapolis, IN: Author.

Roberts, H. M., Evans, W. J., Honeman, D. H., & Balch, T. J. (Eds.). (2004). *Robert's rules of order newly revised* (10th ed.). New York: HarperCollins.

Agriscience I
Unit 4: Developing a Supervised Agricultural Experience (SAE) in Agriscience (15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe the purposes and requirements of the SAE. a. Establish objectives for the SAE. b. Determine the availability of time and money to invest. c. Select a system of record keeping. d. Determine benefits of participation in an SAE. e. Determine types of SAE programs.	**Teaching:** • Provide examples of sound and unsound SAEs using PowerPoint presentation or other graphic presentations. Preassess students' knowledge of SAEs by having them label each example as sound or unsound and describe the strong and weak traits of each. • Discuss the purposes, requirements, objectives, benefits, and types of having an SAE. • Have students conduct research to determine suitable SAE programs. • Have each student complete a plan of activities for their SAE over the coming year to include objectives, time and money, and record keeping. **Assessment:** • Review the preassessment activity to determine student knowledge. • Evaluate the SAE plan using the Sample Rubric for an SAE Plan in Appendix D.
2. Develop a long-range personal plan for the SAE. a. Set long-range goals.	**Teaching:** • Discuss with the students the relationship of short-range and long-range goals in planning the SAE and future careers. Provide examples of suitable short-term and long-term goals for different SAEs. • Identify and discuss the different resources required to conduct each of the different types of SAEs. Also discuss different opportunities commonly found in the school district. • Provide students with examples of long-range plans for the different types of SAEs. Have students prepare a long-range plan for the rest of the school year. (Note: This plan should relate to the student's career/educational plan maintained by the school guidance department. A copy of the supervised experience plans may be included in the student's folder.)

	Assessment: • Evaluate the long-range personal plan for content and neatness.
3. Develop a short-range personal plan. a. Set short-range goals.	**Teaching:** • Provide students with examples of short-range plans for the different types of SAEs. Have students prepare a short-range plan for the rest of the school year. **Assessment:** • Evaluate the short-range personal plan for content and neatness.
4. Complete a training agreement for an SAE. a. Establish requirements of student, parents, supervisor, and/or employer.	**Teaching:** • Describe a training agreement for an SAE. • Have students examine examples of training agreements and discuss the components. • Have each student complete a training agreement, including the requirements of the student, parents, supervisor, and employer as appropriate. **Assessment:** • Evaluate the training agreement for completeness and neatness.
5. Describe agricultural record keeping for an SAE. a. Determine types of records to keep. b. Describe how to maintain various systems of record keeping.	**Teaching:** • For each type of SAE, identify the records that should be maintained by the student. This includes income and expenses, time spent in supervised experience, activities and skills performed, and results of the experience. • Have each student maintain necessary records for the SAE. These records should be checked throughout the year. • At the end of the year, have students prepare an end-of-the-year summary of their experience(s), including their own evaluation of the effectiveness of each experience and the skills and knowledge learned. **Assessment:** • Evaluate records for accuracy, completeness, and neatness.
6. Maintain agricultural records for an SAE. a. Prepare income and expense records. b. Prepare inventory records. c. Compute enterprise summaries.	**Teaching:** • Discuss income and expense records, inventory records, placement records, leadership activity records, and computing

d. Maintain placement records. e. Summarize the SAE program. f. Maintain leadership activity records. g. Compute a net worth statement.	enterprise summaries and net worth statements. • Have the students start filling in their records with their information. • Have each student write a summary of the SAE program to add to his or her notebook. **Assessment:** • Make monthly checks on progress in keeping accurate records of SAE experiences. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives.
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives.
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
ABS1 Employ leadership skills to accomplish goals and objectives in the AFNR business environment.
ABS2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS4 Employ AFNR industry concepts and practices to manage inventory.
ABS5 Utilize technology to accomplish AFNR business objectives.
ABS6 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.

A6 Communicate using the language of algebra.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

National FFA Organization. (2005). *FFA proficiency award and degree* [Computer software]. Indianapolis, IN: Author.

Ricketts, C. (2004). *Leadership: Personal development and career success* (2nd ed.). Clifton Park, NY: Delmar. (ISBN: 0-7668-2536-1)

Steward J. (2000). *Farm and ranch business management* (4th ed.). Moline, IL: Deere.

Agriscience I
Unit 5: Biotechnology **(20 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain the basic principles of heredity. a. Describe the role of genes and chromosomes in heredity. b. Explain the functions of DNA and RNA in heredity. c. Describe the process of cell division in reproduction. d. Discuss mutations, genetic disease, and birth defects in the process of inheritance. e. Calculate a simple problem demonstrating inheritance of dominant and recessive traits.	**Teaching:** • Have students observe and calculate the number of occurrences of a given trait (e.g., widow's peak, attached earlobes, or dimples) in the class. Ask how these observations relate to heredity. • Discuss basic principles of heredity and its role in agriculture now, in the past, and in the future. • Have each student use popsicle sticks, assorted colored markers, and tape to model a pair of homologous chromosomes with marks representing genes. • Have students work in groups based on multiple intelligences and use models of DNA and RNA nucleotides to demonstrate the formation of a protein via transcription and translation. • Have each student scrape the inside of his or her cheek with a toothpick, place the cells on a microscope slide, dye the cells, and observe and draw the cells as seen underneath a microscope (may also use prepared onion tip slides). Have students draw all stages of mitosis. • Have students work in groups to design a collage that identifies the results of mutations including genetic diseases and birth defects. • Demonstrate use of the Punnett Square, and have each student use it to solve sample problems. **Assessment:** • Monitor student participation in all activities using the Group Work Assessment Rubric located in Appendix D. • Evaluate collage using Group Presentation Assessment Rubric located in Appendix D. • Assess problem solutions for accuracy.

2. Discuss terms and concepts related to biotechnology. a. Define terms related to biotechnology such as DNA, RNA, allele, phenotype, gene, heterozygous, homozygous, chromosome, plasmids, clone, explant, mutation, enzyme, hybridization, embryo transfer, genetic engineering, selective breeding, gene mapping, gene splicing, applied research, pedigrees, BST, APHIS, *Bacillus thuringiensis*, USDA, EPA, and FDA. b. Examine the history of biotechnology. c. Investigate emerging issues associated with biotechnology. d. Describe issues of bio security which producers of plants and animals should be applying to protect their products from contamination or destruction.	**Teaching:** • Lead the students in a discussion about biotechnology concepts and history using examples such as the development of seedless watermelons and grapes or topics in videos (e.g., Jurassic Park). • Have each student research and write an essay describing emerging issues associated with biotechnology. These should include but not limited to cloning, ethical issues, health issues, and other plant and animal products declared unsafe for human consumption as a result of bio-technical processes used in their development and production. • Have each student prepare a reflective writing about whether he or she would support the use of diagnostic tests for predispositions for genetic disorders since these tests may be used by those at risk to modify life-style choices but may also be used by insurance companies and employers to exclude predisposed but otherwise healthy people. • Have students research issues of bio security and participate in a class debate. **Assessment:** • Evaluate essay using the Written Report Assessment Rubric located in Appendix D. • Assess reflective writing using the Reflective Writing Rubric located in Appendix D. • Monitor participation in debate.
3. Examine contributions which biotechnology makes to agriculture. a. Identify improvements of animals and plants made possible through biotechnology. b. Describe frost protection. c. Discuss photosynthesis research. d. Describe disease and insect resistance. e. Discuss the practice of animal and plant integration used in disease and insect control.	**Teaching:** • Ask students if they have heard of a sheep named Dolly and how that experiment affected agriculture. • Discuss contributions of biotechnology including improvements of plants and animals such as frost resistance, photosynthesis research, and disease and insect resistance. Have students take notes. • Have students work in groups to research the practice of animal and plant integrated use in disease and insect control and self assess their understanding of

	biotechnology in agriculture. **Assessment:** • Review notes and reteach as necessary. • Monitor student research.
4. Investigate methods of transferring genetic information. a. Describe gene splicing. b. Discuss cloning. c. Describe tissue culture. d. Perform tissue culture.	**Teaching:** • Discuss methods of transferring genetic information. • Have students work in groups to research terms and procedures related to genetic engineering, gene splicing, cloning, and tissue culture as used in agriculture and prepare an oral presentation, brochure, or newspaper article. • Have students work in groups to perform tissue cultures. Have each student prepare a laboratory report based on the activity. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Assess presentation, brochure, or newspaper article for content and appearance. • Evaluate laboratory report for content. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
FPP1 Apply principles of food processing to maintain equipment and facilities.
FPP2 Apply principles of food science to the food industry.

FPP3 Plan, implement, manage, and/or provide services for the preservation and packaging of food and food products.
FPP4 Identify processing, handling, and storage factors to show how they impact product quality and safety.
PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT3 Apply fundamentals of production and harvesting to produce plants.
PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
ANM2 Recognize animal behaviors to facilitate working with animals safely.
ANM3 Provide proper nutrition to maintain animal performance.
ANM4 Know the factors that influence an animal's reproductive cycle to explain species response.
ANM5 Identify environmental factors that affect an animal's performance.
TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR2 Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
TEC1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
TEC2 Use available power sources to plan and apply control systems.
TEC3 Explain geospatial technology to demonstrate its applications.
NRS1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS2 Use effective venues to communicate natural phenomena to the public.
NRS3 Apply scientific principles to natural resource management activities.
NRS4 Employ knowledge of natural resource industries to describe production practices and processing procedures.
NRS5 Practice responsible conduct to protect natural resources.
ENV1 Use analysis procedures to plan and evaluate environmental service impacts.
ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
ENV3 Apply scientific principles to environmental services.
ENV4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
ENV5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.

ABS1 Employ leadership skills to accomplish goals and objectives in the AFNR business environment.
ABS2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS4 Employ AFNR industry concepts and practices to manage inventory.
ABS5 Utilize technology to accomplish AFNR business objectives.
ABS6 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A4 Explore and communicate the characteristics and operations of polynomials.
A5 Utilize various formulas in problem-solving situations.
A6 Communicate using the language of algebra.
A7 Interpret and apply slope as a rate of change.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
B4 Investigate the transfer of energy from the sun to living systems.
B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
B6 Investigate concepts of natural selection as they relate to diversity of life.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E6 Explore cultural contributions to the history of the English language and its literature.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V. (2005). *Introduction to Biotechnology: An agricultural revolution*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-4272-X)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

Agriscience I
Unit 6: Animal Science **(20 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Examine the major body systems of various species. a. Distinguish roles and functions of major body systems. b. Contrast differences in body systems among species.	**Teaching:** • Have students work in groups and use anatomy charts of each species to pronounce and identify major body systems. Have students self assess and peer assess their knowledge. • Have each student draw the body parts and label the functions of the systems of a species on a poster or other display. • Lead students to identify parts from various preserved specimens (fetal pig, grocery products, or other examples). Describe the differences in body systems among the various species. **Assessment:** • Evaluate drawings for accuracy and appearance. • Assess student participation in identification activity.
2. Examine nutrients required by animals for normal growth and development, including their sources, functions, and ration. a. Differentiate the purpose of nutrients, including carbohydrates, fats, proteins, vitamins, minerals, and water. b. Describe nutrient sources, including roughages, concentrates, animal byproducts, minerals, and synthetic nutrients. c. Analyze feed samples. d. Develop a ration for a specific species and class of animal, balancing it using the Pearson Square.	**Teaching:** • Discuss what nutrients are, and give an overview of their functions in the body. • Have students work in groups to examine the roles of each class of nutrient and the sources of these nutrients in feed products; have each group prepare a chart listing the information. • Lead students to analyze various feed samples. Have each student report the results in a laboratory report. • Demonstrate how to develop rations for various classes, and have each student develop a ration for an assigned class using the Pearson Square. **Assessment:** • Assess nutrient chart for accuracy and appearance. • Evaluate laboratory report for content. • Assess ration calculation for accuracy.

3. Examine animal diseases and their control and treatment. a. Classify animal diseases as contagious and non-contagious. b. Analyze fecal and blood samples for parasites and disease. c. Distinguish methods of controlling and treating diseases such as sanitation, isolation, and vaccination. d. Demonstrate vaccination procedures, including proper injection sites and techniques. e. Examine considerations for drug withdrawal in meat and dairy animals. f. Examine the risks to humans from contagious and non-contagious diseases and parasites.	**Teaching:** • Discuss the significance of animal diseases in agriculture and the risks to humans from various diseases and parasites. • Have each student choose contagious and non-contagious diseases and parasites and prepare a written report about their characteristics and effects. • Lead students to collect and analyze samples and report the results in a laboratory report. • Have students work in groups to investigate various classes of diseases and how they may be controlled; have them prepare a television program, game, or chart. • Demonstrate procedures used for various vaccinations. • Discuss drug withdrawal times and considerations. Have each student research a specific drug. **Assessment:** • Evaluate report using the Written Report Assessment Rubric located in Appendix D. • Evaluate disease product for content and appearance. • Monitor student participation in vaccination activity.
4. Examine food products and processing. a. Explain methods of processing, preserving, and storing foods. b. Identify the wholesale cuts of major agricultural species of animals. c. Investigate factors of profitability in processing of animal carcasses including processing yield, shrinkage, and fat versus lean content.	**Teaching:** • Invite a guest speaker from the Extension Service to describe various processes for preserving and storing foods. • Describe the wholesale cuts of each species of meat animal, and show students examples from a local grocery store. • Have students match various wholesale cuts to a diagram of a carcass. • Have each student do a reflective writing about the cuts of meat associated with various holidays. • Have each student research factors of profitability in processes animal carcasses and prepare a collage of information. **Assessment:** • Assess matching activity for accuracy. • Review reflective writing using the

	Reflective Writing Rubric located in Appendix D. • Evaluate collage for content and appearance.
5. Explain some of the economic and practical considerations of livestock production. a. Identify management systems of animal production used with beef and dairy cattle, sheep, rabbits, goats, swine, poultry, horses, aquatic species, and other livestock. b. Identify shelter and facilities required for production of livestock. c. Describe types and breeds of livestock. d. Describe feeds and feeding practices required for livestock. e. Calculate a feed conversion ratio. f. Describe the environmental impact of animal waste management on the livestock industry. g. Describe the concept of bio security as it applies to animal production. h. Describe the concerns of hormones, antibiotics, and probiotics used in animal health and production. i. Describe the importance of factors contributing to cost of production of livestock. j. Describe the practice of artificial insemination in livestock production.	**Teaching:** • Tell students a story or show them a video about a working farm to reveal some of the economic and practical considerations of livestock production. • Have each student list considerations from the story or video and use a graphic organizer to present various management systems to the class. • Have students work in groups to assemble of photo album of shelters and facilities needed for production. • Present information related to livestock breeds, and have students take notes on the associated vocabulary. • Have each student research a breed and prepare a chart or essay. • Describe feeding practices, and demonstrate how to calculate a conversion ratio. Have students take notes on information. • Take students on a field trip to a local feed store to investigate various feeds and feeding equipment. Have each student write a summary of what was learned. • Have students work in groups to review state and federal laws and regulations related to waste management, bio security, drug usage, and biotechnology. Have each group determine what changes farms have made to meet these requirements. • Have each student design an experiment to determine ways to cut costs of production of livestock. • Invite a guest speaker (e.g., veterinarian, county agent, or farmer) to discuss the importance of artificial insemination). Have each student outline what was said. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to

	ensure mastery. **Assessment:** • Use the Socratic Method to assess student understanding of the story or video and laws and regulations. • Evaluate photo album for content and appearance. • Evaluate breed poster or essay for content. • Assess experiment for proper design and feasibility. • Assess student notes and summaries for understanding and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
ANM2 Recognize animal behaviors to facilitate working with animals safely.
ANM3 Provide proper nutrition to maintain animal performance.
ANM4 Know the factors that influence an animal's reproductive cycle to explain species response.
ANM5 Identify environmental factors that affect an animal's performance.
TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
ABS2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS4 Employ AFNR industry concepts and practices to manage inventory.
ABS5 Utilize technology to accomplish AFNR business objectives.
ABS6 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5 Utilize various formulas in problem-solving situations.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Breeds of Livestock. (n.d.). Retrieved March 10, 2006, from http://www.ansi.okstate.edu/breeds/

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Gillespie, J. R. (2004). *Modern livestock and poultry production* (7th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1607-9)

Glen Rose FFA Ag Lesson Plans. (n.d.). Retrieved March 10, 2006, from http://www.glenroseffa.org

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

The Merck Veterinary Manual Online. (n.d.). Retrieved March 14, 2006, from http://www.merckvetmanual.com/mvm/index.jsp

Agriscience I
Unit 7: Mechanical Science **(15 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Demonstrate principles and applications of measurement. a. Demonstrate measurement of linear distance, areas, and volumes using the metric and English systems, including the use of a ruler. b. Demonstrate measurement of land in acres. c. Demonstrate measurement using a micrometer and graduated caliper in metric and English systems. d. Demonstrate liquid measure using metric and English systems. e. Demonstrate temperature measurement using the Fahrenheit and Celsius scales.	**Teaching:** • Use a five pound bag of sugar, flour, or corn meal and a gallon of milk to show the differences between mass, weight, and volume. • Demonstrate the use of various measuring devices. • Divide students into groups based on their learning styles, and have them measure common items such as oil, sugar, seeds, feed, and other items using different measuring devices. • Have each student measure temperatures and convert measurements between the scales. **Assessment:** • Assess measurements for accuracy.
2. Examine principles and applications of fluid power machines. a. Define hydraulics. b. Demonstrate principles of hydraulics.	**Teaching:** • Demonstrate principles of hydraulics. • Have students research the use of hydraulics and make a list of their findings. **Assessment:** • Review uses list for content.
3. Identify and calculate mechanical advantages of six simple machines including lever, inclined plane, wheel, fulcrum, pulley, and axle. a. Describe six simple machines including lever, inclined plane, wheel, fulcrum, pulley, and axle. b. Calculate mechanical advantages of six simple machines including lever, inclined plane, wheel, fulcrum, pulley, and axle. c. Demonstrate an example of mechanical advantage by using simple machines.	**Teaching:** • Show students examples of the six simple machines and describe uses of each. • Have each students select one machine and prepare an oral or written report about its discovery, use, and calculation. • Divide students into groups based on multiple intelligences, and have each group calculate the mechanical advantage and percent efficiency of a chosen simple machine. • Lead students in a panel discussion about the advantages of each machine and how it reduces the work to do a task. **Assessment:** • Evaluate report for content. • Assess calculations for accuracy. • Monitor student participation in panel.

4. Investigate principles and applications of electricity. a. Describe the basic principles of polarity. b. Troubleshoot and repair electrical systems. c. Measure electrical values using a multimeter. d. Calculate watts, amperes, and volts. e. Calculate kilowatt hours. f. Wire simple residential electrical circuits including a light controlled by a switch and a convenience outlet for 110 volt systems.	**Teaching:** • Discuss principles of electricity, using magnetism as example for polarity. • Have each student solve a scenario in which an electrical system needs repair. • Have students work in groups to use a multimeter, perform calculations, and wire circuits. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Assess solution for accuracy. • Monitor participation in group work. • Evaluate calculations for accuracy. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR2 Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR1 Exercise basic skills in blueprint and design development to create sketches, drawings, and plans.
STR2 Read and relate structural plans to specifications and building codes.

TEC2 Use available power sources to plan and apply control systems.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5 Utilize various formulas in problem-solving situations.
A6 Communicate using the language of algebra.
A7 Interpret and apply slope as a rate of change.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Cooper, E. L., & Herren, R.V. (2002). *Agricultural mechanics: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1410-6)

Glen Rose FFA Ag Lesson Plans. (n.d.). Retrieved March 10, 2006, from http://www.glenroseffa.org

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

Agriscience I
Unit 8: Principles of Fiber Science **(10 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Examine fiber science concepts. a. Define terms related to fiber science such as cellulose, lignin, crimp, staple length, boll, pulp, and kenaf.	**Teaching:** • Ask students to give examples of the use of fiber. • Have each student develop a dictionary with terms related to fiber science. • Have students collect, microscopically examine, and sketch fibers from various types of cloth (e.g., cotton, polyester, and wool). Have them burn the fibers, examine them again, and describe the changes that have occurred in each type of fiber. **Assessment:** • Monitor student participation. • Evaluate dictionary for accuracy. • Assess drawings and description of changes for accuracy.
2. Investigate the fiber industry and its economic importance in relation to clothing, paper, textiles, and lumber. a. Investigate the local, state, national, and global economic impact of the fiber industry. b. Describe how technology and mechanization has revolutionized the fiber industry. c. Describe the need for plant fibers. d. Describe the need for animal fibers. e. Investigate the lumber industry and methods to calculate board feet and running (linear) feet.	**Teaching:** • Discuss the fiber industry, including the use of plant and animal fibers. • Have each student research the possible economic impact in an area where a fiber-related industry was lost due to a natural disaster or the factory moving to another country and write an essay. • Have students work in groups to research technology and mechanization in the fiber industry and to prepare a mural or presentation and show to the class. • Have students calculate required materials for a project. Give them a list of the cost of building materials and have them determine the cost of materials for the project. **Assessment:** • Evaluate essay using the Written Report Assessment Rubric located in Appendix D. • Assess mural or presentation for content and appearance. • Evaluate cost estimates for accuracy.
3. Describe the ginning process for cotton. a. Discuss the history of the ginning process.	**Teaching:** • Describe the history of cotton ginning and current methods used.

b. Describe the ginning process for cotton including fiber and uses of the byproducts including seed, hulls, and oil.	• Take students to a cotton ginning operation and have each student summarize observations. **Assessment:** • Monitor student participation using the Field Trip Participation Checklist in Appendix D.
4. Investigate the paper making process. a. Describe the paper making process including types of paper and the byproducts produced.	**Teaching:** • Explain the paper making process including materials and methods used. • Take students on a field trip to observe the paper making process including types of paper and the byproducts produced. • Lead students to work in groups to recycle paper into a usable product. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Monitor student participation using the Field Trip Participation Checklist in Appendix D. • Assess group work using the Group Work Assessment Rubric located in Appendix D. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
FPP1 Apply principles of food processing to maintain equipment and facilities.
FPP2 Apply principles of food science to the food industry.

FPP3 Plan, implement, manage, and/or provide services for the preservation and packaging of food and food products.
FPP4 Identify processing, handling, and storage factors to show how they impact product quality and safety.
PLT1
PLT2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT3 Apply fundamentals of production and harvesting to produce plants.
PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
ANM2 Recognize animal behaviors to facilitate working with animals safely.
STR3 Examine structural requirements to estimate project costs.
TEC1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
ENV3 Apply scientific principles to environmental services.
ABS6 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
B4 Investigate the transfer of energy from the sun to living systems.
B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Camp, W. G., & Daugherty, T. B. (2002). *Managing our natural resources* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1554-4)

Glen Rose FFA Ag Lesson Plans. (n.d.). Retrieved March 10, 2006, from http://www.glenroseffa.org

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

The History Channel (Producer). (n.d.). *Modern marvels: Cotton* [DVD]. (Available from A&E Home Video, P.O. Box 2284, South Burlington, VT 05407, 1-888-423-1212)

Agriscience I
Unit 9: Plant Science **(20 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Examine plant science concepts. a. Define terms associated with plant science such as chlorophyll, allelopathy, herbaceous, and pubescence.	**Teaching:** • Ask students to list the ways plants are important in their daily lives. • Present a lecture on plant science terms and the importance of plants. • Have each student use a U.S. map to research the different types of vegetation in different sections of the country and the related vegetation distribution to the climate. Have them write a summary relating climate (sun and moisture) of an area to vegetation. • Invite a guest speaker or show a video that addresses the effect that climate has on vegetation and how it determines types of agriculture practiced in the region. **Assessment:** • Monitor student participation in activities. • Review summary for content.
2. Investigate major structural parts of plants including roots, stems, and leaves. a. Describe functions of structural parts of plants. b. Explain the food storage processes in roots, stems, and seeds.	**Teaching:** • Use a fern, moss, and flowering plant to show the differences in parts of various plants. • Have students work in groups based on their learning styles to draw the parts of a plant, identify their functions, and present their drawings to the class for peer review. • Have each student research food storage processes and write a brief summary of each. **Assessment:** • Assess drawing for accuracy using Visual Presentation Checklist located in Appendix D. • Evaluate summary for content.
3. Categorize the classes of agricultural plants. a. Examine differences among and classify annuals, perennials, and biennials. b. Examine differences between and classify monocotyledons and	**Teaching:** • Describe differences among various categories of plants, using various plants as examples. • Have each student collect pictures or parts of plants from each category and form a photo album or collage.

dicotyledons. c. Examine differences between and classify deciduous and evergreen.	**Assessment:** • Assess collection for content and appearance.
4. Determine the nutrients needed for proper plant growth. a. Identify secondary and primary plant nutrients. b. Investigate differences between micronutrients and macronutrients. c. Determine fertilizer types and amounts needed by plants for proper growth. d. Analyze the effects of nutrients, water, and pH on plants.	**Teaching:** • Discuss the importance of nutrients for plant growth and the use of fertilizers and other amendments to enhance growth. • Have students work in groups to investigate the effects of various treatments (e.g., vinegar, water, cola, orange juice, and coffee) or fertilizers (amounts and types) on plants and measure the differences in growth and performance. Have each student write a summary of the results. **Assessment:** • Monitor student participation in experiments. • Assess summary for content.
5. Investigate irrigation systems for various applications. a. Examine the uses for drip, flood, sprinkler, and hose and bib systems.	**Teaching:** • Discuss various methods of irrigation systems. • Have students work in groups to examine case studies related to irrigation and recommend the best type of system. **Assessment:** • Assess solution to case study using Case Study Assessment Rubric located in Appendix D.
6. Examine common plant pests and diseases and control methods. a. Identify common plant pests. b. Examine common plant diseases and their causal agents including nutritional causes and bacteria, fungi, and viruses. c. Determine methods of pest control. d. Determine methods of disease control.	**Teaching:** • Discuss various pests and diseases and methods of control. • Have students work in groups to research common pests and diseases found in an assigned crop and develop a chart, map, or article. • Have each student develop a recommendation for methods to control a given pest or disease. **Assessment:** • Evaluate chart, map, or article for content. • Evaluate recommendation for appropriateness.

7. Explain the important plant growth and food production processes. a. Describe photosynthesis. b. Describe transpiration. c. Describe respiration. d. Investigate principles of photosynthesis, transpiration, respiration, and the absence of plant nutrients.	**Teaching:** • Describe and discuss the processes by which plants grow. Have students create a drawing to trace the movement of water and nutrients from the roots to the leaves. • Use an integration project with the biology teacher to reinforce instruction in growth processes. • Conduct experiments to demonstrate principles of photosynthesis, transpiration, respiration, and absence of plant nutrients. **Assessment:** • Assess drawing for content and appearance. • Monitor participation in integration project and experiments using the Group Participation Assessment Rubric located in Appendix D.
8. Examine various methods of plant reproduction. a. Describe the functions of complete and incomplete flowers. b. Label the reproductive parts of a flower. c. Contrast differences in sexual and asexual reproduction. d. Describe principles of plant pollination.	**Teaching:** • Show the reproductive parts of flowering plants and discuss their functions. • Have each student diagram and label parts of a complete flower and an incomplete flower. • Conduct experiments to demonstrate principles of plant pollination. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Assess diagram for accuracy. • Monitor participation in experiments using the Group Participation Assessment Rubric located in Appendix D. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT3 Apply fundamentals of production and harvesting to produce plants.
PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
B4 Investigate the transfer of energy from the sun to living systems.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.

H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

CORD. (n.d.). *Contextual science*. (Available from CORD Communications, 601 Lake Air Drive, Waco, TX 76710, 1-800-231-3015)

Glen Rose FFA Ag Lesson Plans. (n.d.). Retrieved March 10, 2006, from http://www.glenroseffa.org

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

Agriscience I
Unit 10: Soil Science **(20 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Determine soil textures from clay, sand, and silt based soils.	**Teaching:** • Discuss the study of soils in agriculture and the "father of soils" E. W. Hilgard, a Mississippi native. • Show students examples of various textures of soil, explain how their classification is determined, and have each student collect examples of each type. • Have students work in groups to analyze texture by placing soil in a jar with 2-3 drops of detergent and water, shaking, allowing soil to settle out, and measuring layers to determine soil classification. **Assessment:** • Monitor student participation in activities.
2. Determine factors affecting soil classification and capability classes including slope and drainage, permeability, texture, and depth of top soil.	**Teaching:** • Explain factors affecting soil classification, slope, drainage, permeability, texture, and dept of top soil. • Have students work in groups to determine slope and drainage, permeability, texture, and dept of top soil of a given area. • Identify soils in the local area using county soil survey maps and take students on a tour of different areas. Discuss land use categories and how land in the area is used based on the categories. Have each student write a summary of types of land observed. **Assessment:** • Monitor student participation in activities. • Evaluate summary for content.
3. Apply procedures for collecting and utilizing soil samples. a. Collect and process a soil sample. b. Analyze a soil sample for primary nutrients and pH. c. Recommend soil amendments such as macronutrients, micronutrients, fertilizers, and pH adjustments.	**Teaching:** • Demonstrate procedures for collecting soil samples, show examples of analysis results, and discuss uses of soil sampling. • Lead students to collect and process a soil sample and to conduct basic soil analysis tests, including ribbon and porosity tests. • Have each student write a sample soil analysis report using the information collected and recommend amendments for various crops.

	Assessment: • Assess soil report for content and appearance.
4. Investigate factors contributing to soil erosion and various methods of control. a. Investigate principles and methods of soil tillage. b. Examine soil conservation methods.	**Teaching:** • Invite a representative of the USDA or other agency associated with agricultural environmental issues to speak to the class about the causes of effects of soil erosion. Have students summarize important points in their notebooks. Follow up with a discussion to make sure that students have listed all important points in their notes. • Discuss soil tillage principles and methods. • Have students work in groups to research various soil conservation methods and prepare a news report, training video, or learning center. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Assess conservation product for content and appearance. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT3 Apply fundamentals of production and harvesting to produce plants.

PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR5 Plan, implement, manage, and/or provide support services for facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.
TEC3 Explain geospatial technology to demonstrate its applications.
NRS1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS2 Use effective venues to communicate natural phenomena to the public.
NRS3 Apply scientific principles to natural resource management activities.
NRS4 Employ knowledge of natural resource industries to describe production practices and processing procedures.
NRS5 Practice responsible conduct to protect natural resources.
ENV1 Use analysis procedures to plan and evaluate environmental service impacts.
ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
ENV3 Apply scientific principles to environmental services.
ENV4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
ENV5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A4 Explore and communicate the characteristics and operations of polynomials.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B4 Investigate the transfer of energy from the sun to living systems.
B6 Investigate concepts of natural selection as they relate to diversity of life.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Butz, S. D. (2004). *Science of earth systems*. Clifton Park, NY: Thomson Delmar. (0-7668-3391-7)

Camp, W. G., & Daugherty, T. B. (2002). *Managing our natural resources* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1554-4)

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

Plaster, E. (2002). *Soil science and management* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-3935-4)

Agriscience I
Unit 11: Environmental Science and Natural Resources (20 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain the importance of natural resources. a. Describe the importance of forestry, soil, plants, water, and wildlife in the local, county, and state economy.	**Teaching:** • Lead students to brainstorm products and leisure activities made possible by natural resources. Preassess students' knowledge of the field during this activity. • Discuss various environmental and natural resources and their importance to the South and to Mississippi in particular. • Have students prepare a map indicating the importance of natural resources in various counties in Mississippi and other states. **Assessment:** • Evaluate the map for accuracy and appearance.
2. Explore the basic concepts of natural resource conservation and management. a. Classify renewable and non-renewable natural resources. b. Discuss the concept of sustainability as related to natural resources and the environment.	**Teaching:** • Define renewable and non-renewable resources. Have students create a list of renewable and non-renewable natural resources in the area. • Briefly discuss and define the concept of sustainability and relate this concept of the efficient use of natural resources and protection of the environment. Have students research practices in agriculture that exemplify sustainability and prepare a brochure or poster for exhibit to the class. **Assessment** • Evaluate student poster or brochure using the Poster Assessment Rubric located in Appendix D.
3. Examine principles of forestry. a. Compare properties of wood (hardness, weight, shrinkage, warping, and wood working qualities). b. Identify species of trees, comparing hardwoods and softwoods. c. Describe management practices of forest management including growing a wood lot, planning of a harvest cutting, wood lot protection, and prescribed burning.	**Teaching:** • Discuss the properties of wood, including hardness, weight, shrinkage, warping, and wood working qualities. • Conduct field trip(s) to local forest industries to view wood and forest products. Have students record their observations in their journal/notebook. • Have students design a museum-type exhibit explaining the properties of wood and the importance of forestry. Invite other students to visit and evaluate the exhibit.

d. Examine principles of silviculture.	• Use a PowerPoint presentation to present basic information on identifying characteristics of trees, including the differences between hardwoods and softwood and methods to determine species. • Have each student collect, preserve, and display leaves and bark of local species. All specimens are to be identified by common and scientific name. • Explain principles of forest management and give examples of forest management plans. • Have students work in groups based on their learning styles to develop a product such as a training manual, session, or video to teach a new landowner the principles of silviculture. **Assessment:** • Evaluate the field trip participation using the Field Trip Participation Checklist located in Appendix D. • Evaluate the exhibit for content and appearance. • Evaluate students leaf and bark collection. • Evaluate the group product for content and appearance.
4. Identify the characteristics of selected species of wildlife. a. Describe vertebrates and invertebrates. b. Describe interdependency occurring within the wildlife community, including parasitism, mutualism, predation, communalism, and competition.	**Teaching:** • List various species of wildlife commonly found in Southern forests. • Have each student choose one species; research the species to determine characteristics such as classification, habitat, feeding patterns, and other distinguishing characteristics; and write a magazine article about the species. • Compile the articles into one magazine and have the students self-evaluate and peer evaluate the articles. • Discuss the interrelationships among plants, animals, and humans. • Have students prepare a large diagram illustrating the relationships between several species, indicating relationships involving parasitism, mutualism, predation, commensalisms, and

	competition. **Assessment:** • Evaluate the articles using the Written Report Assessment Rubric located in Appendix D. • Monitor student participation in construction of the diagram.
5. Investigate natural resource contamination. a. Discuss the sources of water and potential threats to each source. b. Discuss sources of air pollution and precautions that can be taken to reduce or prevent pollution. c. Explore ways in which agricultural enterprises protect and enhance air and water quality. d. Test water, air, and soil for contaminants.	**Teaching:** • Invite a representative of the Department of Environmental Quality to discuss with the students major threats to air and water quality in the local area. Have students summarize this discussion in their notebook. Follow up with the students to make sure they have recorded important points. • Have each student research the way various agricultural enterprises protect quality and prepare a written report. • Lead students to test water, air, and soil for contaminants. Have each student complete a laboratory report on the findings. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment** • Evaluate the report using the Written Report Assessment Rubric located in Appendix D. • Assess the lab report for accuracy and completeness. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT3 Apply fundamentals of production and harvesting to produce plants.
PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR5 Plan, implement, manage, and/or provide support services for facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.
TEC3 Explain geospatial technology to demonstrate its applications.
NRS1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS2 Use effective venues to communicate natural phenomena to the public.
NRS3 Apply scientific principles to natural resource management activities.
NRS4 Employ knowledge of natural resource industries to describe production practices and processing procedures.
NRS5 Practice responsible conduct to protect natural resources.
ENV1 Use analysis procedures to plan and evaluate environmental service impacts.
ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
ENV3 Apply scientific principles to environmental services.
ENV4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
ENV5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A4 Explore and communicate the characteristics and operations of polynomials.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B4 Investigate the transfer of energy from the sun to living systems.
B6 Investigate concepts of natural selection as they relate to diversity of life.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Butz, S. D. (2004). *Science of earth systems*. Clifton Park, NY: Thomson Delmar. (0-7668-3391-7)

Camp, W. G., & Daugherty, T. B. (2002). *Managing our natural resources* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1554-4)

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

Agriscience I
Unit 12: Entomology **(20 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Define terms related to entomology. a. Define terms such as vector, defoliate, weed, pathogen, entomophagous, metamorphosis, instar, pheromone, and eradication.	**Teaching:** • Have students brainstorm benefits of various insects and the effects of removing those insects from the environment. • List terms related to entomology and have students define those terms to create a dictionary. **Assessment:** • Evaluate dictionary for content.
2. Investigate insect morphology and classification. a. Review insect morphology. b. Arrange insects based on their scientific classification.	**Teaching:** • Remind students of insect morphology as learned in other science classes, and discuss how insects are classified. • Have students collect specimens and classify them according to their characteristics such as sucking, piercing, siphoning, sponging, and chewing and biting mouth parts. **Assessment:** • Evaluate collection for content and appearance.
3. Investigate the effects of insects on society and agriculture through history. a. Discuss the effects of diseases such as Dutch elm disease, potato blight, chestnut blight, b. Investigate the effects of insects on crop storage in various climates.	**Teaching:** • Discuss the effects that insects have had on various societies and in agriculture. • Have each student research a disease and present a report on its effects on society. • Lead students to conduct experiments investigating the effects of insects on crop storage under various conditions. Have each student summarize the results. **Assessment:** • Evaluate report for content and presentation. • Review summary for content.
4. Investigate methods of insect control. a. Investigate biological, cultural, mechanical, clean culture, trap crop, pest resurgence, and chemical control methods. b. Develop an integrated pest management plan.	**Teaching:** • Discuss various methods of insect control, and show students examples of integrated pest management plans. • Have students work in groups to analyze case studies related to insect control and present their solutions to the class. • Have each student develop an integrated

	pest management plan. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Assess case study using the Case Study Assessment Rubric located in Appendix D. • Evaluate pest management plan for accuracy. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
FPP2 Apply principles of food science to the food industry.
FPP4 Identify processing, handling, and storage factors to show how they impact product quality and safety.
PLT3 Apply fundamentals of production and harvesting to produce plants.
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
ANM2 Recognize animal behaviors to facilitate working with animals safely.
ANM5 Identify environmental factors that affect an animal's performance.
TEC3 Explain geospatial technology to demonstrate its applications.
NRS1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS5 Practice responsible conduct to protect natural resources.
ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
ENV3 Apply scientific principles to environmental services.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A6 Communicate using the language of algebra.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
B6 Investigate concepts of natural selection as they relate to diversity of life.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

Secondary Agriscience

CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Amateur Entomologists' Society Bug Identification. (n.d.). Retrieved March 14, 2006, from http://www.projects.ex.ac.uk/bugclub/bugid.html

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Glen Rose FFA Ag Lesson Plans. (n.d.). Retrieved March 10, 2006, from http://www.glenroseffa.org

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

Agriscience II
Unit 1: Communication and Career Skills **(10 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Prepare and deliver an oral presentation. a. Follow the steps to prepare an oral presentation: identify a topic, develop an outline, collect and compile data, and draft a speech. b. Deliver an oral presentation using the basic principles of pubic speaking: voice utilization, stage presence, expression, response to questions, and general effect.	**Teaching:** • Show short video clips from a variety of oral presentations (e.g., President, Grammy winner, and valedictorian). Discuss the importance of oral presentations in our society. • Have students work in groups to brainstorm the sequence of steps that would be necessary in preparing an oral presentation. Use this to preassess their knowledge of the topic. • Have each student follow the steps in preparing an oral presentation and document his or her work on a visual display or in a journal. • Have students compare video clips of presentations from a variety of sources and evaluate whether the basic principles of public speaking were followed. • Have students work in groups to write and produce an informational agriculture television show (similar to *Farmweek* or *Mississippi Outdoors*). **Assessment:** • Evaluate the preparation of the presentation to ensure all steps were followed. • Evaluate the show for demonstration of the principles of voice utilization, stage presence, manuscript composition, expression, response, and general effect.
2. Utilize communication skills in careers. a. Write a cover letter for an agriscience job. b. Update resume to reflect current activities and experiences.	**Teaching:** • Discuss the purposes of a cover letter and resume. Show good and bad examples and have students point out the characteristics of each. • Have each student choose a job from a local newspaper or the Internet and write a mock cover letter to apply for the job. • Have each student review his or her resume from the first year of the program and make appropriate updates.

	• Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Evaluate the letter using the Business Letter Assessment Rubric in Appendix D. • Assess the updated resume using the Resume Rubric in Appendix D. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.

Academic Standards

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E6 Explore cultural contributions to the history of the English language and its literature.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

National FFA Organization. (n.d.). Retrieved March 10, 2006, from http://www.ffa.org

National FFA Organization. (2003). *Career development events handbook 2001-2005*. Retrieved June 20, 2005, from http://www.ffa.org/programs/cde/documents/cde_handbook.pdf

National FFA Organization. (2005). Lesson HS.128: Managing my journey. In *LifeKnowledge-Real lessons for real life* [Computer software]. Indianapolis, IN: Author.

National FFA Organization. (2005). Lesson HS.129: Adjusting your journey. In *LifeKnowledge-Real lessons for real life* [Computer software]. Indianapolis, IN: Author.

National FFA Organization. (2005). *FFA manual*. Indianapolis, IN: Author.

Agriscience II
Unit 2: Supervised Agricultural Experience (SAE) in Agriscience (Review) (15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Continue SAE activities in agriscience. (Ongoing)	**Teaching:** • Review the purposes of the SAE, and lead students as they continue SAE activities throughout the program. **Assessment:** • Monitor progress of the SAE in Agriscience.
2. Maintain agricultural records for the SAE. a. Prepare income and expense records. b. Prepare inventory records. c. Compute enterprise summaries. d. Maintain placement records. e. Summarize the SAE program. f. Maintain leadership activity records. g. Compute a net worth statement. h. Fill out proficiency award and State FFA degree applications.	**Teaching:** • Review steps in maintaining agricultural records for the SAE. • Have each student prepare income, expense, and inventory records. • Have each student compute enterprise summaries, maintain placement records, summarize the SAE program, maintain leadership activity records, and compute a net worth statement. • Assist students to fill out proficiency award and State FFA degree applications. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Assess student records and other activities for accuracy. • Evaluate proficiency award and State FFA degree applications. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
ABS1 Employ leadership skills to accomplish goals and objectives in the AFNR business environment.
ABS2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS4 Employ AFNR industry concepts and practices to manage inventory.
ABS5 Utilize technology to accomplish AFNR business objectives.
ABS6 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.
A6 Communicate using the language of algebra.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

National FFA Organization. (2003). *Career development events handbook 2001-2005*. Retrieved June 20, 2005, from http://www.ffa.org/programs/cde/documents/cde_handbook.pdf

National FFA Organization. (2005). *FFA proficiency award and degree* [Computer software]. Indianapolis, IN: Author.

National FFA Organization. (2005). *FFA manual*. Indianapolis, IN: Author.

National FFA Organization. (2005). *FFA student handbook*. Indianapolis, IN: Author.

Ricketts, C. (2004). *Leadership: Personal development and career success* (2nd ed.). Clifton Park, NY: Delmar. (ISBN: 0-7668-2536-1)

Roberts, H. M., Evans, W. J., Honeman, D. H., & Balch, T. J. (Eds.). (2004). *Robert's rules of order newly revised* (10th ed.). New York: HarperCollins.

Steward J. (2000). *Farm and ranch business management* (4th ed.). Moline, IL: Deere.

Agriscience II
Unit 3: Advanced Biotechnology **(30 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Examine biotechnology. a. Review terms. b. Describe benefits to plants, animals, and humans. c. Examine concerns and ethical issues. d. Discuss the environmental impact. e. Examine regulatory control of research and industry use. f. Apply biotechnology techniques including tissue culture and electrophoresis.	**Teaching:** • Show students products developed with the use of biotechnology (e.g., Bt cotton, diseases resistant tomatoes, seedless melons), and ask them what types of biotechnology were used in their development. Show videos such as *Jurassic Park* or *Gattaca* which address biotechnology issues. • Provide students with relevant terms, and have each student compile a dictionary. • Have each student choose one product improved through biotechnology and present a report to the class about its benefits, potential problems, environmental impact, and control. • Divide students into groups, and conduct a panel debate over ethical issues associated with biotechnology use. • Lead students to perform tissue culture and electrophoresis experiments. **Assessment:** • Preassess student knowledge of biotechnology based on answers. • Review dictionary for accuracy. • Evaluate presentation using the Presentation Checklist located in Appendix D. • Monitor student participation in debate and experiment.
2. Explain career opportunities in biotechnology. a. Describe sample work areas of biotechnology in agriculture. b. Describe biotechnology related work areas. c. Describe positions, salary ranges, educational requirements, and certifications for careers in biotechnology.	**Teaching:** • Have students work in groups to research career areas in biotechnology. • Have each student choose one career; list reasons for choosing the career, including potential salary; and prepare a long-range plan for securing a job in the field, including education and certifications. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to

	ensure mastery. **Assessment:** • Monitor student participation in group research work. • Assess career plan for content and neatness. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
FPP1 Apply principles of food processing to maintain equipment and facilities.
FPP2 Apply principles of food science to the food industry.
FPP3 Plan, implement, manage, and/or provide services for the preservation and packaging of food and food products.
FPP4 Identify processing, handling, and storage factors to show how they impact product quality and safety.
PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT3 Apply fundamentals of production and harvesting to produce plants.
PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
ANM2 Recognize animal behaviors to facilitate working with animals safely.
ANM3 Provide proper nutrition to maintain animal performance.
ANM4 Know the factors that influence an animal's reproductive cycle to explain species response.
ANM5 Identify environmental factors that affect an animal's performance.
TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.

PWR1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR2 Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
TEC1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
TEC2 Use available power sources to plan and apply control systems.
TEC3 Explain geospatial technology to demonstrate its applications.
NRS1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS2 Use effective venues to communicate natural phenomena to the public.
NRS3 Apply scientific principles to natural resource management activities.
NRS4 Employ knowledge of natural resource industries to describe production practices and processing procedures.
NRS5 Practice responsible conduct to protect natural resources.
ENV1 Use analysis procedures to plan and evaluate environmental service impacts.
ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
ENV3 Apply scientific principles to environmental services.
ENV4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
ENV5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.
ABS1 Employ leadership skills to accomplish goals and objectives in the AFNR business environment.
ABS2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS4 Employ AFNR industry concepts and practices to manage inventory.
ABS5 Utilize technology to accomplish AFNR business objectives.
ABS6 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A4 Explore and communicate the characteristics and operations of polynomials.
A5 Utilize various formulas in problem-solving situations.
A6 Communicate using the language of algebra.

A7 Interpret and apply slope as a rate of change.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
B4 Investigate the transfer of energy from the sun to living systems.
B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
B6 Investigate concepts of natural selection as they relate to diversity of life.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E6 Explore cultural contributions to the history of the English language and its literature.
E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills

Secondary Agriscience

CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V. (2005). *Introduction to Biotechnology: An agricultural revolution.* Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-4272-X)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

Agriscience II
Unit 4: Food Science **(20 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Examine the elements, trends, and career opportunities in the food industry. a. Discuss the food industry. b. Determine the importance of the food industry to the consumer. c. Describe the economic scope of the food industry. d. Identify government requirements and other assurances of food quality and sanitation. e. Compare the major crop and animal commodity production areas in the nation and the world. f. Describe the major food commodity groups and their predominant origins. g. Discuss the major operations that occur in the food industry. h. Investigate career opportunities in food science. i. Describe future developments predicted for the food industry.	**Teaching:** • Discuss elements, trends, and career opportunities associated with food science. Ask students how developments throughout history have impacted people's lives. • Have students work in groups based on their learning styles and use the Internet and current publications to research one new and emerging technology, practice, trend, or issue. • Have students use this research to develop an idea for a new product, prepare, and deliver a presentation according to the preferred learning styles in order to sell the idea to a company (the class). Students may use technology to prepare brochures, posters, or handouts to distribute during a multimedia presentation; create a commercial and act it out; or develop a newspaper advertisement. • Have the class self-evaluate their own work and peer evaluate their classmates' work. • Have each student select the one product that he or she thinks is most likely to be successful in the market and prepare a brief report justifying the product chosen and explaining the expected impact of the product on the field. **Assessment:** • Monitor group work to ensure that each member participates in research, idea development, and presentation preparation. • Evaluate each group's project for content, clarity, presentation, and length. • Evaluate each student's report for content as well as grammar and organization.
2. Examine food customs around the world. a. Investigate food customs around the world. b. Discuss the importance of the	**Teaching:** • Divide students into groups based on their learning styles. Have each group research food customs in an assigned region of the

appearance of food products and packaging.	world and prepare a brief list of these customs. • Have each group select a representative to serve on a panel for a panel discussion about different food customs. Have students that are not on the panel develop and ask the panel questions. • Show students examples of food products and packaging. Have them work in groups to identify positive and negative characteristics of each item and prepare a chart listing desirable traits. **Assessment:** • Evaluate customs list for accuracy. • Assess participation in panel discussion. • Evaluate chart for content.
3. Analyze the effects of helpful and harmful organisms in food science. a. Analyze the benefits of organisms in the process of culturing organisms to make food products such as yogurt, cheese, or bread. b. Analyze the harmful effects of organisms in processes such as food spoilage.	**Teaching:** • Describe helpful and harmful organisms commonly found when working with various types of foods. • Divide students into groups and lead them to culture organisms to make yogurt, cheese, or bread. • Have each student research harmful organisms and choose one organism about which to write a brief report. • Have each student summarize what he or she learned about food science and add the information to his or her notebook. **Assessment:** • Monitor students for participation using the Group Participation Assessment Rubric located in Appendix D. • Evaluate harmful organism report using the Written Report Assessment Rubric in Appendix D. • Review the unit summary and reteach as necessary.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
FPP1 Apply principles of food processing to maintain equipment and facilities.
FPP2 Apply principles of food science to the food industry.
FPP3 Plan, implement, manage, and/or provide services for the preservation and packaging of food and food products.
FPP4 Identify processing, handling, and storage factors to show how they impact product quality and safety.
PLT1
PLT2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT3 Apply fundamentals of production and harvesting to produce plants.
PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
ANM2 Recognize animal behaviors to facilitate working with animals safely.
TEC1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
ENV3 Apply scientific principles to environmental services.
ABS6 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.

B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
B4 Investigate the transfer of energy from the sun to living systems.
B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Glen Rose FFA Ag Lesson Plans. (n.d.). Retrieved March 10, 2006, from http://www.glenroseffa.org

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

National FFA Organization. (n.d.). Retrieved March 10, 2006, from http://www.ffa.org

Agriscience II
Unit 5: Advanced Plant Science **(25 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Investigate concepts associated with hydroponics. a. Describe media, medium, hydroponics, amendment, pH, acidity, alkalinity, neutral, primary nutrients, complete fertilizer, starter solutions, water culture, and aquaculture. b. Describe the requirements for water, oxygen, mineral nutrients, light, spacing, temperature, and support. c. Examine types of hydroponics systems, including aggregate culture, water culture, aeroponics, and continuous flow.	**Teaching:** • Lead students in a discussion about what they know about hydroponics and possible benefits of its use. • Divide students into groups and have each group develop a dictionary containing words related to hydroponics. • Describe various requirements in hydroponics. • Have students work in groups to design and conduct an experiment in which one of the requirements was left out of the hydroponics environment. • Have each student write a report outlining the consequences of omitting the given requirement. • Assign each student a type of hydroponics system to research. Have each student present their information to the class using electronic presentation equipment. • Divide students into groups, and have students build a hydroponics system. **Assessment:** • Evaluate dictionary for accuracy. • Evaluate the experiment and its design for adherence to the scientific method and completion. • Assess each report using the Written Report Checklist located in Appendix D. • Evaluate presentation using the Presentation Checklist located in Appendix D.
2. Investigate greenhouse management. a. Develop a pest and disease control plan using integrated pest management concepts. b. Design and utilize watering systems. c. Examine utilization of space.	**Teaching:** • Using presentation media and specimens, identify and discuss with the students considerations for insect control, disease control, watering systems, and utilization of space for various species of greenhouse plants. • Divide students into groups and assign specific tasks to each group in regards to growing out a commercial greenhouse

	crop. Rotate the groups over the growing period, so that each group completes all tasks in regards to the growing of the crop. **Assessment:** • Evaluate student performance on tasks associated with growing out specific greenhouse crops using the Activity Performance Rubric located in Appendix D.
3. Explain procedures to apply for a restricted pest management permit.	**Teaching:** • Using presentation media, identify and describe the different types of plant pests (insects, diseases, weeds, and small animals) and control and management practices (cultural, mechanical, biological, and chemical). • Describe and discuss with the students how the different methods can be used together for optimum control and management of plant pests. • Have students work in groups to determine solutions for pest management case studies. • Have students research standards for a restricted pest management permit and develop a list of requirements. **Assessment:** • Evaluate case study using Case Study Assessment Rubric located in Appendix D. • Review permit list for accuracy.
4. Explain the use of competitive exclusion. a. Identify beneficial and harmful bacteria and other organisms. b. Identify beneficial and harmful plants.	**Teaching:** • Describe and discuss with the students beneficial and harmful organisms. • Have each student research and write a report about a beneficial or harmful organism. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Assess report using Written Report Checklist located in Appendix D. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT3 Apply fundamentals of production and harvesting to produce plants.
PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
B4 Investigate the transfer of energy from the sun to living systems.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

CORD. (n.d.). *Contextual science*. (Available from CORD Communications, 601 Lake Air Drive, Waco, TX 76710, 1-800-231-3015)

Glen Rose FFA Ag Lesson Plans. (n.d.). Retrieved March 10, 2006, from http://www.glenroseffa.org

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

Agriscience II
Unit 6: Advanced Soil Science **(25 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Review the role of soil nutrients in plant growth. a. Describe functions of macro and micro nutrients in plant growth. b. Determine macro and micro nutrients in soil samples and pH. c. Recommend fertilizers for various soils.	**Teaching:** • Discuss the factors that affect soil formation and the process over time by which soil is formed, including chemical and physical weathering. Ask students to describe the components of soil, including nutrients. • Discuss with the class the functions of macro and micro nutrients in plant growth. • Explain the legal requirements for the three analysis numbers on a fertilizer container and explain what each represents. Have students complete an assignment to calculate the actual nutrient content (in pounds) in a given amount of fertilizer. Discuss the effect of pH on the availability of these nutrients. • Divide students into groups to research the components of various types of fertilizers and write an advertisement for a fertilizer, explaining its benefits for a given type of soil. **Assessment:** • Evaluate the advertisement for content and presentation.
2. Investigate soil characteristics. a. Describe processes of soil formation. b. Identify the microscopic structure of soil. c. Describe chemical reactions and their effects on soil properties. d. Discuss the components of soil. e. Describe how particle size determines soil texture. f. Examine soil ecology including bacteria, fungi, protozoa, nematodes, and plants.	**Teaching:** • Discuss soil formation, structure, chemistry, components, texture, and ecology using various soil samples as examples. • Have students work in groups to examine various soil characteristics from samples. • Have each student write a summary of his or her observations. **Assessment:** • Monitor student participation in activities. • Review summary for content.
3. Examine soil and water conservation practices. a. Describe soil degradation. b. Describe the different types of soil erosion and preventative action for	**Teaching:** • Use a PowerPoint presentation or video to illustrate and discuss soil degradation and erosion and different types of soil and water conservation practices.

each type. c. Describe practices of no-till cropping. d. Describe the water cycle. e. Describe the importance of the water table to water resources management and agricultural irrigation. f. Give examples of types of ground water. g. Describe problems created by failure to manage water resources correctly and preventative action to avoid these problems.	• Take students on a field trip of the school campus to compare the depth of topsoil at various locations and determine possible reasons for differences from one site to another. Identify different methods that could be used at each site to prevent further erosion. • Discuss the water cycle, water table, and types of ground water. • Provide students with a series of scenarios and have them identify the soil and water conservation practices that could be used in each case. • Have each student write a brief summary of what they learned about soil science. **Assessment:** • Evaluate student participation in field trip using the Sample Checklist for Field Trip Participation located in Appendix D. • Assess scenario solutions using the Case Study Assessment Rubric located in Appendix D. • Review summary and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT3 Apply fundamentals of production and harvesting to produce plants.
PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.

TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR5 Plan, implement, manage, and/or provide support services for facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.
TEC3 Explain geospatial technology to demonstrate its applications.
NRS1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS2 Use effective venues to communicate natural phenomena to the public.
NRS3 Apply scientific principles to natural resource management activities.
NRS4 Employ knowledge of natural resource industries to describe production practices and processing procedures.
NRS5 Practice responsible conduct to protect natural resources.
ENV1 Use analysis procedures to plan and evaluate environmental service impacts.
ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
ENV3 Apply scientific principles to environmental services.
ENV4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
ENV5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A4 Explore and communicate the characteristics and operations of polynomials.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B4 Investigate the transfer of energy from the sun to living systems.
B6 Investigate concepts of natural selection as they relate to diversity of life.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Butz, S. D. (2004). *Science of earth systems*. Clifton Park, NY: Thomson Delmar. (0-7668-3391-7)

Camp, W. G., & Daugherty, T. B. (2002). *Managing our natural resources* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1554-4)

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

Plaster, E. (2002). *Soil science and management* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-3935-4)

Agriscience II
Unit 7: Advanced Environmental Science and Natural Resources (30 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain the relationship between sustainable agriculture and environment.	**Teaching:** • Show students examples of various agriculture practices throughout the world. Ask them to identify beneficial and harmful practices. • Briefly discuss and define the concept of sustainability and its relationship to the protection of the environment. • Have students work in groups to research practices in agriculture that exemplify sustainability and prepare a poster for exhibit to the class. **Assessment** • Preassess student knowledge of practices. • Evaluate student poster or brochure using the Sample Poster Rubric located in Appendix D.
2. Identify concepts related to environmental quality. a. Define terms related to air, water, and soil quality such as watershed, aquifer, potable, lacustrine, alluvial, conservation tillage, strip cropping, grass waterway, particulates, and percolation. b. Describe sources of point and non-point pollution of air, water, and soil. c. Describe threats to air, water, and soil quality. d. Investigate the greenhouse effect.	**Teaching:** • Have students define terms related to environmental quality and list them in their notebook. • Have students work in groups to take or locate pictures of areas with low environmental quality and construct a photo album describing the areas. • Define water quality and associated issues. • Have each student research major threats to water quality and prepare a chart comparing those threats (e.g., agriculture, industry, terrorism). • Invite an employee of a local water system to speak to the class about testing. • Have students work in groups to test water from various local water systems and analyze the results. • Have each student locate the water quality report for his or her water system and use the report as a model to construct a report for the water tested in class. • Have each student research information about the green house effect and write a report.

	Assessment: • Assess the photo album for accuracy and neatness. • Evaluate chart using the Poster Assessment Rubric located in Appendix D. • Appraise student participation in testing using the Group Participation Assessment Rubric located in Appendix D. • Evaluate greenhouse effect report using the Written Report Checklist located in Appendix D.
3. Cite important relationships between land characteristics and water quality. a. Describe precipitation. b. Discuss the use of land as a reservoir. c. Identify types of ground water and aquifers. d. Describe benefits of living organisms to water quality. e. Investigate wetland ecology including estuary margins, brackish water, marshes, and swamps.	**Teaching:** • Discuss relationships between land and water, including precipitation, reservoirs, ground water, aquifers, and the benefits of living organisms to water. • Have students work in groups to research wetland ecology and prepare a presentation or bulletin board showing examples of wetlands and measures being taken to preserve them. **Assessment:** • Evaluate presentation or bulletin board using Visual Presentation Checklist located in Appendix D.
4. Investigate erosion causes and control. a. Demonstrate the effects of the force of raindrops on soils. b. Discuss the effects of the soil aggregation on absorption. c. Demonstrate the effects of slope on erosion. d. Examine methods of erosion control including living grass, hay, fencing, plant residue, and riparian buffer zones.	**Teaching:** • Discuss various causes of erosion and methods used to control it. • Have students work in groups to design experiments to demonstrate the effects of rain, soil aggregation, and slope on soil. • Have each student make a list of instances of erosion in their area and suggest methods of control for each area. **Assessment:** • Monitor student participation in experiments. • Evaluate erosion control suggestions for appropriateness.
5. Investigate aquatic natural resource conservation. a. Examine how aquatic macro invertebrates may be used as water quality indicators. b. Examine how macro vertebrates may be used as water quality indicators.	**Teaching:** • Discuss methods of aquatic natural resource conservation and the role of animals in detecting quality. • Have students work in groups to collect organisms from streams or ponds. Have them identify these organisms and place

	them into good, fair, and poor water to test the effects of water quality on their survival. • Have each student report the effects of water quality on the organisms. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Monitor student participation in activities. • Evaluate report for accuracy. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT3 Apply fundamentals of production and harvesting to produce plants.
PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR5 Plan, implement, manage, and/or provide support services for facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.
TEC3 Explain geospatial technology to demonstrate its applications.

NRS1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS2 Use effective venues to communicate natural phenomena to the public.
NRS3 Apply scientific principles to natural resource management activities.
NRS4 Employ knowledge of natural resource industries to describe production practices and processing procedures.
NRS5 Practice responsible conduct to protect natural resources.
ENV1 Use analysis procedures to plan and evaluate environmental service impacts.
ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
ENV3 Apply scientific principles to environmental services.
ENV4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
ENV5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A4 Explore and communicate the characteristics and operations of polynomials.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B4 Investigate the transfer of energy from the sun to living systems.
B6 Investigate concepts of natural selection as they relate to diversity of life.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Butz, S. D. (2004). *Science of earth systems*. Clifton Park, NY: Thomson Delmar. (0-7668-3391-7)

Camp, W. G., & Daugherty, T. B. (2002). *Managing our natural resources* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1554-4)

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

Plaster, E. (2002). *Soil science and management* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-3935-4)

Agriscience II
Unit 8: Aquaculture **(25 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Examine concepts associated with aquaculture. a. Define terms related to aquaculture such as spawn, PPM, dissolved oxygen, buffer, turbidity, Secchi disk, and seining. b. Investigate the economic impact of aquaculture at local, state, national, and global levels. c. Compare terrestrial and aquatic food chains.	**Teaching:** • Discuss recent news events and legislation related to labeling fish products and its economic impact. • Provide each student with a list of terms used in aquaculture; have each student write the definitions of the terms on strips of paper using textbooks or the Internet. • Divide students into two teams. Read the definition of a term from the strips of paper prepared by students and have teams compete to identify the correct term. The first team to get the correct answer wins the point and so on until the game is finished. Alternately, students may be given a term and asked to provide the definition for further mastery. • Divide students into groups and have them use the Internet or textbooks to research terrestrial and aquatic food chains. Have students diagram various food chains. **Assessment:** • Evaluate each student's definitions of terms for accuracy. • Evaluate each group's project for content and appearance.
2. Identify major aquatic plant and animal species grown or managed for commercial use.	**Teaching:** • Discuss major species grown in various regions of the world. • Have each student choose one aquatic plant or animal species and present information about it to the class. **Assessment:** • Evaluate presentation using the Visual Presentation Checklist located in Appendix D.

3. Examine water requirements for aquaculture. a. Define terms such as ammonia, nitrite, nitrate, salinity, dissolved oxygen, pH, oxygen demand, and specific gravity. b. Investigate the effects of temperature on aquatic organisms.	**Teaching:** • Discuss the terms related to properties of water and demonstrate proper procedures for measuring water quality parameters. • Have the students work in groups to investigate the effects of various factors, including temperature, on aquatic organisms. Have each student complete a lab report on the activity. **Assessment:** • Observe student participation using the Group Work Assessment Rubric located in Appendix D. • Evaluate lab reports for neatness and accuracy.
4. Explain the major aquaculture production systems. a. Describe caged culture, recirculating tanks, pond culture, and raceways. b. Investigate the role of hatcheries. c. Plan and develop a small-scale aquaculture production system.	**Teaching:** • Discuss terms and advantages related to major production systems. • Have students work in groups to select appropriate culture methods for a given scenario and explain the reasons why in a written report. • Take students on a field trip to observe various production systems. • Have students work in groups to plan a small-scale system. • Under the supervision of the instructor, have students maintain equipment, facilities, and animals. • Have each student maintain a record of daily activities associate with the project and upon completion, write a reflection on the experience. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Evaluate report on selection of culture methods using the Group Participation Assessment Rubric located in Appendix D. • Observe student participation in the field trip using the Field Trip Participation Checklist in Appendix D. • Evaluate plans and records for content and

	neatness. • Assess student reflection using the Reflective Writing Rubric in Appendix D. • Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
FPP1 Apply principles of food processing to maintain equipment and facilities.
FPP2 Apply principles of food science to the food industry.
FPP3 Plan, implement, manage, and/or provide services for the preservation and packaging of food and food products.
FPP4 Identify processing, handling, and storage factors to show how they impact product quality and safety.
PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
PLT2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
PLT3 Apply fundamentals of production and harvesting to produce plants.
PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
ANM2 Recognize animal behaviors to facilitate working with animals safely.
ANM3 Provide proper nutrition to maintain animal performance.
ANM4 Know the factors that influence an animal's reproductive cycle to explain species response.
ANM5 Identify environmental factors that affect an animal's performance.
TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

PWR2 Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR1 Exercise basic skills in blueprint and design development to create sketches, drawings, and plans.
STR2 Read and relate structural plans to specifications and building codes.
STR3 Examine structural requirements to estimate project costs.
STR4 Develop skills required to use construction/fabrication equipment and tools.
STR5 Plan, implement, manage, and/or provide support services for facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.
TEC1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
TEC2 Use available power sources to plan and apply control systems.
TEC3 Explain geospatial technology to demonstrate its applications.
NRS1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS2 Use effective venues to communicate natural phenomena to the public.
NRS3 Apply scientific principles to natural resource management activities.
NRS4 Employ knowledge of natural resource industries to describe production practices and processing procedures.
NRS5 Practice responsible conduct to protect natural resources.
ENV1 Use analysis procedures to plan and evaluate environmental service impacts.
ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
ENV3 Apply scientific principles to environmental services.
ENV4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
ENV5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.
ABS1 Employ leadership skills to accomplish goals and objectives in the AFNR business environment.
ABS2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS4 Employ AFNR industry concepts and practices to manage inventory.
ABS5 Utilize technology to accomplish AFNR business objectives.
ABS6 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.

A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A4 Explore and communicate the characteristics and operations of polynomials.
A5 Utilize various formulas in problem-solving situations.
A6 Communicate using the language of algebra.
A7 Interpret and apply slope as a rate of change.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.
B4 Investigate the transfer of energy from the sun to living systems.
B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
B6 Investigate concepts of natural selection as they relate to diversity of life.
B7 Investigate the interdependence and interactions that occur within an ecosystem.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy

Secondary Agriscience

CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Avault, J. (1996). *Fundamentals of aquaculture: A step-by-step guide to commercial aquaculture*. Baton Rouge, LA: AVA Publishing.

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Creswell, R. L. (2000). *Aquaculture desk reference*. New York: Springer.

Parker, R. (2000). *Aquaculture science* (2nd ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1321-5)

Agriscience II
Unit 9: Advanced Animal Science **(30 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain concepts related to advanced animal science. a. Define terms related to advanced animal science such as artificial insemination, desirable characteristics, genetic probability, pedigree, incomplete dominance, ovulation, heritability, hybrid, hybrid vigor, and colostrum. b. List the gestation and incubation periods for livestock and poultry.	**Teaching:** • Have students design and play a "Jeopardy" game using animal science concepts and terms. • Have each student use gestation/incubation charts to predict the parturition or hatching date of animals in various case studies. **Assessment:** • Observe student participation in game. • Assess correct dates for case studies.
2. Explain how animal traits are passed on to offspring and which traits are best transferred. a. Review genetics concepts. b. Describe desirable characteristics. c. Describe heredity. d. Describe breed selection and improvement.	**Teaching:** • Present information outlining how traits are passed on, including information about chromosomes and heredity. • Have students work in groups to identify desirable characteristics for given species and types of breed selection that has occurred to provide these characteristics. • Have each student prepare a poster or describing one species and the advantages and disadvantage of growing that breed. **Assessment:** • Observe student participation in group work using the Group Work Assessment Rubric located in Appendix D. • Evaluate poster using Poster Assessment Rubric located in Appendix D.
3. Investigate how products are used to improve animal growth and performance. a. Examine supplemental hormones. b. Investigate feed additives. c. Examine antibiotics.	**Teaching:** • Show students examples of growth promoters for animals and explain their use. • Have each student research various growth promoters (e.g., Rumensin or Paylean) and prepare a training brochure for new animal growers to explain the pros and cons of using various products. **Assessment:** • Evaluate brochure for accuracy and appearance.

4. Explain the need and methods for checking the vital signs. a. Describe heart rate and body temperature of different species of animals. b. Demonstrate procedures for checking vital signs.	**Teaching:** • Demonstrate methods for checking vital signs. • Take students to a local veterinary clinic or farm, and have them practice checking vital signs on various species. • Have each student prepare a chart indicating what to check, procedures, equipment needed, and normal values for various species. **Assessment:** • Evaluate student participation using the Field Trip Participation Checklist located in Appendix D. • Assess chart for accuracy.
5. Investigate artificial insemination and embryo transfer. a. Describe the need for artificial insemination in animal science. b. Observe the processes used in artificial insemination of livestock. c. Describe the need for embryo transfer in animal science. d. Observe procedures for embryo transfer.	**Teaching:** • Discuss and demonstrate artificial insemination, sex determination, and sex reversal techniques. • Divide students into groups and have them observe processes used in artificial insemination and procedures for embryo transfer. **Assessment:** • Evaluate student participation using the Group Participation Assessment Rubric located in Appendix D.
6. Examine the poultry industry. a. Describe poultry reproduction. b. Investigate steps in egg formation. c. Hatch and care for poultry. d. Discuss areas of poultry production including broilers, layers, and pullets.	**Teaching:** • Discuss the reproductive process of poultry, methods of hatching and caring for poultry, and areas of poultry production. • Have students work in groups to hatch and care for poultry, and have each student keep a record of activities. • Have each student summarize what he or she learned about the unit and place the summary in his or her notebook. Review the notebooks and reteach as appropriate to ensure mastery. **Assessment:** • Evaluate student participation using the Group Participation Assessment Rubric located in Appendix D. • Assess records for completeness and appearance.

	• Review summary of unit for understanding of material and reteach as needed.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ELR1 Know and understand the importance of professional ethics and legal responsibilities.
ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
ANM2 Recognize animal behaviors to facilitate working with animals safely.
ANM3 Provide proper nutrition to maintain animal performance.
ANM4 Know the factors that influence an animal's reproductive cycle to explain species response.
ANM5 Identify environmental factors that affect an animal's performance.
TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
ABS2 Practice good recordkeeping to accomplish AFNR business objectives.
ABS3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
ABS4 Employ AFNR industry concepts and practices to manage inventory.
ABS5 Utilize technology to accomplish AFNR business objectives.
ABS6 Use marketing and sales principles to accomplish an AFNR business objective.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5 Utilize various formulas in problem-solving situations.
A8 Analyze data and apply concepts of probability.
B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
B2 Investigate the biochemical basis of life.
B3 Investigate cell structures, functions, and methods of reproduction.

B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H3 Describe the relationship of people, places, and environments through time.
H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Breeds of Livestock. (n.d.). Retrieved March 10, 2006, from http://www.ansi.okstate.edu/breeds/

Burton, L. D., & Cooper, E. (2005). *Agriscience: Fundamentals and applications* (4th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-5962-3)

Gillespie, J. R. (2004). *Modern livestock and poultry production* (7th ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1607-9)

Glen Rose FFA Ag Lesson Plans. (n.d.). Retrieved March 10, 2006, from http://www.glenroseffa.org

Herren, R. V. (2005). *Exploring agriscience* (3rd ed.). Clifton Park, NY: Thomson Delmar. (ISBN: 1-4018-9644-8)

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary*. Clifton Park, NY: Thomson Delmar. (ISBN: 0-7668-1146-8)

The Merck Veterinary Manual Online. (n.d.). Retrieved March 14, 2006, from http://www.merckvetmanual.com/mvm/index.jsp

Recommended Tools and Equipment

CAPITALIZED ITEMS

1. Cabinet (for hazardous chemicals) (1)
2. Chamber, environmental (1)
3. Computer with Internet access, CD-ROM drive, color monitor (10)
4. Electrophoresis power supply set (1)
5. Greenhouse, 20 ft. x 30 ft. withdrip pads, fans, heaters, electrical system, benches, and irrigation system (1)
6. Laminar flow cabinet (may replace with culture cabinet) (1)
7. Microscope, student, stereomicroscope, binocular (2x to 4x) (5)
8. Microscope, student binocular (with mechanical stage) (10x to 45x) (5)
9. Plant benches (10)
10. Refrigerator, 21 cu. ft. minimum (1)
11. Table, student laboratory (6)
12. Tank, artificial insemination (optional, only if live insemination is conducted) (1)
13. Tissue culture cabinet or incubator (1)

NON-CAPITALIZED ITEMS

1. African violet culture kit (1)
2. Air pollution sampling pump (battery powered) (1)
3. Air pollution study kit (2)
4. Apron, lab (20)
5. Aquaculture system, complete recirculating (1)
6. Aquarium, 30-55 gal. (1)
7. Autoclave (1)
8. Balance, triple beam (3)
9. Blender, food (1)
10. Bottle, narrow necked with cork stopper (10)
11. Bowl, mixing (4)
12. Brooder (1)
13. Cabinet and sanitizer (for goggles) (1)
14. Cabinet, storage (4)
15. Calculator (10)
16. Centrifuge (optional) (1)
17. Coat, laboratory (20)
18. Colorimeter (optional, replace with spectrophotometer) (1)
19. Dehydrator (1)
20. Dissecting kit (10)
21. Dissecting pan (10)
22. Engraving tool (1)
23. Eye wash station (installed on waterline) (1)
24. First aid kit (adequate for 20 students) (1)
25. Gauge, feeler (5)

26. Gloves, rubber (100 pair)
27. Goggle, splash type (20)
28. Graduated cylinder, 25 ml (5)
29. Graduated cylinder, 50 ml (5)
30. Graduated cylinder, 100 ml (5)
31. Graduated cylinder, 250 ml (5)
32. Graduated cylinder, 500 ml (5)
33. Graduated cylinder, 1000 ml (5)
34. Ground water simulation kit (1)
35. Hot plate (or other heat source such as an electric skillet) (1)
36. Increment borer (1)
37. Incubator, culture (1)
38. Incubator, egg (may replace with one large incubator in poultry areas) (2)
39. Label maker (with tapes) (1)
40. Lab equipment set (1)
41. Mat, propagation (4)
42. Meter, pH (1)
43. Meter, light (1)
44. Meter, dissolved oxygen (necessary with aquaculture system) (1)
45. Microcomputer based laboratory with probes for temperature, motion, and light (1)
46. Micrometers, outside (5)
47. Microvideo flex cam with monitor (1)
48. Microwave (1)
49. Nematode study kits (2)
50. Net, dip (4)
51. Net, insect (5)
52. Petri dishes with cover, plastic disposable (100)
53. Pipette stand with clamps (5)
54. Plant flats (100)
55. Plant tissue culture kit (1)
56. Plant tissue test kit (1)
57. Printer, laser (2)
58. Pulley, double (2)
59. Pulley, single (2)
60. Pulley, triple (2)
61. Refractometer (1)
62. Respirator, chemical (5)
63. Rule, pocket (1/32 in. and 1/64 in. graduations) (10)
64. Safety shower (1)
65. Scale, spring (1)
66. Shade cloth (1)
67. Slide, microscope (100)
68. Small gas engine tool kit (Briggs & Stratton) (5)
69. Small gas engines (Briggs & Stratton, 3-5 hp) (5)
70. Soil tube sampler, 36 in. with step (1)
71. Soil test kit, comprehensive (5)

72. Spectrophotometer, digital (Optional, may replace with colorimeter) (1)
73. Sprayer, 3 gal. (1)
74. Stool, metal (20)
75. Syringe, 3 cc (10)
76. Syringe, 60 cc (10)
77. Tape measure (10)
78. Terrarium, plant (1)
79. Thermometer (5)
80. Titration burette, 50 ml (4)
81. Trap, insect (1)
82. Tree scale stick (5)
83. Voltmeter, triple range (5)
84. Water bath (1)
85. Water pollution detection kit (Lamotte) (Aquaculture--Replace with Hach Farm Pond Test Kit) (1)
86. Weather monitoring system (1)
87. Wheelbarrow, 6 cu. ft. (1)
88. Wisconsin fast plants light system (1)
89. Wisconsin fast plants classroom growth and development kit (3)

Student Competency Profile for Agriscience I

Student:_____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Agriscience Introduction, Opportunities, and Careers

_____1. Introduce concepts and terms associated with agriculture, science, and agriscience.
_____2. Investigate the major areas of agriculture.
_____3. Connect major sciences supporting agriscience.
_____4. Investigate current trends occurring in agriscience.
_____5. Examine the opportunities for careers in agriscience.
_____6. Demonstrate job seeking skills.

Unit 2: Agriscience Lab Safety and the Scientific Method

_____1. Analyze the basic rules of safety in the agriscience laboratory.
_____2. Demonstrate all safety equipment in the agriscience laboratory.
_____3. Practice safety concepts in laboratory activities.
_____4. Examine terms and concepts associated with the scientific method.
_____5. Describe each step of the scientific method.
_____6. Apply the scientific method.

Unit 3: Human Relations/Leadership/FFA Activities

_____1. Discuss concepts related to leadership.
_____2. Investigate the FFA organization.
_____3. Explain opportunities for leadership development through the FFA.
_____4. Participate in parliamentary procedure.

Unit 4: Developing a Supervised Agricultural Experience (SAE) in Agriscience

_____1. Describe the purposes and requirements of the SAE.
_____2. Develop a long-range personal plan for the SAE.
_____3. Develop a short-range personal plan.
_____4. Complete a training agreement for an SAE.
_____5. Describe agricultural record keeping for an SAE.
_____6. Maintain agricultural records for an SAE.

Unit 5: Biotechnology

_____1. Explain the basic principles of heredity.
_____2. Discuss terms and concepts related to biotechnology.
_____3. Examine contributions which biotechnology makes to agriculture.
_____4. Investigate methods of transferring genetic information.

Unit 6: Animal Science

_____1. Examine the major body systems of various species.
_____2. Examine nutrients required by animals for normal growth and development, including their sources, functions, and ration.
_____3. Examine animal diseases and their control and treatment.
_____4. Examine food products and processing.
_____5. Explain some of the economic and practical considerations of livestock production.

Unit 7: Mechanical Science

_____1. Demonstrate principles and applications of measurement.
_____2. Examine principles and applications of fluid power machines.
_____3. Identify and calculate mechanical advantages of six simple machines including lever, inclined plane, wheel, fulcrum, pulley, and axle.
_____4. Investigate principles and applications of electricity.

Unit 8: Principles of Fiber Science

_____1. Examine fiber science concepts.
_____2. Investigate the fiber industry and its economic importance in relation to clothing, paper, textiles, and lumber.
_____3. Describe the ginning process for cotton.
_____4. Investigate the paper making process.

Unit 9: Plant Science

_____1. Examine plant science concepts.
_____2. Investigate major structural parts of plants including roots, stems, and leaves.
_____3. Categorize the classes of agricultural plants.
_____4. Determine the nutrients needed for proper plant growth.
_____5. Investigate irrigation systems for various applications.
_____6. Examine common plant pests and diseases and control methods.
_____7. Explain the important plant growth and food production processes.
_____8. Examine various methods of plant reproduction.

Unit 10: Soil Science

_____1. Determine soil textures from clay, sand, and silt based soils.

_____2. Determine factors affecting soil classification and capability classes including slope and drainage, permeability, texture, and depth of top soil.
_____3. Apply procedures for collecting and utilizing soil samples.
_____4. Investigate factors contributing to soil erosion and various methods of control.

Unit 11: Environmental Science and Natural Resources

_____1. Explain the importance of natural resources.
_____2. Explore the basic concepts of natural resource conservation and management.
_____3. Examine principles of forestry.
_____4. Identify the characteristics of selected species of wildlife.
_____5. Investigate natural resource contamination.

Unit 12: Entomology

_____1. Define terms related to entomology.
_____2. Investigate insect morphology and classification.
_____3. Investigate the effects of insects on society and agriculture through history.
_____4. Investigate methods of insect control.

Student Competency Profile for Agriscience II

Student:_____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Communication and Career Skills

_____1. Prepare and deliver an oral presentation.
_____2. Utilize communication skills in careers.

Unit 2: Supervised Agricultural Experience (SAE) in Agriscience (Review)

_____1. Continue SAE activities in agriscience. (Ongoing)
_____2. Maintain agricultural records for the SAE.

Unit 3: Advanced Biotechnology

_____1. Examine biotechnology.
_____2. Explain career opportunities in biotechnology.

Unit 4: Food Science

_____1. Examine the elements, trends, and career opportunities in the food industry.
_____2. Examine food customs around the world.
_____3. Analyze the effects of helpful and harmful organisms in food science.

Unit 5: Advanced Plant Science

_____1. Investigate concepts associated with hydroponics.
_____2. Investigate greenhouse management.
_____3. Explain procedures to apply for a restricted pest management permit.
_____4. Explain the use of competitive exclusion.

Unit 6: Advanced Soil Science

_____1. Review the role of soil nutrients in plant growth.
_____2. Investigate soil characteristics.
_____3. Examine soil and water conservation practices.

Unit 7: Advanced Environmental Science and Natural Resources

_____1. Explain the relationship between sustainable agriculture and environment.
_____2. Identify concepts related to environmental quality.
_____3. Cite important relationships between land characteristics and water quality.
_____4. Investigate erosion causes and control.
_____5. Investigate aquatic natural resource conservation.

Unit 8: Aquaculture

_____1. Examine concepts associated with aquaculture.
_____2. Identify major aquatic plant and animal species grown or managed for commercial use.
_____3. Examine water requirements for aquaculture.
_____4. Explain the major aquaculture production systems.

Unit 9: Advanced Animal Science

_____1. Explain concepts related to advanced animal science.
_____2. Explain how animal traits are passed on to offspring and which traits are best transferred.
_____3. Investigate how products are used to improve animal growth and performance.
_____4. Explain the need and methods for checking the vital signs.
_____5. Investigate artificial insemination and embryo transfer.
_____6. Examine the poultry industry.

ASSESSMENT

BLUEPRINT

Title of Program: Agriscience I & II 09LM Program Level: Secondary

This program is assessed using the MS-CPAS. The following blueprint summary contains the competencies that are measured when assessing this program. Competencies are grouped into *clusters* and a weight is given to each cluster to determine the number of items needed from each cluster. The numbers of C1s and C2s (item difficulty levels) are also indicated on the blueprint.

Cluster/Competency	Level 1 (C1)	Level 2 (C2)	TOTAL	%
	Number	Number		
Cluster 1: Personal Development **Agriscience I** **Unit 1: Agriscience Introduction, Opportunities, and Careers** **Unit 3: Human Relations/Leadership/ FFA Activities** **Unit 4: Developing A Supervised Agricultural Experience Program (SAE) In Agriscience** **Agriscience II** **Unit 1: Communication and Career Skills** **Unit 2: Supervised Agricultural Experience (SAE) in Agriscience (Review)**	14	4	18	18%
Cluster 2 : Science, Biotechnology, Mechanics, and Food **Agriscience I** **Unit 2: Agriscience Lab Safety and the Scientific Method** **Unit 5: Biotechnology** **Unit 7: Mechanical Science** **Agriscience II** **Unit 3: Advanced Biotechnology** **Unit 4: Food Science**	16	7	23	23%
Cluster 3: Plant Science **Agriscience I** **Unit 8: Principles of Fiber Science** **Unit 9: Plant Science** **Unit 12: Entomology** **Agriscience II** **Unit 5: Advanced Plant Science**	12	6	18	18%

Cluster/Competency	Level 1 (C1)	Level 2 (C2)	TOTAL	%
Cluster 4: Animal Science **Agriscience I** **Unit 6: Animal Science** **Agriscience II** **Unit 8: Aquaculture** **Unit 9: Advanced Animal Science**	14	4	18	18%
Cluster 5: Natural Resources **Agriscience I** **Unit 10: Soil Science** **Unit 11: Environmental Science and Natural Resources** **Agriscience II** **Unit 6: Advanced Soil Science** **Unit 7: Advanced Environmental Science and Natural Resources**	19	4	23	23%
Total Questions:	75	25	100	100%

Appendix A: Agriculture, Food, and Natural Resources Standards[1]

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. Each standard represents a pathway knowledge and skill statement as listed in this document. Standards are clustered by career pathway. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

LEADERSHIP (LEA)

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives.
- a. Embrace empowerment, risk, communication, focusing on results, decision-making, problem-solving, investment in individuals, and resource use and access to develop premier leadership.
- b. Embrace compassion, service, listening, coaching, developing others, team development, and understanding and appreciating others to develop premier leadership.
- c. Embrace enthusiasm, creativity, the future, conviction, mission, courage, concept, focus, principles, and change to develop premier leadership.
- d. Embrace integrity, courage, values, ethics, humility, perseverance, self-discipline, and responsibility to develop premier leadership.
- e. Include self, community, diversity, environment, global awareness, and knowledge to develop premier leadership.
- f. Embrace innovation, intuition, adaptation, life-long learning, and coachability to develop premier leadership.

LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives.
- a. Embrace attitude, exercise, goal-setting, planning, self-discipline, sense of balance, persistence, and respect to develop personal growth.
- b. Embrace friendship, integrity, morals, values, etiquette, citizenship, cross-cultural awareness, acceptance/change, and respect for differences to develop personal growth.
- c. Embrace goal setting, planning, decision-making, principles, respect, attitude, dependability, loyalty, trustworthiness, and communication to develop personal growth.
- d. Embrace learning, critical thinking, reasoning, creative thinking, attitude, dependability, decision-making, and problem-solving to develop personal growth.
- e. Embrace attitude, self-discovery, coping, friendship, self-reliance, sense of balance, empathy, compassion, and integrity to develop personal growth.
- f. Embrace ethics, coping, courage, attitude, self-image/worth, values, principles, and sense of balance to develop personal growth.

[1] *Career Cluster Resources for Agriculture, Food, and Natural Resources.* Retrieved September 21, 2005, from http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

ETHICS AND LEGAL RESPONSIBILITIES (ELR)

ELR1 Know and understand the importance of professional ethics and legal responsibilities.
- a. Apply knowledge of professional and workplace ethics and legal responsibilities to organize guidelines for workplace conduct.
- b. Apply ethical and legal reasoning to workplace situations.
- c. Review appropriate resources to identify national and international rules associated with a desired career.
- d. Identify what ethical issues and concerns affect a desired career field to assist in making career decisions.

ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
- a. Evidence interest and concern to demonstrate natural resource stewardship and ethics.
- b. Exercise personal habits and actions to demonstrate workplace ethics.

FOOD PRODUCTS AND PROCESSING SYSTEMS (FPP)

FPP1 Apply principles of food processing to the food industry.
- a. Develop management plans to maintain equipment and facilities.
- b. Interpret and follow, develop, and implement Hazardous Critical Control Point (HACCP) procedures to establish operating parameters.

FPP2 Apply principles of food science to the food industry.
- a. Apply food science principles to enhance product development.

FPP3 Plan, implement, manage, and/or provide services for the preservation and packaging of food and food products.
- a. Analyze product preparation options to prepare products for distribution.
- b. Compare and select food preservation methods to develop food preservation programs.

FPP4 Identify processing, handling, and storage factors to show how they impact product quality and safety.
- a. Develop a “quality factors program” to comply with local, national, governmental, and international standards.
- b. Develop slaughter/inspection techniques to process food products and analyze food product options.

PLANT SYSTEMS (PLT)

PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
- a. Analyze and evaluate nutritional requirements and environmental conditions to develop and implement a fertilization plan.
- b. Test appropriate materials or examine data to evaluate and manage soil/media nutrients.
- c. Explain and use basic methods for reproducing and propagating plants.

d. Develop and use a plan for integrated pest management.

PLT2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
   a. Examine unique plant properties to identify/describe functional differences in plant structures including roots, stems, flowers, leaves, and fruit.
   b. Classify plants based on physiology for taxonomic or other classifications.

PLT3 Apply fundamentals of production and harvesting to produce plants.
   a. Apply fundamentals of plant management to develop a production plan.
   b. Apply fundamentals of plant management to harvest, handle, and store crops.

PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
   a. Apply basic design elements and principles to create a design using plants.

ANIMAL SYSTEMS (ANM)

ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
   a. Use classification systems to explain basic functions of animal anatomy and physiology.
   b. Recognize the anatomy of animal species to understand how the body structures interact and affect animal health.
   c. Analyze a subject animal to determine the nature of its health status.

ANM2 Recognize animal behaviors to facilitate working with animals safely.
   a. Develop a safety plan for working with a specific animal.

ANM3 Provide proper nutrition to maintain animal performance.
   a. Examine animal developmental stages to comprehend why nutrient requirements are different throughout an animal's life cycle.
   b. Analyze a feed ration to determine whether or not it fulfills a given animal's nutrient requirements.
   c. Record and compare feed variations to assess whether the nutritional requirements of an animal are being met.

ANM4 Know the factors that influence an animal's reproductive cycle to explain species response.
   a. Analyze elements in the reproductive cycle to explain differences in the male and female reproductive systems.
   b. Discuss reproductive cycles to show how they differ from species to species.
   c. Evaluate an animal to determine its breeding soundness.

ANM5 Identify environmental factors that affect an animal's performance.
   a. Recognize optimum performance for a given animal species.
   b. Create a program to develop an animal to its highest potential performance.
   c. Assess an animal to determine if it has reached its optimum performance level.
   d. Develop efficient procedures to produce consistently high-quality animals, well-suited for their intended purposes.

TECHNICAL SKILLS (TS)

TS1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
- a. Select the appropriate tool to perform a given task.
- b. Keep natural resource tools in good working order for efficient work use.
- c. Wear protective equipment and handle natural resource tools and equipment with skill to demonstrate safe use of tools and equipment.

POWER, STRUCTURAL & TECHNICAL SYSTEMS SYSTEMS (PWR)

PWR1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
- a. Relate power generation to energy sources.
- b. Apply principles of lubricants to sort and classify lubricants.

PWR2 Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
- a. Perform scheduled service routines to maintain machinery and equipment.
- b. Observe rules of the road to operate machinery and equipment.

PWR3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
- a. Troubleshoot problems and evaluate performance to service and repair components of internal combustion engines.
- b. Follow manufacturers' guidelines to service and repair power transmission systems.
- c. Evaluate performance and check maintenance manuals to service and repair hydraulic lines.
- d. Troubleshoot from schematics to service vehicle electrical systems.
- e. Use company diagrams and schematics to service vehicle heating and air conditioning systems.
- f. Check performance parameters to service and repair steering, suspension, traction, and vehicle performance systems.
- g. Use tools in the workplace to demonstrate safe and proper skills with construction/fabrication hand tools.

STRUCTURAL SYSTEMS (STR)

STR1 Exercise basic skills in blueprint and design development to create sketches, drawings, and plans.
- a. Use computer skills to develop simple sketches and plans.

STR2 Read and relate structural plans to specifications and building codes.
- a. Examine blueprints and local codes to develop a logical construction plan.

STR3 Examine structural requirements to estimate project costs.
- a. Use bids and billing information to develop a complete materials list and project cost estimate.

STR4 Develop skills required to use construction/fabrication equipment and tools.
- a. Use tools in the workplace to demonstrate safe and proper skills with construction/fabrication hand tools.

STR5 Plan, implement, manage, and/or provide support services for facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.
- a. Design machinery and equipment including vehicles, implements, buildings, and facilities (e.g., feeding, feed storage).
- b. Follow architectural and mechanical plans to construct buildings and facilities.

TECHNICAL SYSTEMS (TEC)

TEC1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
- a. Identify and explain the various types of hardware systems to show their applications and potentials.

TEC2 Use available power sources to plan and apply control systems.
- a. Measure with selective instruments to demonstrate knowledge of basic electricity.
- b. Reference electrical drawings to design, install, and troubleshoot control systems.

TEC3 Explain geospatial technology to demonstrate its applications.
- a. Employ appropriate techniques to demonstrate application of GPS/GIS systems principles.
- b. Use computer applications to produce maps that reflect surveying and mapping principles.
- c. Select an area of personal expertise to demonstrate knowledge of end applications.

NATURAL RESOURCES SYSTEMS (NRS)

NRS1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
- a. Identify resource management components to establish relationships in natural resource systems.
- b. Apply cartographic skills to natural resource activities.
- c. Monitor natural resource status to obtain planning data.
- d. Employ environmental and wildlife knowledge to demonstrate natural resource enhancement techniques.
- e. Examine weather and other criteria to recognize dangers related to work in an outdoor environment.
- f. Learn applicable rules or laws to demonstrate natural resource mitigation techniques.

NRS2 Use effective venues to communicate natural phenomena to the public.
- a. Communicate natural resources information to the general public.
- b. Personally interpret natural resource phenomena to natural resource users.

NRS3 Apply scientific principles to natural resource management activities.
- a. Use science concepts, processes, and research techniques to examine natural resource topics.

b. Examine biological and physical characteristics to identify and classify natural resources.
c. Examine natural cycles and related phenomena to describe ecologic concepts ad principles.

NRS4 Employ knowledge of natural resource industries to describe production practices and processing procedures.
a. Prepare presentations to describe how natural resource products are produced, harvested, processed, and used.

NRS5 Practice responsible conduct to protect natural resources.
a. Employ techniques and equipment needed to prevent wildfire.
b. Use wildfire suppression techniques to demonstrate abilities in firefighting and control.
c. Recognize symptoms of animal and plant diseases and use appropriate techniques to prevent their spread.
d. Recognize insect types and available controls to prevent insect infestation.
e. Use acceptable pesticides to treat insect infestation.
f. Know law enforcement procedures to manage public gatherings and to gain entry into secure, closed, or restricted areas.

ENVIRONMENTAL SERVICE SYSTEMS (ENV)

ENV1 Use analysis procedures to plan and evaluate environmental service impacts.
a. Use instrumentation to monitor samples.
b. Calibrate and service instruments on a timely schedule to maintain environmental instrumentation.
c. Apply statistics, charts, and scattergrams to measure and monitor operations.

ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operation.
a. Consult reliable resources or training to identify the major laws impacting environmental services.

ENV3 Apply scientific principles to environmental services.
a. Apply meteorological knowledge to recognize weather systems and weather patterns.
b. Describe soil composition and properties to demonstrate knowledge of soil science.
c. Explain well design and groundwater supplies to demonstrate knowledge of hydrology.
d. Discuss properties, classifications, and functions in order to understand wetland principles.
e. Discuss properties, classifications, and functions in order to understand watershed principles.
f. Use chemical analysis to conduct tests.
g. Apply sampling techniques and other assessments to demonstrate background knowledge of microbiology.

ENV4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
- a. Use pollution control measures to maintain a safe facility environment.
- b. Apply principles of solid waste management (landfill) to manage safe disposal of all categories of waste.
- c. Apply drinking water treatment principles to assure safe drinking water at a facility.
- d. Apply wastewater treatment operations principles to manage wastewater disposal in keeping with rules and regulations.
- e. Apply hazardous materials management principles to assure a safe facility and to comply with applicable regulations.
- f. Explore conventional and alternative supplies to define energy sources.

ENV5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.
- a. Use technology tools to map land, facilities, and infrastructure.

AGRIBUSINESS SYSTEMS (ABS)

ABS1 Employ leadership skills to accomplish goals and objectives in the AFNR business environment.
- a. Develop a mission statement to guide business activities effectively.
- b. Apply leadership skills to accomplish general business activities from production to public relations.
- c. Apply management skills to accomplish general business activities from production to public relations.

ABS2 Practice good recordkeeping to accomplish AFNR business objectives.
- a. Prepare and maintain all files as needed to accomplish effective record keeping.

ABS3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
- a. Use key accounting fundamentals to accomplish dependable bookkeeping and associated files.

ABS4 Employ AFNR industry concepts and practices to manage inventory.
- a. Monitor inventory levels to accomplish practical inventory control.

ABS5 Utilize technology to accomplish AFNR business objectives.
- a. Use technology and information technology strategies for business improvement.

ABS6 Use sales and marketing principles to accomplish an AFNR business objective.
- a. Conduct market research.
- b. Develop a marketing plan.
- c. Implement a marketing plan.
- d. Merchandise products and services.

Appendix B: Academic Standards

Algebra I[2]

Competencies and Suggested Objective(s)

A1 Recognize, classify, and use real numbers and their properties.
- a. Describe the real number system using a diagram to show the relationships of component sets of numbers that compose the set of real numbers.
- b. Model properties and equivalence relationships of real numbers.
- c. Demonstrate and apply properties of real numbers to algebraic expressions.
- d. Perform basic operations on square roots excluding rationalizing denominators.

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- a. Analyze relationships between two variables, identify domain and range, and determine whether a relation is a function.
- b. Explain and illustrate how change in one variable may result in a change in another variable.
- c. Determine the rule that describes a pattern and determine the pattern given the rule.
- d. Apply patterns to graphs and use appropriate technology.

A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
- a. Solve, check, and graph linear equations and inequalities in one variable, including rational coefficients.
- b. Graph and check linear equations and inequalities in two variables.
- c. Solve and graph absolute value equations and inequalities in one variable.
- d. Use algebraic and graphical methods to solve systems of linear equations and inequalities.
- e. Translate problem-solving situations into algebraic sentences and determine solutions.

A4 Explore and communicate the characteristics and operations of polynomials.
- a. Classify polynomials and determine the degree.
- b. Add, subtract, multiply, and divide polynomial expressions.
- c. Factor polynomials using algebraic methods and geometric models.
- d. Investigate and apply real-number solutions to quadratic equations algebraically and graphically.
- e. Use convincing arguments to justify unfactorable polynomials.
- f. Apply polynomial operations to problems involving perimeter and area.

A5 Utilize various formulas in problem-solving situations.
- a. Evaluate and apply formulas (e.g., circumference, perimeter, area, volume, Pythagorean Theorem, interest, distance, rate, and time).
- b. Reinforce formulas experimentally to verify solutions.

[2] *Mississippi mathematics framework—Algebra I.* (2003). Retrieved September 10, 2003, from http://www.mde.k12.ms.us/curriculum/index_1.htm

c. Given a literal equation, solve for any variable of degree one.
d. Using the appropriate formula, determine the length, midpoint, and slope of a segment in a coordinate plane.
e. Use formulas (e.g., point-slope and slope-intercept) to write equations of lines.

A6 Communicate using the language of algebra.
a. Recognize and demonstrate the appropriate use of terms, symbols, and notations.
b. Distinguish between linear and non-linear equations.
c. Translate between verbal expressions and algebraic expressions.
d. Apply the operations of addition, subtraction, and scalar multiplication to matrices.
e. Use scientific notation to solve problems.
f. Use appropriate algebraic language to justify solutions and processes used in solving problems.

A7 Interpret and apply slope as a rate of change.
a. Define slope as a rate of change using algebraic and geometric representations.
b. Interpret and apply slope as a rate of change in problem-solving situations.
c. Use ratio and proportion to solve problems including direct variation (y=kx).
d. Apply the concept of slope to parallel and perpendicular lines.

A8 Analyze data and apply concepts of probability.
a. Collect, organize, graph, and interpret data sets, draw conclusions, and make predictions from the analysis of data.
b. Define event and sample spaces and apply to simple probability problems.
c. Use counting techniques, permutations, and combinations to solve probability problems.

Biology I[3]

Competencies and Suggested Objective(s)

B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
a. Demonstrate the proper use and care for scientific equipment used in biology.
b. Observe and practice safe procedures in the classroom and laboratory.
c. Apply the components of scientific processes and methods in the classroom and laboratory investigations.
d. Communicate results of scientific investigations in oral, written, and graphic form.

B2 Investigate the biochemical basis of life.
a. Identify the characteristics of living things.
b. Describe and differentiate between covalent and ionic bonds using examples of each.
c. Describe the unique bonding and characteristics of water that makes it an essential component of living systems.

[3] *Mississippi science framework—Biology I*. (2003). Retrieved September 10, 2003, from http://www.mde.k12.ms.us/curriculum/index_1.htm

d. Classify solutions using the pH scale and relate the importance of pH to organism survival.
e. Compare the structure, properties and functions of carbohydrates, lipids, proteins and nucleic acids in living organisms.
f. Explain how enzymes work and identify factors that can affect enzyme action.

B3 Investigate cell structures, functions, and methods of reproduction.
a. Differentiate between prokaryotic and eukaryotic cells.
b. Distinguish between plant and animal (eukaryotic) cell structures.
c. Identify and describe the structure and basic functions of the major eukaryotic organelles.
d. Describe the way in which cells are organized in multicellular organisms.
e. Relate cell membrane structure to its function in passive and active transport.
f. Describe the main events in the cell cycle and cell mitosis including differences in plant and animal cell divisions.
g. Relate the importance of meiosis to sexual reproduction and the maintenance of chromosome number.
h. Identify and distinguish among forms of asexual and sexual reproduction.

B4 Investigate the transfer of energy from the sun to living systems.
a. Describe the structure of ATP and its importance in life processes.
b. Examine, compare, and contrast the basic processes of photosynthesis and cellular respiration.
c. Compare and contrast aerobic and anaerobic respiration.

B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
a. Compare and contrast the molecular structures of DNA and RNA as they relate to replication, transcription, and translation.
b. Identify and illustrate how changes in DNA cause mutations and evaluate the significance of these changes.
c. Analyze the applications of DNA technology (forensics, medicine, agriculture).
d. Discuss the significant contributions of well-known scientists to the historical progression of classical and molecular genetics.
e. Apply genetic principles to solve simple inheritance problems including monohybrid crosses, sex linkage, multiple alleles, incomplete dominance, and codominance.
f. Examine inheritance patterns using current technology (gel electrophoresis, pedigrees, karyotypes).

B6 Investigate concepts of natural selection as they relate to diversity of life.
a. Analyze how organisms are classified into a hierarchy of groups and subgroups based on similarities and differences.
b. Identify characteristics of kingdoms including monerans, protists, fungi, plants and animals.
c. Differentiate among major divisions of the plant and animal kingdoms (vascular/non-vascular; vertebrate/invertebrate).
d. Compare the structures and functions of viruses and bacteria relating their impact on other living organisms.

e. Identify evidence of change in species using fossils, DNA sequences, anatomical and physiological similarities, and embryology.
f. Analyze the results of natural selection in speciation, diversity, adaptation, behavior and extinction.

B7 Investigate the interdependence and interactions that occur within an ecosystem.
a. Analyze the flow of energy and matter through various cycles including carbon, oxygen, nitrogen and water cycles.
b. Interpret interactions among organisms in an ecosystem (producer/consumer/decomposer, predator/prey, symbiotic relationships and competitive relationships).
c. Compare variations, tolerances, and adaptations of plants and animals in major biomes.
d. Investigate and explain the transfer of energy in an ecosystem including food chains, food webs, and food pyramids.
e. Examine long and short-term changes to the environment as a result of natural events and human actions.

English II[4]

Competencies and Suggested Objective(s)

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
a. Produce individual and/or group compositions and/or projects to persuade, tell a story, describe, create an effect, explain or justify an action or event, inform, entertain, etc.
b. Produce writing typically used in the workplace such as social, business, and technical correspondence; explanation of procedures; status reports; research findings; narratives for graphs; justification of decisions, actions, or expenses; etc.
c. Write a response, reaction, interpretation, analysis, summary, etc., of literature, other reading matter, or orally presented material.
d. Revise to ensure effective introductions, details, wording, topic sentences, and conclusions.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
a. Listen to determine the main idea and supporting details, to distinguish fact from opinion, and to determine a speaker's purpose or bias.
b. Speak with appropriate intonation, articulation, gestures, and facial expression.
c. Speak effectively to explain and justify ideas to peers, to inform, to summarize, to persuade, to entertain, to describe, etc.

[4] *Mississippi language arts framework—English II*. (2003). Retrieved September 10, 2003, from http://www.mde.k12.ms.us/curriculum/index_1.htm

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- a. Read, view, and listen to distinguish fact from opinions and to recognize persuasive and manipulative techniques.
- b. Access both print and non-print sources to produce an I-Search paper, research paper, or project.
- c. Use computers and audio-visual technology to access and organize information for purposes such as resumes, career search projects, and analytical writings, etc.
- d. Use reference sources, indices, electronic card catalog, and appropriate research procedures to gather and synthesize information.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- a. Interact with peers to examine real world and literary issues and ideas.
- b. Show growth in critical thinking, leadership skills, consensus building, and self-confidence by assuming a role in a group, negotiating compromise, and reflecting on individual or group work.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- a. Share, critique, and evaluate works in progress and completed works through a process approach.
- b. Communicate effectively in a group to present completed projects and/or compositions.
- c. Edit oral and written presentations to reflect correct grammar, usage, and mechanics.

E6 Explore cultural contributions to the history of the English language and its literature.
- a. Explore a variety of works from various historical periods, geographical locations, and cultures, recognizing their influence on language and literature.
- b. Identify instances of dialectal differences which create stereotypes, perceptions, and identities.
- c. Recognize root words, prefixes, suffixes, and cognates.
- d. Relate how vocabulary and spelling have changed over time.

E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- a. Listen to and read aloud selected works to recognize and respond to the rhythm and power of language to convey a message.
- b. Read aloud with fluency and expression.
- c. Analyze the stylistic devices, such as alliteration, assonance, word order, rhyme, onomatopoeia, etc., that make a passage achieve a certain effect.
- d. Demonstrate how the use of language can confuse or inform, repel or persuade, or inspire or enrage.
- e. Analyze how grammatical structure or style helps to create a certain effect.

E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- a. Read and explore increasingly complete works, both classic and contemporary, for oral discussion and written analysis.

b. Read, discuss, and interpret literature to make connections to life.
c. Read from a variety of genres to understand how the literary elements contribute to the overall quality of the work.
d. Identify qualities in increasingly complex literature that have produced a lasting impact on society.
e. Read for enjoyment, appreciation, and comprehension of plot, style, vocabulary, etc.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
a. Infuse the study of grammar and vocabulary into written and oral communication.
b. Demonstrate, in the context of their own writing, proficient use of the conventions of standard English, including, but not limited to, the following: complete sentences, subject-verb agreement, plurals, spellings, homophones, possessives, verb forms, punctuation, capitalization, pronouns, pronoun-antecedent agreement, parallel structure, and dangling and misplaced modifiers.
c. Give oral presentations to reinforce the use of standard English.
d. Employ increasingly proficient editing skills to identify and solve problems in grammar, usage, and structure.

E10 Use language and critical thinking strategies to serve as tools for learning.
a. Use language to facilitate continuous learning, to record observations, to clarify thought, to synthesize information, and to analyze and evaluate language.
b. Interpret visual material orally and in writing.

U. S. History from 1877[5]

Competencies and Suggested Objective(s)

H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
a. Apply economic concepts and reasoning when evaluating historical and contemporary social developments and issues (e.g., gold standard, free coinage of silver, tariff issue, laissez faire, deficit spending, etc.).
b. Explain the emergence of modern America from a domestic perspective (e.g., frontier experience, Industrial Revolution and organized labor, reform movements of Populism and Progressivism, Women's Movement, Civil Rights Movement, the New Deal, etc.).
c. Explain the changing role of the United States in world affairs since 1877 through wars, conflicts, and foreign policy (e.g., Spanish-American War, Korean conflict, containment policy, etc.).
d. Trace the expansion of the United States and its acquisition of territory from 1877 (e.g., expansionism and imperialism).

[5] *Mississippi social studies framework—U.S. History from 1877*. (2003). Retrieved September 10, 2003, from http://www.mde.k12.ms.us/curriculum/index_1.htm

H2 Describe the impact of science and technology on the historical development of the United States in the global community.
- a. Analyze the impact of inventions on the United States (e.g., telephone, light bulb, etc.).
- b. Examine the continuing impact of the Industrial Revolution on the development of our nation (e.g., mass production, computer operations, etc.).
- c. Describe the effects of transportation and communication advances since 1877.

H3 Describe the relationship of people, places, and environments through time.
- a. Analyze human migration patterns since 1877 (e.g., rural to urban, the Great Migration, etc.).
- b. Analyze how changing human, physical, geographic characteristics can alter a regional landscape (e.g., urbanization, Dust Bowl, etc.).

H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
- a. Interpret special purpose maps, primary/secondary sources, and political cartoons.
- b. Analyze technological information on graphs, charts, and timelines.
- c. Locate areas of international conflict (e.g., Caribbean, Southeast Asia, Europe, etc.).

H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.
- a. Examine various reform movements (e.g., Civil Rights, Women's Movement, etc.).
- b. Examine the government's role in various movements (e.g., arbitration, 26th Amendment, etc.).
- c. Examine the role of government in the preservation of citizens' rights (e.g., 19th Amendment, Civil Rights Act of 1964).
- d. Examine individuals' duties and responsibilities in a democratic society (e.g., voting, volunteerism, etc.).

Appendix C: 21st Century Skills[6]

CS1 Global Awareness

- Using 21st century skills to understand and address global issues
- Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
- Promoting the study of non-English language as a tool for understanding other nations and cultures

CS2 Financial, Economic, and Business Literacy

- Knowing how to make appropriate personal economic choices
- Understanding the role of the economy and the role of business in the economy
- Applying appropriate 21st century skills to function as a productive contributor within an organizational setting
- Integrating oneself within and adapting continually to our nation's evolving economic and business environment

CS3 Civic Literacy

- Being an informed citizen to participate effectively in government
- Exercising the rights and obligations of citizenship at local, state, national, and global levels
- Understanding the local and global implications of civic decisions
- Applying 21st century skills to make intelligent choices as a citizen

CS4 Information and Communication Skills

- Information and media literacy skills: Analyzing, accessing, managing, integrating, evaluating, and creating information in a variety of forms and media; understanding the role of media in society
- Communication skills: Understanding, managing, and creating effective oral, written, and multimedia communication in a variety of forms and contexts

CS5 Thinking and Problem-Solving Skills

- Critical thinking and systems thinking: Exercising sound reasoning in understanding and making complex choices, understanding the interconnections among systems
- Problem identification, formulation, and solution: Ability to frame, analyze, and solve problems
- Creativity and intellectual curiosity: Developing, implementing, and communicating new ideas to others, staying open and responsive to new and diverse perspectives

CS6 Interpersonal and Self-Directional Skills

- Interpersonal and collaborative skills: Demonstrating teamwork and leadership, adapting to varied roles and responsibilities, working productively with others, exercising empathy, respecting diverse perspectives
- Self-direction: Monitoring one's own understanding and learning needs, locating appropriate resources, transferring learning from one domain to another
- Accountability and adaptability: Exercising personal responsibility and flexibility in personal, workplace, and community contexts; setting and meeting high standards and goals for one's self and others; tolerating ambiguity

[6] *21st century skills.* (n.d.). Washington, DC: Partnership for 21st Century Skills.

- Social responsibility: Acting responsibly with the interests of the larger community in mind; demonstrating ethical behavior in personal, workplace, and community contexts

Appendix D: Rubrics

Activity Performance Rubric

Student Name _____ Date _____

Task to be performed_____

	Possible Points	Points Awarded
Safety Personal safety (glasses, clothing, etc.) Safe use of tool Safely performs the task	25	
Performance of the Task Follows the task instructions Performs the task efficiently Performs the task satisfactorily	50	
Lab Maintenance Area clean-up (clean and tidy) Area organization (before, during and after the task)	25	
Total	100	

Comments for deductions:

Business Letter Assessment Rubric

	Excellent 4 Points	Proficient 3 Points	Needs Improvement 2 points	Unsatisfactory 1 Point
Layout/Design	Creatively designed, easily read, excellent business letter	Attractive, easy to read, good business letter	Appears busy or boring, difficult to read, needs improvement	Unattractive or inappropriate, very difficult to read, not acceptable
Information, Style, Audience, Tone	Information is accurate and complete, very well written and presented	Well written and interesting to read	Some information is provided, but is limited or inaccurate	Poorly written, inaccurate, or incomplete
Accurate Parts	Complete with all required parts	Some elements may be missing	Most elements are missing or out of place	Proper form for a letter is not used
Grammar, Punctuation, Wording	Excellent presentation, style, grammar, and punctuation	Fair presentation, style, grammar, and punctuation	Missing information, inaccurate punctuation and/or grammar	Grammar, punctuation, and wording poor
Following Directions and Guidelines	Always on task, always follows directions.	Followed directions with some guidance	Required a good bit of extra guidance	Did not follow directions and did not ask for extra help

Case Study Assessment Rubric

	Excellent 4 Points	Accomplished 3 Points	Needs Improvement 2 Points	Unsatisfactory 1 Point
Comprehension	Shows complete understanding of the issues, and grasps implications beyond the immediate issue	Asks for more details to clarify understanding of the issue	Shows partial understanding of the issue but does not ask for clarification	Resists attempts to get clarification
Strategizing	Develops realistic strategies that would provide a satisfactory conclusion	Chooses appropriate strategies that may satisfy	Shows evidence of strategy that may or may not satisfy	Needs assistance to choose a strategy
Innovation	Devises more than one resolution to the problem	Offers a solution	Offers a solution with a limited point of view	Shows some understanding of the problem
Communications	Convincingly communicates resolution	Explains solution so others can understand	Conveys an opinion	Unsure of how to explain

Field Trip Participation Checklist

_____1. The student arrived at the designated meeting place on time with all materials and supplies required for the field trip.
_____2 The student observed all safety rules and policies while traveling to and participating in the field trip.
_____3. The student demonstrated interest in the content of the field trip by paying attention to the exhibits and speakers, asking pertinent questions, and taking notes.
_____4. The student exhibited a positive attitude toward the events and activities of the field trip.
_____5. The student remained on task throughout the field trip.
_____6. The student exhibited cooperative workplace skills with other students throughout the field trip.

Group Participation Assessment Rubric

	Beginning	Developing	Accomplished	Exemplary	Score
	1 point	2 points	3 points	4 points	
Group Discussions	Rarely contributed to discussions of the group	Contributed good effort to discussions of the group	Contributed great effort to discussions of the group	Contributed exceptional effort to discussions of the group	
On-task Behavior	Exhibited on-task behavior inconsistently	Exhibited on-task behavior some of the time	Exhibited on-task behavior most of the time	Exhibited on-task behavior consistently	
Helping Others	Did not assist other group members	Seldom assisted other group members	Occasionally assisted other group members	Assisted other group members	
Listening	Ignored ideas of group members	Seldom listened to ideas of group members	Occasionally listened to ideas of group members	Always listened to ideas of group members	

Group Presentation Assessment Rubric

	Exemplary	Accomplished	Developing	Beginning	Score
	4 points	3 points	2 points	1 point	
Content	Clear, appropriate, and correct	Mostly clear, appropriate, and correct	Somewhat confusing, incorrect, or flawed	Confusing, incorrect, or flawed	
Clarity	Logical, interesting sequence	Logical sequence	Unclear sequence	No sequence	
Presentation	Clear voice and precise pronunciation	Clear voice and mostly correct pronunciation	Low voice and incorrect pronunciation	Mumbling and incorrect pronunciation	
Visual Aids	Attractive, accurate, grammatically correct	Adequate, mostly accurate, few grammatical errors	Poorly planned, somewhat accurate, some grammatical errors	Weak, inaccurate, many grammatical errors	
Length	Appropriate length	Slightly too long or short	Moderately too long or short	Extremely too long or short	
Participation	Well-balanced participation by all group members	All group members have significant participation	Most group members participate	One main speaker with little participation from other group members	
Eye Contact	Maintains eye contact, seldom looking at notes	Maintains eye contact most of time but frequently returns to notes	Occasionally uses eye contact but reads most of information	No eye contact because reading information	

Group Work Assessment Rubric

	Highly Successful	Meeting Success	Experiencing Difficulty	Score
	3 points	2 points	1 point	
Sharing	Shared ideas with others	Occasionally shared ideas with others	Seldom shared ideas with others	
Listening	Always listened to peers	Occasionally listened to peers	Ignored ideas of peers	
Respecting	Interacted with, encouraged, and supported ideas of others	Occasionally encouraged and supported others	Seldom encouraged and supported others	
Participating	Shared task equally with group members	Did most of the task	Did very little of the task	

Interview Rubric

The Student	Excellent 4	Good 3	Needs Improvement 2	Unacceptable 1
Arrives prior to the interview.				
Displays confidence with body language.				
Maintains eye contact.				
Maintains proper facial expression.				
Provides a self-introduction.				
Extends hand and shakes hands firmly with the interviewer(s)				
Dresses appropriately for the interview.				
Responds in a concise, grammatically correct, and appropriate manner.				
Asks appropriate questions, demonstrates awareness of background of company and requirements of the job.				
Cues on interviewer's closure and responds appropriately.				

Notes:

Parliamentary Procedure Demonstration Rubric

	Points
Required motion	5
Discussion (max. of 5 debates @ 2 pts. each)	10
Additional motion (includes main or alternate main motion)	5
Chair	10
Ability to preside	5
Leadership	10
Team's general effect	15
Conclusions reached by team	10
(Team's use of motions and discussion support disposal of the main motion)	
Team effect	10
(Degree to which discussion was convincing, logical, realistic, orderly, and efficient)	
Team's voice, poise, expression and appearance	5
Completeness and accuracy	5
Format	5
Grammar, style, legibility	5
SUBTOTAL	____
Deductions	
Deductions for parliamentary mistakes	5-20
Deductions for omitting assigned motion	10
TOTAL	____

(Adapted from FFA CDE Handbook)

Poster Assessment Rubric

	Exemplary	Accomplished	Developing	Beginning	Score
	4 Points	3 Points	2 Points	1 Point	
Required Content	The poster includes all required content elements as well as additional information.	All required content elements are included on the poster.	All but 1 of the required content elements is included on the poster.	Several required content elements were missing.	
Labels	All items of importance on the poster are clearly labeled with labels that are easy to read.	Almost all items of importance on the poster are clearly labeled with labels that are easy to read.	Many items of importance on the poster are clearly labeled with labels that are easy to read.	Labels are too small to read or no important items were labeled.	
Attractiveness	The poster is exceptionally attractive in terms of design, layout, and neatness.	The poster is attractive in terms of design, layout, and neatness.	The poster is acceptably attractive though it may be a bit messy.	The poster is distractingly messy or very poorly designed.	
Grammar	There are no grammatical or mechanical mistakes on the poster.	There are 1-2 grammatical or mechanical mistakes on the poster.	There are 3-4 grammatical or mechanical mistakes on the poster.	There are more than 4 grammatical or mechanical mistakes on the poster.	

Presentation Checklist

Student Name _____ Date _____

	Possible Points	Points Earned
1. Appropriate number of slides was included.	**10**	
2. Proper design elements were used.	**20**	
3. Presentation included the motto, creed, emblem, colors, theme, and history of the organization.	**30**	
4. Information was accurate and complete.	**30**	
5. Student worked well with team members.	**5**	
6. Student contributed to the finished product.	**5**	
TOTAL SCORE	**100**	

Reflective Writing Rubric

CATEGORY	4	3	2	1
Writing Structure	Sentences and paragraphs are complete, well-constructed and of varied structure.	All sentences are complete and well-constructed (no fragments, no run-ons). Paragraphing is generally done well.	Most sentences are complete and well-constructed. Paragraphing needs some work.	Many sentence fragments or run-on sentences OR paragraphing needs lots of work.
Content	The writing contains a description of all components of the communication process.	The writing contains a description of three components of the communication process.	The writing contains a description of two components of the communication process.	The writing contains a description of one component of the communication process.
Content Accuracy	The writing contains at least 3 accurate examples of types of communications.	The writing contains at least 2 accurate examples of types of communications.	The writing contains at least 1 accurate example of types of communications.	The writing contains no examples of types of communications.
Content Understanding	Ideas were expressed in a clear and organized fashion. It was easy to figure out what the letter was about.	Ideas were expressed in a pretty clear manner, but the organization could have been better.	Ideas were somewhat organized, but were not very clear. It took more than one reading to figure out what the letter was about.	The writing seemed to be a collection of unrelated sentences. It was very difficult to figure out what the letter was about.

Resume Rubric

	Excellent 25	Well Done 20	Meets Standards 15	Beginning 10	No evidence 0	Score
Format	Resume contains: Name Address Phone Number Objective Education Experience References No Spelling Errors	Resume contains 6 of the criteria. No more than two spelling errors.	Resume contains 5 of criteria. No more than four spelling errors.	Resume contains minimal information. More than 4 spelling errors.	Assignment was not turned in.	
Education	Education includes all of the following: All schools attended. Graduation dates. Diploma/Degree awarded. Major field of study.	Education includes 3 of the following: All schools attended. Graduation dates. Diploma/Degree awarded. Major field of study.	Education includes 2 of the following: All schools attended. Graduation dates. Diploma/Degree awarded. Major field of study.	Education includes 1 of the following: All schools attended. Graduation dates. Diploma/Degree awarded. Major field of study.	Assignment was not turned in.	
Experience	Experience includes: Internships in the field Entry level jobs relevant to current position. Current Position	Experience includes: Internships in the field Entry level jobs relevant to current position.	Experience includes: Entry level jobs relevant to current position as well as current job.	Experience includes current position only.	Assignment was not turned in.	
Realism	Resume contains realistic names and dates. Resume is believable.	Resume is fairly believable with realistic names OR dates.	Resume has unrealistic dates or names.	Resume is obviously unrealistic and contains conflicting information.	Assignment was not turned in.	

Written by D Cordero. Last updated 12/01/99

Role-Play Rubric

Indicators	Proficient 4	Strong 3	Basic 2	Weak 1
Assessment Outcomes	*Highly creative, inventive, mature presence of outcome*	*Detailed and consistent evidence of the outcome*	*Beginning of or some evidence of the outcome*	*Little or no evidence of the outcome*
Focus Question Provided	Group provides a clear, relevant focus question to the audience to give the anticipatory set.	Group provides a focus question to the audience to give the anticipatory set.	Group provides a vague focus question to the audience to give the anticipatory set.	Group provides a very vague or no focus question to the audience to give the anticipatory set.
Knowledge of Content	Group of students are obviously well-prepared and knowledgeable about the content they are role-playing; Highly credible in role; information is completely accurate.	Group of students are mostly prepared and knowledgeable about the content they are role-playing; somewhat credible in role with little or no vagueness; little or no errors in information.	Group of students slightly prepared and somewhat knowledgeable about the content they are role-playing; little or no credible in role with vagueness; errors in information.	Group of students not prepared and vaguely knowledgeable about the content they are role-playing; no credibility in role with multiple errors in information.
Creativity in Presentation	Group of students are serious and methodical in their presentation using believable role-playing that creatively conveys the knowledge desired.	Group of students are somewhat serious in their presentation using mostly convincing role-playing that conveys the knowledge desired.	Group of students are slightly serious in their presentation using slightly convincing role-playing that conveys the knowledge desired.	Group of students are not serious in their presentation not using convincing role-playing that conveys the knowledge desired.
Use of Props	Group of students have collected the relevant props to include the tools demonstrated plus additional props to create the scene and used them effectively to role-play.	Group of students have collected the relevant props to include the tools demonstrated and used them effectively to role-play.	Group of students have collected little or no props to include the tools demonstrated and used them.	Group of students have not collected props to include in the role play.
Collaboration Among Team Members	Group of students assumed necessary roles and carried out their duties in the roles to work in a highly effective collaborative team.	Group of students assumed necessary roles and somewhat carried out their duties in the roles.	Group of students somewhat assumed roles and slightly carried out their duties in the roles.	Group of students showed no signs of collaboration.
Interactive Closure Activity	Group of students provided a highly effective, interactive closure activity that was unique and provided a check for understanding of the role play.	Group of students provided effective closure activity that provided a check for understanding of the role play.	Group of students provided a vague closure activity.	Group of students provided no closure activity.

SAE Plan Rubric

CATEGORY	Excellent 4	Very Good 3	Satisfactory 2	Needs Work 1	SCORE:
Occupational Goals	Detailed long range and short term goals for reaching an occupational goal in the field of agriculture, food, and natural resources occupations are provided.	General long range and short term goals for reaching an occupational goal in the field of agriculture, food, and natural resources occupations are provided.	General long range and short term goals for reaching an occupational objective in fields outside of agriculture, food, and natural resources occupations are provided.	Only vague general statements concerning any occupational goal are provided.	
Resources Required	Detailed resources required to achieve goals are identified.	General resources required to achieve goals are identified.	A general statement on the resources required to achieve the goals is provided.	Very limited information on resources required to achieve program goals is provided.	
Training Agreement	Responsibilities of all parties (students, parents, teachers, employers/sponsors) in the SAE are detailed and accepted by signature.	General responsibilities of all parties in the SAE are identified.	Responsibilities of all parties in the SAE are stated in very general terms.	Responsibilities of all parties are not clearly defined.	
Skills to be Accomplished	A detailed list of skills representing a broad range of activities associated with the SAE is provided.	A general list of skills representing a moderately broad range of activities is provided.	A general list of skills representing a narrow range of activities is provided.	A very limited list of skills to be accomplished is provided.	
Outcomes	A detailed list of outcomes including income and expenses, if applicable, is provided.	A general list of outcomes is provided.	Expected outcomes are listed but not in specifics.	Limited outcomes are identified.	
Total Score:					

Student Journal Rubric

CATEGORY	Excellent 4	Very Good 3	Satisfactory 2	Needs Work 1	SCORE:
Writing Quality	There is a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There is a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style which conveys meaning adequately. Some minor grammatical, syntax, and spelling errors.	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of agriculture.	Content of the activity is related to life in general.	Only limited connections are made between the content of the activity and the surrounding world.	
Total Score:					

Visual Presentation Checklist

Student Name _____ Date _____

	Possible Points	Points Earned
1. Appropriate number of slides was included.	**10**	
2. Proper design elements were used.	**20**	
3. Presentation included the motto, creed, emblem, colors, theme, and history of the organization.	**30**	
4. Information was accurate and complete.	**30**	
5. Student worked well with team members.	**5**	
6. Student contributed to the finished product.	**5**	
TOTAL SCORE	**100**	

Written Report Assessment Rubric

	Exemplary	Accomplished	Developing	Beginning	Score
	4 points	3 points	2 points	1 point	
Content	Clear thesis and focus that remains apparent	Thesis and focus that remains apparent	Addresses subject matter with minimal support	Does not focus on topic	
Grammar	Correct and effective use of grammar and mechanics	Occasional errors in use of grammar and mechanics	Problems in use of grammar and mechanics	Repeated errors in use of grammar and mechanics	
Organization	Ideas flow smoothly and logically with clarity and coherence	Logical order and appropriate sequencing of ideas with adequate transition	Some evidence of an organizational plan or strategy	Lacks organization	

Written Report Checklist

_____/16 Preparation
_____/28 Organization
_____/24 Thoroughness
_____/19 Extra Materials
_____/13 Final Report

Preparation:

1. _____/2 Information written (neatly)
2. _____/2 Sources used listed
3. _____/5 Worked every day (did not waste time)
4. _____/5 Has all materials ready for use
5. _____/2 Cooperative

Organization

1. _____/2 Report in a logical order
2. _____/2 Interesting manner
3. _____/20 Notebook check
4. _____/2 Understanding of topic
5. _____/2 Spelling and sentence structure (do not copy from books)

Thoroughness

1. _____/5 Main points given
2. _____/5 Details to explain given
3. _____/5 Information presented clearly
4. _____/4 More than one source used
5. _____/5 Extra materials are appropriate

Extra Materials

1. _____/2 Neatness
2. _____/7 Creativity
3. _____/2 Dramatic value
4. _____/3 Useful
5. _____/5 Correctness

Final Report

1. _____/3 Written clearly
2. _____/2 Organized
3. _____/2 Sources documented correctly
4. _____/2 Spelling
5. _____/2 Grammar
6. _____/2 Neatness

_____/100 Total points earned