UNIVERSITY OF WISCONSIN-LA CROSSE

Graduate Studies

UPPER MIDWEST ENVIRONMENTAL SCIENCE CENTER SAND PRAIRIE AS A MODEL FOR IDENTIFICATION AND CLASSIFICATION OF PLANTS IN A MIDDLE SCHOOL SCIENCE CLASSROOM

A Chapter Style Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Education-Professional Development

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ABSTRACT

Hoffman, N. Upper Midwest Environmental Science Center sand prairie as a model for identification and classification of plants in a middle school science classroom. ME-PD: Initial Certification (Early Adolescence Through Adolescence/Biology), December 2010, 58 pp. (G. Willhite)

Project 2061's *Benchmarks for Science Literacy* provides educators with specific learning goals that should be used as a basis for curriculum development. The lesson, based on Project 2061's *Benchmarks for Science Literacy*, provides middle school science teachers with a curriculum framework, referred to as a lesson plan, to have students observe basic plant structures and use that basic knowledge to be able to identify a plant. This lesson engages students in the opportunity to observe the similarities and differences in many different types of plants. Students identify plants using a basic field guide. That basic field guide organizes related plants based on families. Students become familiar with how plants are classified by related groups of organisms into families. Once students feel comfortable identifying and classifying plants, they have to tools and skills to research the interdependence of life of a particular plant community.

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CHAPTER I

INTRODUCTION

Science teachers must create meaningful learning experiences aligned with grade level standards for students to develop scientific literacy. Engaging students by capitalizing on their wonder and awe of the rich diversity of life on Earth invites students to actively take part in science and experience the true nature of science by the means of identification and classification. The science teacher's task is to enhance student understandings of the features of organisms by scaffolding curricula and building upon their student's prior knowledge. Furthermore, to enhance understandings of local environments and the organisms that live in them, teachers should provide experiences for their students to engage in fieldwork first hand.

Overview of Project

The goal of this project was to develop a framework, based on grade level standards, for middle school science teachers to engage their students in the analysis of the diversity of life at a local sand prairie. In conjunction with the research cited, this project offers a lesson plan, defined as detailed description of the course of instruction, to be implemented in my future classroom, shared with the Upper Mississippi Environmental Science Center (hereafter referred to as UMESC) on French Island, WI, and to be submitted as a manuscript for publication on the American Association for the Advancement of Science's website Science Netlinks. The lesson plan completely and succinctly prepares teachers to engage students in meaningful classroom work and fieldwork identifying and classifying plants while minimizing apprehensions about their own understanding and misconceptions regarding the identification of sand prairie plants.

Purpose of the Curriculum

Scientific literacy, encompassing science, mathematics, and technology, is defined as the development of the comprehension and habits of mind that students need to become engaged citizens who are able to think for themselves and face life compassionately while making informed decisions regarding the problems that human society faces (Rutherford & Ahlgren, 1989). People who are literate in science are not only those who are considered scientists, mathematicians, or engineers. The scientifically literate, ideally, are able to make sense of the day to day science they encounter and critically solve problems based on their prior knowledge of scientific concepts.

Science literacy involves creating connections among topics. The cumulative effectiveness of instruction relies on the interconnectedness and coherency of ideas in science from kindergarten through high school graduation. Due to high stakes testing, including No Child Left Behind, rote memorization by students often takes the place of interconnected and coherent content knowledge.

Achieving the goals of scientific literacy requires a coherent approach. Project 2061 constitutes one of many efforts to significantly improve the current state of public science education by encouraging science literacy (Rutherford & Ahlgren, 1989). Project 2061 publications, supported by the American Association for the Advancement of Science (AAAS) in part include *Science for All Americans* by Rutherford and Ahlgren (1989), *Benchmarks for Science Literacy*, and *Atlas of Science Literacy: Volume 1 and Volume 2*. These resources emphasize the need for interconnected curriculum that builds upon prior knowledge, skills, abilities and concepts throughout K-12 education.

Student learning in science must consist of the lasting knowledge and skills we want our students to acquire before they become adults (Project 2061, 1993). Project 2061 calls for a significant reduction in the amount of material teachers cover and instead emphasizes the understanding of and connections between science, mathematics, and technology. To compliment these premises, Project 2061 strongly encourages curriculum to be based on *Benchmarks*. *Benchmarks for Science Literacy*, in sum, is a tool and valuable resource for educators to use when designing curriculum consisting of learning goals connected by grade ranges and by connections between learning goals.

Benchmarks is not descriptive curricula, rather *Benchmarks* concentrates on the connections between what students ought to know based on research in science education. Parceled by grade levels and based on *Science for All Americans, Benchmarks* organizes learning goals in science, which they call benchmarks, within twelve chapters. Benchmarks are defined as a standard or point of reference in measuring or judging quality and value and are given as reference points for curriculum reform in science (Colburn, 2003). The terms benchmarks and learning goals may be used interchangeably in this context. The ideas in *Benchmarks* are interconnected between both grade ranges (K-2, 3-5, 6-8, 9-12) and between interconnected benchmarks among a single grade range.

In addition to *Benchmarks,* Project 2061 accomplished the task of organizing benchmarks into strand maps. These two publications, entitled *Atlas of Science Literacy, Vol1* and *Vol 2,* are a collection of conceptual maps that show the connections and learning progressions between grade levels on a single page. Both atlases consider the challenge of science education reform of making science education coherent; each benchmark depends on and supports others (Project 2061, 2007). In their own words, Project 2061 (2007) states that

> "the enduring message of Atlas [Vol. 1 & Vol. 2] will be that thinking carefully about the growth of understanding from kindergarten through high school graduation is an essential part in planning what students can be expected to learn and how best they can be helped to do so" (p.xiii).

The benchmarks and respective connections in the atlases aid student learning and are a critical part of achieving scientific literacy. The maps prove to be of great importance for guiding curriculum development because benchmarks are illustrated in concept maps and clearly exemplify interconnected themes in science. The development of curriculum materials that are coherent and interconnected rather than fragmented ultimately remains the goal for this project.

For the purposes of this project, maps and benchmarks within Chapter 5: The Living Environment were selected as a framework for the curriculum. The Living Environment includes maps and benchmarks entitled:

- Diversity of Life,
- Heredity,
- Cells,
- Interdependence of Life,
- Flow of Matter and Energy, and
- Evolution of life.

Curiosity of living things is an enduring trait of humans. Before students can understand the rich interdependence of organisms on Earth, they must learn about the rich diversity of life on Earth.

The diversity of life benchmarks primarily consist of distinguishing general similarities and differences among organisms. Teachers, beginning in kindergarten and extending through high school graduation, are tasked with guiding the students toward a better understanding of the features of organisms that connect or differentiate them (Project 2061, 1993).

Table 1. Benchmark Information

5A: Diversity of Life, 6-8, #3 • Similarities among organisms are found in internal anatomical features, which can be used to infer the degree of relatedness among organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance. 5A: Diversity of Life, 6-8, #4 • For sexually reproducing organisms, a species comprises all organisms that can mate with one another to produce fertile offspring.
Project 2061, 1993, p. 104

There are millions of different types of individual organisms that inhabit the earth at any one time (Rutherford & Ahlgren, 1989). Biologists refer to the different types of organisms as species. There are almost two million different species that are currently recognized by scientists. In many cases, different species will have both a common and a scientific name. Naming organisms is one important part of the scientific discipline called taxonomy. It has been stated by notable scientists in the field that "It is time to accelerate the taxonomy and scientific natural history, two of the most vital but neglected disciplines of biology "(S.N. Stuart, et al., Science. 328, 177(2010)).

Taxonomy also encompasses describing and classifying organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance (Project 2061, 1993). Biologists classify organisms into a hierarchy of groups based on similarities and differences in their structure (Rutherford & Ahlgren, 1989).

The initial goal of this research was to conduct a needs assessment on February 4, 2010 between representatives at UMESC, Professor D. Gerber of UW-La Crosse, and the thesis candidate. Ultimately, the results of the meeting coalesced into a project to develop curriculum for teachers about identifying plants in the sand prairie at UMESC. More specifically, the curriculum should minimize teacher's apprehensions about identifying plants while introducing students to the scientific endeavor of naturalistic fieldwork.

The lesson, put forth in chapter three, provides middle school science teachers with a framework to have students observe basic plant structures and use that basic knowledge to be able to identify a plant. This lesson engages students in the opportunity to observe the similarities and differences in many different types of plants. Students identify plants using a basic field guide. That basic field guide organizes related plants based on families. Students become familiar with how plants are classified by related groups of organisms into families.

UMESC Sand Prairie Site Description

The Upper Midwest Environmental Sciences Center (UMESC), 2630 Fanta Reed Rd., La Crosse, WI, provides various learning environments for students of all ages including an outdoor classroom, an indoor learning laboratory, interpretive displays, hands-on exhibits, interpretive trails, and a restored native prairie. Of significance to this project is the restored native sand prairie. Currently, UMESC offers tours of the prairie, including plant identification and importance of prairie habitats, by volunteer naturalist Bob Lee. In developing a framework for middle school science teachers involving identification and classification of plants at the sand prairie by students in grades sixeight, I have consulted and worked with Mr. Randy Hines, Wildlife Biologist and Partnership Coordinator, of UMESC.

Thesis

Identifying and classifying grassland plants in the field provides students with an opportunity to enrich their knowledge and understanding of the diversity of life, especially of those organisms close to or within their own communities.

CHAPTER II

LITERATURE REVIEW

Key Terminology

American Association for the Advancement of Science (AAAS) - The world's largest general science professional association. Also called "triple A-S", this association is dedicated to advancing science through education and leadership.

Full Option Science System (FOSS) - a K-8 research based curriculum dedicated to improving the teaching and learning of science.

French Island, WI – an island, most of which is part of La Crosse, WI, located adjacent to La Crosse, WI.

National Science Teacher Association (NSTA) – The world's largest organization committed to accelerating science teaching and learning for all.

Project 2061 – An American Association for the Advancement of Science initiative to prepare students for scientific, technological, and mathematical literacy.

Science for All

Since the 1960's, science education in America has seen dramatic change in the philosophy and implementation of science and science education (Smith & Gunstone, 2009). The emergence of alphabet learning kits like Full Option Science System (FOSS) and other alphabet curricula has impacted elementary, and to some extent, secondary education. One impetus for this change has been the philosophy of "Science for All", and the 1989 publication of *Science for All Americans.*

The phrase "Science for All" may be defined as "a belief that meaningful learning of science can be extended to all students and citizens, not just those with interests in science related careers" (Fensham, 2008). All citizens must be scientifically literate to:

a. appreciate the world around them, and
b. make informed personal decisions (Hazen, 2002).

The goal of the "Science for All" movement in schools is to educate students about the nature of science so that the general public may have a common knowledge of how science works and how scientists' practice their discipline. Although this movement highly regards students preparing for a career in science, the goal isn't to academically stress those students who wish to pursue non-science careers. According to the National Science Teachers Association (NSTA) the following premises are important to understanding the nature of science:

Table 2. NSTA's Postion on the Nature of Science

Scientific knowledge is simultaneously reliable and tentative. Having confidence in scientific knowledge is reasonable while realizing that such knowledge may be abandoned or modified in light of new evidence or reconceptualization of prior evidence and knowledge.
Although no single universal step-by-step scientific method captures the complexity of doing science, a number of shared values and perspectives characterize a scientific approach to understanding nature. Among these are a demand for naturalistic explanations supported by empirical evidence that are, at least in principle, testable against the natural world. Other shared elements include observations, rational argument, inference, skepticism, peer review and replicability of work.
Creativity is a vital, yet personal, ingredient in the production of scientific knowledge.
Science, by definition, is limited to naturalistic methods and explanations and, as such, is precluded from using supernatural elements in the production of scientific knowledge.
A primary goal of science is the formation of theories and laws, which are terms with very specific meanings. Laws are generalizations or universal relationships related to the way that some aspect of the natural world behaves under certain conditions. Theories are inferred explanations of some aspect of the natural world. Theories do not become laws even with additional evidence; they explain laws. However, not all scientific laws have accompanying explanatory theories. Well-established laws and theories must be internally consistent and compatible with the best available evidence; be successfully tested against a wide range of applicable phenomena and evidence; possess appropriately broad and demonstrable effectiveness in further research.
NSTA Board of Directors, 2000, retrieved Oct. 15, 2010 from: http://www.nsta.org/about/positions/natureofscience.aspx

"Science for All" represents the consensus of the scientific community (Rutherford & Ahlgren, 1989). Key players involved in the reform of science education include the American Association for the Advancement of Science (AAAS henceforth) and its think tank Project 2061; the National Research Council; the National Academies: Advisors to the Nation on Science, Engineering, and Medicine; the National Science Teacher Association; the National Governors Association; the Council of Chief State School Officers; the Carnegie Corporation; and Achieve (Leshner, Malcom, Roseman, 2010; American Association for the Advancement of Science, 1993; & The National Academies of Science, 2010). Efforts by these key players consist of paring down the amount of information taught to students, while striving for adult literacy in the four domains of science: biological and health sciences, mathematics, physical and information sciences and technology, and social and behavioral sciences (Roseman & Koppal, 2008). Emphasis remains on “meanings, connections and contexts, rather than fragmented bits and pieces of information, and favors quality of understanding over quantity of coverage” (Rutherford & Ahlgren, 1989, p.xv).

In order to better understand “Science for All”, an understanding of the history of the scientific education movements is necessary. Shamos (1995) asserts that science education reform was a happening long before the “Science for All” movement. However, the nation’s concerns about the societal or civic aspects of science regarding science education is a post World War II trend. For example, before the “Science for All” movement, the goal was to teach science to those preparing for careers in science or science education. Students not seeking a degree or career in science would still have some exposure to science but not the full opportunities offered to those who would seek careers in science or science education. In comparison, the emergence of science literacy was meant to prepare students to cope intelligently with “science-based societal issues” in the 1950s like: the atomic bomb, nuclear energy, and, later, issues including the environment, toxic waste, acid rain, depletion of resources, over population, and genetic engineering to name a few (Shamos, 1995, 76-77).

With the launching of the Soviet Union’s Sputnik into orbit in October 1957, huge sums of money were allocated to create science education programs and provide resources for educators of all grade levels regarding elementary science, technology, and mathematics. According to Shamos (1995), several billion dollars went into expanding and improving the education of these programs and resources; even more was spent on these efforts then on the development of the atomic bomb thirty-five years earlier.

From 1957 through the 1980s, many important events occurred impacting the science literacy movement including:

- the publishing of Silent Spring by Rachel Carson in 1962,
- astronauts landing on the moon in 1969,
- the environmental education movement in 1969, and
- the National Science Foundation publishing "The Task Ahead for the NSF", a report that maintains that its goal is "to educate scientists who will be at home in society, and to educate a society that will be at home with science" (University of Arkansas's Project to Advance Science Education, n.d.).

However, the 1980s would hold a different perspective on the science literacy movement: one of doom and gloom. Also called the "Age of Crisis", a number of reports were published detailing the declining achievement in math and science of American students. Of particular importance is the publishing of *A Nation at Risk.* In 1983, The National Commission on Excellence in Education published this report. It supposes that our education system was failing our students and that the education system was a threat to the future (National Commission on Excellence in Education, 1983). Born from this report were the ideas of national standards, requirements for professional and competent educators, graduation requirements of certain courses including math and science, and other issues that continue to be debated today.

The 1990's witnessed the "Age of Science Reform" (University of Arkansas's Project to Advance Science Education, n.d.). The media attention received during the

1980's fueled the creation of voluntary national standards. The decision to adopt national standards was still under control and the responsibility of the state.

Since the 1990's, we've seen an emergence of "The Age of Accountability". This era of education, science in particular, focuses on closing the achievement gap through the federal mandate of standardized testing. An example of "The Age of Accountability" is the Trends in International Mathematics and Science Study, or TIMSS. This voluntary study was created to test 4^{th} and 8^{th} graders achievement in math and science from around the world. This test ranks international students' achievement in comparison with American students.

Project 2061 Benchmarks for Science Literacy

In 1990, Rutherford & Ahlgren, under the support of the American Association for the Advancement of Science (AAAS), published *Science for All Americans.* This book and national report of the same name, which is the collaborative effort of several hundred scientists, mathematicians, engineers, physicians, philosophers, historians, and educators, laid the initial foundation and guidelines for reforming science education within the context of science literacy and Science for All (Roseman & Koppal, 2008; Rutherford & Ahlgren, 1990). These momentous publications directly influenced Project 2061, an affiliated AAAS effort.

Societal progress is expected to grow during a human's life span. Project 2061, a report of 150 teachers and administrators initiated by the AAAS, relies on the premise that science, along with math and technology, will change drastically between the last (1985) and next (2061) appearance of Halley Comet (Project 2061, 1993). In 1993, informed by *Science for All Americans, Benchmarks for Science Literacy* was published by AAAS. This publication outlines: "*what all students should know or be able to do in science, mathematics, and technology by the end of grades 2, 5, 8, and 12*" (AAAS, 1993, p.XI). Benchmarks, defined as a standard or point of reference in measuring or judging quality and value are given as reference points for curriculum reform in science (Colburn, 2003). Once again, information is pared down and emphasizes connections among ideas (Roseman, Koppal, 2008).

Project 2061's *Benchmarks* is often used as a guide for curriculum reform and curriculum development by teachers, administrators, and curriculum specialists. According to Project 2061, *Benchmarks* is readily available as a tool to be used along with *Science for All Americans* to transform curriculum development (Project 2061, 1993, p. XV). Teachers can use *Benchmarks* to assess their K-12 curriculum framework with regards to science literacy (Project 2061, 199, p. XV).

Benchmarks have left a lasting impression with regards to science education reform (Shekhtman & George, 2005). Despite being published three years earlier, *Benchmarks* greatly influenced the development of the 1996 National Research Council's Science Education Standards (Leshner, Malcom, Roseman, 2010; Roseman & Koppal, 2008; Lempinen, 2007).   Additionally, AAAS publications based on *Benchmarks*, have proven useful to guide the design and sequence of curriculum (AAAS, 1997, p. ix).

The effort to establish what have been referred to as "common, internationally benchmarked, state-approved standards" has been fueled by a March 2010 National Governors Association and the Council of State School Officers (CSSO) call for English-language and mathematics standards. States have called for national standards to be put forth for states to adopt (Leshner, Malcom, Roseman, 2010). Simultaneously, a major privately and publically funded development is taking place to establish a framework for such standards in addition to the National Science Education Standards published in 1996. The AAAS along with Project 2061 supports these efforts (Leshner, Malcom, Roseman, 2010).

AAAS's Project 2061 is noted as informing the National Research Council's National Science Education Standards published in 1996. The National Research Council of the National Academy of Science "gratefully acknowledges AAAS's Project 2061 and believes that use of *Benchmarks for Science Literacy* by state framework committees, school and school-district curriculum committees, and developers of instructional and assessment materials complies fully with the spirit of the content standards" (National Research Council, 1996, p.15).

5 E Learning Cycle

Recently, the use of coordinated and coherent sequencing of lessons has gained popularity in the science education community (Bybee, Taylor, Gardner, et al; 2006). The 5 E method is a framework for structuring science lessons that incorporates inquiry, either student or teacher facilitated, and is named after the 5 E's: engagement, exploration, explanation, elaboration, and evaluation (Jorgenson, Cleveland, & Vanosdall; 2004). Inquiry, an approach to scientific investigation that begins with a question or problem, often leads to the development of additional questions. Depending upon the lesson, inquiry may be guided by the teacher or student initiated. The 5E method involves posing a question, planning a procedure, and formulating results (Jorgenson, Cleveland, & Vanosdall; 2004). The 5 E method is recommended by the National Science Teachers Association as a foundational model of lesson planning;

Additionally, the NSTA recommends that middle school science classrooms focus 80% of classroom time on actively investigating and inquiring (Jorgenson, Cleveland, & Vanosdall; 2004).

Table 3. Summary of the BSCS 5E Instructional Model

Engage	The teacher or a curriculum task accesses the learners' prior knowledge and helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge. The activity should make connections between past and present learning experiences, expose prior conceptions, and organize students' thinking toward the learning outcomes of current activities.
Explore	Exploration experiences provide students with a common base of activities within which current concepts (i.e., misconceptions), processes, and skills are identified and conceptual change is facilitated. Learners may complete lab activities that help them use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct a preliminary investigation.
Explain	The explanation phase focuses students' attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept. An explanation from the teacher or the curriculum may guide them toward a deeper understanding, which is a critical part of this phase.
Elaborate	Teachers challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.
Evaluate	The evaluation phase encourages students to assess their understanding and abilities and provides opportunities for teachers to evaluate student progress toward achieving the educational objectives.
Bybee, Taylor, Gardner, etal, 2006, retrieved Oct. 15, 2010 from: http://www.bscs.org/pdf/bscs5eexecsummary.pdf	

The 5 E method pairs well with Project 2061's *Benchmarks.* The 5E method enables middle school teachers to provide a rich and contextual learning environment for students to do science that is relevant (Jorgenson, Cleveland, & Vanosdall; 2004). This premise balances with Project 2061's ideology of effective learning and teaching of science stating that "sound teaching begins with questions and phenomena that are interesting and familiar to students" (Rutherford & Ahlgren; 1990; p.188).

As the research describes, solid science curriculum should be based on the learning goals of *Benchmarks* and should provide inquiry-based learning experiences. The lesson plan, to follow in chapter 3, depends significantly on AAAS and Project 2061 *Benchmarks*. In addition, the sequence of the lesson follows the 5E learning method.

CHAPTER III

IDENTIFICATION AND CLASSIFICATION OF GRASSLAND PLANTS

Science Netlinks, a vetted website by the Thinkfinity partnership, provides "a wealth of resources for science educators" (American Association for the Advancement of Science, 2010). The resources include lessons, resources, benchmarks, and science updates and are aligned with Project 2061 benchmarks. In addition, the website is internet based and free of charge.

Of importance to this research project are the lessons available on Science Netlinks. These lessons are benchmarked according to Project 2061 standards and reviewed by both a scientist and a science educator before being added to the website. The lessons are written for the science educator and include ready-to-use student components such as worksheets called "Student Sheets" or "E-Sheets" (American Association for the Advancement of Science, 2010). These lesson plans are often quite expansive and may require one day to several weeks of classroom time.

This chapter contains a complete lesson plan submitted to Science Netlinks for consideration for publication on their website and to be used in the thesis candidate's future teaching career. The lesson, developed for students in grade 6-8, is aligned with Project 2061 benchmarks. The lesson plan follows the 5E learning cycle and includes authentic field work, interactive activities, and classroom discussions.

The purpose of this lesson plan is for students to observe similarities and differences of plants found in grasslands and use these observations to better understand how plants are identified and classified. This curriculum is aligned with the American Association for the Advancement of Science's Project 2061 benchmarks for science literacy. Of importance is the Diversity of Life Benchmark for students in grades 6-8. This benchmark states that:

> Similarities among organisms are found in internal anatomical features, which can be used to infer the degree of relatedness among organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance. (American Association for the Advancement of Science, 1993, p.104)

Context

There are millions of different types of individual organisms that inhabit the earth at any one time (Rutherford & Ahlgren, 1990). Biologists refer to the different types of organisms as species. There are almost two million different species that are currently recognized by scientists. In many cases, different species will have both a common and a scientific name. Naming plants is one important part of the scientific discipline called taxonomy. It has been stated by Stuart, Wilson, McNeely, Mittermeier, and Rodriguez (2010) of the field of taxonomy and classification that: "It is time to accelerate taxonomy and scientific natural history, two of the most vital but neglected disciplines of biology" (p. 177).

Taxonomy also encompasses describing and classifying organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance (American Association for the Advancement of Science, 1993). Biologists classify organisms into a hierarchy of groups based on similarities and differences in their structure (Rutherford, et al, 1990).

The purpose of this lesson is to have students observe basic plant structures and use that knowledge to be able to identify grassland plants. This lesson engages students in the opportunity to observe the similarities and differences among many species.

Students will identify grassland plants using a basic field guide. Students will become familiar with how plants are classified by related groups of organisms into families.

> After completing fifth grade, students should have a basic understanding that:
> (1) A great variety of kinds of living things can be sorted into groups in many ways using various features to decide which things belong to which group, and
> (2) Features used for grouping depend on the purpose of the grouping. (American Association for the Advancement of Science, 1993, p.103)
> After completing eighth grade, students should have a basic understanding that:
> (3) Similarities among organisms are found in internal anatomical features, which can be used to infer the degree of relatedness among organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance. (American Association for the Advancement of Science, 1993, p.104)

Students often hold misconceptions about classification schema. Middle school students may believe that classification systems are natural, when they are in-fact man-made systems that help organize the diverse organisms found on Earth (American Association for the Advancement of Science, 1993). In addition, these same students may have a restricted understanding of the word "plant" and not understand plants also include trees, vegetables, and grasses (American Association for the Advancement of Science, 2007). It is important for teachers to pose questions to students to bring forth misconceptions.

Planning Ahead

The following includes an article for the students to read, materials needed for this lesson, and resources to prepare the teacher for the lesson. These components are plainly laid out and are all encompassing for this lesson with the intent that any teacher may simply follow this lesson and implement it successfully in his or her classroom.

Websites used.

"How to Identify Plants in the Field" American Museum of Natural History

PDF: http://www.amnh.org/education/resources/card_frame.php?rid=19&rurlid=57

Website: http://www.amnh.org/education/resources/card_frame.php?rid=19&rurlid=46

Materials.

- Identification and Classification of Grassland Plants-Student Sheet (See Appendix A)
- Identification and Classification of Grassland Plants-Teacher Sheet (See Appendix C)
- Student Field Journals (See Appendix B)
- Mock Field Journals (This is an example of a Student Field Journal for the teacher) (See Appendix E)
- Video "Identification and Classification of Grassland Plants" by Johnson and Mobley (2010) (See Appendix F for the script of this video)
- Field Guide:

  Peterson, R. (1986). *Peterson first guides®: Wildflowers.* Italy: Houghton Mifflin.
- Access to grasslands

- Magnifying Glass or Hand lens
- Metric Ruler (small, could photocopy onto transparency/overhead projector sheets, 15cm; For downloadable rulers visit: http://www.aspb.org/education/transparencyrulers.pdf)
- Paper and Pencils for drawing plants in the field
- Student permission slips from parents/guardians may be necessary for this project depending on your school policies.

Reading materials for you include The Barometer of Life http://www.sciencemag.org/cgi/gca?SEARCHID=1&FULLTEXT=barometer+life&FIRSTINDEX=0&hits=10&RESULTFORMAT=&gca=328%2F5975%2F177&sendit.x=73&sendit.y=10#328/5975/177 from *Science*, 2010. This article provides context and a rationale for why taxonomy is important in the current setting of science. You can also refer to the Background Resources (See Appendix D) for materials that provide more information on plant identification, classification, and prairies.

Engagement

This section aligns with "engagement" of the 5E learning cycle. To engage students, the teacher should provide focus questions or problems to connect students to the lesson. This brings forth misconceptions the students may have, activates background knowledge, and promotes curiosity.

Biology, as a science, has a descriptive component (Wilson, 2003). This lesson scaffolds upon what students know about the living world around them and focuses on identification and classification in a grassland setting. More specifically, the grassland ecosystem utilized here is a sand prairie. However, the lesson may be modified to accommodate any grassland ecosystem or plant identification and classification in general.

The teacher should begin lesson by engaging students in a brainstorming session about plants and plant identification. The teacher should query students regarding what they know about plants, plant identification, plant classification, and prairies. The teacher may record student responses on the board and should consider these prompts to keep the discussion lively:

- What do you know about plants?
- What are the main structures of plants?
- What features do plants have that we can typically see?
- What features to plants have that we typically cannot see?
- Why is plant structure similar and different among species? (Tall vs. short, flowering vs. cone-baring, found in water vs. found in the desert)?
- How do we organize plants and other living things in our environment?
- How do we tell the difference between two similar plants?
- What is a prairie? What do you know about prairies?

Exploration

This section aligns with the "exploration" component of the 5E learning cycle. The students are provided with activities to generate new ideas and expand upon their knowledge base. For the purposes of this lesson, students will explore a grassland ecosystem.

The teacher and his or her students should visit a grassland area, in this case a sand prairie. Students, in groups, engage in the identification of flowering plants and then determine which family the identified plant belongs in. The teacher must refer to a field guide for floristic timings of plant blooms. This will help the teacher narrow down which plants may be in bloom at the time of your visit. The teacher is strongly encouraged to visit the grassland before hand to check for flowering plants.

Prairies, a type of grassland plant community, consist of treeless grass covered landscapes. In addition to grasses, non-grassy herbs commonly called forbs as well as woody shrubs may be found. More than any other plant community in Wisconsin, the prairie has declined dramatically due to agriculture (Curtis, 306). Common Sand Prairie Species include Bergamot, Gray Headed Coneflower, Blackeyed Susan, Indian Grass, Prairie Rose, New Jersey Tea, Canadian Wild Rye, Big Bluestem, Poppy Mallow, Purple Prairie Clover, Missouri Goldenrod, Daisy Fleabane, Lead Plant and Spiderwort. The teacher should not despair if he or she is not confident with identifying and classifying prairie plant species. A simple field guide engages even a novice naturalist in identifying plants in the field.

At the grassland area, the teacher should show students how to use the tools they will need to identify plants. The tools include a field guide, a field notebook, a ruler for scale, hand lenses, magnifying glasses, and a camera. Many times, field guides are organized by the color of the flower of the plant. The teacher should show students how to identify plants in the field. In the classroom, the teacher may consider using an image or picture from a website on an overhead projector or Smartboard as an example to guide them through the identification process. Students should make their own field journals. Field journals can be easily made and created from reusing common classroom materials. See the teacher sheet (Appendix C) for more information on creating field journals.

Students may tape transparent metric rulers into their field journal for easy access to scaling plant parts. If using hand lenses, students should place the lens in front of their eye and then move their head closer to or further from the plant to bring it into focus. The teacher should instruct students that their magnifying glasses should be used for the sole purpose of examining plants and that they should refrain from trying to start fires. Also, the teacher should tell students what will be expected of them in the field regarding behavior, participation, and completion of their field journals. For example, visitors to the prairie should never dig or collect plants, or damage the area (Ladd, Oberle, 1995). **Note:** As a precautionary measure and to minimize risk, you should make yourself aware of any students who may have allergies to bee stings. Bees are found in the prairies and pollinate flowers; the risk for a student to be stung is something to consider.

At the prairie, the teacher will give students a tour but shouldn't identify any specific plants. After touring the prairie, the teacher assigns students with the task of identifying all plants that are in flower. To do this, students should work in groups. Each group should be provided with a copy of a field guide; we suggest using *Peterson first guides®: Wildflowers*.. Each group should also be provided with a digital camera for at least a portion of their time in the field; the students should snap a picture of the plants they identify. If a digital camera cannot be used, have students draw the plants they see and identify in the field. For each plant identified, the students should write the common name and family name in their field journal. Students should document the visible features of the flowering plants.

Explanation

In this section of the lesson, teachers provide students with an activity to explain and develop further information related to the field work at the grassland. This section aligns with the "explanation" section of the 5E learning cycle.

To compliment the field work about plants and identifying plants, students should read the article "How to Identify Plants in the Field" from the American Museum of Natural History's website (Appendix A). The teacher may decide to have students read the article before visiting the grassland area or after the field work has been completed. Students may access this electronically via a computer with internet access or be provided with hard copies of the handouts. The teacher may have students read the article on their own or have students take turns reading aloud to the class. After reading, students should be instructed to answer the questions on the student sheet (See Appendix A).

Elaboration

In this section of the lesson, teachers provide resources for students to elaborate upon all the knowledge and skills they've developed related to the field work. This section aligns with the "elaboration" component of the 5E learning cycle.

The teacher may show students the video on grassland plant identification and classification. This video, created by Johnson and Mobley (2010) at the University of Wisconsin-La Crosse, features identification and classification among species in the UMESC sand prairie. In the video, students will see what a prairie looks like, how to identify plants, and what classification consists of. Students will learn how professional scientists and college students interested in science identify plants in the field. Students should use their student sheet again (See Appendix A) to answer the questions about the video. The teacher may choose to show the entire video or specific clips based on your own preference and schedule.

After students have time to answer the questions, the whole class should discuss the article and video, the answers to the questions, and any questions they may have. Answers to the discussion, article, and video questions may be found on the teacher sheet (See Appendix C). Students should understand from the article and video that biologists identify and classify plants using different tools and that students can learn about plants by using the same methods that biologists use.

CHAPTER IV

CONCLUSION

The identification and classification of plants are meaningful educational activities, aligned with grade level benchmarks that can be incorporated into middle school science curricula.

Assessment

A lesson should be engaging to students and encourage students to inquire about the nature of science. In addition to engaging students in lessons, educators must be able to evaluate and respond to student's strengths and areas of improvement via assessment. Research can be collected through these assessments. Statistically analyzing these assessments reveals student's growth and understanding of identification and classification.

Formative assessments are a quick way to see if students understand and are able to manipulate the information presented in class. In addition, formative assessments permit the teacher to adjust instruction accordingly based on student performance (Jorgenson, Cleveland, & Vanosdall; 2004). Formative assessments should be ongoing and may take the form of a quick quiz, a worksheet, a question-of-the-day, observations, student self-assessments, or other methods. For a formative assessment of student understanding for this lesson, consider scoring the student sheet (See Appendix A). The answers to the student sheet may be found on the teacher sheet (See Appendix C).

Summative assessments are ways to test for students' understanding of substantial amounts of information and to determine the extent to which students have achieved a learning target (Keeley, 2008). Summative assessments differ from formative assessments and tend to be more formal in nature, given at the endpoint of instruction (i.e. a unit plan), and usually involve grading. Examples of summative assessments include unit exams, term papers, or in-depth projects. For a summative assessment of student understanding for this lesson, have students write like a field biologist and complete their field journals (See Appendix B and Appendix E). Each student or group, depending on time availability, should also report to the class on one of their identified plants. Students can create a mural of prairie plants they researched and share this information with the class too (Yager, 2006, p.61).

Extensions

Students may be motivated to learn more about prairies and grasslands. The Science Netlinks tool http://www.sciencenetlinks.com/tools.php?DocID=128&Grade=3-5 and Science Books and Films Award Winner (2006) http://www.sbfonline.com/Subaru/Pages/PrairieBuilders.aspx entitled "The Prairie Builders: Reconstructing America's Lost Grasslands" tells a story of a prairie destroyed by and rebuilt by people in Iowa. A remarkably poignant review of this book by a middle school student may be found here: http://www.sbfonline.com/Subaru/Pages/PrairieBuildersYAreview.aspx.

After students are able to identify and classify grassland plants, lessons can be implemented to undertake prairie monitoring and investigate changes in the composition of vegetation in the plant community (Monson-Meyer, 2004). Aligned with Project 2061 benchmarks entitled "Interdependence of Life", middle school students may be engaged in authentic research via prairie monitoring while learning about interspecific and intraspecific competition, abiotic factors, and the human impact on particular grassland plant species.

For interested students, the teacher may consider introducing a more advanced field guide. In this lesson plan, you have introduced your students to *Peterson First Guides®: Wildflowers*. A more advanced field guide that would build on what your students have already learned is *Peterson Field Guides®: Wildflowers of Northeastern/North-Central North America*.

Implementation in Student Teaching

Beginning in October, 2010 the thesis candidate will implement this lesson plan into an elective botany class at Onalaska High School. The lesson will be slightly adjusted to accommodate the developmental needs of juniors and seniors. By creating this framework, the thesis candidate is prepared to implement and facilitate an identification and classification project for students while reflecting on how to improve the design.

Implementation in Future Career

Beginning in her future career as a secondary biology teacher, the thesis candidate will seek approval from administration to implement this lesson plan into her classes. This lesson plan may easily be altered to align with forthcoming national standards, state standards, and district-wide curriculum. The undertaking of this project demanded the creation of partnerships between USGS: UMESC, The Prairie Enthusiasts, Mississippi Valley Conservancy, the Communication Studies Department at UW-La Crosse while working within AAAS's framework for developing curriculum. The time and effort put into this project ultimately proves that the thesis candidate is prepared to develop and teach lessons aligned with standards while working well with stakeholders.

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APPENDIX A

IDENTIFICATION AND CLASSIFICATION OF GRASSLAND PLANTS-STUDENT SHEET

Identification and Classification of Grassland Plants-Student Sheet

To learn more about identifying plants, read: "How to Identify Plants in the Field." Answer these questions after reading the article. Be ready to share your answers with your classmates.

- What does a botanist study?
- Why is identification of organisms important in biology?
- How does using a field guide help to identify plants?
- What tools should you use when identifying plants in the field?

Check with your teacher before continuing.

Now watch the Identification and Classification of Grassland Plants video. This video will introduce you to sand prairies, which are a type of grassland ecosystem. The video specifically focuses on those in and around La Crosse, Wisconsin. Answer these questions about the video. Be prepared to discuss the answers with your classmates.

- Why are prairies rare? How does the effect the plants, animals, and other organisms at the prairie?
- Name the main structures of plants to look at for identifying.
- What tools should you use when identifying plants in the field? Why?
- Why is it important to photograph a plant rather than pick a plant?
- What are classification systems used for?
- How is the scientific name of an organism different from the common name?
- Which is the scientific name? Which is the common name?
    - *Tradescantia ohiensis*
    - Spiderwort
    - Lead Plant
    - Purple Prairie Clover
    - *Amorpha canescens*
    - *Petalostemum purpereum*

APPENDIX B

FIELD JOURNAL-STUDENT SHEET

Field Journal-Student Sheet

Complete one sheet for each plant you identify.

Date:

Location:

Common Name:

Family Name:

Plant Description:

Leaves

Stem

Flower Color

Smell

Height

Other features

After recording information about the plant, sketch the plant. Include leaves, flowers, and stems.

APPENDIX C

IDENTIFICATION AND CLASSIFICATION OF GRASSLAND PLANTS-TEACHER SHEET

Identification and Classification of Grassland Plants-Teacher Sheet

Answers to classroom discussion questions

- What do you know about plants?

Students may talk about houseplants, vegetable gardens, flower gardens or any other place they may see plants. They may talk about plants being photosynthetic and making their own food by using sunlight. Answers will vary.

- What are the main structures of plants?

The main structures of plants are the organs: the roots, stems, and leaves. Students may consider flowers to be organs, however, a flower is a modified stem produced for reproduction.

- What features do plants have that we can typically see?

Typically, we can see that plant's stems, leaves, flowers, fruit, and seeds depending on the time of the year (although, some seeds may be too small to see without any aid). Some roots may grow above ground also.

- What features to plants have that we typically cannot see?

Typically, we cannot see the plant's roots which are buried below the ground, any rhizomes which are also below the ground and the plant's individual cells.

- Why is plant structure similar and different among species? (Tall vs. short, flowering vs. cone-baring, found in water vs. found in the desert)?

Different plants use different survival strategies to stay alive and reproduce. Some plants that are close relatives may look similar. For instance, different types of maple trees (red maple, silver maple, sugar maple) look more similar than a maple tree and a rose bush. Both are plants and both have evolved to use different survival mechanisms.

- How do we organize plants and other living things in our environment?

Students may say that scientists name living things and that we group animals with animals and plants with plants. However, ask them how do we then organize all plants? They may say by appearance. In fact, scientists classify plants by looking at fruits and seeds, general structure, genetic material, etc.

- How do we tell the difference between two similar plants?

Observation

- What is a prairie? What do you know about prairies?

Depending on where your school is, students may not know what a prairie is. A prairie, for the most part, is a treeless plant community consisting of grass, woody plants, some shrubs, and very few trees. Students may talk about the great plains, bison, prairie dogs, or Native Americans. Answers will vary.

Answers to "How to Identify Plants in the Field" questions.

- What does a botanist study?

A botanist is a scientist who studies plants

- Why is identification of organisms important in biology?

Identifying organisms is important in biology because it is the way to know the names of things and to communicate with others about what you observe in the field.

- How does using a field guide help to identify plants?

Using a field guides gives you a frame of reference for comparing the known species listed in the book with the unknown specimen you're trying to identify.

- What tools should you use when identifying plants in the field?

Please see the materials list and the AMNH reading.

Answers to video questions

- Why are prairies rare? How has the decline of prairies affected the plants, animals, and other organisms at the prairie?

Prairies are rare because over time they've been plowed for agricultural purposes, used for pastures, or developed into cities or suburbs. Plants and animals that were native to the prairie declined due to loss of habitat.

- Name the main structures of plants to look at for identifying.

Look for leaves, stems and flowers and fruits, if present, when identifying a plant.

- What tool should you use when identifying plants in the field? Why?

You should use plant identification books since you do not know all of the plants found at a prairie. This way, you can reference the book rather than memorizing all the plants!

- Why is it important to photograph a plant rather than pick a plant?

The plant might be endangered and at risk for extinction.

- What are classification systems used for?

Classification systems are created and used by scientists so they can clearly communicate with one another about the relatedness of organisms.

- How is the scientific name of an organism different from the common name?

The scientific name is written as two words that are italicized. The first word is written so that the first letter is capitalized and the second word is written in all lower case. Scientists use the Latin name for the scientific name. The common name may vary depending on what part of the world you're in. Different people call the same plant different common names but the scientific name is always the same.

- Which is the scientific name? Which is the common name?
    - *Tradescantia ohiensis*-Scientific
    - Spiderwort-Common
    - Lead Plant-Common
    - Purple Prairie Clover-Common
    - *Amorpha canescens*-Scientific
    - *Petalostemum purpereum*-Scientific

Field Journals

A field notebook can be made by stapling paper together and clipping it to a clipboard for ease of writing in the field. However, we recommend using cardboard, printed copies of the field journal sheets, duct tape and string. Cut two pieces of cardboard for each field journal (approximate dimensions: 10" by 12"), these will be the front and back covers. Sandwich the field journal sheets between the cardboard covers and three hole punch and bind with string or staple all pieces together. Connect the front and back covers using a strip of duct tape. Punch a single hole in the middle right hand side of the front and back cover; attach string. Use string to tie the covers closed when not in use.

Have students write their names and any other important information on the front cover. Students may decorate the covers, if time permits.

APPENDIX D

BACKGROUND RESOURCES

Background Resources

Websites:

The Prairie Enthusiasts: www.theprairieenthusiasts.org

Great Plains Nature Center: www.gpnc.org

Plains Conservation Center: www.plainscenter.org

Konza Prairie LTER Site: www.konza.ksu.edu

Tallgrass Prairie National Preserve: www.nps.gov/tapr

USDA Plants National Database: www.plants.usda.gov

Missouri Prairie Foundation: www.moprairie.org

Mississippi Valley Conservancy: www.mississippivalleyconservancy.org

USGS-UMESC: www.umesc.usgs.gov/umesc_education.html

Books:

Peterson, R. (1986). *Peterson's first guide to wildflowers of North America*. Italy: Houghton Mifflin.

Collard, S. (2005). *The Prairie Builders: Reconstructing America's Lost Grasslands.* Houghton Mifflin.

APPENDIX E

MOCK FIELD JOURNAL

Mock Field Journal

Complete one sheet for each plant you identify.

Date: July 2, 2010

Location: USGS Sand Prairie

Common Name: Lead Plant

Family Name: Fabaceae

Plant Description:

Leaves: ¾” long and ½” wide, many present, attached to stem alternately

Stem: Light gray-green color

Flower Color: Purple

Smell: None detected

Height: About 3’ Tall

Other features: Flowers are small and grouped in a spike at the top of the plant

After recording information about the plant, sketch the plant. Include leaves, flowers, and stems.

APPENDIX F

VIDEO SCRIPT

Video Script

Hi, my name is Nicole and I am a student at the University of Wisconsin-La Crosse. My major areas of study are biology and education. Basically, I am interested in teaching middle school or high school science as a career.

Sean Mobley is also a student at UW-La Crosse. Together, we are making a film about identifying and classifying prairie plants where we live. But first, let's find out a bit about where we live and why prairie plants are important.

La Crosse, WI is located in south-western Wisconsin. La Crosse is in an area of Wisconsin called the "Driftless Region". Because the glaciers didn't pass over this area during the last ice age, the land consists of great bluffs and valleys locally called coulees. La Crosse sits on a bed of sand and generally has sandy soils. This sand, deposited by the mighty Mississippi River over many, many years, is the result of melting glaciers. Today, La Crosse supports a variety of ecosystems including forests, wetlands, and grasslands. The specific ecosystem we're going to focus on is the Prairie.

Prairies are a type of grassland ecosystem that once covered the United States from Texas to Canada and from the Appalachian Mountains in the east to the Rocky Mountains in the west. Because they looked like waves in the sea, prairies were often called seas of grass. In the 1800s, pioneers could easily lose their way among the tall prairie grasses that could reach heights of more than six feet tall. Could you imagine travelling in a wagon or on horseback through a tunnel of grass!!??

Today, less than 0.01% of the vast expanses of original native prairies remain today. The remnants are isolated by plowed farmlands for crops, pastures for livestock like cattle, or towns and cities that have developed over the years.

Prairie ecosystems are rare. That means that some native plants and animals that call the prairie home are also rare! In fact, large animals such as buffalos, burrowing animals such as prairie dogs, ground-nesting animals such as prairie chickens, and pollinating animals such as butterflies and other insects have declined in numbers.

Many people are working to save the prairies and native species that grow in them so that they do not disappear. Local agencies, like The Prairie Enthusiasts and Mississippi Valley Conservancy, purchase lands to preserve prairies and their inhabitants. Some people even donate their lands so that they are preserved.

Here in La Crosse, prairie plants are found in many places. Some of the places are wild. Some have been saved by people. The United States Geological Survey on French Island, which is close to La Crosse, has a sand prairie that is available for educational purposes. This seven acre prairie is restored meaning that it was planted on this site. In addition, the New Holland Sand Prairie near New Amsterdam is a great asset to the area. Government agencies and local groups, like The Prairie Enthusiasts, manage these protected prairies so they remain intact.

Educating people about the importance of prairies is critical. Efforts to save prairies include inventory and protection of species. Field biologists, volunteers, and others discover, describe, protect and identify prairie species. As students, you can learn about prairies by better understanding the kinds of animals, plants, and other organisms that live in prairies. To do this, you must first know how to identify these organisms. Just like field biologists, you can identify a specific plant by looking at its external and internal parts.

Identifying plants requires close attention to detail and knowledge of the structures of plants. The best time to identify plants during the school year is in the fall before leaves are shed or in the spring after the plants start leafing out and flowering. Identification is easiest when leaves, stems, flowers and possibly fruits are present.

First, let's review the three main organs of a plant. There are the roots, the stems, the leaves. Pay close attention to these organs when attempting to identify a plant.

Begin identifying by looking at the leaves. Leaves are categorized as being simple or compound. Simple leaves, like that of an oak, have blades that are one continuous piece. Compound leaves have multiple leaflets. An example of a compound leaf type may be found on the Lead Plant. Depending on the species, the compound and simple leaves may be toothed or smoothed, lobed or entire, and smooth or fuzzy.

The next step is to figure out how the leaves are attached to the plant stem. This is called Leaf Attachment. Leaf Attachment may be opposite, alternate, or whorled. Opposite leaf attachment consists of leaves attached to the stem opposite of each other. Alternate leaf attachment consists of leaves alternately placed on each side of the stem. Whorled leaves are around the stem. In addition, leaves may be present along the length of the stem or just present at the base of a plant.

If you're lucky enough to be in the field while the plant is flowering, the flower may be used to identify the plant too. Look at the color and shape of the flower. Is the flower singular or clustered with many other flowers?

Flowers are structures that plants use to sexually reproduce. From flowers come fruit! Fruit may be used to identify plants, if present. Fruits come in a variety of different shapes and sizes. Some fruit may look like a strawberry whereas some may look like a peapod.

Now that you know what to look for, let's discuss plant identification books. You're not expected to know or memorize every plant in the prairie! There are many great resources you can use to ID plants. You could work with someone who knows the plants like a local expert. You could also use an identification book like a field guide. Look for a book with plants that grow in your state. Peterson's First Guide to Wildflowers of North America by Roger Tory Peterson is a great book to use when first starting to identify plants. The book is arranged by the color of the flowers, like white, orange, yellow, or purple.

Plants can be identified by using a common name. Common names are names like "Lead Plant". That's the plant that is seen here. Plants are also grouped into families. Family names are used by scientists and are given to plants that have many similarities. Lead Plant is in the Pea family, called Fabaceae. Also in the Pea family is Purple Prairie Clove. Both of these plants are found in prairies in Wisconsin.

When you are identifying plants, remember that some plants found in prairies are endangered. You must not pick endangered plants when in the field. In fact, in Wisconsin it is against the law to pick or remove any natural thing from a state park or natural area. Be wise and use your eyes. Don't pick or remove anything when you're in the field without permission. Better yet, take a picture like we have done and share your plant pictures with your classmates.

Now that you know what to look for to identify plants, let's apply it to how biologists group living things. Classification is the way scientists group organisms based on how closely they are related to one another. With plants, scientists look at the parts of a plant just as we did for identifying them. However, for classification, they focus on the similarities and differences among different plant species. They usually observe the flowers and fruits the most. Classifying living things, plants included, requires a system which scientists from all over the world can use. Because languages vary, scientists need a way to clearly communicate with one another. They use the same classification system and the same naming system around the globe.

Spiderwort is a plant classified in the Commelinaceae family. The scientific name contains two words: the first word is always capitalized just like when you write your own first name, the second word is always written in lowercase. Here is an example of a scientific name: *Tradescantia ohiensis*

All plants are in the kingdom Plantae.   As you classify a plant from kingdom to species, fewer and fewer remain at each level. For example, all Spiderworts are plants, but not all plants are Spiderworts.

As you classify from Kingdom down to Species, you get fewer and fewer species included in each group. For example, we mentioned that Spiderwort belongs in the Family Commenlinaceae. However, over 90 other species that are similar also belong in this family. At the species level though, Spiderwort is unique compared to any other living thing on earth. It is a challenge to classify plants all the way to species level, even for scientists, but by practicing you will become more familiar with the methods and language that scientists use.

Now you know a little bit about prairies and their significant decline over the last 100 years. You know that many living organisms live at the prairie. Challenge yourself to identify and classify plants at the prairie. You'll find the open sky and waves of plants to be even more important now that you know about prairies' throughout the country.

Extensions:

To learn more about prairies and the people who are passionate about their restoration check out "The Prairie Builders".

You can also visit The Encyclopedia of Life at www.eol.org to learn more about classification and the great diversity of organisms on Earth.

For more resources on plant identification, visit the Biodiversity Counts website produced by the American Museum of Natural History.