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Tina Marie Kopinski

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EVALUATING THE KNOWLEDGE OF AT RISK HIGH SCHOOL STUDENTS IN ECOLOGY THROUGH ALTERNATIVE ASSESSMENT

By

Tina Marie Kopinski

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ABSTRACT

EVALUATING THE KNOWLEDGE OF AT RISK HIGH SCHOOL STUDENTS IN ECOLOGY THROUGH ALTERNATIVE ASSESSMENT

By

Tina Marie Kopinski

This purpose of this study was to determine if the use of alternative methods of evaluating At Risk students is favorable to traditional practices of tests and quizzes. Resources were consulted on the needs of Special Education children and Diverse Learners, and lessons plans reflected these findings. The scientific topics taught in the study unit were those in Ecology: characteristics of life, taxonomy, symbiotic relationships, nutrient cycles, food webs, succession, alien species, populations, and biomes. A Final Assessment Portfolio project was used in place of a comprehensive test. To determine the efficacy of this study, the following assessment tools were used: Pre-Unit Survey, Post-Unit Survey, Pretest, and Posttests in the form of Weekly Quizzes.

To my family, who has always believed I can do anything I want, and has put up with a lot from me while figuring out exactly what that is.

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Introduction

Statement of Purpose and Demographics

This study was conducted at Dexter High School (DHS) in Dexter, Michigan. The official count of students at the end of the 2006-2007 school year was 1141, making it Class A or Division II in most sports where appropriate (Pearson School Systems, 2006). In the fall of 2006, I was challenged with two sections of a class called "Practical Biology." The original intent of this class was to give those students who struggle with science and have little or no intention of continuing in it a place to succeed and meet the requirements set forth by the high school and the State of Michigan. Most of the students were intent on pursuing trade skills through the school's Consortium program in their junior and senior years, to prepare them for the work force right out of high school. There was also a handful of students who were college bound, but science was not their forte and they would have met with defeat in the "regular" biology class. Since the inception of Practical Biology, the dynamics of the school, the community, and the class, has changed. Dexter was mostly a farming community within as little as ten to fifteen years ago, but it is has since been flooded with an explosion of subdivisions. This has occurred as more and more people who work in nearby Ann Arbor seek to live outside the city but keep its conveniences close by. The proximity of Ann Arbor has contributed to the wide range of students (and their parents) seen at Dexter High School. Ann Arbor is home to the University of Michigan and the hospital by that name, as well as St. Joseph Mercy Hospital and until recently a large Pfizer facility. Many of the students' parents work at these places, and this plays a part in what previous knowledge they bring to class. Of course, there are still several families in the area that have been in Dexter for generations as part of the farming community, and those children bring a different set of experiences to the classroom with them. Currently, over 90% of the graduates of DHS go on to two or four year colleges and universities. There has been a big push in the community to offer more Advanced Placement (AP) classes so that students can earn some college credit before they arrive on campus. The State of Michigan has recently introduced a whole new set of standards and requirements that students will be expected to complete for graduation (Michigan Department of Education, 2001- 2007). There is a lot of pressure on students from many angles to have four years' credit in all core subjects, and also fit physical education, foreign language, and fine or performing arts into their schedules. This push towards the upper end of academics has left a lot of students in the dust, and yet we are to "leave no child behind" per our president. Consequently, many students opt to (or their parents tell them to) take the college preparatory track of classes when they probably aren't ready. Students no longer want to take Practical Biology instead of Biology; it's seen as the slow class, the dumb class, the easy class, etc. As a result, there are usually only two sections of it that run all year. They are small classes, and they are very heavily packed with students with special needs or those with behavioral problems that see it as an easy way to get through their required biology. There are still some students who are in Practical Biology for its original purpose, but it is hard for them to not get swept up in some of the drama that the other students create. Because of this, class sizes are huge and teachers are forced to teach to the middle level academic abilities of their classes in an attempt to bring along as many students as they can (Tapp, 2005).

Biology is generally taken the second year of high school at Dexter, so all but 2 of the students in these two sections were sophomores (the remaining 2 were juniors). Not all students participated in the study so that I was not able to collect and use their work for data analysis, but they were subject to the same instruction as the others. For this reason, and because their presence in the classes contributed to the environment in which this information was taught, they are included in the following demographic set up. This study was conducted with two sections of Practical Biology that were extremely different in their makeup. The first class consisted of 21 students, 20 of whom were male. As has become the norm, a large portion of the students in this section were classified as Special Education and therefore had Individual Education Plans (IEPs). Many of their IEPs required that they have access to extra assistance on homework or in understanding questions on tests when needed. Therefore, during class there was one female paraprofessional and one female special education teacher present in addition to myself. The second class consisted of 11 females and 9 males, for a total of 20, and one female paraprofessional was on hand as well for the same reason. The large discrepancy of males to females in the first class proved to provide a challenge to the three female adults and myself. That first class was extremely lopsided, even for the male dominated sophomore class (Figure 2) (Pearson School Systems, 2006).

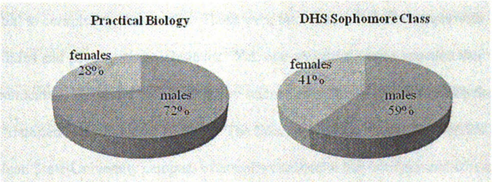


Figure 1. Male to female ratio in Practical Biology versus the sophomore class at DHS.

The total number of students in both classes was 41, with 24 IEPs, 3 Individual Student Plans (504) for behavioral modification, and 14 students with no special needs classification. Of those with Special Education classification, almost half were Learning Disabled (LD), and several were classified as Otherwise Health Impaired (OHI) for Attention Deficit Disorder (ADD) or Attention Deficit Hyperactive Disorder (ADHD). Table 1 shows the complete breakdown of the students with IEPs in Practical Biology.

With such a diverse group of people in one room, the year was going to be full of challenges, not the least of which was keeping track of all the students' individual accommodations! With that in mind, I set out to develop a unit that would not only

Table 1. Classification of Special Education students in Practical Biology.

	emotionally impaired	learning disabled	hearing impaired	otherwise health impaired	speech and language impaired	cognitive impairment	autism	physically impaired
IEP	2	10	1	6	4	1	1	1

encompass the appropriate science standards, but would incorporate everyday skills that everyone in the class could use. Some of the goals for the students were organization and individual accountability, and also a sense of enthusiasm for the scientific topics. They needed to take responsibility both inside and outside of the classroom for performing tasks and completing assignments. A good work ethic and pride in their work was essential to completing these tasks. These were two classes full of students with learning disabilities and poor writing techniques. Yet, one objective was to improve their communication skills and help them enjoy science even though many felt like they had been "dumped" into Practical Biology. The time spent researching (Summer 2006, Michigan State University campus) eventually resulted in the development of a unit that encompassed the entire first marking period (nine weeks). Its scientific focus was ecology, but the main goal was to engage this diverse group of learners and integrate as many of the students' necessary modifications into the structure of the class as I could. One common IEP requirement was to have a homework planner signed by the teacher once a week (or even daily) in order to help keep the student on track. Many of the Special Needs students were allowed extended testing times and/or were allowed to use their notes on quizzes and tests. Still others had language disabilities that entitled them to a copy of the paraprofessional's notes, provided they had made an effort in class to obtain them on their own. The study unit was aimed at incorporating as many of these modifications into the structure of the class as possible. That way, I would be covering most of the accommodations of all the special needs students and providing *all* the students with some basic organizational and coping skills for an otherwise difficult class. For ideas on how to focus this diverse group of learners, I turned to the available literature.

Literature Review

According to Piaget, the students in Practical Biology classes should be at the point in their development where they can handle abstract thinking. However, even though he gives a characteristic age range for this step in their cognitive development, true abilities vary for every individual (Genetic Epistemology (J. Piaget), 2005). Throw in the disabilities of many of the students, and you have a class with an incredibly wide range of learning styles and capabilities. It has been noted that "teachers tend to teach the way that they were taught" (Edwards, et. al, 2006). In this particular setting, that would not work well as I learned by reading the chapter, taking copious notes, making flashcards, and drawing flowcharts of scientific processes. Many of the students in Practical Biology have learning disabilities in the areas of writing and reading comprehension, while others are classified as speech or language impaired. Instructing these students in the traditional manner would not be appropriate. So, I looked for suggestions on how to best serve such a diverse group of learners. In general, most of my sources pointed to eliminating traditional methods of instruction in favor of alternative assessment, group work, and eliminating an arduous textbook. In short, my new direction became constructivism. Constructivism is basically a theory about how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. We are active creators of our own knowledge, and to do this we must ask questions, explore, and assess what we know. In the classroom, the constructivist view of learning can point towards a number of different teaching practices. It usually means encouraging students to use active techniques (experiments, real-world problem solving) to create more knowledge and then to reflect on and talk about what they are doing. The teacher makes sure she understands the students' preexisting conceptions, and guides the activity to address them and then build on them (Educational Broadcasting Corporation, 2004).

One of the central ideas in constructivism is to do away with the textbook and teacher as the primary sources of information. Instead of being fed isolated facts or concepts, the students are given an overall picture and framework in which to work, and then to guided into discovering the bulk of the information themselves. As a group, the students of Practical Biology are not readers, so this move away from the text was welcome. Practical Biology and Biology at Dexter High School use different textbooks because of the different level of students, but really neither one is stellar (Modern Biology, 1986). I recently found that many of the textbooks schools use cover far too many topics and none of them in depth. The reason for this is that they are mass marketed for schools in many different states that all have different sets of standards. The result is a textbook that has more than one school needs and it becomes daunting in the eyes of the student. There is also a problem with delivery of material. There are so many different ways of teaching any one topic that textbooks have for the most part stayed with the traditional presentation of information; this makes them too large, too encyclopedic, and loosely structured pedagogically. In 2001, the American Institute of Biological Sciences (AIBS) reviewed 10 sets of biology textbooks and accompanying instructional materials used in secondary schools. It reported that the "content of all of the instructional materials is accurate and up to date, but the way the materials are present for teaching leaves for vast improvement" (National Science Teachers Association, 2006). It seems that many teachers and professors are jumping on the band wagon of using the textbook as a resource only. In 2004, Honors Biology 163 at the University of Michigan was taught without it, by Dan Kilonsky. His approach to teaching biology is called active learning, and instead of using a text he provides the students with lecture notes ahead of time, daily quizzes, and a lot of interaction time. "You can't just transfer knowledge from one person to another," Kilonsky says. "Knowledge is constructed, and learned, by each individual in their own way" (Bates, 2004). With that in mind, I set out to change the curriculum to one where we could develop an organized notebook of information and use it as a tool for learning, leaving the textbook as a resource for vocabulary and reinforcement of topics.

A move towards constructivism means a move towards imbedded or alternative assessments. This simply means using methods other than traditional testing to determine if students have mastered the appropriate concepts. Everything from projects, poems, and papers, to homework and in-class assignments can be used as an assessment (Barton & Osborne, 2001). I ultimately decided not to abandon traditional testing altogether; however, I did scale things down to weekly quizzes over smaller topics. Other assessments included numerous in-class activities, posters and projects, homework assignments, and a portfolio as the final assessment in place of a comprehensive unit test. I chose a portfolio as the final assessment for several reasons. When designed correctly, portfolios can determine whether or not the student knows a scientific concept. It can also determine whether or not the student can apply this new scientific concept by creating or doing something that illustrates the concept (Valdez, 2001). It allows students to reflect on the work they've already done by letting them choose the pieces they want to include. It forces students to assess their own strengths and weaknesses on different topics throughout the unit, and it allows the instructor to see these in the presentation of the portfolio so that she may alter instruction to be more helpful in the future. In reflecting on the unit's work, students are also able to see their own progress as individuals instead of being compared to others in the class (Barton & Osborne, 2001). The portfolio also gives students a chance to show what they've learned from beginning to end in the unit; it provides a timeline of learning to the person reading the portfolio. For the students in Practical Biology, it also gave them some much needed practice in writing skills.

Along with alternative assessment comes alternative instruction. Students with learning disabilities, attention span issues, or behavioral problems aren't likely to succeed if you force them to sit through a lengthy lecture. Instead, it is advised to break subjects into smaller topics than can be mastered in shorter amounts of time by doing a hands-on group activity. This way, students learn to solve problems independently and help each other with the material (ERIC Clearinghouse on Urban Education, 1988). This is truly the base of the constructivist model, and it fit perfectly into my classroom. Ultimately, I found that the more varied instruction can be the better for all those involved. Surprisingly, this included me; of course it's easier to lecture and be done with a topic, but it's a lot more interesting and to watch the students figure out some of the information on their own. So, instead of a traditional lecture, one source suggested giving the students modified lecture notes with blanks at key points in the information. This would allow the students to pay attention to and participate in the lecture instead of trying to write down all the important information and missing out on the discussion. Other tools I found were to review using games or puzzles, use a slide show or PowerPoint presentation to illustrate new concepts, and of course try to use as many real-life examples for things as possible (Miller, 2002).

The key to not losing the students in all these activities is organization. Learners with mild disabilities need consistency; therefore teachers should establish a daily routine in their classrooms (Aefsky, 2000). Anything that happens on a daily basis should basically be done in the same way every time. This can be something as simple as writing the weekly schedule on the board or having a standard place for papers to be handed in. Though activities are meant to be student-directed to allow for questioning and understanding, a fair amount of structure must be included at the start of the unit in order to scaffold and model the process for the students. This group, especially, needed concrete instructions to get them started. My goal, however, was to move away from this rigidity as we progressed through the unit. In the meantime, I found suggestions for guiding the students along the right path. Even for my weekly quizzes I discovered some tricks for making them easier to conquer. Test-taking skills were briefly discussed at the beginning of the year and then again before the first quiz. I also found some guidelines on the formatting of my quizzes: make sure the directions are short and step-by-step, leave plenty of space for written answers (due to writing disabilities), have various types of questions on the quizzes, and provide a word bank where possible (Spinelli, 2002).

Concepts in Ecology

The concepts taught during this nine-week unit on ecology were determined in large by the standards outlined in the May draft of the High School Science Course Content Expectations (Michigan Department of Education, 2001-2007). These will be finalized and used to govern high school curriculum starting with the fall of 2007. I broke down the large unit of ecology into topics that could be assessed by weekly quizzes. The first topic was simply "what is ecology?" and what do we mean when we say we're studying the "environment?" Next we tackled the technical subject of taxonomy and discussed how and why things are classified. The systems of Aristotle and Carolus Linnaeus were compared to each other and to the modern system of using common ancestry (phylogeny) to classify organisms. Focus was put on the classification of humans and the six-kingdom system, as well as why Latin is used as the language of science. We also learned how to use a dichotomous key to identify species. You are given two basic structural characteristics to choose from to start, and then follow the instructions to a second set of choices, and so on. Eventually the characteristics given are so specific that picking your last choice gives you the name of the species.

Food webs and symbiotic relationships came next. Vocabulary covering the terms for plant-eaters, meat-eaters, and those who eat both plants and animals (herbivore, carnivore, and omnivore, respectively) were review. Symbiotic relationships were a new topic; this is where two organisms of different species live together. Examples of predation, parasitism, mutualism, and commensalism were studied. Predation is where one animal, the predator, hunts and kills another, the prey. Parasitism exists when one organism in the relationship is harmed (but not necessarily killed) and the other benefits, as in a tapeworm inside of a human. Mutualism is a relationship where both organisms involved benefit from each other like a honeybee pollinating a flower. Commensalism is present when one organism gains something and the other is not affected by this. A good example would be a squirrel using an abandoned woodpecker hole in a tree as its new home. Included here as well was the concept of biomass and how the energy transferred lessens with each step of the food chain, even though the overall amount of energy stays the same.

The next three topics looked more in depth at how biotic and abiotic factors interact with one another. The water, carbon, and nitrogen cycles were presented individually and then as an integrated concept to see how they all depend on each other. The main ideas presented on the nutrient cycles were how organisms assimilate each nutrient, use it, and recycle it back into the environment. Primary and secondary succession followed, and students were asked to differentiate between the two and give examples. Primary succession occurs when bare rock is exposed due to a natural phenomenon such as a volcanic eruption or a receding glacier. Decomposers such as fungi and bacteria then enter the area and break the rock down into soil, and a general progression ensues as to what organisms invade next. Secondary succession is very similar except that the disturbance leaves behind the soil, so the succession process does not take as long. Typical disasters that can cause secondary succession are forest fires, tornadoes, or floods. Students also discussed the pros and cons of man-made fires in forests in an attempt to control blazing wildfires from undergrowth accumulation.

The study of populations was a very vocabulary intensive subject. Terms like immigration, the movement of organisms into a population, and emigration, the movement of individuals out of a population, were used to describe the movement of things in and out of populations. Included in this discussion were natality (birth rate), mortality (death-rate), and density-dependent and independent factors. Also controlling the size of a population is an area's carrying capacity; this is the number of organisms an area can support based on the amount of available resources. Food, water, shelter, and space were taught as the resources all organisms must have to survive.

The very last topic was intended to bring everything together: a survey of the Earth's major biomes. The students got into small groups and each did a presentation on one of these biomes: tundra, desert, coniferous forest, deciduous forest, tropical rainforest, savanna, prairie, and the chaparral. The focus was put on characteristic plants and animals, as well as overall climate and geographic location.

Implementation

Week 1: Basic Organizational Tools and Practices

Practical Biology started in the fall of 2006 with a defined structure and a daily routine. There was a white board on the side of the room that was reserved solely for the weekly schedule. In the corner of this board was written a *Question of the Day*, along with the date, objectives, and any homework for that night. Students were to get a new *Weekly Assignment Sheet* each Monday and write down the daily question (Appendix C_2). Many students with IEPs have a stipulation that I am to sign their planner either every night or once a week; this weekly assignment sheet took the place of that and eliminated students having to come see me and be singled out by their peers. We spent the first 5-10 minutes of class answering the *Question of the Day*, taking attendance and collecting papers from the night before if need be. In the front of the room was a designated bin for all assignments to be handed in, marked with the appropriate class period.

Students were provided with a class notebook, a three-ring binder just for this class that was organized according to a table of contents (Appendix C_1). Every time we started any new sheet of paper, it was numbered and entered in the table of contents. For example, on the first day of class I handed the students a syllabus and a safety contract. These were items 1 and 2, and were written down in the table of contents as such. There was also a place to keep track of the date of the assignment and the score they earned if the student wanted to (Figure 2). Most students had not organized their binders in this manner before. Usually they separate homework, labs, and test/quizzes into different sections. This way, everything was in chronological order so that an entire unit was all in one place. Before each major test or every two quizzes (whichever came first), I would tell the students what pages to make sure they had in order and what to study. I would then check in the notebooks on those test/quiz days and give them points for staying organized and not losing their assignments (practices borrowed from Aefsky, 2000).

Date	Pg #	Assignment	Score
	1	*Syllabus*	
	2	*Safety Contract*	
	3	*How can I do better in science class?*	
	4	*MSU Consent form*	

Figure 2. Sample from the students' Table of Contents.

The major reason for having the students organize their papers was that several of the students with IEPs were allowed to use their notes on tests and quizzes as part of their accommodations. I decided to incorporate this into the class and let all the students use their notebooks on all tests and quizzes, including the final exam. The students knew about the exam ahead of time, so that was a big incentive to keep up with their notebook. As I wanted to reward students for being responsible and organized, they were *not* allowed to use their textbooks on any tests or quizzes. This also ensured that students would put a little more effort into their notes and assignments.

Within the first week of class, more routines were put into place. I handed out a list of tips called *How Can I Do Better in Science Class?* as students are often asking me what they can do to bring their grade up (Appendix C_3). It was at this time that I also introduced and explained the study to the students. The only difference in what they were going to do was participate in a pretest (Appendix B_2), as well as a survey before and after the study (Appendices B_1 and B_3). Otherwise, on a day-to-day basis they were doing nothing different; I was simply going to collect some of their work and make copies to look at later. Thirty-four students total turned in consent forms and ended up participating. There were 23 males and 11 females, 32 sophomores and 2 juniors. Near the end of the first week, I distributed a *Checklist of Study Habits and Test-Taking Skills* (Appendix C_4). I went through some basic studying and test-taking strategies with the students the day before and of the first quiz. This began another routine of having a weekly quiz in order to break up the large subject of ecology into manageable topics. Figure 3 is a basic overview of the unit (objectives, activities, and comment on success).

	Objectives	Activities	Successful?
Week 1: Basic Organizational Tools and Practices	1. Emergency routes, safety 2. What is Biology? Topics covered this year 3 Needs for the class 4. Spontaneous generation vs. biogenesis	1. Introduce all organizational tools: Question of the Day (QofD), Table of Contents, syllabus/rules, test-taking strategies, safety contract, language of science- why Latin/Greek? 2. MSU consent form and explanation 3. Hand out books and How to Use Your Science Book and Break it Down as HW 4. Sketch a Scientist 5. Go over test-taking strategies with examples 6. Quiz #1	All organizational tools were received well. Students excelled on Quiz #1 which covered basic safety rules and procedures for the classroom.
Week 2: Life and Introduction to Ecology	1. What is life? 2. Characteristics of living things: 3. Levels of organization- where are we going to focus for this unit? 4. Announce portfolio, 5. What is ecology? 6. Introduce Bottle Biology	1. Outdoor activity: biotic vs. abiotic 2. Char. of Living things: coloring with notes 3. HW: Vocab – biotic, abiotic, biosphere, resources; p. 704-709 #1-4 4. **ECOLOGY PRETEST** 5. Brainstorm and concept map on ecology 6. Quiz #2- ntbk check. 7. Intro to BioBottle: go through options, assign partners, take home list of needed materials	1. Combination of outdoor activity, notes, and homework assignment worked well (Quiz #2 was good). 2. Pretest was frustrating for many students 3. Students see excited about BioBottles

Figure 3. Overview of the Objectives and Activities in the First Marking Period.

	Objectives	Activities	Successful?
Week 3: Taxonomy	1. Construct Biobottles! 2. Characteristics of 6 kingdoms- Define terms: autotroph, heterotroph, prokaryote, eukaryote 3. System of Classification and the rules for writing scientific names. 4. The more levels organisms have in common, the more closely related they are.	1. Finish construction and fill Biobottles. 2. HW: answer questions on article, "How many species are there?" 3. HW: Read section 14.1, 14.2, and 14.3. Define the vocab, then do the matching 1-5 and questions for review 1-7 4. Levels of classification activity- grid with charac. 5. Quiz #3	1. Construction of BioBottles went as planned 2. A lot of reading with assignments this week; first struggle with getting homework turned in
Week 4: Symbiotic Relationships and Food Webs	1. Dichotomous keys 2. Symbiotic relationships and related vocabulary 3. Energy pyramids. Why the world should become vegetarians!	1. Online dichotomous leaf key with samples from outside 2. Shark dichotomous key. 3. Community Studies. 4. Vocab for energy pyramids 5. Study skills worksheet 46-1 6. Quiz #4-ntbk check	1. Dichot. key activities too brief-student responses suffered. 2. Community Studies: great group work
Week 5: Nutrient Cycles	1. Water Cycle 2. Carbon and Nitrogen Cycles	1. define vocabulary for water cycle- fill in diagram 2. Water cycle game 3. Notes and pictures of carbon and nitrogen cycles. 4. Review all cycles- make large poster as class with all three cycles on one picture 5. Take Quiz #5. 6. Read Chapter 50 and section 51.1; define the words on the worksheet.	1. Water Cycle had good mix of activities-Quiz #5 responses were good. 2. Other nutrient cycles need more time or different act.; responses suffered
Week 6: Succession and Alien Species .	1. Population cology 2. Primary and Secondary Succession 3. Alien Species	1. OH DEER! 2. Hudson Bay Population Study 3. Tree Tops Valley: Story of Succession Questions and Fire diagrams 4. Alien Species PowerPoint 5. Quiz #6- ntbk check	1. OH DEER!: success students did well on Quiz 2. Tree Tops Valley too long 3. Alien Species ppt. Ss enjoyed it
Week 7: Populations	1. Carrying Capacity and things affecting population size 2. Begin Biomes	1. Carrying Capacity Lab: Owls as Predators 2. Review worksheet for Quiz: 47-1 plus extra questions. 3. Quiz #7 4. Intro Biome Project- assign biomes	1. Owl Lab: Students acted out and understood what happens when resources run out
Week 8: Biomes	1. Levels of organization: Biomes 2. Climatogram	1. Biome projects 2. Ntbk check 3. Biome chart- write down info from each poster	1. Students picked own groups which resulted in some uneven group work
Week 9: Portfolios and Wrap-Up	1. Portfolios! 2. Conclude BioBottles 3. Ecology Unit Post-Unit Survey	1. Quiz #8 2. Portfolios! 3. Clean BioBottles and make Conclusions 4. Post-Unit Survey	1. Quiz #8 the best 2. Students cooperative about Post-Unit Survey 3. Portfolios great!

Figure 3 (cont'd).

Week 2: Life and Introduction to Ecology

The second week began with a discussion of what it means to be alive and what the requirements are for being considered a living organism (Griffin, 1986). We ventured out into the outdoor lab to compare biotic to abiotic factors, and explained why each thing we saw was categorized as such (Appendix C_5). The Pre-Unit Survey and Pretest (Appendices B_1 and B_2) were administered early in the week and collected for later data analysis. The next day we officially started the ecology unit with a concept map that asked simply, *What is Ecology?* (Appendix C_6). I introduced the portfolio project (Appendix B_{4h}) so that students would be thinking all through the unit which pieces they might want to include. I also wanted them to keep their papers in the best condition possible for the portfolio so they wouldn't have to rewrite anything. The week finished with our second quiz (Appendix B_{4a}) and an introduction to a long term project: the *BioBottle*. Using ideas and modified directions from Bottle Biology, Second Edition, I developed a laboratory procedure (Appendix C_7) that would allow students to design a small contained ecosystem within the confines of a 2-liter soda bottle (Department of Plant Pathology, University of Wisconsin-Madison, 2003). Students worked in small groups of 2 or 3 and decided what type of bottle to make. Some chose to try to maintain a fish in the bottom chamber and grow a bean plant out of the top (*TerrAqua* Column), while others worked on a compost pile to see how long it would take to break down certain materials. The task was to get together with another pair and develop a hypothesis about competing *BioBottles*. One group had two people make a *TerrAqua* Column out of store bought materials while the other pair used things collected from the outdoor lab. They each formed their own hypothesis about whose *BioBottle* in the group would survive the longest and why. One group was allowed to work alone and build an entire *EcoColumn*. They had plants on top, a compost pile in the middle, and fish on the bottom. Their goal was to see if they could get all three layers to be self-sustaining, modeling an actual ecosystem! All students were responsible for dividing up the tasks of bringing in materials and setting up the *BioBottles*, as well as recording observations for the life of their projects.

Week 3: Taxonomy

Week three saw the construction of the *BioBottles* and an introduction to taxonomy. This topic used the first fill-in-the-blank lecture notes of the year (Appendix C_8), and well as the first homework book and reading assignment. The book assignment was fairly easy; it was mostly vocabulary definitions so that they would be prepared for the language when they got to class. The reading assignment was a little long, but the students did well and returned with questions answered the next day about the number of different species in the world (Tangley, 1997). Basically, no one has any idea because there are so many! We worked on learning the characteristics of the six kingdoms: Archaebacteria, Eubacteria, Protista, Fungi, Plantae, and Animalia. In doing so, we learned new vocabulary such as prokaryote and eukaryote, and heterotroph and autotroph. Some time was spent on an activity that compared the characteristics of various animals' structure to each other and how that related to their classification (Investigation 4.1: The Levels of Classification, 1986). The overall conclusion was that the more levels of classification animals have in common with each other, the more closely related they are. The third week wrapped up with another quiz (Appendix B_{4b})

and I encouraged students to think about picking their first portfolio piece and writing it up so they wouldn't have to do the whole thing at the last minute.

Week 4: Symbiotic Relationships and Food Webs

The next week started with a wrap up of taxonomy by learning how to use a dichotomous key. I picked a few leaves from the outdoor lab and as a class we used an online dichotomous key to identify what tree they must have come from (Wisconsin Department of Natural Resources, 2007). For homework, the students had to use a paper dichotomous key to identify 14 different types of sharks (no reference available- widely used activity). The rest of the week was spent learning about the difference between a food chain and a food web, and all the symbiotic relationships that occur within each. Students also used fill-in-the-blank lecture notes for this topic (Appendix C_9) and then spent two class periods constructing their own food webs out of pictures cut from old National Geographic magazines (Appendix C_{10}). A rubric was given ahead of time so that students would know exactly what to include on their posters for full credit (Lantz Jr., 2004). Thursday, students learned about energy pyramids (not the nutritional food pyramid) and why energy is lost as you move up the food chain. We discussed why there are many who advocate for the world to go vegetarian because it would be more energy efficient (Appendix C_{11}). The week concluded with *Quiz 4* (Appendix B_{4c}).

Week 5: Nutrient Cycles

The halfway point of the unit began with vocabulary and diagrams of the water cycle (Appendix C_{12}). Students were familiar with most of the "-tion" terms, but things like transpiration, percolation, and infiltration were new to them. We played a water cycle game that allowed each student to pick scenario cards and pretend to be a drop of water. We discovered that you could spend your entire existence as a water molecule in only a few steps of the water cycle (Project Learning Tree, 1993). The carbon and nitrogen cycles were also introduced. These proved a little more technical and confusing to the students, and so a large class collaborative drawing was made that showed all three cycles and how they interact with each other. This seemed to help with comprehension, and the fifth week ended with our fifth quiz (Appendix B_{4d}).

Week 6: Succession and Alien Species

In the sixth week of the ecology unit, the natives were getting restless, so to speak. So, we began our investigation of populations with an outdoor activity called *OH DEER!* (Project Wild, 1992). In this survival game, four students started out on one side of the field as "deer." The rest of the class lined up on the opposite side of the field and pretended to be food, shelter or water, symbolized by how they held their hands. Food was signified with hand over the stomach, water as hands over the mouth, and shelter hands held overhead in a teepee. Both groups started facing away from each other; the "deer" also had to pick a symbol without knowing what the other side was up to. When I gave the signal, both groups turned and faced each other. The "deer" had to find students with symbols that matched their own; this allowed them to take that person back to the other side and they became a deer. If they could not find food, water, or shelter, then they died and became part of the resources. After awhile, the students on the resource side of the field became clever and decided to all be one type of resource, signifying a drought or famine year, and many of the "deer" died. At one point I let some of the students be wolf predators that had to skip while the deer could run. It was interesting to see the population of "deer" fluctuate, and the kids had a great time too.

Two days were spent learning about what other factors affect population growth (Appendix C_{13}). We also discussed what happens when whole ecosystems are disturbed by either natural or manmade disasters. Students compared and contrasted what happens during primary and secondary succession, as well as how forest fires can be both good and bad (Project Learning Tree, 1996). We ended the topic by discussing how other artificially introduced organisms like alien species have affected the ecosystems in and around the Great Lakes (Appendix C_{14}). The week finished with *Quiz 6* (Appendix B_{4e}).

Week 7: Populations

Week 7 was shortened by a teacher in-service day, so we used it to wrap up some projects. An activity was done in class to simulate the carrying capacity of a population (Appendix C_{15}). Students were owls pretending to forage and feed their fledglings by "hunting" M&Ms candy in green Easter grass. Parent owls had to feed their offspring equally and get them each a set number of M&Ms in order for them to survive the round (each round= one year). Different groups of owls had different scenarios: some had one parent, some had two parents but one had a broken talon, some had only a few fledglings and some had huge owl families. At the end of the week we cleaned up our *BioBottles* that had mostly perished. Our seventh quiz was on Thursday (Appendix B_{4f}), and I introduced the final small project of creating a poster brochure for each of the major biomes on Earth, *Traveling to the Biomes* (Appendix C_{16}).

Week 8: Biomes

Traveling to the Biomes was the name of our last project before students started putting their portfolios together. Students formed groups of three and were assigned one of the eight major biomes: tundra, desert, coniferous forest (taiga), deciduous forest, tropical rainforest, savanna, prairie, and chaparral. Students were to find information in their books and online about the climate and characteristic plants and animals in their biome. They had to represent the typical climate of the biome by using a climatogram, which they learned how make early in the week (Appendix C_{18}). They were also responsible for finding a National Park within their biome and giving a description of what a person might do while visiting. Students had to list items to pack and things to look for while visiting each biome, as well as dangerous or unusual things they might encounter. The project culminated with a poster that was tri-folded like a travel brochure; students had to post their findings in an attractive manner on the poster as if they were working for a travel agency. When the posters were complete, they were displayed around the room for everyone to examine. Though each group became particularly knowledgeable about their assigned biome, it was important that they have the basic information on all eight of the major biomes. Therefore, once the projects were displayed, the students went around the room and filled in a chart with the climate, geographic location, and typical plants and animals for each of the biomes studied (Appendix C_{17}). The last quiz of the unit was on the following Monday so that students could have enough time to fill in this chart.

Week 9: Portfolios and Wrap-Up of the Ecology Unit

Upon completion of *Quiz 8* (Appendix B_{4g}), the last week of the marking period was devoted to preparing the students' *Portfolios*. The requirements were reviewed and I assisted students in picking out the pieces they wanted to use. Students had access to computers so they could type up information about each piece. This information was to include why they chose each piece, what they did well and what they would change if they could do it over (a suggestion borrowed from Valdez, 2001). Also, students had to discuss in writing what objectives were accomplished by completing the piece and key terms that were learned. The final draft of the *Portfolio* was to be presented in its own folder or three-ring binder with an illustrated cover page and table of contents. Once again, a rubric for grading the portfolio was handed out ahead of time with the instructions so that students would know exactly what to include for full credit (Appendix B_{4h}).

Portfolios were turned in on the last day of the first marking period. I graded them over the weekend, and on Monday the students completed the *Post-Unit Survey* (Appendix B_3). This survey included their opinions on how well they knew the topics, what their favorite project was, and if any of their organizational or study habits had changed over the course of the unit.

Overview of the Unit

In essence, this study began with the implementation of several organizational tools such as the *Question of the Day* and the class notebook with a *Table of Contents*. Daily routines and expectations were established like the bin to turn in papers and the weekly schedule on the board. Once these were in place, a *Pretest* and *Pre-Unit Survey* were given to determine the students' previous knowledge in ecology and their opinions on how well-prepared they thought they were for class. Various activities were employed to convey the content of ecology to a wide range of learning styles. The assessments used were *Posttests* in the form of weekly quizzes, biweekly notebook checks, and the evaluation of the many activities previously mentioned. At the conclusion of the unit, a

Portfolio was the final assessment as well as a *Post-Unit Survey* to get the students opinions on how well they felt things went.

Results/Evaluation

Pre-Unit Survey

The purpose of the *Pre-Unit Survey* (Appendix B_1) was to assess the attitudes and organizational habits of the students in Practical Biology. Preliminary questions asked about future plans and whether or not they included science. The latter half of the survey questioned their study habits and how well-prepared they were for class every day. All of the data herein was self-reported by the students. No content-related questions were asked on the *Pre-Unit Survey*.

From the very beginning of this unit, I had doubts about the students' interest and willingness to participate in the various activities I had planned. My skepticism stemmed from the *Pre-Unit Survey* I handed out the day before we began the first lesson on ecology. Figure 4 shows that the students in Practical Biology set some lofty goals for themselves, but continuing in science is not one of them. Of the 34 students polled, 27 of them are intent on continuing their education after high school, with 26 of those students predicting they are headed for a two or four-year college or university. Out of the students that said they will continue, only 3 were certain they would end up in science professions.

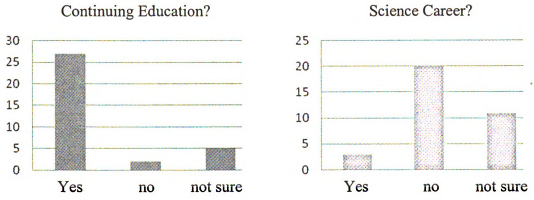


Figure 4. Number of students who are considering continuing their education after high school, and whether or not those plans include science. (n=34)

Also, while only a handful of students listed science as their least favorite class, only a few listed it as their favorite (Figure 5). In general, the class was made up of many students who at best seemed indifferent about science, and their placement in this class meant that they probably struggled with the subject in the past. Indeed, when asked, the students confessed that their normal grades in science class ranged from Bs to Ds; not

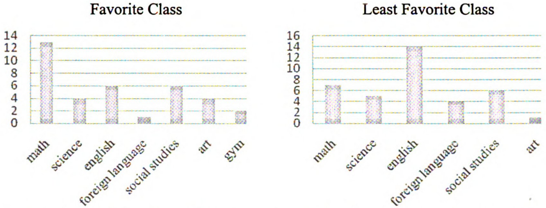


Figure 5. Students' favorite (n=36) and least favorite (n=37) class, according to the Pre-Unit Survey. Some students reported more than one for each category.

one person responded positively with an "A" as their normal achievement level in science (Figure 6). No one reported failure, either. A large number of students listed English as their least favorite class. As many of the students' disabilities were related to reading comprehension and writing skills, this did not surprise me. It would, however, mean that some of our projects would present a challenge to most of the class.

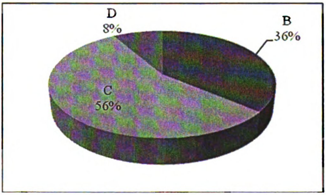


Figure 6. Average grade in science classes as reported in the Pre-Unit Survey.

The focus of this study was to give the students structure and daily routine in which to provide a good atmosphere for learning ecology. In order to make sure that they could succeed in my (and any) science class, I asked them about their own organizational habits before we started the ecology unit. Students were asked how often they were prepared for class, and how often they wrote down homework assignments in their planners. A few students filled in "Always" for all the good habits and "Never" for all the bad ones, and I suspect it was because they were filling in what they thought I wanted to hear; their responses were not tallied (Figures 7 and 8). My goal in asking students

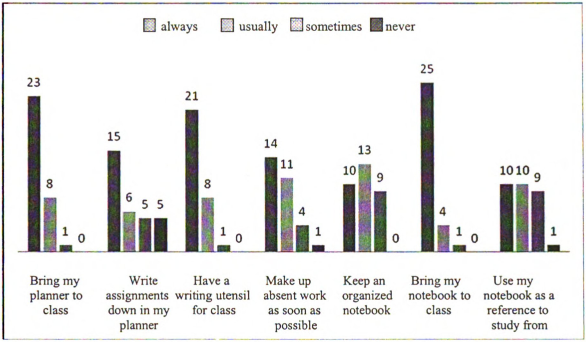


Figure 7. Student responses to how often they employ positive organizational skills. (n=34; some surveys had no response)

about their habits was to make them more aware of what they were doing on a daily basis. The students reported that they were pretty good at being prepared for class and bringing all the necessary materials with them. I hoped the integrated structure of Practical Biology would give them a chance to improve these areas. In keeping with that, I also had students evaluate their strategies for conquering difficulties with the class material. Do they ask a friend for help? Do they speak up and ask questions in class? I was surprised at how many students use the teacher and their book as a last resort. They

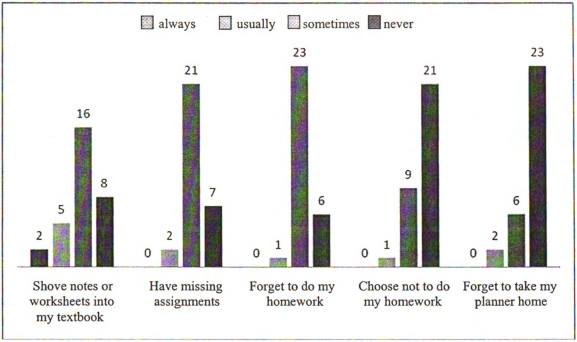


Figure 8. Student responses to how often they employ negative organizational skills. (n=34; some surveys had no response)

turn to their friends first, look through their notes next, and *then* ask questions during class (Table 2). I was also curious about the students' study habits and test-taking strategies. Many of the *Pre-Unit Survey* questions asked them to evaluate the same

Table 2. Students' first response to academic difficulty in class.

read book	talk to teacher	talk to friend	go back through notes	ask questions in class
3	4	11	8	6

things listed on our *Checklist of Study Habits and Test-Taking Skills* from the first week of class (Appendix C_4). Students checked off all the techniques they use in order to prepare for an upcoming quiz or test (Figure 9). I also added in a section that asked students about the environment in which they study. Many of the students in both sections have trouble focusing in class when in the company of their peers. I was

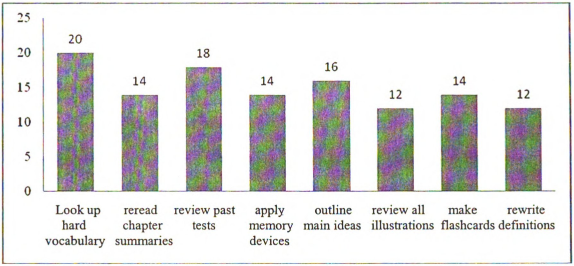


Figure 9. Students' study skills in Practical Biology, as reported in the Pre-Unit Survey. (n=34)

curious whether or not they would seek to eliminate distraction at home or if it was a problem for them there as well. As it turns out, many of the students said that they found a quiet room at home to study in, but most of them listened to music while preparing for a test or doing homework (Table 3). The Post-Unit Survey will be addressed in the *Discussion/Conclusion* section.

Table 3. Pre-Unit Survey report on Practical Biology study environments. (n=32)

listen to music	turn on the TV for background noise	go to a friend's house to study	Find a quiet room in the house	Go to the library
18	2	1	11	0

Pretest versus Posttest Analysis

To determine the students' previous knowledge of ecology, the *Pretest* (Appendix B_2) was taken the day before the unit was to begin. Then, each week, we concluded with a quiz on a smaller topic within the unit which was used as the posttest. Figures 10 through 18 show an itemized comparison between the *Pretest* and the quiz answers that students gave. Figure 10 shows the difference in their responses for the questions regarding the definition of ecology and what possible jobs a person could have if they were interested in the field. The most remarkable difference was in question 2, where several students left the *Pretest* blank with respect to the occupations of an ecologist, but the *Posttest* (Quiz 2, Appendix B_{4a}) shows that 100% of the students provided the correct answer. A similar trend continued with many questions; many students left more than

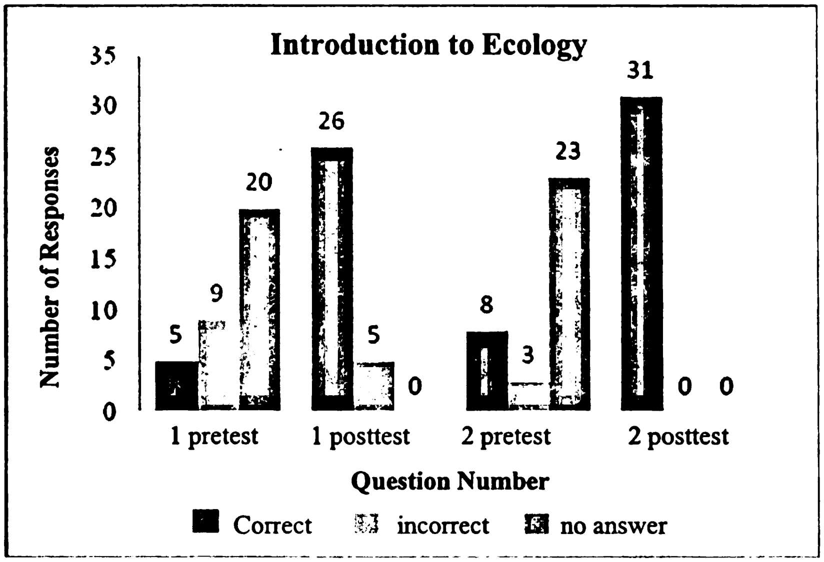


Figure 10. Comparison of student Pretest to Posttest responses on introductory ecology. (n=34, 31)

half of the *Pretest* blank, but then were able to correctly respond to the item on the *Posttest* (Figure 11 and 12). Very few questions were left unanswered on the quizzes; I expected this because one of the test-taking skills we worked on was making sure that everything was attempted. You would also think that with the use of their notes, almost all the students would have correct responses on the *Posttest* questions, but that was not the case (Figure 13). From monitoring the students and helping them with questions during the *Posttest*, two main reasons for this became very clear. In spite of all my

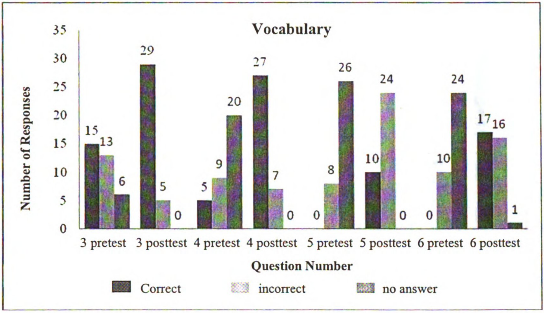


Figure 11. Pretest versus Posttest answers, questions 3 through 6: vocabulary. (n= 34)

efforts, there were still some students who had not taken very good notes or filled in all of their worksheets. Therefore, they had no information to fall back on for reference during the quizzes. The other scenario stemmed from either the students' disabilities or from a lack of patience or maturity. Whatever the cause, this second group of students was not

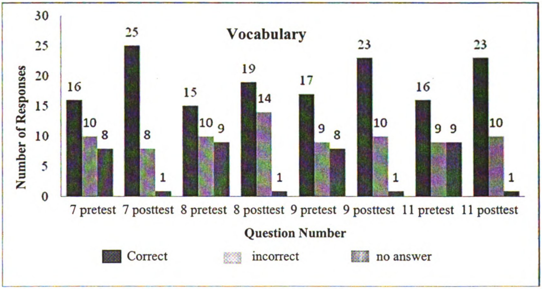


Figure 12. Pretest versus Posttest answers, questions 7 through 9, 11: vocabulary. (n=34)

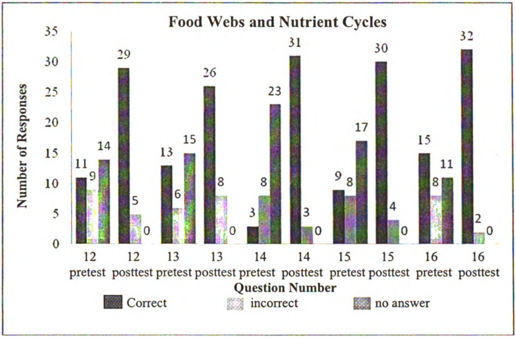


Figure 13. Pretest versus Posttest answers, questions 12 though 16:
Food Webs and Nutrient Cycles. (n=34)

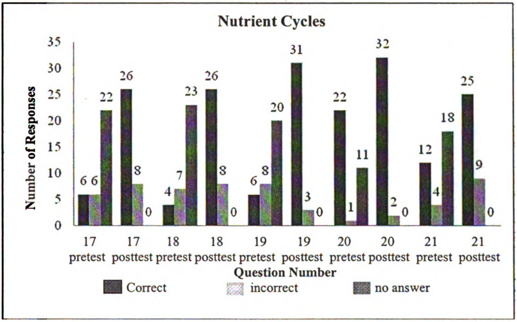


Figure 14. Pretest versus Posttest answers, questions 17 though 21: Nutrient Cycles. (n=34)

taking the time during quizzes to look up answers they didn't know. Some of them had excellent notebooks with the missing answers right in front of them, but they were not using this resource. I was able to guide a few students at different times through this process, but they readily reverted.

However, most results showed vast improvement from the *Pretest* to the *Posttest*. Because I am aware of the middle school curriculum in our district, I can safely say this improvement was mostly due to the students learning new topics to which they had not previously been exposed. Once we completed the lessons in class they showed competency in most areas. On the topic of succession and animal niches, over half of the Practical Biology students left this entire section blank on the *Pretest* even though it was a matching exercise. However, they showed understanding during class which was reflected on the *Posttest* questions. The two tall peaks on Figures 15 and 16 for questions 27 through 36 signify that almost everyone left these questions blank on the *Pretest* and

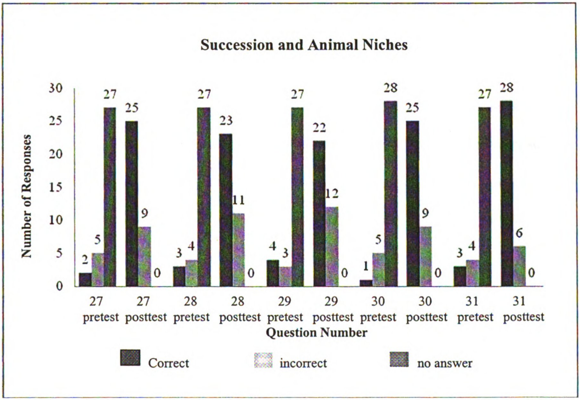


Figure 15. Pretest versus Posttest answers, questions 27-31: succession and animal niches. (n=34)

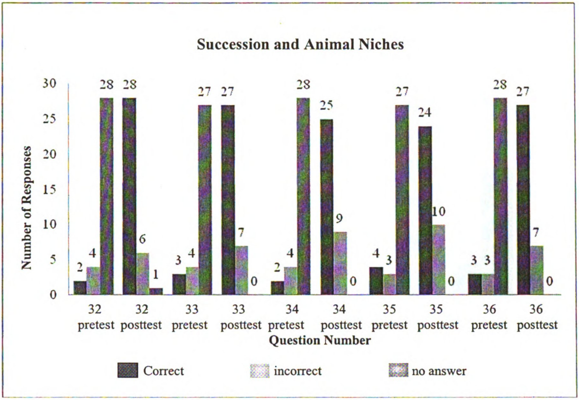


Figure 16. Pretest versus Posttest answers, questions 32-36: succession and animal niches. (n=34)

the majority of students got them all right on the *Posttest*. Occasionally, there was a question or two that was poorly worded or excessively specific, and the students struggled with these. Question number 22 was one that asked for the vocabulary word "fixation" or that bacteria "fix" nitrogen. Many students put that bacteria change nitrogen or implied that they do something with it, but couldn't come up with the specific term. Therefore, this was one question that did not show positive improvement from the *Pretest* to the *Posttest*. Question ten was part of a small matching section on the *Pretest* which about half of the students got right. On *Posttest Quiz 4* (Appendix B_{4c}), this same term was part of a larger matching section including a similar term. The two comparable words were "heterotrophy" and "consumer," and the descriptions given by me were not sufficiently different enough for the students to tell them apart. Consequently, more people got the question wrong on the *Posttest* than on the *Pretest* (Figure 17).

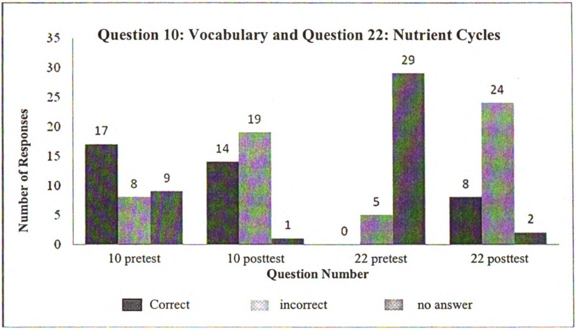


Figure 17. Results from poorly written questions. (n=34)

A few questions produced unexpected difficulties for the students, and I'm unsure as to the explanation for this. The first small section of questions was about symbiotic relationships. On the *Pretest*, most everyone left this section blank as they did many others. However, on the *Posttest*, even with their notes, many students could not correctly choose which situation represented parasitism, mutualism, or commensalism (they had little problem with predation). I found this interesting because if you had asked a student in class for the straight definitions of these relationships, they probably could have told you the correct answers. When faced with examples instead of definitions, they faltered and could not make the connection. This inability of the students to apply knowledge is typical in both Practical Biology and the regular Biology class. Figure 18 shows the results of the symbiotic relationship questions as well as questions 47 and 48 about the climatogram. Question 47 asked students to use provided data and graph a climatogram from it. Question 48 then asked the students to identify what biome the data could have come from based on the graph. Only 3 students attempted to draw the climatogram on the *Pretest,* and yet 14 attempted to answer question 48 and identify the appropriate biome. Eleven of their responses were based on a graph they didn't draw. It is possible that students could figure out what the data meant without knowing how to plot it on the graph. However, this hypothesis is thrown out in light of the fact that 12 of the 14 who attempted to identify the biome did so incorrectly. On *Posttest Quiz 8* (Appendix B_{4g}), only about 60% of the students drew the climatogram correctly, but they did a much better job of correctly identifying which biome the data correlated with. The follow-up questions about the climates of the various biomes showed the typical improvement from *Pretest* to *Posttest.*

The completion of the unit's activities should have given the students the appropriate knowledge to succeed on topics that were largely new to them. Thus, the remainder of the *Pretest* versus *Posttest* improvements was as anticipated. Out of the remaining subjects, the most impressive in terms of student achievement was the last question assessed. It was a short answer about alien species in the Great Lakes area. On the *Pretest,* only one student answered the question correctly and the rest didn't even attempt it. After the *Alien Species PowerPoint* (Appendix C_{14}) presentation in class, it was clear that the students actually had extensive knowledge and experience with local alien species like lampreys, zebra mussels, and purple loosestrife. Most of the students were aware that these species are not native to Michigan. When asked during lecture about their reason for not answering the question on the *Pretest*, they responded that they didn't know these organisms were referred to as alien species. The students were actually very interested in this topic and offered stories and information during class discussion. This was a "new" topic about which they had previous knowledge. This

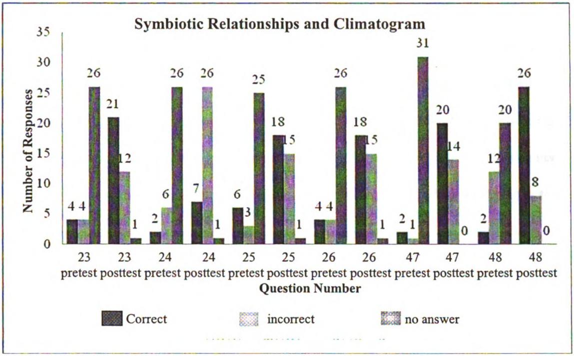


Figure 18. Pretest versus Posttest, questions 23-26, 47, 48:
Symbiotic Relationships and the Climatogram. (n=34)

was empowering to students who normally struggle with written responses, as was reflected in their answers on the quiz. There were still two students who did not answer the question, but every person who attempted it got it right.

Final Assessment: Portfolio

The final assessment was the *Portfolio (*Appendix B_{4h}). Though grading them was a daunting task, overall the outcome was positive. It took a lot of prodding to get students working on this project, but once they had chosen the ten pieces they wanted to include, the rest went pretty smoothly. The normal difficulties when doing a large project with forty individuals were a small factor during the last week of the unit. There were some printing issues and some lost assignments, but in the end a large majority of the students turned in good quality work. Students made positive comments about the portfolio project in place of a test on the *Post-Unit Survey* (Appendix B_3). Many students felt that it gave them a better chance of doing well since so many of them have difficulty taking tests. One girl reported, "I really liked the portfolio. I don't think I would rather have a test because I blank out when I get a test in front of me. .... And I feel like I could show more on the portfolio..." Another student commented that the *Portfolio* was a great tool for reviewing. "It allowed you to look back on all of your work and see if you need to improve... and overlook it for the exam." Almost every student had good things to say about the *Portfolio*, even those that ended up not getting full credit. Most of their comments alluded to the fact that they thought they wouldn't have done as well on a big unit test. I only received one survey response from a student who said he would have rather had a test, and there were a few comments about needing more time or requiring fewer assignments in the *Portfolio*.

Discussion and Conclusion

General Discussion

For this study, I had two classes of students with a wide range of abilities and behaviors, and no idea how I was going to effectively teach them the basic ideas of ecology that the State of Michigan deemed necessary for all high school students. The literature suggested that Special Needs students require definite structure in the classroom with daily routines. Sources also indicated that I should vary activities to fit a diverse set of learning styles. I ultimately decided upon integrating some constructivist methods in with traditional practices. I believe I found a good balance of individual and group work. Students completed the reading and book assignments by themselves, and there were several classroom group projects like *BioBottles* and *Community Studies*. There were also a few assignments that combined writing and pictorial requirements like *The Water Cycle* and *Traveling to the Biomes,* which gave students who like to draw a chance to show their skill. In retrospect, I do wish I had found a few more activities where the students could move around like in *OH DEER!*. Interactive activities such as *OH DEER!* and *Carrying Capacity Lab: Owls as Predators* gave the students the opportunity to simulate an environmental process and make their own conclusions about the outcome. *Community Studies* is a great example of an activity that paired traditional instruction with constructivism. I used lecture notes to provide the students with the overall picture of a food web and some basic vocabulary. Then, they had to create an appropriate food web that showed how organisms in an ecosystem interact and label their project using the vocabulary I had given them. It was great to watch the students figure out where animals, plants, and fungi all belonged on their posters.

I was most pleased with the numerous structural components of the unit. I don't think the students or I have ever been more organized! Instead of using the textbook as a primary resource, we developed an organized notebook of vocabulary lists, activities and labs, and used them as reference tools during projects and quizzes. I certainly noticed a difference from the previous year in terms of lost papers and missing assignments; there were fewer this time around. *Weekly Assignment Sheets* provided a place to write down a class-starting *Question of the Day* and homework assignments. I also provided the students with fill-in-the-blank notes. Previously, they were so busy trying to keep up with the writing that they were not focused on what I was saying. This way, when we came to a blank, as a class we would try to figure out the missing word (usually a new vocabulary word) together.

Leichart Scale Analysis

Upon reading through the *Post-Unit Survey* responses of the students, I determined that the habits of the students hadn't changed that much in general, but there were a few improvements in specific areas. The same questions on the *Pre-Unit Survey* about being prepared for class were asked of the students on the *Post-Unit Survey*, and those responses did not change (See Figures 7 and 8 for Pre-Unit Survey results). Those who exhibited individual responsibility in bringing their planner and writing down assignments continued to do the same, and those who habitually forgot their writing utensils hadn't gotten much better at it. However, there was an upward trend in the number of students who regularly claimed to bring their notebook to class (Figures 19 and 20). Since it became such an integral part of our daily routine, this was a positive result. Also, those students who said they "never" brought their planner to class or

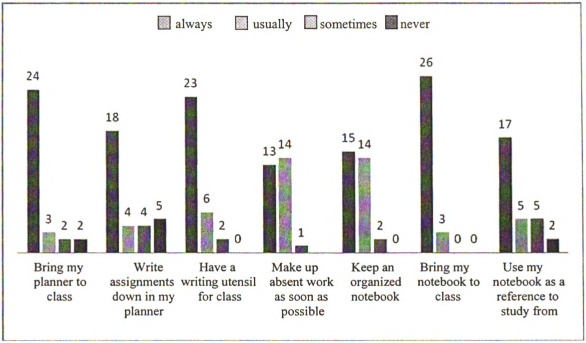


Figure 19. Students' Post-Unit Survey responses to how often they employ positive organizational skills. (n=31; some surveys had no response)

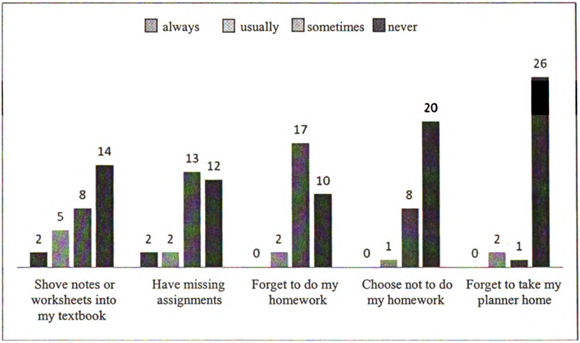


Figure 20. Students' Post-Unit Survey responses to how often they employ negative organizational skills. (n=31; some surveys had no response)

"usually" forgot to write down the assignment in their planner were doing that by filling out their *Weekly Assignment Sheets*. Since most students got full credit on those each week, I can assume that they were, in fact, filling out their planner in a different format.

Home study habits and the environments students set up for themselves did not seem to change, but in retrospect there was nothing in my unit specifically targeted to that area of their academic lives. I would like to work on this as they will not always be allowed to use their notes as a crutch and need some better techniques for preparing for tests and quizzes. However, a lot more of the test-taking strategies were checked off on the *Post-Unit Survey* than on the *Pre-Unit Survey* (Table 4). Going through the checklist at the beginning of the unit and then emphasizing these skills during the quizzes yielded some positive results. Whenever a student handed in a quiz in what seemed like record time, I would ask him or her a few questions. Did you answer every question? Did you read the directions to make sure you did each part correctly? The most common response was, "oh yeah…," and then the student would head back to their desk to try again. By the end of the unit I didn't have to remind students so much about these strategies, and several of them asked for help to make sure they did everything right without being prompted.

Table 4. Pre-Unit versus Post-Unit Survey responses: test-taking strategies. (n=31)

	maintain a positive attitude	read directions carefully	look for and use clue words	answer easy questions first, hard later	make sure ALL questions are answered	eliminate wrong answers	make sure answers are neat and legible	proofread for mistakes
Pre Unit	22	25	23	17	14	24	17	16
Post Unit	27	28	25	25	28	22	21	19

Student Opinions and Written Responses

In addition to questions about their organizational and study habits, the students were asked to give their opinions about the structure of the unit and its activities on the *Post-Unit Survey*. The students written responses indicated that their favorite and most helpful assignments while learning ecology were *OH DEER!*, the *Owl Carrying Capacity Lab*, and *Traveling to the Biomes*. They liked the first two the best because both activities involved getting up and moving around with each other and the students were also able to see the point behind them. Many students also listed these as the most helpful to them, saying that when things were fun, they were easier to remember. I agree! According to *Post-Unit Survey* responses, the *Traveling to the Biomes* project was a favorite more among the females because they liked the groups they had picked and enjoyed doing more artsy projects. Some of the boys agreed, but they were more likely to cite the previous favorites as their own (they got a little rowdy and enjoyed running around outside). *Traveling to the Biomes* was also listed as one of the most helpful projects, along with the *BioBottle*, because it allowed students to see how everything worked together.

There were also activities that the students did not like or didn't think were very helpful. The *Tree Tops Valley* activity and the dichotomous key work were not well-received by the students. Many students (n=15) noted that the *Tree Tops Valley* article on succession was too long and boring; therefore it was their least favorite *and* not very helpful because they got lost in it. I was surprised by the dichotomous key response because we did an online example together in class and then the students got to classify sharks; usually predatory animals elicit a positive response no matter what you're doing with them. However, several students' written responses indicated that they never really understood the point of the dichotomous key or how it worked. The basic dichotomous key on *Posttest Quiz 4* (Appendix B_{4c}) was simple enough for students to manage, and it was not part of my *Pretest/Posttest* analysis. Consequently, I was not aware of the students' misunderstanding until I read the students' responses on the *Post-Unit Survey*. If I decide to keep this topic in the unit, these activities will need to be revised to be more helpful to the students.

Conclusions

Taking a look back at the entire ecology unit, there are some activities I would keep as well as those I would change. Starting the unit with the *Ecology Concept Map* (Appendix C_6) was a good activity, because it allowed students to see the scope of learning about organisms and their environment. The *BioBottle* was a great project, but it should be moved to later in the unit. According to the conclusions on their lab write-ups, not enough students understood the point of the project. They likely would have *after* learning more about ecology. The modified lecture notes were very helpful. Even with few words for the students to fill in, a small group of kids couldn't keep up because their abilities were so low. The contrast between the typed notes and their own handwritten vocabulary words in the blanks also allowed for easy retrieval of information during quizzes. Interestingly, there was an additional longer reading assignment that not many students commented on in the *Post-Unit Survey*. The article entitled *How Many Species Are There?* was lengthy, but students did not react negatively to it as they did the *Tree Tops Valley* piece. The topic of all the various diverse species in the world and just how numerous they are was more appealing than the story of how a mountain recovered from a forest fire. I will keep the species article in the unit, but will replace the *Tree Tops* reading. As previously mentioned, more time needs to be spent on the topic of classification, particularly the use of the dichotomous key, with modification of relevant activities. We need to do more examples or even add a lab activity where students go out and find a few leaves they don't know and then use the online key themselves. After working in class groups on this subject, students should meet with success on an individual assignment such as the shark dichotomous key I used this time.

The most successful topic within the unit was definitely food webs and ecological relationships. The students brought in previous knowledge on the subject and were eager to show what they knew. This, coupled with some new information, provided excellent results on the weekly quiz (Figures 15 and 16). During the *Community Studies* activity, most students seemed to enjoy making the food web posters and successfully labeled different types organisms as well as various trophic levels. I would not change a thing in this section.

Nutrient cycles brought the most challenging information with an onslaught of new vocabulary. The students performed well on the *Posttest* questions (Figures 13 and 14) concerning the water cycle due to previous knowledge, a diagram, and the *Water Cycle Game* (Project Learning Tree, 1993). However, I was lacking in appropriate activities for the carbon and nitrogen cycles, and this was apparent on the *Posttest* (Figures 14 and 17). Students had lecture notes and a diagram to consult, but were confused on the overall paths of different molecules in the cycles.

The activities in population growth and succession produced mixed results. As discussed earlier, *OH DEER!* was very successful, as was the *Owl Carrying Capacity*

Lab. Both activities allowed the students to be interactive, and they analyzed the data afterward for an overall picture of what was happening as a result of their behaviors during the activity. Other assignments included the *Tree Tops Valley* article (already on the chopping block) and the presentation of alien species. I was excited about the students' enthusiasm toward the topic of alien species, and I will do more with it in the future. In the spring garlic mustard sprouts in our outdoor lab forest and takes over. It would be a great project for all of my classes to clear the forest of this alien species.

The last section before the portfolio project was biomes. I gave students the rubric for their *Traveling to the Biomes* project (Appendix C_{16}), showed them how to make a climatogram (Appendix C_{18}), and then sent them on their way. At this point in the year, students were familiar with the classroom resources and knew exactly what was expected of them by the eighth week of the marking period. A few groups needed to be prodded into using their classroom time wisely, but overall the students' projects turned out well and can be left as is.

The students' portfolios and their comments on the *Post-Unit Survey* indicate that I made the right decision in using them in place of a unit test, but there are some aspects that should be changed. I would like to find a way for students to make comments on their work without being quite so structured. I read the same strengths or weaknesses many times over in one person's portfolio. Also, from a time perspective, I think it would be more useful and less of a chore if I reduced the number of required portfolio pieces. Using the last week of the marking period in class was sufficient time for the students to complete this project, and it was a good way to review and wrap up the unit. Overall, the students succeeded at displaying their knowledge of ecology, and performed much better on the portfolio than they would have on a comprehensive unit test. From observing my students on quiz days, it seems they come to class with a lot of anxiety and preconceived notions of failure upon encountering larger tests. I can only speculate this is from past experience, and it would explain their enthusiasm at doing a project in place of a test.

After the end of the ecology unit, all of the structural elements I had put in place remained with the exception of the weekly quizzes. I had basically run out of detailed lesson plans at the end of the first marking period and found myself improvising through the next unit. I just didn't have enough time over the summer beforehand to plan out more than the nine week study period, nor did I know whether or not such planning would be useful. Having completed this study, I would definitely like to do the same things for the rest of Practical Biology: plan out varied activities, modified lecture notes, etc. for the remaining units in the class. My reason for this is the let down of the students in Practical Biology once the second marking period began. Though the number of things we did during the first marking period seemed intense, it really kept the students' interest and they became used to the routine. I actually had students disappointed that the second marking period was "normal," without the weekly quizzes. The general consensus was, and I agree, that they performed better on the shorter topics and integrated projects than when several things were put together in a unit test. The smaller number of concepts covered on the quizzes was met with more positive student attitudes; the lesser amount of questions seemed doable in comparison with a large test.

With all the accommodations necessary for the Special Needs students in Practical Biology, creating an entirely constructivist classroom would not be appropriate.

True constructivism focuses on the students as the cultivators of information, with the teacher acting as a guide rather than a fountain of facts. This method of acquiring knowledge is very powerful, but also lends itself to longer activities as students seek to gain understanding. Unfortunately, many of the students' disabilities make it difficult to concentrate on one problem for a long period of time, and extended group projects turn into behavioral issues. My ultimate conclusion is that structural integration of organizational skills and some constructivist practices such as alternative assessment is the way to go with At Risk students. Our Question of the Day and the Weekly Assignment Sheets brought routine to the class for those who needed it. The class notebook and assignment bin for turning in papers helped keep the students organized. The adults in the classroom provided more assistance than hoped for in a constructivist setting, but it was necessary in order to help struggling students. Traditional testing was kept to a minimum with small weekly quizzes. Instead, group projects, posters, notebooks, and ultimately a portfolio were used to assess student understanding. There was, and will continue to be, a wide variety of learning styles in Practical Biology. Though a few activities need improvement, the overall implementation of this study was a success. I look forward to adjusting all of the units in Practical Biology to reflect these methods of learning.

APPENDICES

Alternative Assessment in Ecology
Parent Consent and Student Assent Form

Purpose: I am currently enrolled as a graduate student in Michigan State University's Department of Science and Mathematics Education (DSME). My thesis research is on using alternative assessment in ecology as a way to help the students in Practical Biology succeed. "Alternative assessment" simply means I will be using organizational tools, labs, projects, short quizzes, and finally a portfolio to assess your child's knowledge rather than the traditional large unit test.

Data Collection: Data for the study will be collected from standard student work generated in the course of teaching this unit such as pre and post tests, lab activities, notebook checks, quizzes, and surveys. I am asking for your permission to include your child's data in my thesis. Your child's privacy is a foremost concern. The consent form will be collected by the teacher in the next room and sealed in an envelope until grades for the marking have been posted. Only then will I know whose information I may use so that the results of the study and your child's evaluations are not biased in any way. Your child's identity will not be attached to the data in my thesis paper or in any images used in the thesis presentation. Your child's privacy will be protected to the maximum extent allowable by law.

Participation: Participation in the study is voluntary. Students who do not participate in the study will not be penalized in any way. Students who do not participate in the study will still be expected to participate in class and complete assignments. Students who participate in the study will not be given extra work to complete. You may request that your child's information not be included in this study at any time and your request will be honored.

Risks/Benefits: There are no known risks associated with participation in this study. Your participation in this study may contribute to the understanding of the relationships in the ecosystem around you, and how you interact with that environment. You will also take with you the skills to organize your schoolwork and keep track of assignments, as well as some valuable studying and test-taking strategies.

If you are willing to allow your child to participate in the study, please complete the attached form and return it to me by September 12, 2006. If you have any questions about the study, please contact me by e-mail at tinak@dexter.k12.mi.us or by phone at (734) 424-4240 x7304. Questions about the study may also be directed to Dr. Merle Heidemann at the DSME by e-mail at heidema2@msu.edu, by phone at (517) 432-2152, or by mail at 118 North Kedzie, East Lansing, Michigan 48824. If you have any questions or concerns regarding your child's rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact- anonymously, if you wish- Peter Vasilenko, Ph.D., Director of Human Research Protections by e-mail at irb@msu.edu, by phone at (517) 355-2180, by fax at (517) 432-4503, or by mail at 202 Olds Hall, East Lansing, Michigan 48824.

Thank you,

Tina Kopinski
Biology Teacher
Dexter High School

_______ **I do not wish** to have my child's work used in this thesis project. I acknowledge that my child's work will be graded in the same manner regardless of participation in the study.
Child's name: ________________________________
(print student name)

____________________________________ ____________________
(Parent/Guardian signature) (Date)

________ I voluntarily **agree to allow** ______________________________ to participate in this study. (print student name)

Please check all that apply.

________ I give Ms. Kopinski permission to use data generated from my child's work in Practical Biology class to be used in the thesis project. All data from my child will remain confidential.

________ I give Ms. Kopinski permission to use pictures of my child during her work on this thesis project. My child will not be identified in these pictures.

________ I do not wish to have my child's picture used at any time during this thesis project.

________________________________ ________________
(Parent/Guardian signature) (date)

I voluntarily agree to participate in this thesis project.

________________________________ ________________
(Student signature) (date)

Ecology: Pre-Unit Survey

You are not required to put your name on this assignment

Circle the answer that fits you best.

1) Do you plan to continue your education after graduating from Dexter High School?
   Yes No Not sure

2) If you answered yes to the previous question, please indicate where you will continue your education.
   College/University Trade School Military On-the-job training/ Apprenticeship

3) If you plan to continue your education, will you need to take another biology course?
   Yes No Not sure

4) Do you plan to have a career that is related to science?
   Yes No Not sure

5) If you answered yes to the previous question, please list what career you are considering.
   ____

6) My favorite class is
   Math Science English Foreign Language
   History/Social Studies Other (please list which one) __________________

7) My least favorite class is
   Math Science English Foreign Language
   History/Social Studies Other (please list which one) __________________

8) My usual grade in science classes is
   A B C D F

9) When you have trouble in a class, what do you do? Please number your choices with 1 being the first thing you do and 6 being the last thing you would try.
   ____ Read the book
   ____ Talk to the teacher
   ____ Talk to a friend who has the class
   ____ Go back through the class notes
   ____ Ask questions in class
   ____ Other (please describe) ____________________________________

10) When you get ready to study, which of the following do you do? Please number your choices with 1 being the thing you are most likely to do and 6 being the thing you are least likely to do.
   ____ Listen to music
   ____ Turn on the TV for background noise
   ____ Go to a friend's house
   ____ Go to the public library
   ____ Find a room in the house that is quiet
   ____ Other (please describe) ______________________________________

11) When you're actually studying the material for a test/quiz, which of the following do you do? Check off all that apply.

____ look up hard vocabulary words to understand meanings
____ outline main ideas
____ review all illustrations
____ make flashcards
____ rewrite definitions
____ reread chapter summaries
____ review previous test/quizzes for mistakes
____ apply memory devices

12) When you take a test, which of the following do you do? Check off all that apply.

____ maintain a positive attitude
____ read directions carefully before trying to answer questions
____ identify and use clue words
____ write answers neatly and legibly
____ answer easy questions first, difficult last
____ make sure you've answered every question
____ proofread for mistakes
____ eliminate wrong answers

13) Which part of science class is most helpful to you?

____Lecture/Class discussion
____Homework
____Quizzes/Tests
____In-class work
____Labs
____Other (please describe):
____

14) Which part of science class is least helpful to you?

____Lecture/Class discussion
____Homework
____Quizzes/Tests
____In-class work
____Labs
____Other (please describe):
____

15) What is your favorite part of science class?

____Lecture/Class discussion
____Homework
____Quizzes/Tests
____In-class work
____Labs
____Other (please describe):
____

16) What is your least favorite part of science class?

____Lecture/Class discussion
____Homework
____Quizzes/Tests
____In-class work
____Labs
____Other (please describe):
____

16) What kind of assignments do you typically do the best on?

____Notes/worksheets in class
____Homework problems
____Quizzes/Tests
____Posters/projects
____Labs
____Other (please describe):
____

17) Do you prefer working alone or in groups (please circle)?

Alone Partners/group of 3 Big groups of 4-6

Why? ____________________________________

18) Please shade the box that most fits how often you do the following things.

Bring my planner to class	Always	Usually	Sometimes	Never
Write assignments down in my planner	Always	Usually	Sometimes	Never
Have a writing utensil for class	Always	Usually	Sometimes	never
Make up absent work as soon as possible	Always	Usually	Sometimes	Never
Keep an organized notebook	Always	Usually	Sometimes	Never
Bring my notebook to class	Always	Usually	Sometimes	Never
Use my notebook as a reference to study from	Always	Usually	Sometimes	Never
Shove notes or worksheets into my textbook	Always	Usually	Sometimes	Never
Have missing assignments	Always	Usually	Sometimes	Never
Forget to do my homework	Always	Usually	Sometimes	Never
Choose not to do my homework	Always	Usually	Sometimes	Never
Forget to take my planner home	Always	Usually	Sometimes	Never

Name: ____________________

Practical Biology Pretest: Ecology Unit

1. What is ecology? (1 pt.)

2. Name three jobs a person might have if they were interested in ecology.(3 pts.)
   a.
   b.
   c.

Multiple Choice. Write the correct answer to the left of each question. (1 pt. Each)

3. Organisms that can make their own food are called:
   a. Autotrophs   b. heterotrophs   c. eutrophs   d. none of these

4. A cell that has a nucleus and membrane-bound organelles is a:
   a. Prokaryote   b. eukaryote   c. akaryote   d. symkaryote

Short Answer.

5. Give the kingdom for each of the following (1 pt. Each):
   A. ancient bacteria ______________________
   B. multicellular eukaryotes, all autotrophic ___________________
   C. filamentous eukaryotes, use absorption ____________________
   D. insects, mammals, heterotrophic ______________________
   E. "true" unicellular prokaryotes ________________________
   F. uni- or multicellular eukaryotes; hetero- or autotrophic ______________

6. The following is the classification of the Monarch butterfly.
   Kingdom: Animalia
   Phylum: Arthopoda
   Class: Insecta
   Order: Lepidoptera
   Family: Danaidae
   Genus: Danas
   Species: plexippus

Use this information to write the scientific name of the Monarch here (2 pts.):

Vocabulary (1 pt. Each)

Match each word with its definition:

_____7. population

_____8. community

_____9. ecosystem

_____10. consumer

_____11. Producer

A. Many species of organisms interacting.

B. Unit of the biosphere in which living and nonliving things interact

C. organisms that must eat others for food

D. organisms that are the base of the food chain

E. Group of organisms of one species in an area

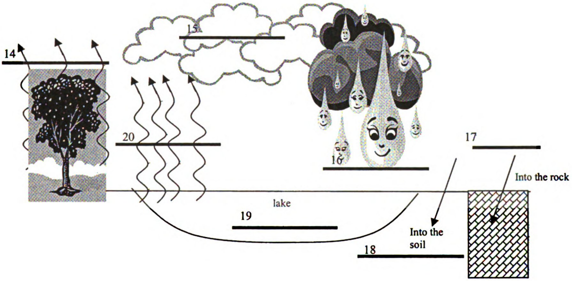
12. (4 pts.) Draw a food web below that includes the following organisms: grass, deer, wolf, rabbit, lettuce plant, mouse, snake, owl

13. (2 pts.) Put the following in order of energy flow: consumers, decomposers, producers, sun

__________________, __________________, __________________, __________________

Water Cycle (7 pts.)

Label the following diagram of the water cycle with these words: transpiration, precipitation, evaporation, collection, infiltration, percolation, and condensation.



Fill in the blanks, 1 pt. each.

21. One loop of the carbon cycle works because plants take in ______________ and give off ___________ while animals take in ______________ and give off ______________.

22. In order to be useful to plants and animals, nitrogen must be ___________ by bacteria in the soil.

Fill in #23- 26 with the correct relationship: mutualism, commensalism, predation, parasitism

_________________ 23. What type of relationship is there between first and second level consumers?

_________________ 24. What type of relationship is there between bats that fly from plant to plant and eat some of the fruit/nectar?

_________________ 25. What type of relationship is there between you and a mosquito?

_________________ 26. What type of relationship does a bird have with the tree it nests in?

(1 pt. each) Vocabulary Matching.

Please write the letter of the word that corresponds to the definition, description, or example in the blank to the left of each question.

_____ 27. This occurs on a piece of land that has been cleared by a glacier.

_____ 28. The different array of plants and animals in an ecosystem.

_____ 29. A species that depends almost solely on one food source, such as the panda bear that feeds on bamboo.

_____ 30. This can happen as a result of a tornado, forest fire, or human destruction.

_____ 31. This type of community is one that has reached full maturity and cannot develop any further.

_____ 32. An animal's rhythm that is dependent on the length of the day.

_____ 33. A period of inactivity brought about by cooler temperatures; the animal does NOT wake up during this time for anything.

_____ 34. A species that has numerous food sources, such as a great white shark.

_____ 35. The type of community that would be the first to colonize a new area.

_____ 36. A period of inactivity in an organism brought about by high temperatures.

a. Primary succession

b. Secondary succession

c. Estivation

d. Hibernation

e. Biodiversity

f. Generalized species

g. Pioneer community

h. Climax community

i. Circadian Rhythm

j. Specialized Species

<u>Fill in the Blank. (1 point each).</u>

37. The number of organisms an area can support is called its ____________ ____________.

38. Bacteria in a Petri dish will grow according to a(n) ____________ ____________ curve until they run out of space.

39. Disease is a density- ______________ factor in a population.

40. You as an owl in the carrying capacity lab were competing with other owls for rodent food. This is an example of ________________ competition.

41. A population of deer out in the wild have a natural carrying capacity, and their population will grow according to a(n) ________________ curve.

42. During the owl lab, the green "rodents" were harder to find in the grass; this was due to a defense known as ______________________.

43. In nature, poison ivy and poison sumac both have red stems (and branches in the case of sumac) to let others know to stay away from their noxious chemicals. This is an example of _______________ _______________.

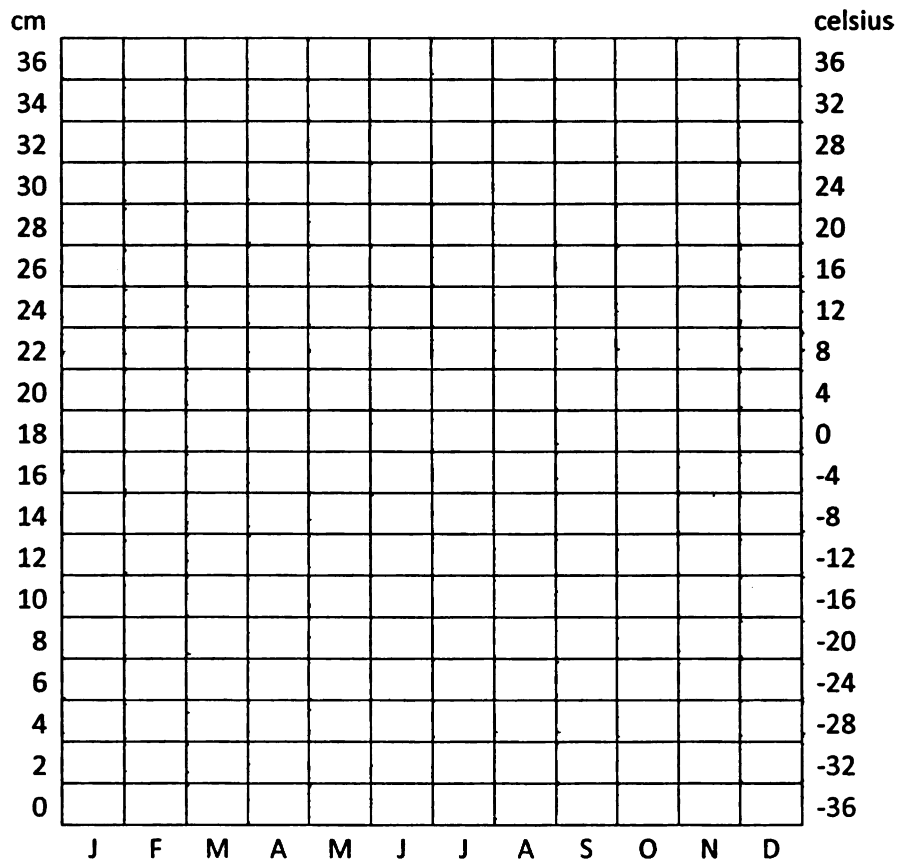
44. The weather is a density- ______________________ factor in a population.

45. In the African savanna, lions and hyenas often go after the same food source. This is an example of ______________________ competition.

46. The availability of food, space, water, and shelter, as well as the incidence of disease and predation, are all ____________________ ___________________ when it comes to how well a population will grow.

47. Use the following information to plot a climatogram on the graph provided below. (5 pts.)

	J	F	M	A	M	J	J	A	S	O	N	D
T	24.6	25.1	26.4	28.5	30.6	31.9	31.1	30.1	31.1	28.8	26.5	25.1
P	0.8	0.5	1.3	0.5	0.3	0.3	0.0	0.3	0.3	0.3	0.3	0.3



Multiple Choice. Write the correct answer to the left of each question.

Use the climatogram that you drew above to answer the following:

48. Looking at the temperature and rainfall of the climatogram, which biome does it best describe?
    a. Desert b. tundra c. tropical rainforest d. deciduous forest

49. Which of the following biomes is known to have various types of pine trees?
    a. Coniferous forest b. tropical rainforest c. prairie d. tundra

50. Which of the following biomes has trees that lose their leaves in the fall?
    a. Deciduous forest b. coniferous forest c. tropical rainforest d. tundra

51. Which of the following biomes would have the most rainfall **AND** have a very warm climate?
    a. Deciduous forest b. tropical rainforest c. tundra d. Chaparral

52. Which of the following biomes would be the most likely to have all four seasons?
    a. Deciduous forest b. tropical rainforest c. tundra d. desert

53. Which of the following biomes would have the least rainfall AND have a hot, dry climate?
    a. Tundra b. tropical rainforest c. prairie d. desert

54. Which of the following biomes would have the least rainfall AND have a cold, dry climate?
    a. Tundra b. tropical rainforest c. prairie d. desert

Short Answer: *Please answer the following in complete sentences.*

55. (4 pts.) Pick two of the alien species in the Great Lakes area and describe why they are "bad."

Ecology: Post-Unit Survey

You are not required to put your name on this assignment

1. Please shade the box that most fits how you feel.

Taxonomy- the classification of living thing	I could explain the topic in detail	I could explain the main ideas/ draw a picture with labels	I know some of the main ideas, but I couldn't explain them	I know some of the key words	I've never heard of that topic before
Dichotomous Keys	I could explain the topic in detail	I could explain the main ideas/ draw a picture with labels	I know some of the main ideas, but I couldn't explain them	I know some of the key words	I've never heard of that topic before
Food Chains/ Food Webs/ Energy Pyramid	I could explain the topic in detail	I could explain the main ideas/ draw a picture with labels	I know some of the main ideas, but I couldn't explain them	I know some of the key words	I've never heard of that topic before
Symbiotic Relationships	I could explain the topic in detail	I could explain the main ideas/ draw a picture with labels	I know some of the main ideas, but I couldn't explain them	I know some of the key words	I've never heard of that topic before
Water Cycle	I could explain the topic in detail	I could explain the main ideas/ draw a picture with labels	I know some of the main ideas, but I couldn't explain them	I know some of the key words	I've never heard of that topic before
Carbon/ oxygen and Nitrogen Cycles	I could explain the topic in detail	I could explain the main ideas/ draw a picture with labels	I know some of the main ideas, but I couldn't explain them	I know some of the key words	I've never heard of that topic before
Population Growth	I could explain the topic in detail	I could explain the main ideas/ draw a picture with labels	I know some of the main ideas, but I couldn't explain them	I know some of the key words	I've never heard of that topic before
Succession	I could explain the topic in detail	I could explain the main ideas/ draw a picture with labels	I know some of the main ideas, but I couldn't explain them	I know some of the key words	I've never heard of that topic before
Climatograms	I could explain the topic in detail	I could explain the main ideas/ draw a picture with labels	I know some of the main ideas, but I couldn't explain them	I know some of the key words	I've never heard of that topic before
Biomes	I could explain the topic in detail	I could explain the main ideas/ draw a picture with labels	I know some of the main ideas, but I couldn't explain them	I know some of the key words	I've never heard of that topic before

2. How did you like the portfolio? Would you rather have had a test at the end of the unit? Do you think the portfolio allowed you to truly show what you had learned about ecology this marking period? Explain.

3. Rate the activities from this unit by shading the box that best fits how you feel.

Ecology Concept Map	Very Helpful	Somewhat Helpful	Not Helpful
Bottle Biology	Very Helpful	Somewhat Helpful	Not Helpful
Levels of Classification Chart	Very Helpful	Somewhat Helpful	Not Helpful
Tree Leaves Dichotomous Key	Very Helpful	Somewhat Helpful	Not Helpful
Sharks Dichotomous Key	Very Helpful	Somewhat Helpful	Not Helpful
Community Studies: Food Web Posters	Very Helpful	Somewhat Helpful	Not Helpful
Identifying Symbiosis in a movie	Very Helpful	Somewhat Helpful	Not Helpful
Nutrient Cycle Diagrams	Very Helpful	Somewhat Helpful	Not Helpful
Water Cycle Game	Very Helpful	Somewhat Helpful	Not Helpful
OH DEER!	Very Helpful	Somewhat Helpful	Not Helpful
Tree Tops Valley Story	Very Helpful	Somewhat Helpful	Not Helpful
Alien Species PowerPoint	Very Helpful	Somewhat Helpful	Not Helpful
Population Density Laboratory	Very Helpful	Somewhat Helpful	Not Helpful
Owl Carrying Capacity Lab	Very Helpful	Somewhat Helpful	Not Helpful
Traveling to the Biomes	Very Helpful	Somewhat Helpful	Not Helpful
Making Climatograms	Very Helpful	Somewhat Helpful	Not Helpful

Consider the above list when answering the next set of questions.

4. Which activity was the <u>*most*</u> helpful to you in learning and remembering the information? Why?

5. Which activity was the <u>*least*</u> helpful to you in learning and remembering the information? Why?

6. What activity was your favorite? Why?

7. What activity was your least favorite? Why?

8. Which activity did you do the best on? Why do you think that is?

<u>Have your habits changed?</u>

9. When you have trouble in this class, what do you do? Please number your choices with 1 being the first thing you do and 6 being the last thing you would try.

____ Read the book
____ Talk to a friend who has the class
____ Ask questions in class
____ Other (please describe)
____ Talk to the teacher
____ Go back through the class notes

____

10. When you get ready to study, which of the following do you do? Please number your choices with 1 being the thing you are most likely to do and 6 being the thing you are least likely to do.

____ Listen to music
____ Go to a friend's house
____ Find a room in the house that is quiet
____ Other (please describe)
____ Turn on the TV for background noise
____ Go to the public library

____

11. When you're actually studying the material for a test/quiz, which of the following do you do? Check off all that apply.

____ look up hard vocabulary words to understand meanings
____ outline main ideas
____ review all illustrations
____ review previous test/quizzes for mistakes
____ apply memory devices
____ reread chapter summaries
____ make flashcards
____ rewrite definitions

12. When you take a test, which of the following do you do? Check off all that apply.

____ maintain a positive attitude
____ read directions carefully before trying to answer questions
____ identify and use clue words
____ write answers neatly and legibly
____ answer easy questions first, difficult last
____ make sure you've answered every question
____ eliminate wrong answers
____ proofread for mistakes

**Please shade the box that most fits how often you do the following things. **

Bring my planner to class	Always	Usually	Sometimes	Never
Write assignments down in my planner	Always	Usually	Sometimes	Never
Have a writing utensil for class	Always	Usually	Sometimes	Never
Keep an organized notebook	Always	Usually	Sometimes	Never
Make up absent work as soon as possible	Always	Usually	Sometimes	Never
Bring my notebook to class	Always	Usually	Sometimes	Never
Use my notebook as a reference to study from	Always	Usually	Sometimes	Never
Shove notes or worksheets into my textbook	Always	Usually	Sometimes	Never
Have missing assignments	Always	Usually	Sometimes	Never
Forget to do my homework	Always	Usually	Sometimes	Never
***Choose* not to do my homework**	Always	Usually	Sometimes	Never
Forget to take my planner home	Always	Usually	Sometimes	Never

Name: ____________________

Practical Biology Quiz #2: Life and Introduction to Ecology

(15 points)

1. What is ecology? (1 pt.)

2. Name three jobs a person might have if they were interested in ecology.(3 pts.)
    a.

    b.

    c.

3. Name one major problem humans could fix/avoid if they knew or cared a little more about ecology. (1 pt.)

4. Write a letter to R2D2 explaining to him that he cannot be a Jedi because he is not a living being. Give him at least 5 reasons and ***explain*** them; he is, after all, only a robot. (10 pts.)

Dear R2D2,

Name: ______________________________

Practical Biology Quiz #3: Taxonomy

Multiple Choice. Write the correct answer to the left of each question. (1 pt. Each)

1. ______ Which characteristic(s) best describes the kingdom Plantae?
   a. Multi-cellular   c. includes bacteria
   b. Unicellular   d. none of these   e. both a and b

2. ______ Which organism best fits in the Fungi Kingdom?
   a. Cat   c. AIDS virus
   b. butterfly   d. mushroom   e. none of these

3. ______ Organisms that can make their own food are called:
   a. Autotrophs   b. heterotrophs   c. eutrophs   d. none of these

4. ______ A cell that has a nucleus and membrane-bound organelles is a:
   a. Prokaryote   b. eukaryote   c. akaryote   d. symkaryote

5. ______ Linnaeus' classification system was based on:
   a. Common names   c. Common ancestors
   b. Genetic differences   d. Structural similarities

Short Answer.

6. Give the kingdom for each of the following (1 pt. Each):
   A. ancient bacteria ______________________________
   B. multicellular eukaryotes, all autotrophic ________________________
   C. filamentous eukaryotes, use absorption ___________________________
   D. insects, mammals, heterotrophic ______________________________
   E. "true" unicellular prokaryotes ________________________________
   F. uni- or multicellular eukaryotes; hetero- or autotrophic __________________

7. Give one example of an organism that would fit into the Kingdom Protista (1 pt.).

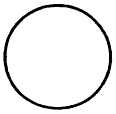
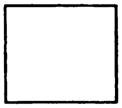
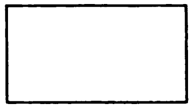
8. The following is the classification of the Monarch butterfly.
   Kingdom: Animalia
   Phylum: Arthopoda
   Class: Insecta
   Order: Lepidoptera
   Family: Danaidae
   Genus: Danas
   Species: plexippus

Use this information to write the scientific name of the Monarch here (2 pts.):

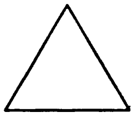
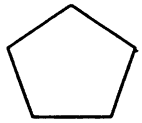
9. True or False? (1 pt.) The greater the number of taxa two organisms have in common, the more closely related they are.

Practical Biology Quiz #4: Symbiotic Relationships and Food Webs

<u>Leftover from last week→ (5 pts.) Dichotmous Key! Key out the 5 following "organisms."</u>

1.________________ 2.________________ 3.________________

4. ________________ 5. ________________

1a. Has no sharp edges..........*Cornelius*
1b. Has sharp edges...............go to 2.

2a. Has four sides...................go to 3.
2b. Has sides that number something other than four.......go to 4.

3a. All sides are equal in length..........*Bob*
3b. Sides unequal in length...............*Francesca*

4a. Having 3 sides...............*Leo*
4b. Having 5 sides...............*Gertrude*

<u>Vocabulary (1 pt. Each)</u>
Match each word with its definition:

_____1. autotroph	A. Many species of organisms interacting.
_____2. heterotroph	B. Organism that must consume others for energy
_____3. population	C. Unit of the biosphere in which living and nonliving things interact
_____4. community	D. An organism that can make organic compounds using sun energy
_____5. ecosystem	E. Group of organisms of one species in an area
_____6. herbivore	F. heterotrophs that eat plants and animals
_____7. carnivore	G. organisms that must eat others for food
_____8. omnivore	H. heterotrophs that feed on plants
_____9. consumer	I. heterotrophs that feed on animals
_____10. producer	J. organisms that are the base of the food chain

11. (4 pts.) Draw a food web below that includes the following organisms: grass, deer, wolf, rabbit, lettuce plant, mouse, snake, owl

12. (2 pts.) Put the following in order of energy flow: consumers, decomposers, producers, sun

_____________________, _________________________, __________________________, _________________________

Fill in #13-16 with the correct relationship:
mutualism, commensalism, predation, parasitism

_______________________13. What type of relationship is there between first and second level consumers?

_______________________14. What type of relationship is there between bats that fly from plant to plant and eat some of the fruit/nectar.

_______________________15. What type of relationship is there between you and a mosquito?

_______________________16. What type of relationship does a bird have with the tree it nests in?

17. Give an explanation that would justify the following statement: "The most efficient way to feed the world population is to promote the eating of plants or plant products." (5 pts.)

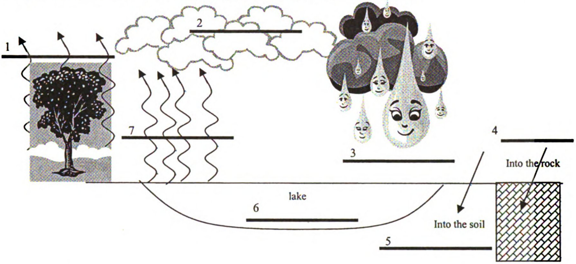
Name: ________________________

Practical Biology Quiz #5: Nutrient Cycles

(26 points)

Water Cycle *(7 pts.)*

Label the following diagram of the water cycle with these words: transpiration, precipitation, evaporation, collection, infiltration, percolation, and condensation.



Carbon Cycle *(6 pts.)*

(2 pts.) What are two sources of CO_2 for the carbon cycle?

8. ________________

9. ________________

Fill in the blanks, 4 pts.

10. One loop of the carbon cycle works because plants take in ______________ and give off ____________ while animals take in _______________ and give off ______________.

Nitrogen Cycle, *(3 pts.)*

Fill in the blank, 1 pt. each

11. In order to be useful to plants and animals, nitrogen must be ___________ by bacteria in the soil.

12. The nitrogen from dead organisms or animal waste gets back into the atmosphere because ______________ bacteria turn it back into N_2.

13. *(1 pt.)* What is a major industrial or chemical use of nitrogen in the U.S.? ____________

---

*Note: There was an additional diagram that encompassed the water, nitrogen, and carbon cycle all at once, but it was drawn by hand and not in good condition to reproduce for this thesis.

Practical Biology Quiz #6: Succession and Alien Species

(25 points)

(1 pt. each) Vocabulary Matching.

Please write the letter of the word that corresponds to the definition, description, or example in the blank to the left of each question.

1. _____This occurs on a piece of land that has been cleared by a glacier.
2. _____ The birth rate of a population.
3. _____ The death rate of a population.
4. _____ The different array of plants and animals in an ecosystem.
5. _____ A species that depends almost solely on one food source, such as the panda bear that feeds on bamboo.
6. _____ An animal that is active primarily during the day.
7. _____ This can happen as a result of a tornado, forest fire, or human destruction.
8. _____ An animal that is active primarily at night.
9. _____ This type of community is one that has reached full maturity and cannot develop any further.
10. _____ An animal's rhythm that is dependent on the length of the day.
11. ____ A period of inactivity brought about by cooler temperatures; the animal does NOT wake up during this time for anything.
12. _____ A species that has numerous food sources, such as a great white shark.
13. _____ The movement of organisms into an area.
14. _____ The movement of organisms out of a population.
15. _____ The type of community that would be the first to colonize a new area.
16. _____ Using one organism to try and get rid of another.
17. _____ A period of inactivity in an organism brought about by high temperatures.

a. Primary succession
b. Secondary succession
c. Natality
d. Mortality
e. Immigration
f. Emigration
g. Estivation
h. Hibernation
i. Biodiversity
j. Diurnal
k. Nocturnal
l. Generalized species
m. Pioneer community
n. Climax community
o. Circadian Rhythm
p. Biological control
q. Specialized Species

Short Answer: *Please answer the following in complete sentences.*

1. (4 pts.) Pick two of the alien species in the Great Lakes area and describe why they are "bad."
2. (4 pts.) Explain what happens during migration and why it is considered a type of periodicity.

Name: ________________________

Practical Biology Quiz #7: Population

(18 points)

Fill in the Blank. (1 point each).

1. The number of organisms an area can support is called its ______________ __________.

2. Bacteria in a Petri dish will grow according to a(n) ______________ ______________ curve until they run out of space.

3. Disease is a density- ________________ factor in a population.

4. You as an owl in the carrying capacity lab were competing with other owls for rodent food. This is an example of ______________________ competition.

5. A population of deer out in the wild have a natural carrying capacity, and their population will grow according to a(n) _____________________ curve.

6. During the owl lab, the green "rodents" were harder to find in the grass; this was due to a defense known as ______________________.

7. In nature, poison ivy and poison sumac both have red stems (and branches in the case of sumac) to let others know to stay away from their noxious chemicals. This is an example of ______________ ______________.

8. There are some bright red berries in the forest that are perfectly edible, but most people avoid them because there are others that are bright red and poisonous. The "fakers" are using _________________ mimicry to fool us.

9. The weather is a density- ______________________ factor in a population.

10. In the African savanna, lions and hyenas often go after the same food source. This is an example of ______________________ competition.

11. A honeybee is a ________________ mimic of the wasp (and vice-versa), since both share similar appearance and coloring, and both are capable of stinging.

12. The availability of food, space, water, and shelter, as well as the incidence of disease and predation, are all ___________________ __________________ when it comes to how well a population will grow.

Essay: Answer the following question in complete sentences on the back of the quiz. (6pts.)

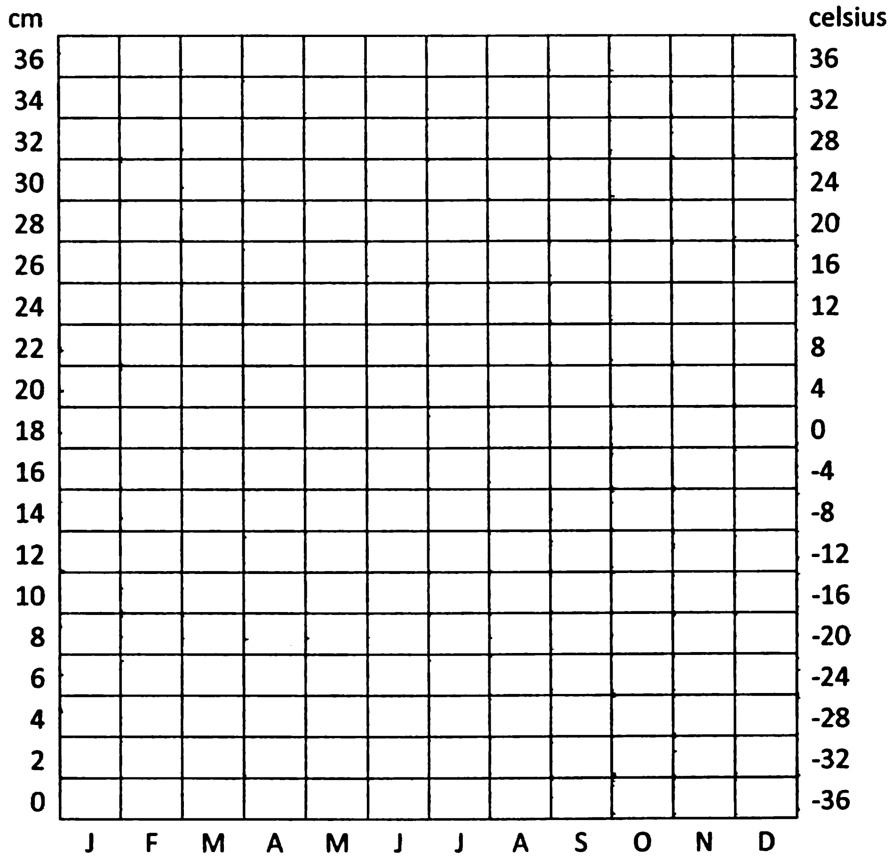
Discuss two things from the "Carrying Capacity Lab: Owls as Predators" activity we did in class that made it difficult to get "rodents." What does each difficulty represent in the wild? How might it affect a real owl population? Make sure you answer ALL parts of the question for full credit!!

Name: ______________________________

Practical Biology Quiz #8: Biomes!

1. Use the following information to plot a climatogram on the graph provided below. (5 pts.)

	J	F	M	A	M	J	J	A	S	O	N	D
T	24.6	25.1	26.4	28.5	30.6	31.9	31.1	30.1	31.1	28.8	26.5	25.1
P	0.8	0.5	1.3	0.5	0.3	0.3	0.0	0.3	0.3	0.3	0.3	0.3



Multiple Choice. Write the correct answer to the left of each question.

Use the climatogram that you drew above to answer the following:

2. _____Looking at the temperature and rainfall of the climatogram, which biome does it best describe?
   a. Desert b. tundra c. tropical rainforest d. deciduous forest
3. _____In which biome would you most likely see a polar bear or an arctic fox?
   a. Deciduous forest b. tropical rainforest c. savanna d. tundra
4. _____ Which of the following biomes is known to have various types of pine trees?
   a. Coniferous forest b. tropical rainforest c. prairie d. tundra
5. _____ Which of the following biomes has trees that lose their leaves in the fall?
   a. Deciduous forest b. coniferous forest c. tropical rainforest d. tundra
6. _____ Which of the following biomes would you most likely see elephants, tigers, giraffes, and zebras?
   a. Deciduous forest b. tropical rainforest c. savanna d. tundra
7. _____ Which of the following biomes would have the most rainfall **AND** have a very warm climate?
   a. Deciduous forest b. tropical rainforest c. tundra d. Chaparral
8. _____ Which of the following biomes would be the most likely to have all four seasons?
   a. Deciduous forest b. tropical rainforest c. tundra d. desert
9. _____ Which of the following biomes has many types of grasses and flowers, but has few trees?
   a. Deciduous forest b. tropical rainforest c. prairie d. desert
10. _____ Which of the following biomes would be located in Africa where you could go on safari?
   a. Deciduous forest b. coniferous forest c. savanna d. tundra
11. _____ Which of the following biomes has many cacti?
   a. Tundra b. prairie c. desert d. savanna
12. _____ Which of the following biomes would have the least rainfall AND have a hot, dry climate?
   a. Tundra b. tropical rainforest c. prairie d. desert
13. _____ Which of the following biomes would have the least rainfall AND have a cold, dry climate?
   a. Tundra b. tropical rainforest c. prairie d. desert
14. _____ Which of the following biomes has the largest biodiversity in the world?
   a. Coniferous forest b. scrub forest c. deciduous forest d. tropical rainforest
15. _____ In which of the biomes would you most likely see rabbits, chipmunks, snakes and lizards all at the same time?
   a. Tundra b. chaparral c. desert d. savanna

Ecology Portfolio: A Final Assessment

This Portfolio will be used as an alternative to the traditional unit test that students would normally take at the end of a unit. Instead, you will pick out a collection of assignments, quizzes, projects, etc. that you think BEST represents what you have learned about ecology. You will be asked to give a brief description of each assignment you choose, reflect on why you chose each piece, list the key words or phrases that you learned about the topic by doing the assignment, and give some tasks that you were able to do as a result of completing the assignment.

To make it a little easier for you, all possible assignments that could be included in the Ecology Portfolio will be listed, and you can pick from those. There will also be a standard format that you can follow to write up each piece so that they all look the same. We will be taking digital pictures of big projects and things done in groups so that they, too, may be included in your portfolio.

It is important to do your best (as you always should ☺) throughout the entire unit on these assignments so that you don't have to rewrite things. You don't want to put sloppy pieces into your portfolio, so do them right the first time!!

You will be producing a final product that you can be proud of- it will allow me to see what you've learned about ecology this year and showcase your best work at the same time. Therefore, you should make sure that you're using in-class time wisely throughout the unit to write up rough drafts, and then all you'll have to do is type up the final copies during our last week.

Your final draft of the Ecology Portfolio is due NOVEMBER 3, 2006.
It will be the final grade of the 1st Marking Period, worth 175 points!

Picking Portfolio Pieces:

Your Ecology Portfolio must contain 10 total focus pieces→

1. Pick 2 from each of the following major topics:
    a. Taxonomy
    b. Ecological Relationships
    c. Nutrient Cycles
    d. Populations
2. Pick 1 from each of these topics:
    a. Introduction to Ecology
    b. Biomes
3. Of the ten that you choose:
    a. 2 must be Quizzes (underlined): ________________ and ________________
    b. 2 must be Homework (HW) or In-class worksheet (Wksht) assignments: ____________________________ and __________________________
    c. 1 must be one of our major projects (denoted by a *): ________________
    d. 5 others of your own choosing

Putting it all together:

Use the following as a checklist for when the final copy of each requirement is done!

Overall Document

___ 1. Cover page:

a. Title _____
b. Name and Teacher's Name_____
c. Subject and Hour _____
d. Date _____
e. Illustration ______

___ 2. Table of Contents

10 total Portfolio Pieces:

1. Pick 2 from each of the following major topics (circle the ones you choose):

______ a. Taxonomy
   i. HW: p. 212 vocabulary and review questions
   ii. HW: Levels of Classification
   iii. Quiz #3: Taxonomy
   iv. HW: Shark Dichotomous Key

______ b. Ecological Relationships
   i. *Community Studies: Food Web Poster*
   ii. Wksht: Ecology Trophic Levels and Energy Flow
   iii. Wksht: Study Skills Worksheet 46-1
   iv. Quiz #4: Symbiotic Relationships and Food Webs

______ c. Nutrient Cycles
   i. Wksht: Water Cycle notes and diagram
   ii. Water Cycle Game
   iii. Wksht: Carbon, Oxygen, and Nitrogen Cycles
   iv. Quiz #5: Nutrient Cycles

______ d. Populations
   i. HW: Chapter 50 and 51.1 Vocabulary
   ii. OH DEER!
   iii. Tree Tops Valley
   iv. Quiz #6: Succession and Alien Species
   v. Population Density Lab
   vi. Owl Carrying Capacity Lab
   vii. Wksht: Critical Thinking Diagram Worksheet 47-1
   viii. Quiz #7: Populations

2. Pick 1 from each of these topics (circle the ones you choose):

_____ a. Introduction to Ecology
   i. Ecology Concept Map
   ii. *Bottle Biology*
   iii. Quiz #2: Life and Introduction to Ecology

_____ b. Biomes
   i. *Traveling to the Biomes*
   ii. Wksht: Climatograms
   iii. Quiz #8: Biomes!

Portfolio Piece Write-Up

1. Title of Assignment should be at the top of the paper
2. Give a brief (2-3 sentences maximum) description of what you were supposed to do for the assignment.
3. Tell the reader your reason for picking this piece. This part should be 3-5 sentences.
   a. Example starters might be: "I chose this piece because…" or "I included this project because…"
4. What are some of the strengths of the piece- what did you do well? What are some things you would redo or could do better of you were to do the assignment over? ("Get a higher score/grade" or "Get more right" doesn't count!)
5. List as many key terms learned or used during this assignment. EVERY assignment has at least 5, and you should try to get 5-10 (especially for larger projects) for each piece.
6. List 3-5 major objectives you accomplished as a result of completing this assignment.
   a. Example:
      Objectives
      As a result of this assignment, I can:
      - Distinguish between biogenesis and spontaneous generation
      - Explain how Pasteur disproved Spontaneous Generation
      - Understand and describe the emergency routes for Room 304
   b. Words to use when writing objectives:

- classify	- analyze	- compare	- design
- explain	- describe	- understand	- distinguish
- calculate	- identify	- demonstrate	- label
- interpret	- contrast	- predict	- discuss
- apply	- illustrate		

The following is a sample write-up. Follow the format, but you may NOT copy it!

Quiz #1: Introduction to Practical Biology

The purpose of this assignment was to assess my knowledge on things taught in the first week of class. Topics covered were: emergency routes, safety procedures, test-taking skills, spontaneous generation, and biogenesis.

I decided to include this quiz because I got an A on it. I studied really hard and made sure I paid attention in class when the teacher was telling us about the safety procedures. I completed the homework assignment on spontaneous generation and biogenesis, and those helped as well.

Some of the things I did really well on the test were the multiple choice and the short answer question where you had to list the steps of cleaning up broken glass. I was able to eliminate wrong answers pretty well on the multiple choice and ended up getting most of them right. I didn't do so well on the explanation of Pasteur's experiment because I didn't use complete sentences. Next time I will be sure to read the directions more carefully.

Key Terms

Biogenesis spontaneous generation safety procedures Safety equipment
emergency route Redi Spallanzani Pasteur Latin

Objectives

As a result of this assignment, I can:
- Distinguish between biogenesis and spontaneous generation
- Explain how Pasteur disproved Spontaneous Generation
- Use my Language of Science Packet to define new words
- Understand and describe the emergency routes for Room 304

Ecology Portfolio Grading Rubric:

Overall: Spelling	>10 errors 0	9-10 errors 1 2	6-8 errors 3 4 5	3-5 errors 6 7 8	0-2 errors 9 10
Overall: Typed	Not Typed 0	Some parts not 1	All typed 2		
Overall: Presentation	Not covered 0	In paper folder, flimsy cover 1	In binder or sheet protector 2		
Cover Page: Title	Don't have it 0	Have it 1	Large print 2		
Cover Page: Name/teacher	Don't have it 0	Have it 1			
Cover Page: Subject/Hour	Don't have it 0	Have it 1			
Cover Page: Date	Don't have it 0	Have it 1			
Cover Page: Illustration	Don't have it 0	Have it 1	Descriptive of topic 2		
Table of Contents	Don't have it 0	Incomplete 1	Complete list 2	Complete list with page #s 3	
Piece 1: Title	Don't have it 0	Have it 1			
Piece 1: Description	Don't have it 0	1 sentence 1	2-3 sentences 2		
Piece 1: Reason	Don't have it 0	1-3 sentences 1	3-5 sentences 2		
Piece 1: Strengths/ Weaknesses	Don't have it 0	"aren't any" 1	Only strength OR weakness 2	Both descriptions 3	
Piece 1: Key Terms	Don't have it 0	1-3 terms 1	3-5 terms 2	>5 terms 3	
Piece 1: Objectives	Don't have it 0	1-2 objectives 1	1-2 with descriptors 2	3-5 objectives 3	3-5 with descriptors 4

Class Notebook Table of Contents

Date	Pg #	Assignment	Score
	1		
	2		
	3		
	4		
	5		
	6		
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	27		

Weekly Assignment Sheet

These will be collected every Monday for the week before.

Directions: As soon as you come to class each day, copy down the day's objectives, the Question of the Day, and the homework assignment. All homework is due the next day unless otherwise indicated. For the Question of the Day, you must write down the QUESTION AND ANSWER. Test and quiz questions can come from the Q of D, and if you only have an answer, you won't know what to study!

Week of:

Monday	Date: Objectives: Question of the Day: Homework:
Tuesday	Date: Objectives: Question of the Day: Homework:

Wednesday	Date: Objectives: Question of the Day: Homework:
Thursday	Date: Objectives: Question of the Day: Homework:
Friday	Date: Objectives: Question of the Day: Homework:

How Can I Do Better In Science Class?

1. **BE ORGANIZED-** Set up a science assignment book, notebook, and folder for keeping papers.
2. **USE YOUR TEXTBOOK-** Read the objectives at the front of each chapter; read the questions and problems at the end of the chapter- be sure that you really understand these and can answer them completely. Now you know what thw author wants you to learn.
3. **PAY ATTENTION TO CONTENT OF ASSIGNMENTS-** What does the teacher want you to take away from the assignment? What terms are in bold? What were the major ideas?
4. **TAKE GOOD NOTES-** If the teacher writes it down, you are expected to know something about it; write down examples that are given- they will often help you remember concepts. When you get home THAT DAY... read through your notes and fill in parts that are not complete, you will not remember all of the details if you wait until test day.
5. **Review each night-** study vocabulary daily. DO NOT WAIT UNTIL THE NIGHT BEFORE TO CRAM FOR TESTS. Doing this only uses your short term memory, and you will not be able to demonstrate a true understanding of the material.
6. **Review with a partner-** read your notes to them to be sure they are understandable. Make flashcards for vocabulary. Quiz each other, practice explaining concepts to each other; you have truly mastered the material when you can explain it to someone else.
7. **Become an Active member of the class-** Follow the lesson. ASK QUESTIONS if you do not understand. Use class time to start homework. Come to class prepared to discuss reading from the night before.
8. **MAKE SURE YOU UNDERSTAND THE PURPOSE OF EACH LAB-** Labs are used to reinforce or demonstrate concepts we are studying… be sure you understand what we are trying to do. You are expected to know what happened in labs.
9. **Use your study sheets-** If the teacher gives you a study sheet, fill it in before we go over it in class. Be sure to correct all answers. STUDY those correct answers. Just because the sheet is filled out does not mean you are finished. Use your work!
10. **STUDY FOR TESTS-** Study noted, study sheets, labs, and homework, Go to the front of the chapter and answer objectives. Go to the end of the chapter and answer questions.

**** USE YOUR RESOURCES- Ask friends to study with you…use the classroom resources…ask the <u>teacher</u> to clear up confusions… seek extra help before/after school…****

Checklist of Study Habits and Test-Taking Skills

While studying for a test, do you:	**Yes**	**No**
- set up a quiet, comfortable area conducive to studying?		
- gather and organize all study materials before beginning the study process?		
- find out exactly what will be covered on the test?		
- find out what kind of test it will be (essay, multiple choice, etc.)?		
- develop a study plan, deciding objectives for each projected study session?		
- look up hard vocabulary words to understand meanings?		
- skim chapter headings to recall the overall ideas in each chapter?		
- reread chapter summaries?		
- review all visual illustrations when studying?		
- space studying over an extended period of time rather than cramming?		
- review previous tests and quizzes to determine test-taking errors?		
- apply memory strategies (pneumonic devices, keywords)?		
During tests, do you:		
- maintain a positive attitude?		
- understand directions before answering questions?		
- identify and carefully use clue words?		
- use strategies such as eliminating wrong answers, etc.?		
- answer easy questions first, difficult last?		
- write answers neatly and legibly?		
- carefully record answers?		
- proofread answers, checking for errors?		

STUDYING
If, after completing this checklist, you realize you have more "no" answers than "yes," you may need to change your studying habits. Use the checklist as a set of guidelines for changing your study behaviors in order to be well prepared for your next test or quiz.

TEST TAKING

Knowing the material and understanding the topics is only half the battle. Some of the brightest students struggle when it comes to taking tests, simply because they've never learned how. Fifty questions in a short amount of time can be quite overwhelming if you're not sure where to begin!! The following page has some strategies for attacking different types of test questions head on→ use them as guides and good luck!

How to Take a Test!

Overall Test-Taking Strategies

1. Read directions and underline key phrases and words; then do the same as you read each question.
2. Answer questions that you are sure of first.
3. Place a check by questions that you are unsure of and skip these.
4. Review a test and check answers after finished.
5. Place an "X" on pages that you have reviewed so you do not waste time.
6. Find out the following before test day:
   a. What is on the test?
   b. What was on the previous test?
   c. Set up and follow study procedures.
   d. Know the test terms
   e. Develop a positive mental attitude

Different Kinds of Questions on a Test

Multiple Choice

1. Formulate an answer after reading the questions and *before* reading the answers.
2. Read each answer as though it were true or false.
3. Draw a line through inappropriate answers.
4. Know the rules of grammar, such as when to use "a" and "an" to determine if the answer will begin with a vowel or consonant sound.
5. Use other questions in the test as clues.

Matching

1. Begin with the first term in the column and scan the other column for the answer.
2. Write the answer in the blank and cross off that choice in your answer column.
3. Skip terms or items that you are unsure of and return to them after all questions are answered.

True or False

1. Become familiar with the vocabulary of these questions: all, some, never, always, every, none, sometimes.
2. Look at all parts of the questions; all parts must be accurate to be true.
3. Use other questions on the test as cues to possible answers.

Essay

1. Develop a rough outline and verbalize thoughts while studying.
2. Develop a key-points outline, put main ideas in order, and then fill in the facts.
3. Answer an opinion questions with the way you feel about the questions.

Name: ________________________
Date: _______________ Pg: _____

What is Life?

How do you determine if something is living, dead, or never alive? All living things tend to share the same or similar fundamental characteristics. These characteristics of life are used to determine if something is living or not living.

Think about characteristics that are common to all living things. Answer the following questions before beginning the lab.

1. List as many processes as you can that occur while an organism is alive but stop when it is dead.

2. Two groups of living organisms are called plants and animals. List a few ways in which life activities differ between plants and animals.

3. How does an organism's growth compare to the growth of an icicle?

Procedure:
In a certain area outside pick out ten specimens to observe. Of the specimens that you choose, try to find things that for all the life categories (living, dead, and never alive). As you look at each specimen, ask yourself if it has some or all of the characteristics of a living organism.

Record any characteristics you observe that would classify each specimen as living or no-living in the data table on the back of this sheet. Also indicate which category of life you would classify the object.

LIFE CATEGORIES: LIVING
DEAD BUT ONCE ALIVE
NEVER ALIVE/NON-LIVING

Specimen	Life Category	Characteristics
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

What is Ecology?

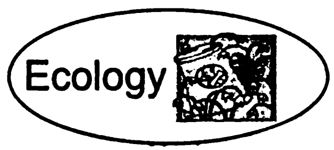
★Ecology means the study of ____

★That's great, but what do ecologists do? How is it used in the real world?

Procedure:

1. Think of things in the news, movies, or T.V. shows that you think are ecology related topics. Brainstorm topics with the people around you and write them on a scrap piece of paper.

2. Below, put the topics together that you just brainstormed into a concept map. Use words, drawing, and symbols to illustrate your topics, and link related ones with lines. When you're finished, add color to your drawings and symbols. Be creative!



Name: ____________________

Bottle Biology: An Ecosystem in a Bottle.

**All ideas borrowed from Bottle Biology, Second Edition, developed by the Department of Plant Pathology, University of Wisconsin-Madison. For more ideas, go to www.bottlebiology.org **

Purpose:

1. To observe changes in an ecosystem contained in the classroom.
2. To practice comparing variables in a scientific setting.
3. To use everyday materials in constructing a smaller version of a large ecosystem.

Materials:

This really depends on what type of bottle you decide to build, but everyone will need some of the following things from the classroom: **clear book-binding tape, Bunsen burner, probe, scissors, razor blade, heavy cotton string or felt, fillers for your column.** Once you have decided on a project, list the additional materials you will need below:

______________________ ______________________

______________________ ______________________

______________________ ______________________

______________________ ______________________

______________________ ______________________

Procedure:

1. In groups of two or three, decide what type of Biobottle you would like to make. (Each individual needs to fill out a handout, though.) You may choose one from the packets of directions the teacher has, or you can just use them as guidelines and come up with your own.
2. Get together with another group that wants to do the same kind of bottle and figure out an experiment you could do together. Example: Try 2 Terraqua columns, one with store bought materials and one with outside materials. See which one does better over the course of the unit.
3. Once you have decided what you will compare, make your own individual hypothesis and write it here (remember not to say "I think.").
   Hypothesis:
   ____
4. Completely read through ALL the directions for constructing your Biobottle. Decide who will be responsible for each thing that you need, and then put that person's initials next to it on your list of materials→ don't forget to bring in your own bottles!
5. Once you have collected your materials, follow the directions given to you by the teacher for your particular column. Pay attention to any notes written in on the directions by the teacher, because she's done all of these before!
6. After construction and filling of your Biobottle is complete, set it up in the back of the classroom to be observed for the remainder of the ecology unit. Be sure that

your bottle is secure and won't tip over; they tend to get top-heavy. Take a "before" picture of your Biobottle when it's ready to go.

7. Make an observation chart for yourself to keep track of your Biobottle's progress. Make sure you write something down for every day we have class until the end of the ecology unit. If your bottle needs to be watered, be sure that you do that- don't let yourself be the reason your Biobottle "didn't work." It might be a good idea to take a picture of you column once a week to document your progress as well.
8. At the conclusion of the unit, several things need to happen:
    a. Take an "after" picture of your Biobottle.
    b. Make a final observation and determine if your hypothesis was correct.
    c. Decide whether or not you want to keep your column going and make arrangements for that.
9. Clean up!! ☺

Safety:

1. Be careful when using razor blades. Only use them to make an initial cut into the bottle and then use scissors for the rest.
2. Tie back long hair and roll up long sleeves when using the Bunsen burner.
3. Try to make all your holes at once so you can turn the burner off when you're done. Melting plastic doesn't smell good- open a window or make your holes in a fume hood so you don't inhale noxious odors.

Observations/Data:

Use a separate piece of paper for you day-to-day observations. Be sure to attach photographs of your Biobottle as it progresses!

Conclusion:

Write a short paragraph here that summarizes your experiment. Be sure to include whether or not your hypothesis was correct along with any reasoning you may have for that. Also, if anything went wrong during the course of the experiment, this is the place to explain that.

____

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Taxonomy: The Classification of Living Things

Aristotle- Greek philosopher, over _______________ ago, developed a classification for plants and animals. Split plants into three groups: herbs with soft stems, shrubs with several woody stems, and trees with a single woody stem. He divided animals into ___________ dwellers, ___________ dwellers, and _______________ dwellers.

Carolus Linnaeus- 18th century Swedish botanist who set up a classification system based on *structural similarity*.

Human Classification

Kingdom- highest level: ___________________

Phylum (Division in plants)- __________________

Class- ________________________

Order- ________________________

Family- ________________________

Genus (plural genera)- ___________________

Species (plural species)- ___________________

Binomial Nomenclature- System of naming organisms; first name= genus, second name= species. This is written in italics, with the genus name capitalized. If it is handwritten, the genus I still capitalized, and the whole name is underlined.

Ex. *Homo sapiens* or (handwritten):

Vocabulary:

Eukaryote- a cell that has a ____________________ and other membrane- bound _______________ like chloroplasts and mitochondria (we'll learn about these later ☺).

Prokaryote- a cell that has _____ ____________ or other membrane-bound organelles- all the "stuff" in the cell is just randomly throughout.

Autotroph- an organism that ____.

Heterotroph- an organism that gets its food from ______________________________.

Unicellular- made up of __________ cell

Multicellular- made up of ____________ cells

Terrestrial- ________________________________

Aquatic- ___________________________________

Sexual Reproduction- males and females must mate, and _________________________ unite for reproduction to take place.

Asexual Reproduction- reproduction is possible ________________________; the organism can reproduce on its own.

Kingdoms

BACTERIA: ALL bacteria are ________________. They are unicellular and obtain their nutrients mainly through __________________. They live in terrestrial and aquatic habitats, and are divided into two kingdoms→

Archaebacteria: ______________ bacteria that live in ______________ conditions like deep-sea vents, _________________________, and hot springs.

Eubacteria: most bacteria are in this kingdom; __________ bacteria living virtually everywhere!

Protista: made up of ____________ organisms that can be unicellular, _______________, or multicellular. They lack specialized __________ systems and obtain their food by absorption, ingestion, or ___________________. They reproduce sexually or asexually.

Fungi: made up of ________________ unicellular and multicellular ______________ organisms. Fungi absorb their nutrients rather than ingesting them. Most species are terrestrial, and they reproduce ________________.

Plantae: make up of ________________ eukaryotic ____________________ organisms, most of which are _______________. They can reproduce sexually or asexually.

Animalia: made up of multicellular ____________________ heterotrophic organisms that obtain nutrients by ________________ food. They are terrestrial and aquatic, and most reproduce _____________________ (though they are some that can reproduce asexually).

Food Webs and Symbiotic Relationships

food chain: the transfer of the sun's ____________ through many organisms

food web: a system of __________________ existing within an ________________

herbivores: heterotrophs that feed on _________________

carnivores: ________________ that feed on other _________________ (meat)

___________________: organisms that eat both plants and animals

scavengers: an animal that feeds on __________ organisms; eats ______________

decomposers/saprobes: an organism that helps _____________________ dead organisms and _______________ their nutrients

symbiotic relationship: a relationship that exists between two _______________, typically between two ______________ species.

parasitism: a relationship in which one organism (______________) obtains its nutrients at the expense of another (_______), but usually doesn't ______ it (+/-)

Example: flea on a dog; tick on a deer

mutualism: a relationship between two species in which both ________________ from living together (+/+)

Example: barnacles on a whale, shark and remora

commensalism: a relationship where one organism _________________ and the other is ____________________ (+/o)

Example: bird nesting in a tree; algae riding on a turtle's back

__________________: the use of or defense of a resource by one individual that reduces the availability of the resource to the other individual

Example: two owls fighting over who gets a mouse for dinner

Predation (predator/prey): the type of interaction in which one animal (_____________________) seizes another animal (_________) and it is for food.

Example: lion killing and eating a zebra

Community Studies

Make a poster of a food web→ choose from the following organisms, and show them in the correct producer/consumer relationships. Cut out pictures from magazines if possible, and draw something in if you can't find it.

Rules:

- You must have at least 5 food chains within the web.
- You must have at least two 4-creature food chains.
- You must have a scavenger and a decomposer.
- Label each organism as a producer, herbivore, carnivore, omnivore, scavenger, or decomposer.

green algae	frog	mold	raccoon
bacteria	grass	mountain lion	rose
black bear	hawk	mushrooms	turkey vulture
cardinal	human	opossum	snake
coyote	grasshopper	owl	sparrow
deer	maple tree	petunia	wolf
fox	mice	rabbits	woodchuck

Don't forget to take a picture of your food web for your portfolio!! ☺

Check out the back of this worksheet for the grading rubric. Make sure you make a nice, neat, legible poster that meets all the requirements for a good grade!!

Making a Poster: Community Studies

Teacher Name: **Ms. Kopinski**

Student Name: ______________________________

CATEGORY	4	3	2	1
Title	Title can be read from 6ft. away and is quite creative	Title can be read from 6ft. away and describes content well.	Title can be read from 4ft. away and describes content well	The title is too small and/or does not describe the content of the poster well.
Label Clarity and Size	All items of importance on the poster are clearly labeled with labels that can be read from at least 3ft. away	Almost all items of importance on the poster are clearly labeled with labels that can be read from at least 3ft. away	Several items of importance on the poster are clearly labeled with labels that can be read from at least 3ft. away	Labels are too small to view OR no important items were labeled.
Labels-accurate	All the organisms are labeled correctly and in the right spot on the food web; arrows going the right direction.	Most of the organisms are labeled correctly and in the right spot on the food web; OR arrows going the wrong direction.	Some of the organisms are labeled correctly and in the right spot on the food web; arrows might be going the right direction.	Less than half of the organisms are labeled correctly or in the right spot on the food web; arrows going the right or wrong direction.
Number of Food Chains	Has five (or more) food chains	Has four food chains.	Has three food chains.	Has one or two food chains
Type of Food Chains		Has two food chains with 4 organisms.	Has one food chain with 4 organisms.	Has no 4-organism food chains.
Scavenger/ Decomposer		Has a scavenger AND a decomposer	Has a scavenger OR a decomposer	Has neither.
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. It is not attractive.

Date Created: **Jun 30, 2006 12:37 pm (CDT)**

Ecology Trophic Levels and Energy Flow

producers: organisms that make their own food

primary consumers: 1st level is an herbivore

secondary consumers: 2nd level is a carnivore

tertiary consumers: 3rd level consumers, typically "top carnivores" with no natural predators

Biomass: the amount of matter that is living

Productivity: the amount of energy that is accumulated in an ecosystem

Law of Conservation of Energy (and Matter): Energy (Matter) cannot be created nor destroyed; it can only be changed.

ENERGY

The SUN is the ultimate source of energy for almost all organisms on Earth.

Ex.

Plants and green algae convert solar energy to chemical energy (stored in SUGARS) during PHOTOSYNTHESIS

This makes them AUTOTROPHS/PRODUCERS because they are able to capture and change their own energy.

HETEROTROPHS/CONSUMERS have to eat other organisms because they cannot capture energy in this way.

ENERGY FLOWS FROM THE SUN TO PRODUCERS TO CONSUMERS TO DECOMPOSERS AND BACK TO PRODUCERS

PYRAMID MODEL OF ENERGY FLOW:

ENERGY is LOST at each step of a food chain (trophic level), most is lost as heat during RESPIRATION (breakdown of food inside organisms)
***p. 730 in your book**

Water Cycle Vocabulary

____________________- the area of land that guides water through small streams toward a major stream or river.

____________________- release of water vapor through stomata in plants

____________________- molecules at the *surface* of the water have enough energy to escape the liquid and turn to vapor.

____________________- water vapor loses energy and turns to liquid

____________________- rain, sleet, hail, snow→ forms of water falling from the sky

____________________- slow movement of water downward through rock

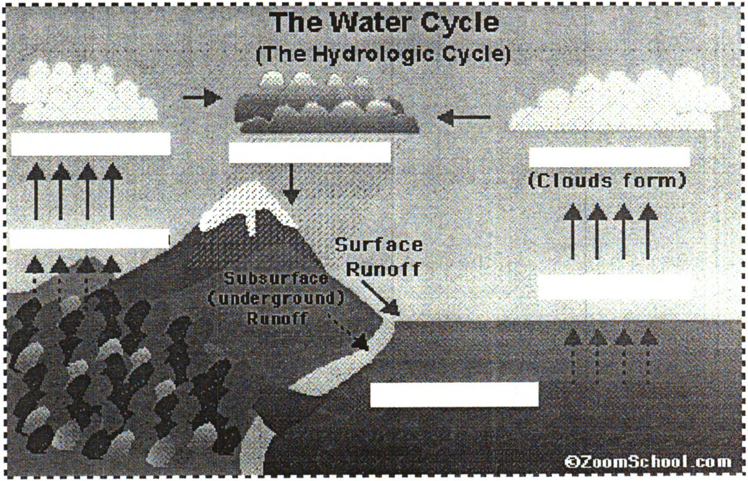
____________________- slow downward movement of water through layers of soil

____________________- exchange of gases in the lungs, gills, etc., which includes exhaling water vapor

____________________- getting rid of waste!

<u>Instructions: Fill in the white boxes at each step of the water cycle with the correct term.</u>

<u>List of terms to use</u>: precipitation, evaporation, transpiration, collection, condensation (2)



<u>Diagram from:</u>

Col, Jeananda. Enchanted Learning. http://www.EnchantedLearning.com, 1998.

Chapter 50 and 51.1 Vocabulary: Introduction to Population Growth

****Those with a star are not in your book- we will define them in class*****

Biotic community-

Habitat-

Niche-

*Specialized species-

*Generalized species-

Diurnal-

Nocturnal-

Periodicity-

Rhythmic type-

Circadian rhythm-

Tidal rhythm-

Annual rhythm-

Hibernation (give conditions too)-

Torpor-

Estivation-

Migration-

*Natality-

*Mortality-

*Immigration-

*Emigration-

Succession-

Primary succession-

*Secondary succession-

Pioneer (species)-

*Climax (species)-

*Climax community-

Invasion of : Alien Species

- In the history of the United States, approximately 50,000 non-indigenous (non-native) species are estimated to have been introduced into the United States.
- Introduced species, such as corn, wheat, rice, and other food crops, and cattle, poultry, and other livestock, now provide more than 98% of the U.S. food system at a value of approximately $800 billion per year (USBC 1998).
- Other exotic species have been introduced for landscape restoration, biological pest control, sport, pets, and food processing.
- Some alien species, however, have caused major losses in agriculture, forestry, and several other segments of the U.S. economy, in addition to harming the environment. One recent study reported approximately $97 billion in damages from 79 exotic species during the period from 1906 to 1991.

- Invading non-indigenous species in the United States cause major environmental damages and losses adding up to more than $138 billion per year.
- There are approximately 50,000 foreign species and the number is increasing. About 42% of the species on the Threatened or Endangered species lists are at risk primarily because of non-indigenous species.
- In other regions of the world, as many as 80% of the endangered species are threatened due to the pressures of non-native species (Armstrong 1995). Many other species worldwide that are not listed are also negatively affected by alien species.

David Pimentel, Lori Lach, Rodolfo Zuniga, and Doug Morrison
College of Agriculture and Life Sciences
Cornell University
Ithaca, NY 14850-0901
June 12, 1999

Alien Species around Michigan:

The BIG ONES:

Water Hyacinth	Garlic Mustard
Zebra Mussels	Emerald Ash Bore
Gypsy Moth	Purple Loosestrife

Lesser Known:

Starlings	Ringneck Pheasant
Canada Thistle	Chestnut Blight
Dutch Elm Disease	

The BIG ONES

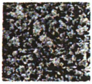
- Water Hyacinth
- Garlic Mustard
- Zebra Mussels
- Emerald Ash Borer
- Purple Loosestrife
- Gypsy Moth

Water Hyacinth

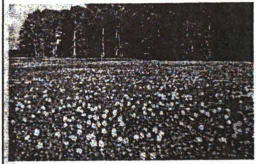
Water hyacinth is a plant that grows chiefly in the tropical regions of the world. It floats on lakes, rivers, and swamps and grows to a height of about 2 feet (61 centimeters) above the water. The water hyacinth has as many as 38 purple flowers grouped around the top of the stem.

Diseases and insects control the growth of water hyacinths in South America, where the plants first grew. But in the Southern United States and other regions where people have introduced the plant, there are no natural controls on its growth. In those regions, water hyacinths are a serious environmental problem because they grow so fast.

The plants may double in number every 10 days. They form floating mats that can cover entire water surfaces and destroy the plant and animal life below. Plants need sunlight to live, and fish must have oxygen. The thick growth of water hyacinths blocks the sunlight, and the roots of the plants use up the oxygen in the water. In addition, boats cannot travel on waterways that are choked with water hyacinths.



Many scientists are exploring possible uses of water hyacinths. In the early 1970's, researchers began the experimental use of the plants to clean up polluted streams. Water hyacinths can absorb many chemicals–including sewage and industrial wastes–from the water in which the plants grow. Thus, polluted water might be purified by passing it through tanks that contain water hyacinths. Other people are studying the possibility of making cattle feed from dried water hyacinths.



Garlic Mustard

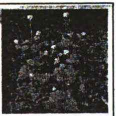
The leaves of garlic mustard give off a distinctive odor of garlic, and the plant was probably introduced from Europe (where it is a native) by early settlers who were looking for a good source of salad greens. Garlic mustard is a cool-season plant and grows best in moderate to deep shade. It gets an early start in the spring, and makes so much shade that native wildflowers cannot thrive. The first victims of garlic mustard are therefore spring ephemerals such as trillium, bloodroot, Jacob's ladder, and wild geranium.

Invasive Plants Association of Wisconsin
www.ipaw.org/invaders/garlic_mustard/gm.htm

The seeds are sticky and readily attach themselves to animal fur, shoes, auto tires, etc. The plant is rapidly spread by human activity, as well as by animals. Within a few years, garlic mustard can become dominant on the forest floor, shading out all native plants.

Even worse, garlic mustard forms lots of seeds, and these seeds can remain alive in the soil for as much as five years. Thus, killing or removing the living garlic mustard plants does not stop the infestation. More plants will arise next year from the plentiful "seed bank."

Invasive Plants Association of Wisconsin
www.ipaw.org/invaders/garlic_mustard/gm.htm



Small infestations can be readily controlled by pulling second year plants by hand. The best time to pull plants is when they have just started flowering, but before any seeds have been made. Pulling works best if the soil is moist, after a rain. Be sure to pull all the roots out, because roots left in the ground can resprout and form new plants. It is best to put all flowering plants in bags and remove them from the property, because plants that are pulled and laid on the soil may go ahead and set seed. Do not place garlic mustard plants in compost or any other vegetative material, where the seeds might remain alive. Put the bags in a landfill, where they will be immediately buried.

Invasive Plants Association of Wisconsin
www.ipaw.org/invaders/garlic_mustard/gm.htm

The key to garlic mustard control is to attack early, before it has a chance to become widespread. If the woods are already infested, be prepared for a long battle. However, this battle can be won! It just takes time and persistence. Garlic mustard control is a multi-year project. Don't forget the seed bank. Just because this year's crop has been removed does not mean that your work is finished. Be prepared to come back next year, and the next, and the next, until "finally" the area is under control.

Invasive Plants Association of Wisconsin
www.ipaw.org/invaders/garlic_mustard/gm.htm

Zebra Mussels

The zebra mussel is a freshwater bivalve that invaded the Great Lakes about 1986.

Individuals are less than 2 - 3 cm in length and often have a "zebra-striped" coloration that gives them their name. They attach to other mussels (as in this view) and other hard surfaces with adhesive threads (byssal threads).

The Zebra mussel is a freshwater, Eurasian shellfish that is a major pest in North America. They cover boat bottoms, piers, fish traps and nets, and marker and navigation buoys. In addition, zebra mussels cover native freshwater mussels and smother them, resulting in the elimination of native mussels from some regions. The explosive growth of zebra mussels may threaten the food supply of many species of fish and shellfish native to the Great Lakes.

Zebra mussels are native to the area around the Caspian and Black seas. They were first found in North America in 1987. Their larvae had been unintentionally released into the Great Lakes in ballast water (the water kept in the hold of a ship to keep the vessel stable). By 1994, zebra mussels had spread to all the Great Lakes, the Hudson and Mississippi rivers, and the Arkansas River as far west as Oklahoma. Biologists believe they eventually will spread to more than half the lakes and rivers of North America.

Zebra mussels first appeared in Lake St. Clair (yellow star, north of Lake Erie), from a ship's ballast water from the Black Sea region. They rapidly spread downstream with the current, and upstream and to other watersheds on boats.

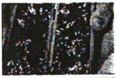
Anchored by their adhesive byssal threads, zebra mussels often live together in very high densities. This allows for a greater chance of successful fertilization. The mussels are open most of the day filtering surrounding water for food.

They are remarkable water filters. When water fowl birds eat zebra mussels the result is elevated levels of contaminants in the birds which leads to reproductive problems. Some people view their water filtration abilities also as a con.

Zebra Mussel Frequently Asked Questions
by Jeffrey L. Ram, Ph.D., Wayne State University

Zebra mussels also attach to other organisms, such as these native (North American) mussels from Lake Erie. Heavy loads of zebra mussels have killed essentially all native Unionid mussels in western Lake Erie, an early site of the zebra mussel invasion.

Zebra mussels are a pest organism because they not only attach to one another, but also to man-made objects, including water intakes and other plumbing of water, power, and other companies that use fresh water. This picture illustrates how mussels have caused a complete blockage of a pipe.



How do we get rid of them??

Predation due to water fowl could control the populations; however, predation would be limited to the warmer months when the Great Lakes are not frozen over,plus the birds would continue to have reproductive problems.

Usually in power and water plants, chemical treatments such as chlorine have been used; however, there are environmental problems associated with this since high levels can produce carcinogenic organic side products.

High temperature recirculated water works (e.g. in a power plant) but depends on the original design engineering taking those temperatures into account (e.g. you might not be able to do it in certain parts of a nuclear power plant).

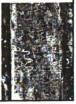
Zebra Mussel Frequently Asked Questions
by Jeffrey L. Ram, Ph.D., Wayne State University

It's the larvae that actually causes all the damage. It lives under the bark of the ash trees and makes tunnels that destroy the tree tissue.

Emerald Ash Borer

Emerald Ash Borer (EAB) is an aggressive wood borer that attacks and kills all species of ash. Although stressed trees are always more prone to borer attack, evidence from Michigan suggests healthy well maintained trees are also killed by this beetle.

The are a several symptoms seen in trees attacked by the Emerald Ash Borer. Initial damage appears as thinning and dieback in the upper canopy of the tree as larvae feed under the bark they damage the conductive tissue. Trees will often show dead branches in the top portion of the tree. Excessive amounts of green shoots (suckering) may appear on the lower trunk. Because there are other problems that cause die-back and death on ash trees, you MUST look further to confirm. Peel bark away look for S-shaped tunnels that snake around under the bark in a serpentine manner.

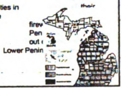


The Michigan Departments of Agriculture and Natural Resources, U.S. Department of Agriculture–APHIS and Forest Service, Michigan State University and other state and federal agencies are actively working to contain and halt the spread of the Emerald Ash Borer (EAB) in our state.

Help protect Michigan's natural resources by following these firewood recommendations: BUY IT, BURN IT, LEAVE IT! Buy firewood when you reach your destination, burn firewood on site, and leave unused firewood behind.

Michigan's quarantine contains 21 counties in entirety and 31 outlier sites. In response of these outlier sites, hardwood WITHIN Michigan's Lower restricted and movement areas and out of the

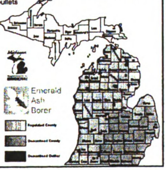
their firew Pen out Lower Penin



Please use the following bullets in combination with Michigan's EAB quarantine map to ensure compliance with state restrictions.

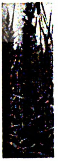
*All hardwood firewood movement from the 21 quarantine counties and 31 outliers is prohibited.

*All hardwood firewood movement from Michigan's entire Lower Peninsula into the Upper Peninsula, other states, or Canada is prohibited.



Purple Loosestrife

Purple loosestrife is a common species in the loosestrife family. It is a tall plant with purple or reddish flowers. It spreads rapidly and is a troublesome weed in the northeastern and north-central parts of the United States. In some states, it is illegal to plant or sell purple loosestrife. It arrived in eastern North America in the early 1800's. Plants were brought to North America by settlers for their flower gardens, and seeds were present in the ballast holds of European ships that used soil to weigh down the vessels for stability on the ocean.



Purple loosestrife is a very hardy perennial which can rapidly degrade wetlands, diminishing their value for wildlife habitat. Wetlands are the most biologically diverse, productive component of our ecosystem. Hundreds of species of plants, birds, mammals, reptiles, insects, fish and amphibians rely on healthy wetland habitat for their survival.

However, when purple loosestrife gets a foothold, the habitat where fish and wildlife feed, seek shelter, reproduce and rear young, quickly becomes choked under a sea of purple flowers.

An estimated 190,000 hectares of wetlands, marshes, pastures and meadows are affected in North America each year, with an economic impact of millions of dollars.

Controlling the spread of purple loosestrife is crucial to protecting vital fish, wildlife and native plant habitat! Purple loosestrife can easily spread if improper control methods are used.

Estimate the size and density of the infestation, and then choose one or more appropriate loosestrife control options. In areas too heavily infested to pull, cut, or dig plants, these control techniques can still be used to control plants that may sprout as a result of seeds escaping the area. Watch drainage ditches or streams leading from heavily infested areas, as new purple loosestrife colonies are likely to become established there. Pulling, cutting or digging plants in these more manageable infestations will limit the spread of purple loosestrife beyond the area of heavy infestation.

Biological Control

When a plant from one continent is introduced to another, it usually leaves behind the natural enemies that help prevent population explosions where it normally grows. The purpose of biological control is to reunite a plant with its natural enemies.

The aggressive spread of purple loosestrife across North America prompted the consideration of biological control in the battle against this invader. Obviously,extreme caution must be taken when introducing one organism to control another. Prior to any introduction of a biological control agent, intensive testing is conducted to ensure that a safe and effective agent is selected.

There is a type of beetle that eats Purple Loosestrife and ONLY Purple Loosestrife, which is good. The Purple Loosestrife Project let schools order beetles, raise them, and then release them in areas infested by Purple Loosestrife.

Unfortunately, due to budget cuts, we can no longer order the beetles from the lab in Michigan, and for all the good intentions the PLP has come to an abrupt stop.

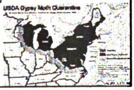
Gypsy Moth

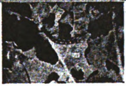
The gypsy moth is a leaf-eating insect belonging to the insect order lepidoptera which includes butterflies and moths. Ranked as America's single most destructive pest of trees and shrubs, it was brought to Massachusetts from Europe in 1869 as part of a failed attempt to breed a hardier silk worm. The insect escaped and headed for the trees with disastrous effects.

Female gypsy moths cannot fly and have the habit of depositing their eggs on objects near the trees on which they were feeding as caterpillars. These objects might be picnic tables, car wheel wells, grills or any outdoor household article or lawn ornament. When these objects are moved from an infested area, the gypsy moth eggs "hitchhike" into other areas, hence the name gypsy moth.

The United States government realized early on that this insect would be a serious problem. In the early 1900s, a federal quarantine was placed on all trees in the infested area. Since the female moth cannot fly and the larvae can only move a few miles on the wind, the quarantine kept the moth isolated to the northeast United States for decades.

But with a helping hand from people, the moth has expanded its territory in recent years, from western Pennsylvania all the way through Ohio, Michigan and Illinois, and into central Wisconsin. Because of the way the moth deposits eggs, people camping in infested areas during prime laying periods (July through August) are particularly carrying the pest camping gear or even wells of their cars.





Gypsy moth caterpillars are ferocious eaters. One caterpillar can eat up to one square meter of vegetation during its development. When these caterpillars congregate on trees, they can eat all the leaves on an adult tree in a matter of days, leaving that tree weak and susceptible to diseases and other insects. In northeastern states, gypsy moth caterpillars have been known to defoliate entire forests. When gypsy moth becomes established, property values can decrease, large sums of money are spent by state and federal governments to control it, and much of the beauty of the natural forested landscape is threatened or lost.

Minnesota Department of Agriculture, 625 Robert Street North, Saint Paul, Minnesota
webinfo@mda.state.mn.us

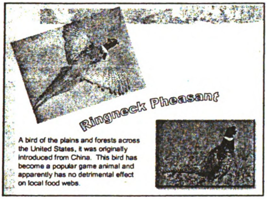
The Lesser Known

- Starlings
- Ringneck Pheasant
- Canada Thistle
- Chestnut Blight
- Dutch Elm Disease

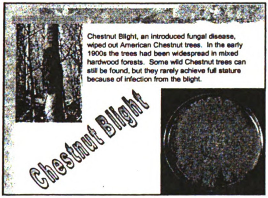
Starlings were introduced from Europe in 1890 by a drug manufacturer. Eugene Scheifflin let 40 pairs of starlings go in New York's Central Park, because he wanted to establish in this country every bird species mentioned by Shakespeare.

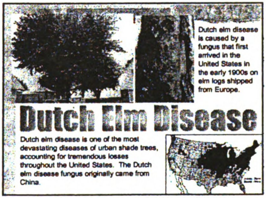
Starlings

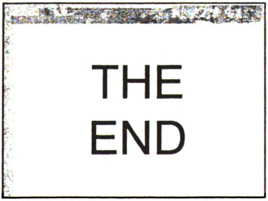
Starlings are now established throughout North America and often considered pests.


Ringneck Pheasant
A bird of the plains and forests across the United States, it was originally introduced from China. This bird has become a popular game animal and apparently has no detrimental effect on local food webs.


Canada Thistle
It is a native of Eurasia, first appearing in Canada 200 years ago. It is now one of the most prevalent weeds in the Northern United States.


Chestnut Blight, an introduced fungal disease, wiped out American Chestnut trees. In the early 1900s the trees had been widespread in mixed hardwood forests. Some wild Chestnut trees can still be found, but they rarely achieve full stature because of infection from the blight.
Chestnut Blight


Dutch elm disease is caused by a fungus that first arrived in the United States in the early 1900s on elm logs shipped from Europe.
Dutch Elm Disease
Dutch elm disease is one of the most devastating diseases of urban shade trees, accounting for tremendous losses throughout the United States. The Dutch elm disease fungus originally came from China.


THE
END

RESOURCES AND CARRYING CAPACITY LAB: OWLS AS PREDATORS

INTRODUCTION

All organisms require certain things for their existence. Food, water, cover, and living space are necessary for animals to live. The environment in which the animal is living, that is, its habitat, must supply these resources. Because of limited supplies of resources, a habitat can only support a certain number of animals. This number is called the environment's carrying capacity.

Fortunately, different species of animals are able to take advantage of different kinds of food, thus the environment is able to support a much greater number of animals than if they all ate the same food. For example, in a forest you may find birds that eat seeds and berries, birds that eat worms and grubs, birds eating insects, birds that eat meat and so on. In each of these cases, the birds have different roles in the ecosystem food web; this role is known as the animal's niche.

The owl is a woodland predator that feeds on small animals. The number of owls an ecosystem can support is determined by the amount of food available for the owls to eat. Thus, the carrying capacity of the habitat for owls is directly related to the availability of small animals for food.

To demonstrate this principle, each class member will become part of an owl family, and will be responsible for feeding the family members.

PROCEDURE:

1. Each class member will be assigned a family group. Each cup represents a member of the family. Some families will have two parents and offspring, while others will have only one parent to feed the offspring. Additional factors may come into play and the teacher will explain these. (Some owls may be missing a foot or some talons.)
2. The food you will gather is rodents, represented by M&Ms candy. Class members will gather the M&Ms using forks, which represent the owl's claws. A minimum number of rodents are necessary to prevent starvation, but this number will be revealed only after the hunt is over. In addition, the rodents must be evenly distributed among family members. When hunting, you may carry only one M&M at a time on the fork. If you drop the M&M, you must get another.
3. After the hunt is over, data must be collected and recorded in Table I (one per family). Information to be written down includes the total amount of rodents eaten by each family member, as well as the colors eaten by each.
4. Data from all the different families is next collected and entered into Tables II and III. From this information, you will be able to compute the survival rates for the owl population. To determine the rate of survival, divide the number of surviving owls by the original number of owls in each family.

DATA ANALYSIS:

Using the data collected on Tables I, II and III, answer the following questions.

Rodent Population:

1. How many rodents did the owls eat? ________
2. How many rodents survived predation? __________

Owl Population:

1. How large was the initial owl population? ____________
2. How many owls were killed by starvation? ___________
3. How many owls were killed by contamination? _________
4. How many owls survived? ___________

CONCLUSION QUESTIONS:

1. Did the number of adults in the family influence the number of fledglings that survived? What evidence do you have to support your answer?

2. Did the owl with the broken claw provide for its family as well as the owls without this condition? What is the evidence to support your conclusion?

3. Did the number of fledglings in each family influence the survival rate in the family? What evidence would support this answer?

4. If we had played his game with only 100 rodents, would this have influenced the outcome? Explain your answer.

5. In the natural environment, the number of rodents and owls in a given area stays relatively the same from generation to generation instead of "dying out." Explain why this happens.

6. How do humans and their activities influence the populations of owls?

7. A beetle enters the forest where the owls are nesting. The beetle carries a fungus that destroys the trees where the owls build their nests. Predict how this event may influence the populations of the owls and rodents in this area.

TABLE #1

FAMILY #________(# OF ADULTS______# OF FLEDGLINGS______)

RODENTS EATEN

COLOR	MALE	FEMALE	F-1	F-2	F-3	F-4	F-5	F-6	F-7	TOTAL
red										
orange										
yellow										
green										
blue										
brown										
TOTAL										

THE TOTAL NUMBER OF RODENTS EATEN BY THE FAMILY IS ________
THE AVERAGE NUMBER OF RODENT EATEN PER OWL IS ______
THE AVERAGE NUMBER OF COLOR 1 RODENTS EATEN/OWL IS ______
THE AVERAGE NUMBER OF COLOR 2 RODENTS EATEN/OWL IS ______
THE AVERAGE NUMBER OF COLOR 3 RODENTS EATEN/OWL IS ______
THE AVERAGE NUMBER OF COLOR 4 RODENTS EATEN/OWL IS ______
THE AVERAGE NUMBER OF COLOR 5 RODENTS EATEN/OWL IS ______

TABLE #2

FAMILY #	NUMBER OF RODENTS EATEN
1	
2	
3	
4	
5	

FAMILY #	NUMBER OF RODENTS EATEN
6	
7	
8	
9	
10	

TOTAL RODENTS EATEN _________

Traveling to the Biomes

You are travel agents that are trying to sell your vacations. Your job is to create a poster in the format of a travel brochure for an adventuresome trip to a particular biome! For example, you can search for bears and moose in the cold tundra or go on safari in the savanna! Remember you are trying to persuade your audience that these are the places they *have* to go for a good time, so be colorful and creative!

You will be assigned one of the following biomes (circle yours):

Tundra	Coniferous Forest (Taiga)
Deciduous Forest	Tropical Rainforest
Desert	Savanna
Prairie (Temperate Grassland)	Chaparral (Scrub Forest)

Your poster must include the following:

1. Pictures that clearly show what the biome looks like.
2. Description of the climate and give recommendations on what to pack on their trip.
3. Provide a climatogram for the biome (on a separate sheet of graph, attached to the poster).
4. Based on the climatogram, recommend the best time of the year for your customer to go and explain.
5. Name a National Park that the customer can go to so that they can explore the biome. Give the location of the national park and provide a map so that they can see its location.
6. Provide a list and brief description of at least 5 different activities offered at the national park.
7. Name at least 5 unique animals they might see in the biome.
8. Name at least 5 kinds of vegetation they might get to see while traveling in the biome.
9. Provide any other information that a traveler should know when they are going to this particular region. (language difference, potential dangers, etc.)
10. A title for the biome vacation and clearly marked sections of the brochure.

Check each thing off when you have completed each task for the poster.

Ms. K., where can I find all this information??? Excellent question...

1. Basic information on each biome: textbook pp. 710-722, Biome coloring sheet, and this *excellent* website → http://www.mbgnet.net/
2. Pictures of my biome and its animals/vegetation: you may print pictures off the internet, cut them out of magazines (ask first!), use clip art, or draw them and then paste them on if you are artistically inclined! ☺

3. Descriptions of the climate and what to pack: online is probably the quickest- try the DNR and National Parks Services
4. For all your National Parks needs: try this website with A LOT of information about U.S. National Parks→ http://gorp.away.com/gorp/resource/us_national_park/main.htm, or try Googling "National Parks" if your biome is not in the United States
5. To get the data for your climatogram: go to this link→ http://www.worldclimate.com/, and type in a city within your biome. Click on "Average rainfall" for the precipitation and "24-hour Average Temperature" for that part of your graph.

When is all this due?

1. The posters are due within the first ten minutes of class on **Friday, October 27, 2006.** You will be working on them with your small group all week and NOTHING leaves the classroom so that all the posters will be turned in on time, finished or not! (I'm hoping for finished ☺.)
2. Posters/brochures will be set up at each lab station where students can browse them and take notes on important information. ALL students are responsible for the major things on your "Biome Project Notes Sheet" for the quiz on Monday over ALL the biomes, so do a good job taking notes!!

Grading...

Overall Poster Worthiness→

Neatness and Legibility (large print)....................................5 pts.
Logic (makes sense, information is relevant to audience)...... 5 pts.
Creativity (use of color, nice pictures, definite effort)............5 pts.
Spelling and Grammar ....5 pts.
Total Poster Worthiness..20 pts.

Required Content→

Picture of biome ....5 pts.
Description and recommendations for packing .... 5 pts.
Climatogram and recommended time for visit ....10 pts.
National Park location, map, and activities ....10 pts.
Five unique animals and five possible types of vegetation .....5 pts.
Title for vacation and easy to find/marked sections ....5 pts.
Extra information, pictures, etc ....5 pts.
Total Content ....45 pts.

GRAND TOTAL...... 65 points

Biome Project Notes Sheet

1. Tundra	
General Location	
Climate Description	
Animals	
Plants	
National Park and its location	
2. Coniferous Forest (Taiga)	
General Location	
Climate Description	
Animals	
Plants	
National Park and its location	
3. Deciduous Forest	
General Location	
Climate Description	
Animals	
Plants	
National Park and its location	
4. Tropical Rainforest	
General Location	
Climate Description	
Animals	
Plants	
National Park and its location	

5. Desert	
General Location	
Climate Description	
Animals	
Plants	
National Park and its location	

6. Savanna	
General Location	
Climate Description	
Animals	
Plants	
National Park and its location	

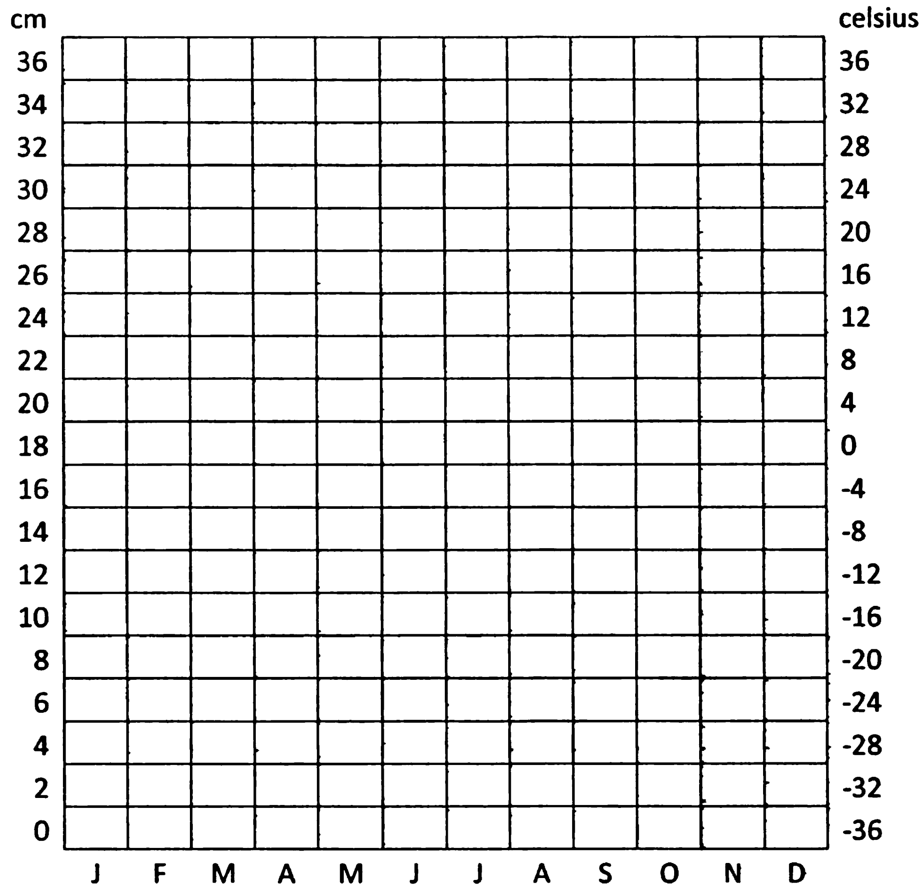
7. Prairie	
General Location	
Climate Description	
Animals	
Plants	
National Park and its location	

8. Chaparral	
General Location	
Climate Description	
Animals	
Plants	
National Park and its location	

Climatogram!

1. Use the following information to plot a climatogram on the graph provided below.

	J	F	M	A	M	J	J	A	S	O	N	D
T	25.6	25.6	24.4	25.0	24.4	23.3	23.3	24.4	24.4	25.0	25.6	25.6
P	25.82	24.9	31.0	16.5	25.4	18.8	16.8	11.7	22.1	18.3	21.3	29.2



★★Now that you know how, find climate data for your biome and construct a climatogram for your project! ★★

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