

AP and IB Biology
Ecology Summer Work
Albert Einstein High School
2009-2010



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AP and IB Biology
2009-2010
Dr. Small



Dear AP or IB Biology Student:

Attached is your Ecology Summer Work packet, a journey into the world around you, and an introduction to our first unit of study for the fall semester. In the packet you will find the summer work project, which includes field observation and producing a summary of the material in a creative format. Please read the instructions carefully.

To help you to prepare for the project, and the unit of study, I have attached Unit Objectives, which identify the key information for each chapter in your textbook. You do not have to complete the Chapter Objectives; they are just a guideline of what will be learned. The Guided Notes for each chapter, however, are to be completed and turned in along with your project, on the first Friday of school (September 4).

We will be using the textbook **Biology; 6th Edition: by Campbell and Reece**. You may check out a copy of the textbook before the school year ends on June 17, or may decide to purchase a copy of the book (ISBN# 0-8053-0009-0). There are several websites that sell used textbooks for significantly less than the cost of a new book (www.half.com or you might try Amazon or EBay). You are NOT required to purchase a book. If you do not obtain a book by the end of the school year, or register late, you may contact me by email to arrange to check out a book.

If you have any questions feel free to contact me over the summer at Judy_A_Small@mcpsmd.org. I will check my email regularly, but not always the same day as you send your questions. I will also be out of town without email contact for one week this summer, most likely the first week in August.

Have a great summer and I look forward to seeing you in the fall.

Dr. Judy Small
Albert Einstein High School

AP and IB Biology Summer Work

Dr. Small

The Ecology Project (Due the 1st Friday of School)

Introduction:

One of the wonderful things about summer is that you have time to go outside and enjoy nature. What better time to study ecological principles for your AP or IB Biology class? After you have read and completed the work for all the assigned chapters, you are to take your own field trip through an ecosystem of your choice. This can be in your own backyard, the beach, an estuary, a forest, an open field, a weedy urban lot, a section at the zoo, any of Maryland's ecosystems..... You get the picture.

Purpose:

In this exercise, you will investigate the structure and function of an ecosystem and generate a product to display your unique ecosystem.

Requirements:

1. *Field Trip Observations*

Spend some time (at least one hour) observing the features of your study site, both abiotic and biotic. Based on your observations, write a brief description of the study site, including its physical and biological features. These observations should be recorded in a notebook or in some sort of written or typed form, and include the following:

- Identify the location of your ecosystem.
- Identify the biological community in your ecosystem, including producers, primary consumers, secondary consumers, and higher-level consumers. Be sure to give common names and scientific names of organisms. (The library should have several identification books for plants and animals or you may use on-line resources)
- Describe how these organisms are ecologically linked to each other.
- List abiotic factors in your environment and how these components are important to the biotic community.
- Identify one example of a predator-prey relationship in your ecosystem.
- Identify one example of a symbiotic relationship in your ecosystem. In the explanation you should describe how this relationship affects both organisms.
- Observe one organism in your ecosystem for at least 10 minutes. Describe the behavior of this organism and the evolutionary significance of this behavior.
- Describe evidence that demonstrates the impact humans may have on your ecosystem.

2. *Final Project*

After your field trip, you will generate a product addressing all of the topics noted in your "Field Trip Observations." This can be in the form of an illustrated children's book, a scrapbook, a video documentary, etc... Please do not put all of this on a poster board. This project should be somewhat interactive. I give you full creative freedom to generate your own visual representation to document your ecosystem field trip.

- Feel free to take pictures, draw, or collect the organisms at your study site for better identification and to help you in developing your final project.

Ecology Field Trip Scoring Guide

Field Trip Observations notebook	10
Final Project	
Location and description of ecosystem	5
Biological Community	
Producers	5
Primary Consumers	5
Secondary Consumers	5
Higher-Level Consumers	5
Ecologically linked - food web, trophic levels.....	10
Abiotic factors and importance	10
Predator-prey relationship	5
Symbiotic Relationships	10
Animal Behavior and significance	10
Human impact	5
Effectiveness of showing ecological relationships.....	5
Mechanics, neatness, and creativity.....	10
<p style="text-align: right;">Total Points:</p>	100

- All projects are due on the 1st Friday of school.
- Projects not turned in on the due date will receive a zero.

Chapter 50
An Introduction to Ecology and the Biosphere
Chapter Objectives

The Scope of Ecology

1. Define ecology.
2. Distinguish between the abiotic and biotic components of the environment.
3. Describe the relationship between ecology and evolutionary biology.
4. Define organismal ecology, population ecology, community ecology, ecosystem, ecology, and landscape ecology.

Factors Affecting Distributions of Organisms

5. Define biogeography.
6. Explain how natural range expansions and species transplants can affect dispersal and the role of dispersal in limiting species distribution.
7. Describe the problem of transplanted or introduced species.
8. Explain how habitat selection can limit the range of otherwise suitable habitats.
9. Describe and illustrate biotic and abiotic factors that affect the distribution of organisms.
10. Explain how climate affects the geographic distribution of organisms.

Aquatic and Terrestrial Biomes

11. Distinguish among the various zones found in aquatic biomes.
12. Define and compare the many types of freshwater and marine biomes: Lakes, wetlands, streams and rivers, estuaries, intertidal, oceanic pelagic, coral reefs, and marine benthic.
13. Describe the characteristics of the major terrestrial biomes: tropical forest, savanna, desert, chaparral, temperate grassland, temperate forest, coniferous forest, and tundra.

The Spatial Scale of Distributions

14. Explain why the distribution of a species is often not easily accounted for.

Chapter Terms:

ecology	aphotic zone	neritic zone	oceanic zone
abiotic components	thermocline	biotic components	benthic zone
pelagic zone	organismal biology	population	community
ecosystem	biosphere	climate	biome
tropics	turnover	photic zone	benthos
detritus	littoral zone	limnetic zone	profundal zone
oligotrophic	eutrophic	mesotrophic	wetlands
estuary	intertidal zone	coral reef	abyssal zone
canopy	permafrost	regulator	conformer
principle of allocation	acclimation		

**Chapter 51
Behavioral Biology
Chapter Objectives**

Introduction to Behavior and Behavioral Ecology

1. Define behavior, behavioral ecology, and ethology.
2. Describe the evolutionary basis for behavioral ethology.
3. Explain the difference between ultimate and proximate causations of behavior.
4. Define and illustrate a FAP. Explain what triggers an FAP.
5. Define imprinting and explain the importance of the sensitive period. Illustrate these concepts using examples from bird song.

Genetic Components of Behavior

6. Explain how genes and the environment contribute to behavior.
7. Explain the nature vs. nurture controversy
8. Explain the difference between innate and learned behaviors.
9. Define and illustrate kinesis, taxis, and migration. Explain how each term can be considered a directed movement.
10. Explain with examples how animal signals and communication are under genetic control.
11. Relate an animal's mode of communication to its lifestyle.
12. Using the example of the North American prairie voles, example how researchers study whether a particular behavior has a strong genetic component.

Environment and Genetics

13. Explain how environment can modify genetically controlled behaviors.
14. Discuss the ultimate bases of learning.
15. Explain how maturation, habituation, spatial learning, cognitive maps, associative learning, and problem solving influence behavior.
16. Distinguish between classical conditioning, operant conditioning and observational learning.
17. Define play and describe several possible adaptive advantages of this behavior.
18. Define cognitive ethology.

Behavioral Evolution

19. Describe how variation in prey selection and variation in aggressive behavior illustrate how behavioral traits can evolve by natural selection.
20. Describe what evidence supports behavioral evolution.

Behavior and Fitness

21. Explain the optimal foraging theory and describe optimal foraging strategies in terms of energetics and prey densities.
22. Compare and contrast the 3 main mating systems
23. Define parental investment and explain how parental investment influences the different mating behaviors of males and females.
24. Discuss how the needs of the young influence the development of mating systems.
25. Describe how the certainty of paternity influences the development of mating systems.
26. Distinguish between intersexual selection and intrasexual selection. Explain why intrasexual selection is considered agonistic behavior and how does it lead to a dominance hierarchy.
27. Explain how dominance hierarchies and territories may stabilize population densities.
28. Explain how "Game Theory" applies to the appearance of three different male phenotypes in the side-blotched lizard.

Social Behavior

29. Define altruism, inclusive fitness, and kin selection, and explain how they are related.
30. Discuss why altruistic behavior might evolve.
31. Define reciprocal altruism.
32. Define illustrate social learning. Explain how social learning can form the roots of "culture."
33. Define and describe the premise of sociobiology.

Chapter Terms:

behavior	ethology	fixed-action pattern	sign stimulus	foraging
learning	maturation	kin selection	imprinting	critical period
play	cognition	associative learning	habituation	classical conditioning
cognitive maps	migration	Operant conditioning	sociobiology	ritual
kinesis cognitive	ethology	social behavior	territory	agonistic behavior
taxis	reciprocal altruism	dominance hierarchy	monogamous	parental investment
polygamous	polygyny	polyandry	pheromones	inclusive fitness
promiscuous				

Characteristics of Populations

1. Define the scope of population ecology
2. Define population.
3. Define and distinguish between density and dispersion.
4. Describe conditions which may result in clumped dispersion, random dispersion, and uniform dispersion of populations.
5. Describe the characteristics of populations which exhibit Type I, Type II, and Type III survivorship curves.

Life History Traits

6. Give examples of the trade-off between reproduction and survival.

Population Growth

7. Compare the geometric model of population growth (exponential population growth) with the logistic model.
8. Explain how an environment's carrying capacity affects the intrinsic rate of increase of a population.
9. Distinguish between r-selected populations and K-selected populations.
10. Explain how a "stressful" environment may alter the standard r-selection and K-selection characteristics.

Population-Limiting Factors

11. Explain how density-dependent factors affect population growth.
12. Describe how weather and climate can function as density-independent factors in controlling population growth.
13. Explain how density-dependent and density-independent factors may work together to control a population's growth.
14. List 3 major characteristics of a life history and explain how each affects the:
 - a. number of offspring produced by an individual
 - b. population's growth
15. Explain how predation can affect life history through natural selection.
16. Describe several boom-n-bust population cycles, noting possible causes and consequences of the fluctuations.

Human Population Growth

17. Describe the history of human population growth.
18. Describe the problems associated with estimating Earth's carrying capacity.

Chapter Terms:

population	density	dispersion	mark-recapture method
clumped	fecundity	death rate	generation time
sex ratio	life table	random	exponential population growth
uniform	biogeography	demography	carrying capacity
birth rate	life history	semelparity	logistic population growth
iteroparity	cohort age	structure	K-selected populations
survivorship curve	r-selected populations	zero population growth	equilibrial populations
opportunistic populations	intraspecific competition	density-dependent factor	intrinsic rate of increase
			density-independent factor

**Chapter 53
Community Ecology
Chapter Objectives**

What is a Community?

1. Define a community.

Interspecific Interactions and Community Structure

2. Explain how interspecific competition may affect community structure.
3. Describe the competitive exclusion principle and explain how competitive exclusion may affect community structure.
4. Distinguish between an organism's fundamental niche and realized niche.
5. Explain how resource partitioning can affect species diversity.
6. Define and compare predation, herbivory, and parasitism.
7. Relate some specific predatory adaptations to the properties of the prey.
8. Describe the defense mechanisms evolved by plants to reduce predation by herbivores.
9. Describe how cryptic coloration and aposematic coloration aid an animal in avoiding predators.
10. Distinguish between Batesian mimicry, and Mullerian mimicry. Explain how predators use mimicry to obtain prey.
11. Distinguish among parasitism, mutualism, and commensalism.
12. Explain the relationship among species richness, relative abundance, and diversity.
13. Distinguish between a food chain and a food web.
14. Describe two hypotheses that explain why food chains are usually short, and a key prediction of each hypothesis.
15. Distinguish between dominant species, keystone species, and foundation species.
16. Explain how each species affects community structure.

Disturbance and Community Structure

17. Give examples of humans as widespread agents of disturbance.
18. Describe and distinguish between primary and secondary succession.

Biogeographic Factors Affecting Biodiversity of Communities

19. Describe how natural and human disturbances can affect equilibrium and species diversity.
20. List the factors involved in limiting a species to a particular range.
21. Compare and contrast the individualistic hypothesis of H.A. Gleason and the interactive hypothesis of F.E. Clements with respect to communities.

Chapter Terms:

Species richness	relative abundance	species diversity	predation
Individualistic hypothesis	secondary succession	coevolution	parasitism
Interactive hypothesis	parasitoidism	herbivory	community
Interspecific interactions	biogeography	cryptic coloration	mimicry
Aposematic coloration	predator	Batesian mimicry	parasite
Mullerian mimicry	hosts	endoparasites	ectoparasites
Interspecific competition	ecological niche	fundamental niche	prey
Interference competition	realized niche	symbiosis	symbiont
Exploitative competition	commensalism	mutualism	keystone species
Resource partitioning	exotic species	stability	disturbances
Character displacement	ecological succession	primary succession	recruitment
Competitive exclusion principle	dynamic equilibrium hypothesis	intermediate hypothesis	disturbance

Chapter 54
Ecosystems
Chapter Objectives

What is an Ecosystem Approach to Ecology?

1. Define an ecosystem.
2. Explain the importance of autotrophic organisms with respect to energy flow and nutrient cycling in ecosystems.
3. List and describe the importance of the 4 consumer levels found in ecosystems.
4. Explain how decomposition connects all trophic levels in an ecosystem.

Primary Production in Ecosystems

5. Explain why the amount of energy used in photosynthesis is so much less than the amount of solar energy that reaches Earth.
6. Define and compare gross primary production and net primary production.
7. Compare primary production in marine, freshwater, and terrestrial ecosystems.

Secondary Production in Ecosystems

8. Explain why productivity declines at each trophic level.
9. List factors that can limit ecosystem productivity.
10. Explain why energy is said to “flow” rather than “cycle” within ecosystems. Use the example of insect caterpillars to illustrate energy flow.
11. Define, compare, and illustrate the concepts of production efficiency and trophic efficiency.
12. Distinguish between energy pyramids and biomass pyramids.
13. Explain why world-wide agriculture could feed more people if all humans consumed only plant material.
14. Explain the green-world hypothesis. Describe six factors that keep herbivores in check.

The Cycling of Chemical Elements in Ecosystems

15. Explain the general concept of biogeochemical cycles.
16. Describe and diagram the hydrologic (water cycle)
17. Describe and diagram the carbon cycle and how it results from the reciprocal processes of photosynthesis and cellular respiration.
18. Describe and diagram the nitrogen cycle and explain the importance of nitrogen fixation to living organisms.
19. Describe and diagram the phosphorous cycle.
20. Explain why soil in tropical forests contains lower levels of nutrients than soil in temperate forests.

Human Impact on Chemical Dynamics of the Biosphere

21. Describe how agricultural practices can interfere with nitrogen cycling
22. Describe how deforestation can affect nutrient cycling within an ecosystem.
23. Explain how “cultural eutrophication” can alter freshwater ecosystems.
24. Explain why toxic compounds usually have the greatest effect on top-carnivores.
25. Describe how increased atmospheric concentrations of carbon dioxide could affect the earth.
26. Describe how human interference might alter the biosphere.

Chapter Terms:

Ecosystem	trophic structure	trophic level	primary producers
Biomass	primary consumers	standing crop	limiting nutrient
Detritus	secondary consumers	tertiary consumers	detritivores
Food chain	denitrification	food web	production
Consumption	decomposition	biomass pyramid	turnover time
Pyramid of numbers	biogeochemical cycle	nitrogen fixation	ammonification
Greenhouse effect	ecological efficiency	productivity pyramid	
Long-term Ecological Research		biological magnification	
Gross primary productivity		net primary productivity	
Secondary productivity		primary productivity	

Chapter 55
Conservation Biology and Restoration Ecology
Chapter Objectives

The Biodiversity Crisis

1. Define conservation biology and restoration ecology and describe their goals.
2. Describe the three levels of biodiversity.
3. Describe the importance of biodiversity.
4. Describe the four major threats to biodiversity and give an example of each.

Conservation at the Community, Ecosystem, and Landscape Levels

5. Define biodiversity hot spots and explain why they are important.
6. Describe how habitat fragmentation affects population dynamics.
7. Describe how population viability analysis and estimates of minimum viability size and effective population size are used to evaluate the chances of a species persisting or becoming extinct.
8. Describe the conflicting demands that arise in conservation management plans.
9. Describe how edges and corridors influence landscape biodiversity.
10. Discuss why nature reserves are important to preserving biodiversity.
11. Explain the importance of bioremediation and the augmentation of ecosystem processes in restoration efforts.
12. Describe the process of adaptive management.
13. Explain the goals of the Sustainable Biosphere Initiative.
14. Define biophilia and explain why the concept gives some biologists hope.

Chapter Terms:

conservation biology	biodiversity	biodiversity crisis
source habitat	sink habitat	biodiversity hot spot
endemic species	endangered species	threatened species
metapopulation	landscape ecology	population viability analysis
minimum viable population	movement corridor	minimum dynamic area
effective population size	zoned reserve	systems restoration ecology
bioremediation	sustainable development	
sustainable biosphere initiative		

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Guided Notes Chapter 50: An Introduction to Ecology and the Biosphere

1. Define Ecology:

2. List examples of factors that limit geographic distribution.

3. Explain the relationship between Ecology and Evolution.

4. Define the terms:

a. Biosphere

b. Ecosystem

c. Community

d. Population

5. How does dispersal influence distribution?

6. How does behavior and habitat limit distribution?

7. What are some biotic factors that affect distribution?

8. What are some abiotic factors that affect distribution?

9. Define the term biome.

10. What is the largest biome on earth?

11. Identify factors that are significant to organism distribution and abundance in a lake.

12. What is the difference between a lake that is oligotrophic and one that is eutrophic?

13. What are the most important factors influencing terrestrial distribution?

14. Fill in the following Chart:

Biome Abiotic Characteristics Biotic Characteristics

Biome	Abiotic Characteristics	Biotic Characteristics
Tropical Rain Forest		
Desert		
Savanna		
Temperate Grassland		
Temperate Deciduous (Broadleaf) Forest		
Coniferous Forest		
Arctic Tundra		

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Guided Notes Chapter 51: Behavioral Ecology

1. Define Behavioral Ecology.

2. Explain the difference between proximate and ultimate causes?

3. Define the two basic types of behavior.

4. What is a fixed action pattern? Give an example.

5. What is imprinting? Give an example.

6. Describe the following innate behaviors:

a. Kinesis _____

b. Taxis _____

c. Migration _____

d. Signals _____

7. What are pheromones and how do they help in communication?

8. Discuss the differences between innate and learned behaviors.

9. Describe the following learned behaviors.

- a. habituation _____
- b. Spatial Learning _____
- c. Cognitive Maps _____
- d. Associative Learning _____
 - Classical Conditioning _____
 - Operant Conditioning _____
- e. Cognition and Problem Solving _____

10. Explain how behavioral traits can evolve.

11. Describe the Optimal Foraging Theory

12. Define the three types of mating/parental care systems:

- a. Promiscuous _____
- b. Monogamous _____
- c. Polygamous _____

13. Give an example of:

- a. Intersexual Selection _____
-

b. Intrasexual Selection _____

14. Describe the following behaviors:

a. Agonistic behavior _____

b. Dominance Hierarchy _____

c. Altruistic Behavior _____

d. Social Learning _____

15. When will natural selection favor altruism?

16. Explain the evolutionary adaptation of kin selection.

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Guided Notes Chapter 52: Population Ecology

1. How can an ecologist estimate the numbers of individuals in a population?

2. What are some possible difficulties in counting populations?

3. Describe three patterns of dispersal:

a.

b.

c.

4. Compare the survival strategies of species and give an example of each type.

a. Type I _____

b. Type II _____

c. Type III _____

5. What are the differences between semelparity and iterparity reproduction?

6. Write the formula for population growth without limits. Define the terms.

7. Define carrying capacity.

8. Write the formula for population growth with limits. Define the terms.

9. What happens to a population when the number of individuals approaches carrying capacity?

10. Compare K-selected and r-selected species. Give examples of each.

11. Identify factors that regulate population size.

12. Compare density-independent and density-dependent factors limiting populations.

13. Look at the growth curve of the human population. How does it compare to the growth curves earlier in the chapter?

14. Have humans reached K? What factors are significant when explaining our growth curve?

15. Look at the age structure diagrams of different countries. How might the age structure influence?

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Guided Notes Chapter 53: Community Ecology

1. Define interspecific interactions.

2. Fill in the chart of interspecific interactions:

Interaction	Effects on Population Density	Example
Competition		
Predation (includes parasitism)		
Mutualism		
Commensalism		

3. What is the competitive exclusion principle?

4. Describe Gause's experiment with Paramecia.

5. Define ecological niche.

6. Define and give an example of resource partitioning.

7. Define and give an example of the following animal defenses:

a. Cryptic coloration

b. Aposematic coloration

c. Batesian mimicry

d. Mullerian mimicry

8. Describe several defense mechanisms to predation in plants.

9. How is co-evolution significant in community ecology?

10. What is meant by the "trophic structure" of a community?

11. What does a food web show that isn't indicated by a food chain?

12. What limits the length of a food chain?

13. Define the following terms:

a. Dominant species

b. Keystone species

c. Foundation Species

14. Why are keystone species important to a community?

15. Define ecological succession.

16. What is the difference between primary succession and secondary succession?

17. Describe the debate between the Integrated and Individualistic Hypotheses.

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Guided Notes Chapter 54: Ecosystems

1. How does the definition of ecosystems expand on the concept of the community?

2. What is needed to maintain a self-sustaining ecosystem?

3. Define the following energy budget terms:

a. Primary productivity _____

b. Gross primary productivity _____

c. Net primary productivity _____

4. Which ecosystems have the highest productivity per unit area?

5. What factors do you think contribute to such high productivity?

6. Why is the open ocean so low in productivity?

7. What is secondary productivity?

8. What happens to the size of each level in the idealized pyramid as energy is transferred through the trophic levels?

9. Explain what happens to the energy and biomass as it is passed through the trophic levels?

10. Why is it essential that elements move through biogeochemical cycles in the ecosystem?

11. What are the major processes that move carbon through the ecosystem?

12. What is the impact of combustion on the carbon cycle?

13. Identify the role of each of the following in the nitrogen cycle:

a. Nitrogen fixation _____

b. Ammonification _____

c. Nitrification _____

d. Denitrification _____

e. Assimilation _____

14. Why is human population growth at the root of environmental issues?

15. Define cultural eutrophication. Why is it a problem?

16. What is the source of acid rain?

17. Why is acid rain a problem?

18. What happens in biological magnification?

19. What would be some of the properties of molecules that could be candidates for biological magnification?

20. What are possible reasons for global warming called the greenhouse effect?

21. Is depletion of the ozone layer a possible reason for global warming?

22. What is the cause for the depletion of the ozone layer? Why is it a problem?

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Guided Notes Chapter 55: Conservation Biology and Restoration Ecology

1. What is conservation biology?

2. What is Restoration Ecology?

3. Define the three levels of Biodiversity

a. Genetic Diversity _____

b. Species Diversity _____

c. Ecosystem Diversity _____

4. What are some potential benefits of species and genetic diversity?

5. What are the four major threats to Biodiversity?

6. Explain how the extinction vortex works.

7. How does loss of genetic variation relate to a species ability to evolve?

8. Why is management aimed at conserving a single species considered poor ecosystem management?

9. What is the goal of Landscape Ecology?

10. What are some of the strategies used to preserve and protect landscape structure and biodiversity?

11. Describe the following restoration ecology attempts:

a. Bioremediation _____

b. Biological Augmentation _____

c. Adaptive Management _____

12. What is the goal of sustainable development?
