

**LIVING PLANET  
UNIT THREE****SUMMARY OF UNIT THREE MATERIAL****The videotapes to watch for this unit are:**

- Video Episode 5 - Seas of Grass
- Video Episode 6 - The Baking Deserts

**For each video episode in this unit:**

- read the **CONCEPTS** section in the study guide
- answer the **Concepts Study Questions**
- watch the Video Episode
- answer the **Video Study Questions**

**OVERVIEW OF UNIT 3 LEARNING OBJECTIVES****Video Episode 5 - Seas of Grass**

To become acquainted with:

1. characteristics of grasslands
2. characteristics of grasses
3. ecology of major grasslands: location, climate, characteristic life forms and their adaptations
4. the differences between major grasslands, including location, climate, life forms and specific adaptations
  - South American savanna
  - South American pampas
  - South American llanos
  - North American prairies
  - Eurasian steppes
  - South African veldts
  - East African savannas
5. kin selection

**Video Episode 6 - The Baking Deserts**

To become acquainted with:

1. the characteristics of deserts
2. ecology of deserts: location, climate, characteristics, life forms and adaptations
3. the differences between major deserts, including location, climate, life forms and specific adaptations
  - Sahara
  - Arizona desert
  - Kalahari
  - Namib
4. adaptations of plant life that allow them to live in desert conditions
5. adaptations of animal life that allow them to live in desert conditions
6. adaptations of animals that live in the sand dunes

## CONCEPTS FOR EPISODE 5: SEAS OF GRASS

### CHARACTERISTICS OF GRASSLANDS

Grasslands are found in areas where the average rainfall is 10 to 30 inches per year (25-80 cm/yr). This is not enough rain to support forests but this is enough for grasses to flourish. Grasses also need good light and they cannot tolerate much shade. Many grasslands are exposed to periodic dry periods and severe droughts. Usually, the grasslands are found on flat or rolling terrains, such as the flat mid-western stretches of the United States.

Fire is a major factor in maintaining grasslands. Periodic fires sweep over the natural grassland, converting dead material into nutrients which are available for immediate use. Fire also destroys any woody plants, such as shrubs or trees, that have begun to supplant the grasses. Thus, fire helps the grassland remain a grassland.

Grasses are, of course, the most conspicuous feature of a grassland. Most of us only look at the top layer of vegetation, that tall green layer made of grasses and flowering plants. This **herbaceous layer** is actually only the top of three layers, and not the most important. The **ground layer** and the underground **root layer** are the two main layers.

The ground layer is easily visible in winter and early spring. As light levels increase in the spring, the plants respond with vigorous growth. The ground layer becomes shaded by the tall growth. This area, in an ungrazed or unmowed situation, is cooler, more humid and receives less wind than the herbaceous layer. Undisturbed grasslands accumulate a thick layer of mulch, made of decomposing vegetation. This layer retains moisture in the soil, as well as maintaining stable soil temperatures. Grass seeds can easily germinate under these conditions. Runoff and erosion decrease. Decomposers thrive in this layer, slowly releasing nutrients into the surrounding soil. It takes about 3 or 4 years for natural mulch to completely decompose. This litter has many insects, spiders, rodents, lizards and other animals.

The root layer is the largest layer of all. More than 50% of the body of a grass is underground. Most of the excess food produced by photosynthesis is stored underground. The roots form a dense, thick layer deep into the soil. Many grasses have underground stems, called **rhizomes**, which serve to spread the plant and store food. Roots grow to different depths, allowing nutrients to be absorbed from different depths in the soil. This layer contains abundant animal life, such as insect eggs, earthworms, ants and other invertebrates. Many grasslands also have burrowing mammals: prairie dogs, marmots, ground squirrels, viscachas, gerbils, hamsters, meerkats and wombats. Most of these animals are mentioned in the video.

When most of us think of grasslands, we think of big herds of mammals that graze on the abundant grass. Watch the video for capybara, bison, pronghorns, saiga antelope, zebra, wildebeest, giraffe, dik diks, impala, antelopes and white-eared kob.

## TERMITES

In tropical grasslands, termites play a very important role in the ecosystem. Termites are NOT white ants. They are not closely related to ants, even though they may have somewhat similar lifestyles.

Termites require warmth and humidity so they are most abundant in tropical and subtropical areas. Termites in grasslands build complex nests with chimneys that draw air for ventilation. Termites are also very common in tropical savannas where they build very large mounds with tall chimneys that help air circulate through the colony.

Termites have a complex social structure that includes **castes**. Castes refer to a group within a society that has a specific job. In termite societies, the castes include:

1) the **reproductive individuals**. These are the king and queen. Unlike ant societies, the king lives with the queen and they both live for a relatively long time. Their job duties are simple: start the new colony (the mound), then reproduce. The reproductive individuals keep reproducing during their entire life. A reproductive queen that is laying eggs is very large; the king is not as huge but he is larger than the other caste members.

Termites are fascinating to read about. The king and queen raise the first group of offspring. When the first set of offspring mature, the king and queen spend the rest of their lives reproducing. The queen becomes huge and turns into an egg-laying "machine."

2) the **workers**. These are the "peons", the working members of the society that take care of the offspring, gather food, build the nest, maintain the nest, dispose of dead bodies and any other mundane day-to-day task. The workers have small bodies. Workers can be male or female.

3) the **soldiers**. These are the "armed forces". Their sole purpose is to defend the mound from invaders. They are bigger than workers. They have some method of attack, such as very large sharp jaws or chemical spray guns on their heads which disperse nasty compounds that deters most intruders. Soldiers can be male or female (varies between species).

Even though there are some predators that love to eat termites, they usually only stay for a little while. They cruise in for fast food (however many termites they can eat within a few minutes) before the soldiers drive them off.

Termite colonies grow slowly and they last for decades. Termites are most abundant in the tropical rain forests where most species eat mainly wood, leaves and plant parts. Termites that live in savannas eat grass and other plant parts. [There is very little **wood** in a grassland; there are lots of grasses.]

Reference: Grzimek, Bernhard (editor). 1984. *Grzimek's Animal Life Encyclopedia: Insects*. Van Nostrand Reinhold, New York.

## SOCIETIES AND KIN SELECTION

The study of highly social animals (termites, ants, bees, wasps, naked mole rats and one type of shrimp) raises some very interesting questions. In these animals, as we saw in the termites, one female dominates reproduction, while the other animals do the work. The working members usually do not reproduce.

Why would any organism give up its right to reproduce in order to raise the offspring of another organism? In order to be successful in an evolutionary sense, the name of the game is reproduction. Money is NOT important: success = babies. [After all, if you don't have children, then your genes die out. From an evolutionary standpoint, you have ZERO impact on the future.]

Superficially, such a society does NOT make sense from the worker's point of view. The worker gives up its right to reproduce and spends its life maintaining the colony and raising the offspring of the king and queen. This seems like a great idea for the king and queen but LOUSY for the worker.

However, if you look more closely at the family tree of these social animals, you will find the workers are closely related to the king and queen and to each other. At that point, you begin to see the workers are raising their sisters and brothers. By helping their parents produce more sisters and brothers, their own genes are represented in their millions of siblings.

At this point, it begins to make more sense for a worker to stay in the colony and raise siblings rather than trying to reproduce. The chances of a single worker being able to survive, find a mate, found a new colony and have offspring are virtually zero.

By now, you know that biologists name everything. So what would you call a situation where someone hangs around their parents and raises their siblings (kin)? **Kin selection.**

Remember, these are **adaptations**. The individual doesn't **consciously** decide to give up its reproductive rights. This behavior has evolved over time because individuals who carried out this behavior left more copies of their genes (as siblings) than individuals who didn't.

## ANTS AND PLANTS - MORE INFORMATION ABOUT THEIR RELATIONSHIPS

Many scientists look at the relationships between ants and their plant hosts as examples of symbiosis. There are three *National Geographic* articles that illustrate different viewpoints. The "Ants and Plants" article can be found in the May 2000 issue. The article discusses tropical "ant plants" which provide suitable housing and food in exchange for resident ant colonies that vigilantly patrol the plants and protect them from enemies (such as grazing herbivores).

The second article, "Ants and Plants-A Profitable Partnership", can be found in the February 1999 issue. This article discusses how the world's only swimming ants (found in Borneo) help their pitcher plant hosts digest other insects for nutrients.

For a different viewpoint, check out the article in the May 1999 issue, "Ants and Plants-Friends and Foes". This article looks at conflicts of interest: how ants pollinate and guard plants in exchange for food AND how plants retaliate when ants take crucial nutrients that are necessary for the plant to survive.

**Websites:** <http://www.botgard.ucla.edu/html/botanytextbooks/lifeforms/antplants/index.html>  
[http://www.zoo.org/factsheets/pitcher\\_plant/trop\\_pit\\_plant.html](http://www.zoo.org/factsheets/pitcher_plant/trop_pit_plant.html)

**CONCEPTS STUDY QUESTIONS FOR EPISODE 5 - Seas of Grass:**

1. Describe the zonation or stratification that exists in grasslands. Describe the plant components, processes and animals found in each layer.
2. Describe the social castes of termites.
3. What is necessary for an organism to be successful in an evolutionary sense?
4. Explain why kin selection causes worker termites to care for their siblings instead of having their own offspring.

5. After watching Video Episode 5, compare the major grasslands of the world by location, special climate features, and species that live there.



**Locator: Savanna, Brazil**

4. Describe the giant anteater.
  - a. What is its diet?
  - b. What is its defense against predators?
  - c. How does the giant anteater collect termites?
  - d. How are they protected from the cold?
  - e. Why are the young carried on the back of the adult?
  
5. The following predators are associated with termites and their mounds. Give a brief description of each animal and describe their diet.
  - a. beetle larvae
  - b. giant armadillo
  - c. Oxymytras mouse
  - d. carnivorous ants
  
6. Describe the soldier termites. What is their function?
  
  
7. Grass is composed primarily of cellulose, which is very difficult to digest. What adaptation allows the termites to digest cellulose?

8. Describe the grass cutting ants. How do these ants deal with the problem of cellulose? What do they eat? Describe their nest. How do they tend their gardens?

**Locator: Pampas, Brazil**

9. Since grasslands have no trees, how do the birds that live on the grasslands proclaim their territories?

10. Briefly describe the following grassland inhabitants, particularly their diet.

a. seriema

b. tapir

c. savanna deer

d. armadillo

e. tegu lizard

11. Identify the two places where grassland birds build their nests.



18. Describe the maned wolf. What does it eat? How does it mark its territory?

19. Why are trees not found on the pampas of Argentina or Brazil?

20. Describe the effects of the dry season on these grasslands.

**Locator: Llanos, Venezuela**

*species mentioned in this section: capybara, caiman*

21. Why do these grasslands flood during the rainy season? How long are they flooded?

22. Which organisms do well in the flooded conditions?

23. What is the effect of the flooded conditions on burrowing rodents?

**Locator: Prairies of North America**

24. The main source of water during the rainy season of this grassland is \_\_\_\_\_.

The temperatures during the winter get as low as \_\_\_\_\_.

25. How do the following animals cope with the winter conditions?

a. ground squirrels

b. prairie dogs

c. prairie chickens

d. pocket gopher

26. During the winter, where does the grass plant store its food and nutrients?

27. Describe the following inhabitants of the prairie and explain how they survive the winter months.

a. bison

b. pronghorn

c. coyote

28. What two winter conditions are responsible for the deaths of many animals?

29. Describe the aggressive behavior displays of the coyotes.

30. How do rattlesnakes survive the winter?

31. Describe the courtship and mating rituals of the prairie chicken.

32. What is a prairie dog town?

33. When do the prairie dogs mate and have young?

34. Describe the mating behavior of the bisons. What is the gestation period for bison?

35. Why are the prairie dogs considered to be "good farmers"?
  
  
  
  
  
  
  
  
  
  
36. What do prairie dogs do when they spot predators or intruders?
  
  
  
  
  
  
  
  
  
  
37. What are ruminants? What animals are ruminants?
  
  
  
  
  
  
  
  
  
  
38. What two factors are responsible for the comparatively small amount of rainfall received by North American prairies?

**Locator: Steppes, Russia**

39. Where are the steppes located?
  
  
  
  
  
  
  
  
  
  
40. Describe the saiga antelope and its adaptations to the cold steppes.
  
  
  
  
  
  
  
  
  
  
41. What catastrophic condition occurs regularly in the steppes?
  
  
  
  
  
  
  
  
  
  
42. Explain the extraordinary method of reproduction found in the saiga antelope.

**Locator: Tropical grasslands, Africa**

43. How are the tropical grasslands in Africa different from the other grasslands?

44. Where do trees grow in the tropical grasslands of Africa?

45. Why is fire a major factor in preserving grasslands?

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**ADDITIONAL INFO.** In the video, Attenborough does not distinguish between the two types of African grasslands: the veldts of South Africa and the savannas of East Africa. This information is covered in his book, pages 131-133. The grassland shown in the video is the savanna of East Africa.

The **savanna** of East Africa is the only remaining large grassland in Africa. These grasslands are a mixture of tall and short grasses along with tough thorny trees and shrubs. *Acacia* trees, like the one in the video, are drought-resistant and have a relationship with many animals. Certain animals, especially gazelles and elephants, eat the fruit. The tough hard seeds pass unharmed through their digestive systems and are dropped onto soil. In fact, some *Acacia* seeds cannot germinate unless they have passed through the digestive tracts of elephants, where digestive juices break down the tough outer seed coat.

The **veldt** of South Africa used to be extensive. These rolling plains were rich in grasses and there were no trees. European settlers in the early 1800s reported extensive herds of antelope and other large grazing herbivores. One naturalist in 1880, according to Attenborough, estimated **one** migrating springbok herd alone contained one million individuals (p. 131).

Through extensive hunting and habitat loss, these great herds dwindled. Some species, such as the quagga (a type of zebra) were totally wiped out. By 1883, the quagga was extinct. Today, these grazing herds, as well as the natural grassland, are a tiny fraction of their original size.

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46. Where, in Africa, are the grasslands located? How old are these grasslands?

47. Which grassland has the greatest variety and largest number of grass-eating herbivores in the world?
48. The animals have evolved with the grasslands, ensuring that almost every part of the grass is eaten by something. These vegetarians in turn are eaten by predators. What are the prey species of the following predators?
- a. serval
  - b. lions
  - c. hunting dogs
  - d. cheetahs
49. Describe the mating and territorial behavior of dik dik.
50. What do dik dik eat? How do they elude predators?
51. What do impala eat? How do they elude predators?
52. Describe the mating and territorial behavior of impala.

53. What do wildebeests eat?

54. Why do the wildebeest have to migrate constantly?

55. Describe the mating and territorial behavior of wildebeest.

**Locator: Sudan**

56. Describe the lifestyle of the people who live in eastern Sudan.

57. Why are the kob antelopes so important to the survival and well being of the people of Sudan?

58. Describe the migratory route of the kob antelope.

59. How many kobs migrate each year? How many are killed by the Murle people?

60. Summarize the characteristics of grassland, particularly the hardships that the grass can survive.

61. How does a grassland become a desert?

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**ADDITIONAL INFO.** Even though Attenborough does not examine Australia in this videotape, there are **four types of Australian grasslands**. These are quite extensive, covering close to 47% of the continent. Much of this is due to prolonged, periodic droughts, which trees cannot withstand.

There are tropical savannas in the north, and dry grasslands that surround much of the arid interior. The grassland mammals are marsupials, such as marsupial mice. The large grazing herbivores are kangaroos and wallabies. Wombats are the marsupial burrowing mammal. There are numerous birds, many nomadic. Large flightless emus are found in small groups in these grasslands. Here, the male emu, like the rhea, guards his eggs from multiple females and rears the young. Lizards and snakes are especially abundant in these Australian grasslands. [So what are the other two Australian grasslands? Lowland native grasslands and subalpine grasslands.]

References:

Curry-Lindahl, Kai. 1981. *Wildlife of the Prairies and Plains*. Henry N. Abrams, Inc., New York.

Smith, Robert Leo. 1992. *Elements of Ecology*, 3rd ed. HarperCollins, New York.

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## CONCEPTS FOR EPISODE 6: THE BAKING DESERTS

### CHARACTERISTICS OF DESERTS

Although there are many types of deserts, certain features are common to all. Rainfall is scarce. The rate of evaporation is very high, exceeding the rate of rainfall. Temperatures fluctuate widely within a 24-hour period, with cool nights and hot days. The ground soaks up heat during the day and then releases it quickly into the air at night.

In general terms, a desert is hot for part of the year and dry. Generally, any place that gets less than 10 inches of rainfall per year (25 cm/yr) is a desert. Based on total annual rainfall, deserts range from semideserts (6-15 in/yr) to true deserts (less than 5 in/yr) to extreme deserts (less than 3 in/yr). In some deserts, rain may fall only once every 18 months or 2 years. Rainfall is typically sporadic, with long dry spells punctuated by heavy storms. Cloudbursts are common in some deserts, with rainfall occurring faster than the soil can absorb it. This results in rapid surface runoff and flash flooding in dry streambeds.

Based on temperature, deserts vary considerably. There are **hot deserts**, like the Sahara, which are **warm** throughout the year. Some are **cold deserts**, such as the Great Basin Desert, with temperatures falling below freezing during the winter. Cold deserts are **cold** for **part** of the year. **ALL** deserts experience great swings of temperature over a 24-hour period. Perhaps another way of looking at this is to consider precipitation. The main form of precipitation in a cold desert is snow, while warm deserts experience precipitation as rain.

Desert soils are typically poor in organic matter (humus) even though there may be high levels of minerals. Vegetation is sparsely scattered, due to the lack of water. The salt content may also be quite high. This is due to evaporation, which removes water from the soil but leaves the salt behind.

### PROBLEMS AND ADAPTATIONS

Desert plants and animals have similar problems. Water problems can be summed up as: how to get water when it is available, how to keep water, and how to survive long periods without water. Food and heat are also problems. See the video for plant and animal solutions.

#### ***Problem 1: How To Get Water***

Most plants get their water through their roots and desert plants are no exception. As a rule of thumb, plants have about the same amount of roots below ground as they have stems and leaves above ground. Desert plants, however, have more extensive root systems, typically 2-6 times more roots than visible stems and leaves. There are three general strategies:

- (1) Deep root systems, which penetrate the ground for several meters, often to the water table.
- (2) Shallow roots that spread out for many meters around the plant and take up almost every drop of soil moisture.
- (3) Instead of relying on roots, absorb fog droplets or dew droplets across the leaves.

#### ***Problem 2: How To Keep Water***

Organisms that live in the desert live in an area where evaporation exceeds precipitation. In other words, more water is lost by evaporation than replaced by rainfall. Controlling water loss is a major problem. Watch the video for examples of:

(1) Have sunken stomata. Plants must have stomata (openings) in their leaves for gas exchange. However, this also allows water to evaporate. Many plants have sunken their stomata into pits. (Remember the conifers. They use the same strategy.)

(2) Close the stomata during the hot daytime and open them at night when it's cool.

(3) Get rid of the thin leaves and move photosynthesis and the stomata to the thick stem. (This is one method used by cacti. Look for the saguaro cactus in the video.)

**Problem 3: How To Survive Long Periods Without Water**

Again, there are many strategies used by plants to survive for long periods without water. Some of these are mentioned in the video.

(1) Many plants store water internally. When the rains come, the plant soaks up tremendous amounts of water, which is then stored somewhere in the plant body.

(2) One technique is drought-avoidance. These are ephemeral plants, which survive drought in the form of seeds. When the rains come, the seed germinates, grows and reproduces within a short time. As the normal desert conditions return, the adult plant dies, leaving only its seeds behind.

(3) Some plants are drought-deciduous, losing most of their leaves during the dry season. New leaves are grown when the rains come. The creosote bush uses this strategy.

(4) Some plants are drought-tolerant and are able to withstand desiccation (drying out). One example is the resurrection plant, which becomes brown when it dries out totally, yet becomes green and active when water is available.

**Problem 4: How To Handle The Heat**

Bodies absorb heat and there is a lot of heat in the desert. The plant or animal has to either be able to:

- (1) tolerate the heat,
- (2) modify some part of its body to minimize excess heating, or
- (3) avoid the hot parts of the day.

Look for examples in the video.

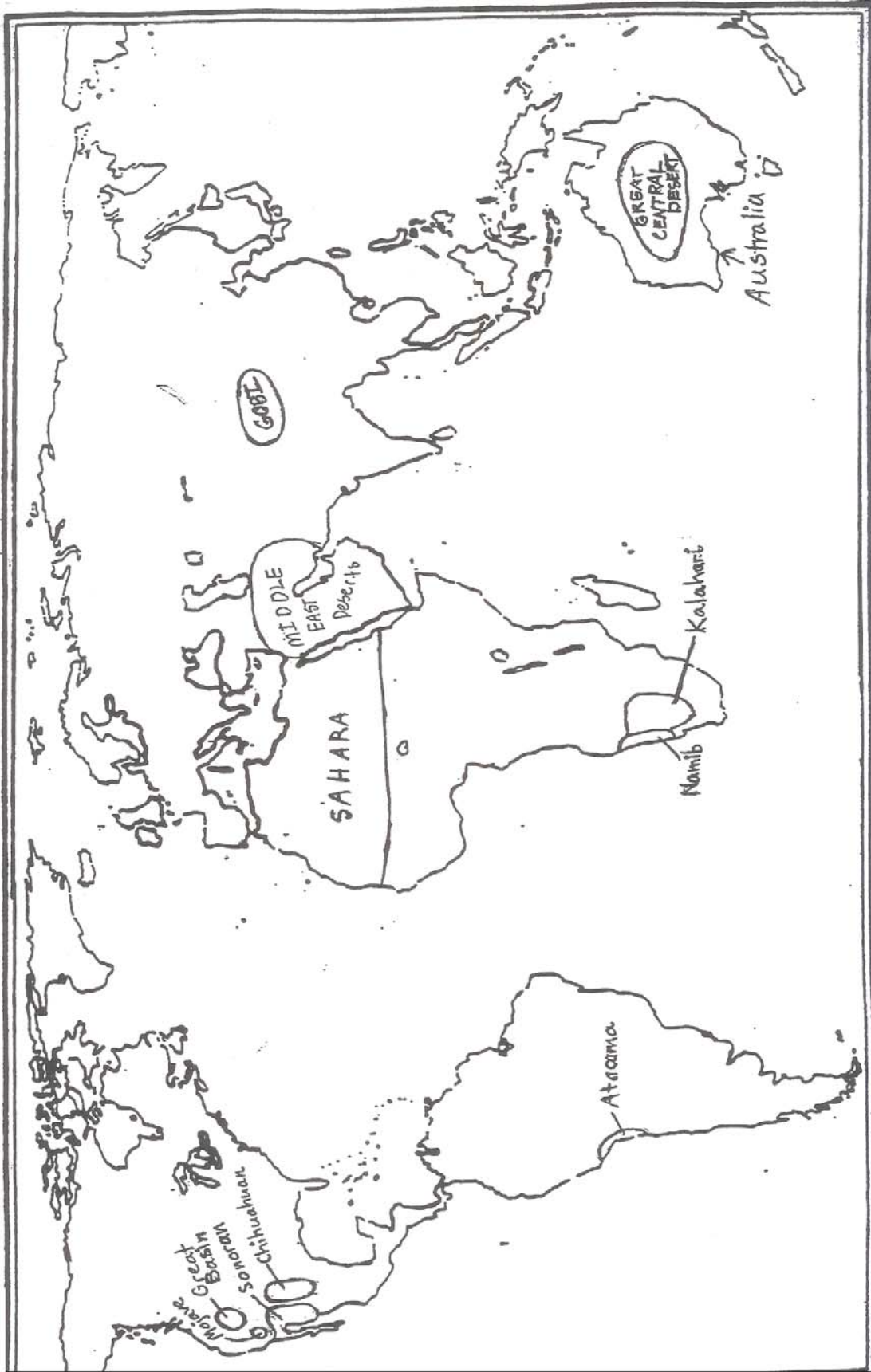
**Problem 5: How To Acquire Food**

Plants are able to make their own food through photosynthesis. For animals, the availability of food can be variable - lots of food after the rains and then long periods of little food. Many animals, such as desert rodents, store food. Other animals, such as birds and larger grazing animals, have the mobility to move about the desert, seeking the spots where food is more abundant. Ectotherms have a distinct advantage over endotherms, since endotherms require more daily food to fuel their internal reactions. Hence, there are lots of desert ectotherms.

References:

- Smith, Robert Leo. 1992. *Elements of Ecology*, 3rd ed. HarperCollins, NY.  
Vankat, John L. 1979. *The Natural Vegetation of North America*. Wiley & Sons, NY.  
Wagner, Frederic H. 1980. *Wildlife of the deserts*. Harry N. Abrams, Inc., NY.

THE WORLD'S MAJOR DESERTS



**CONCEPTS STUDY QUESTIONS FOR EPISODE 6 - THE BAKING DESERTS:**

1. Describe the characteristics of deserts (climate and soil).
2. Explain the difference between hot and cold deserts.
3. Describe adaptations used by desert plants to obtain water.
4. Describe adaptations used by desert plants to keep water ONCE THEY GET IT.
5. Describe adaptations used by desert plants to survive long periods without water.



**VIDEO STUDY QUESTIONS FOR EPISODE 6 - THE BAKING DESERTS:**

1. Be able to name the major deserts of the world and their geographic location.

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**ADDITIONAL INFO.** You will find fascinating information about the Atacama Desert at:

[http://www.worldwildlife.org/wildworld/profiles/terrestrial/nt/nt1303\\_full.html](http://www.worldwildlife.org/wildworld/profiles/terrestrial/nt/nt1303_full.html)

For example, there are places in the Atacama Desert where there is NO recorded rainfall and places where decomposition does not occur because there is no moisture.

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**Locator: Sahara desert**

2. Describe the Sahara desert -- its boundaries, size, daily temperatures and maximum recorded temperature.

3. What evidence exists to suggest that the Sahara was once grasslands instead of desert?



8. What deserts lie north and south of the equator?

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**ADDITIONAL INFO.** Most deserts occur within two distinct belts north and south of the equator, between 15 degrees and 35 degrees N and S latitude, centered between the Tropic of Cancer (23½ degrees latitude N) and the Tropic of Capricorn (23½ degrees latitude S).

Attenborough describes one major force that creates desert conditions - the movement of air masses that are dry because they have lost their moisture to other parts of the land. There are other forces that create dry air. As air rises up tall mountains, the air cools and rain falls on the mountains. As the air currents pass over the mountains and descend, there is little moisture. Many deserts, such as the Great Basin Desert, lie in the rain shadow of mountains.

Other deserts lie in the interior of continents. By the time air gets to the interior, it has been stripped of its moisture. Their remote location is responsible for the formation of the Gobi Desert, the interior of the Sahara and the central deserts found in the interior of Australia.

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9. When are animals active in the Sahara? Why?

10. Be familiar with the different animals that live in the Sahara. Know the diets for the animals listed with a star (\*).

- a. striped hyena

b. fennec fox\*

c. gecko

d. jerboa\*

e. gerbils\*

f. caracals\*

g. scorpion\*

h. black widow spider\*

i. wolves\*

11. How are the wolves in the Middle Eastern deserts different from other wolves?

12. What strategy is used by these animals to avoid the heat?

13. Which animals are active during the day?

**Locator: Desert, Arizona**

- 14. When is the Gila monster active? Is it active throughout the day or at special times?
  
- 15. Describe the Gila monster. What is unusual about the Gila monster? What does it eat?

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**ADDITIONAL INFO.** Until recently, it was thought there were only two poisonous lizards: the Gila monster and the Mexican beaded lizard, found also in the southwestern United States and Mexico. New information suggests that several other lizards may be poisonous, including the Komodo dragon. **Website:** [http://www.livescience.com/animals/051117\\_lizard\\_venom.html](http://www.livescience.com/animals/051117_lizard_venom.html)

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- 16. What does the tortoise eat? How does it survive the desert heat?
  
- 17. How do birds, such as the poor wills, survive the extreme heat of the desert? How does their method of cooling compare to the method used by most mammals?

**Locator: Desert, Africa**

- 18. How does the sand grouse regulate its temperature during the day? What does it eat? How does the male supply water to the young?



25. Describe the desert holly and its adaptations to the heat.

26. Describe the creosote bush and its adaptations to desert life.

27. What is the oldest living organism? How old is it?

28. How infrequent is rain in the Mojave desert?

**Locator: Desert, Arizona**

29. Describe the cactus family. Where are cactus found?

30. Describe the saguaro cactus and its adaptations to desert life.

31. What prevents other animals from using the water reserves of the saguaro cactus?

**Locator: Kalahari desert**

32. How do the Bushmen of the Kalahari desert find water during the dry season?

**Locator: Namib desert**

33. When can patches of grass be found in this desert? How long do they live?

34. Describe the Welwitschia plant and its adaptations to desert life. Why is it considered to have traits of both conifers and flowering plants?

35. What is unusual about the Namib desert? How do animals, such as the darkling beetles, take advantage of the fog?

36. Describe the changes that occur to the stems and seed heads of dead plants when rain finally does come. Explain how seeds are dispersed.

**Locator: Arizona desert**

37. Describe the reproductive cycle of the spadefoot toads.

38. How do fairy shrimp get into these desert pools?

39. Why are there two different forms of the tadpoles of the spadefoot toads? How does this ensure survival of the species?

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**ADDITIONAL INFO:** In his book, Attenborough elaborates on the two types of tadpoles. Carnivorous tadpoles have the advantage if it doesn't rain again. Since they are eating meat, they grow faster. Thus, they have a higher chance of making it to the adult stage before the pool dries up.

On the other hand, if it **does** rain again, the pool becomes muddy. It becomes hard for the carnivorous tadpoles to see their prey. The vegetarian tadpoles have an advantage in this situation because they don't need to see to eat algae. In this situation, they grow faster and have a better chance of becoming adults. (pp 156-159)

David Pfennig (when he was at UT as a graduate student) studied this system. He found that a carnivorous tadpole can tell by taste whether or not a vegetarian tadpole is a brother or sister. If the vegetarian tadpole **is** a sibling, then the carnivorous tadpole will NOT eat it. If the vegetarian tadpole is **NOT** related, then the carnivorous tadpole has lunch. This is another example of an animal foregoing a personal benefit (a meal) so that a relative will have a better chance to survive and reproduce. Thus, this is another case of kin selection. (See *Science*, January 1992. He also has another article on kin recognition in *Scientific American*, June 1995.) You can also find information about kin recognition at this web site:

[http://findarticles.com/p/articles/mi\\_m1169/is\\_n2\\_v33/ai\\_16502769](http://findarticles.com/p/articles/mi_m1169/is_n2_v33/ai_16502769)

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40. How are sand grains formed?

41. Explain how sand dunes are formed. How do sand dunes move?

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**ADDITIONAL INFO.** Not all sand dunes move. If the wind blows mainly from one direction and is relatively constant, the sand is blown up one side of the dune and down the other. Thus, the sand dune moves.

As Attenborough explains in his book, sand dunes do **not** move if the wind is constantly shifting, blowing first in one direction and then in another. These sand dunes are relatively stable and become named landmarks.

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42. What are the difficulties of moving on top of sand?

43. How have some animals, such as the sidewinder and Namib fringe-toed lizard, solved the problem of coping with the surface of hot, shifting sand?

44. What is the advantage of burrowing in the sand? What are the problems with burrowing?

45. Describe the blind skink. What adaptations to living in the sand are found in it?

46. Describe the golden mole. Does it have eyes? Does it have ears? What is its diet?

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**ADDITIONAL INFO:** The golden mole is mentioned in the Earth Almanac section of the May 1997 issue of *National Geographic*. The golden mole hunts insects on the surface of the sands. When s/he's full, s/he swims into the sand about a foot down and becomes torpid, reducing the energy demands. After about 19-20 hours, it's time to hunt again.

How can the mole survive being buried in the sand for so long? The uniform size of the sand grains allow air flow through the spaces between the grains. That way, they get enough oxygen to breathe.

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