North Carolina Science Olympiad

School Name: _____

Student Names:

(Print Legibly)

_____,_____

Circle One:

Varsity

Or

Junior Varsity

(If your school has more than one Junior Varsity, circle the number that corresponds with your team, if you don't know look at your wristband.)
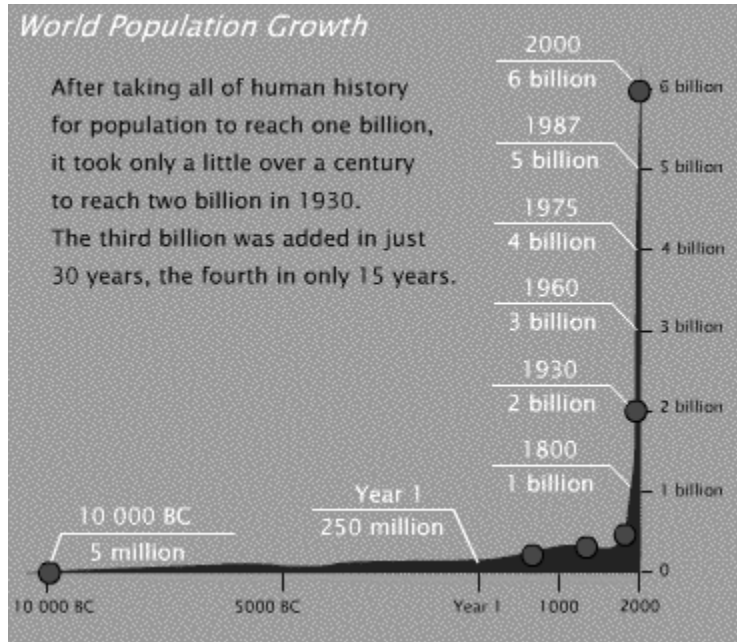
1   2   3   4

Division B
(Middle School)

Raleigh Regional Tournament

Event Name: ECOLOGY C

Principles of Ecology

1. Briefly define ecology:

2. Match the following four fundamental levels of ecological organization with examples given below:

   _____ Community

   _____ Population

   _____ Biosphere

   _____ Ecosystem

   a. A group of organisms that inhabit a particular geographic area such as a forested ravine on the north side of a mountain.

   b. A group of tree species (cypress, tupelos, and maples etc…) all occupying a floodplain of the Tar River

   c. A bottomland swamp forest consisting of trees, shrubs, herbaceous plants, insects, mammals, herpetiles, etc…all interacting with the soil, water, air, and sun.

   d. The portion of the earth that contains living organisms.

3. Briefly differentiate between the terms niche and habitat.

4. Briefly differentiate between interspecific and intraspecific by giving an example of organisms engaged in both scenarios.

Population ecology is the study of how organisms (this includes human beings) interact with themselves and with their environments. Through the course of evolution, it has taken approximately 2 million years for human population to reach one billion, yet only 12 years for human population to jump from 4 billion to five billion.

Source: http://naturalsciences.sdsu.edu/classes/lab2.7/lab2.7.html

5. How do scientists describe the shape of this population growth curve? _____

6. Describe the mathematical nature of this curse. _____

7. Define the ecological concept of carrying capacity (k):

8. When the earth reaches its carrying capacity for human population, how might the shape of the curve change (i.e. what might the shape of the curve look like)? In the space provided below draw your answer and label both x and y axes, but not the numbers.

9. Density and distribution of individuals contribute to a species' success in a particular environment. Draw three general patterns of population in the boxes below. Use dots to represent only individuals in each box.

Random	Clumped	Uniform

10. Which of the following factors may influence species distribution? Circle the correct answer.
    a. Predation
    b. Competition
    c. Resource abundance
    d. All of the above

Use the food web on the following page to answer the questions. Red solid arrows indicate increases that are directly caused by humans. Green arrows show indirect increases. Brown arrows show decreases. Example: the brown arrow connecting humans and avian predators shows that human activity has reduced the number of avian (bird) predators and the green arrow connecting avian predators and granivorous (grain eating) bird shows that reduced numbers of avian predators has increased the number of granivorous birds.

11. What effect would tripling the number of cats have on the number of spiders? Circle One (Increase or decrease)

12. What effect would decreasing water and nutrients have on herbivorous insects? Circle One (Increase or decrease)

13. List 3 groups from the diagram below that are on the second trophic level (primary consumers)? _____ _____ _____

14. Suggest a path by which a molecule of water from a sprinkler could end up in a cat (without the cat drinking the water from the sprinkler).
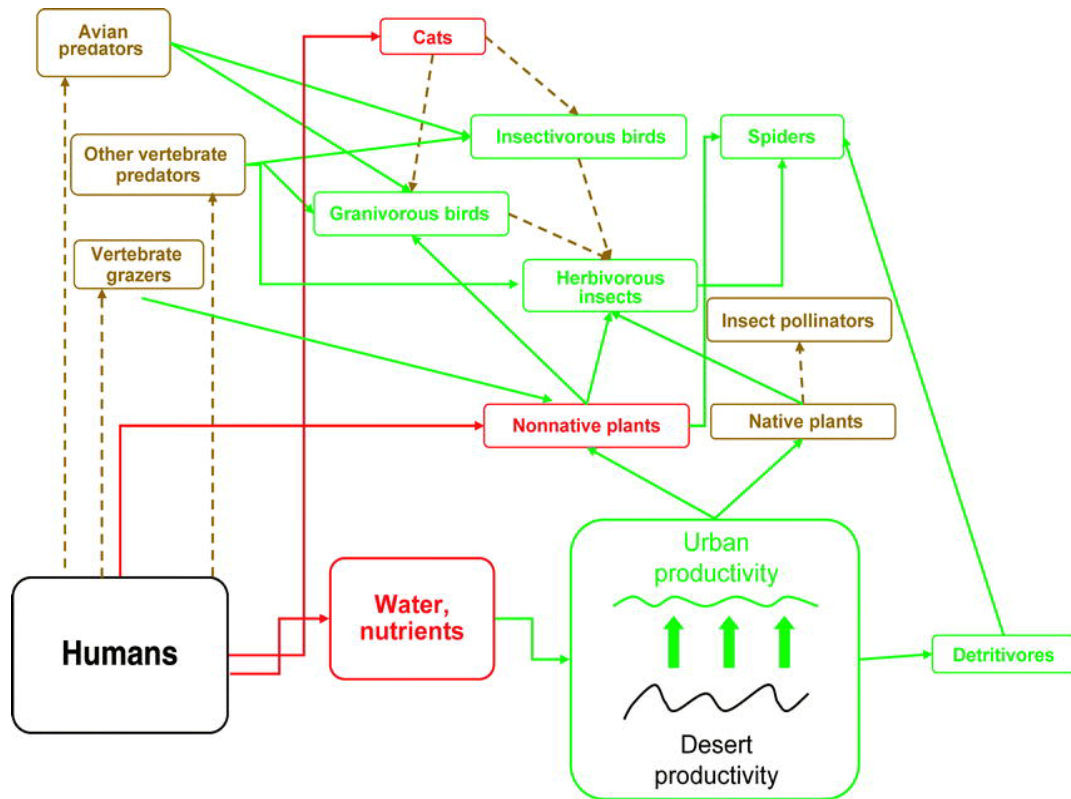
Forest and Desert Ecosystems

15. What are the major primary producers of forests? _____

16. What proportion of the earth's land surface is covered by forests? _____

17. Forests contain approximately _____ % of carbon stored in living organisms on land.

18. How might the destruction of forests contribute to climate change?

19. If a forest is cleared/destroyed for agricultural purposes, and each year thereafter the farmer grows plants in the field to feed humans, how is this any worse than a natural forest if the crops are photosynthetic organisms much like trees?

20. Ecologists have identified three general categories of forest that typically occupy different areas of the globe between the equator and the poles. In the figure below, identify each of the three forest types and which color they are represented by. Use the legend at the bottom to place your answer.


World Forests

_____   _____   _____
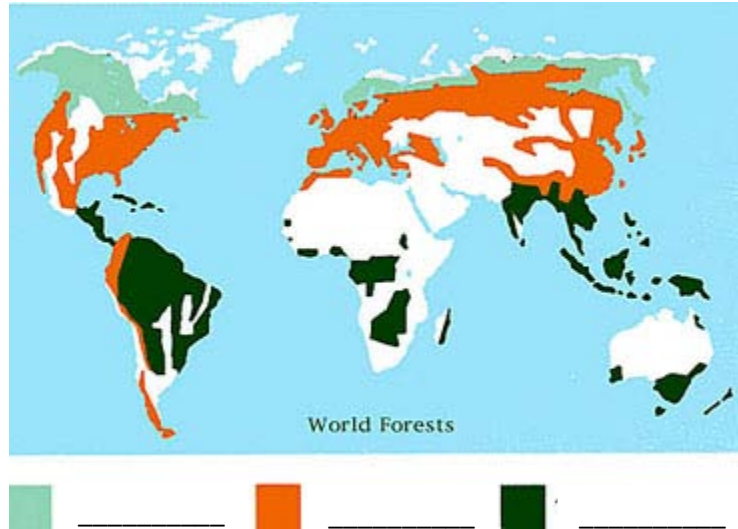
21. There is a clear latitudinal gradient in this map except along the west coast of South America. What abiotic factor may be contributing to this anomaly?

22. How may climate change affect this map?

23. Why is there a greater abundance of the dark green forest type in the southern hemisphere than in the northern hemisphere?

24. What is the most crucial limiting resource in a desert? _____

25. What proportion of the earth's land surface consists of desert ecosystems? _____

26. Are all desert ecosystems perpetually hot environments? Explain your answer.

27. Organisms that inhabit desert ecosystems have evolved to become highly adapted to these environments. Give two example organisms that exhibit evolutionary adaptations that allow them to be competitive in the desert environment and briefly describe the adaptation. Give one flora and one fauna.

28. What is the largest desert ecosystem in the world? _____

29. What continent is almost entirely a desert? _____

30. Are there any desert ecosystems in the US? If so, than where (generally speaking)?
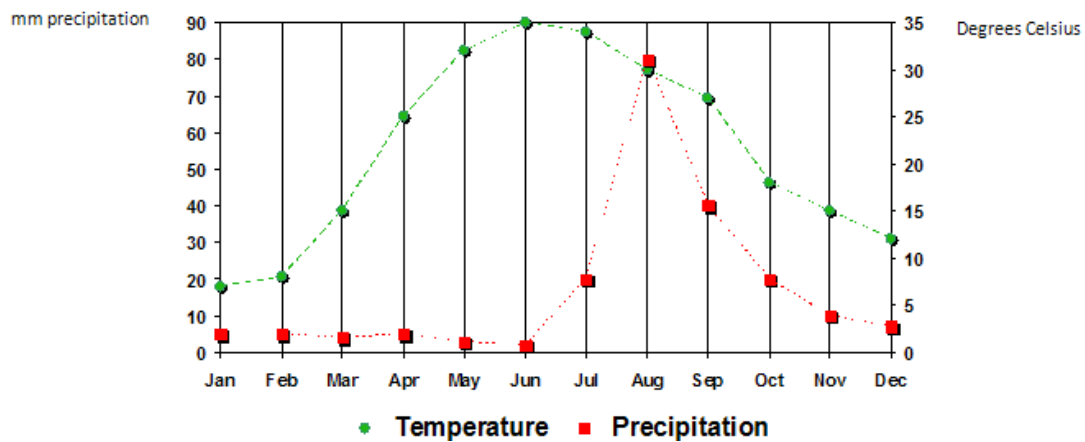

Using the data from the desert ecosystem above, answer the following questions:

31. In what month would you expect soil moisture to be lowest?
    a. June
    b. July
    c. August
    d. September

32. Between what months would you expect the seeds of annual plants to germinate?
    a. March-May
    b. August-October
    c. December to February

33. If 1 inch = 25.4 mm, approximately how much rain fell in August in inches? _____

Units on the y axis show the depth in cm of the water table below the surface of a marsh near Rose Bay, NC. The data and time of the measurements are show on the x axis. (0:00 = midnight and 12:00 = noon)
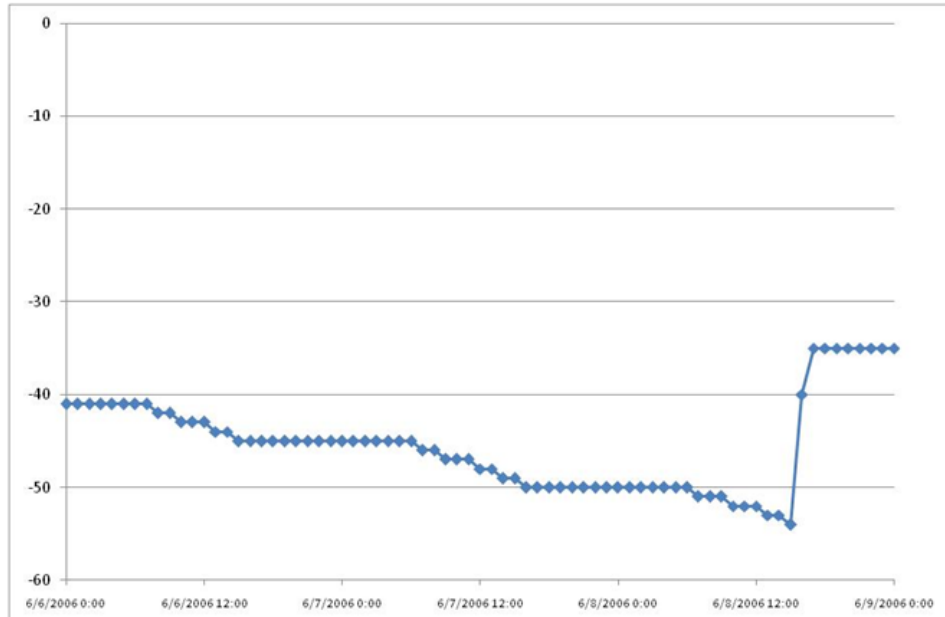
34. Using the graph above describe what is going on.

<u>Principles of Ecology –</u>ANSWER KEY – ANSWER KEY – ANSWER KEY-

1. Briefly define ecology: The systematic study of how organisms interact with one another and with their environment.

2. Match the following four fundamental levels of ecological organization with examples given below:

    B   Community

    A   Population

    D   Biosphere

    C   Ecosystem

    a. A group of organisms that inhabit a particular geographic area such as a forested ravine on the north side of a mountain.

    b. A group of tree species (cypress, tupelos, and maples etc…) all occupying a floodplain of the Tar River

    c. A bottomland swamp forest consisting of trees, shrubs, herbaceous plants, insects, mammals, herpetiles, etc…all interacting with the soil, water, air, and sun.

    d. The portion of the earth that contains living organisms.

3. Briefly differentiate between the terms <u>niche</u> and <u>habitat</u>.
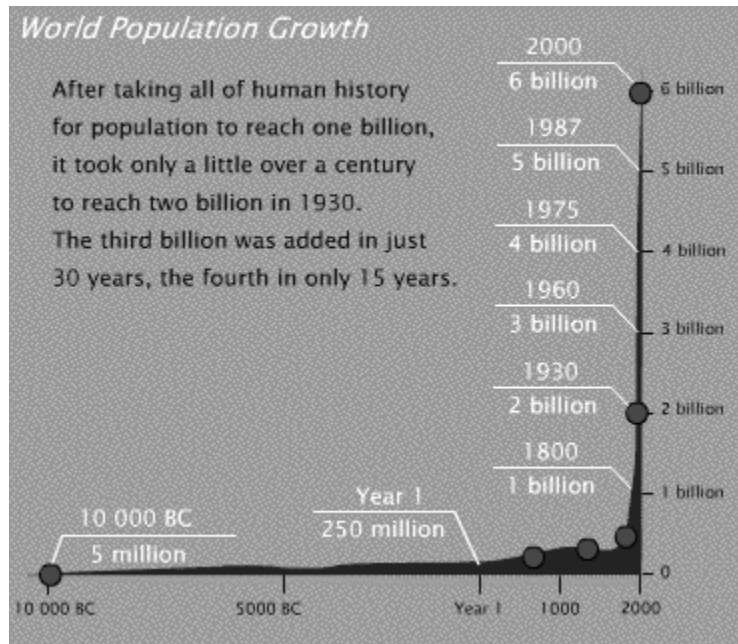
    A niche describes the functional role of an organism in a community; e.g. its job. A habitat, on the otherhand is the physical place where an organism live (i.e. geographically where it fulfills its niche, e.g. a pine forest, a brackish marsh, a ravine, etc….

4. Briefly differentiate between interspecific and intraspecific by giving an example of organisms engaged in both scenarios.

    Interspecific relates to competition between two different species
       e.g. between a moose and deer for say palatable vegetation

    Intraspecific relates to competition between individuals of the same species/population.
       e.g. Loblolly pine trees competing for light.

Population ecology is the study of how organisms (this includes human beings) interact with themselves and with their environments. Through the course of evolution, it has taken approximately 2 million years for human population to reach one billion, yet only 12 years for human population to jump from 4 billion to five billion.
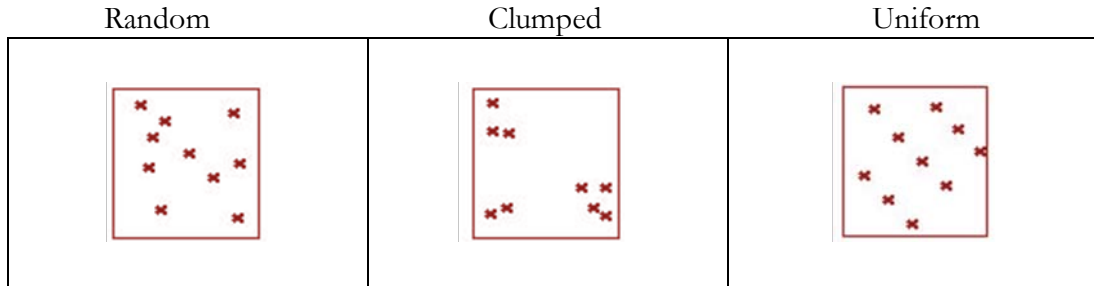

World Population Growth

After taking all of human history for population to reach one billion, it took only a little over a century to reach two billion in 1930. The third billion was added in just 30 years, the fourth in only 15 years.

2000
6 billion — 6 billion
1987
5 billion — 5 billion
1975
4 billion — 4 billion
1960
3 billion — 3 billion
1930
2 billion — 2 billion
1800
1 billion — 1 billion
Year 1
250 million
10 000 BC
5 million

10 000 BC   5000 BC   Year 1   1000   2000

Source: http://naturalsciences.sdsu.edu/classes/lab2.7/lab2.7.html

5. How do scientists describe the shape of this population growth curve? _____ J Curve _____

6. Describe the mathematical nature of this curse. _____ Exponential _____

7. Define the ecological concept of carrying capacity (k):

   The maximum number of individuals of a species or population that a given environment or area can sustain.

8. When the earth reaches its carrying capacity for human population, how might the shape of the curve change (i.e. what might the shape of the curve look like)? In the space provided below draw your answer and label both x and y axes, but not the numbers.
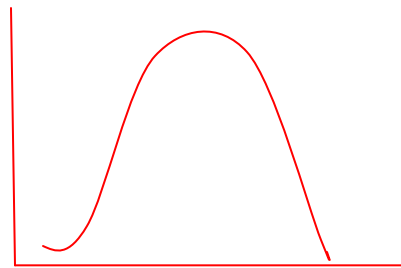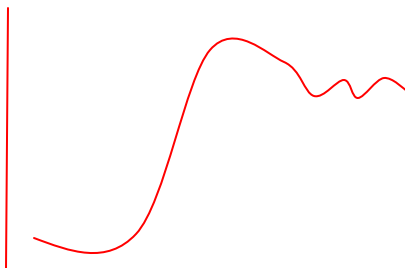
9. Density and distribution of individuals contribute to a species' success in a particular environment. Draw three general patterns of population in the boxes below. Use dots to represent individuals in each box.
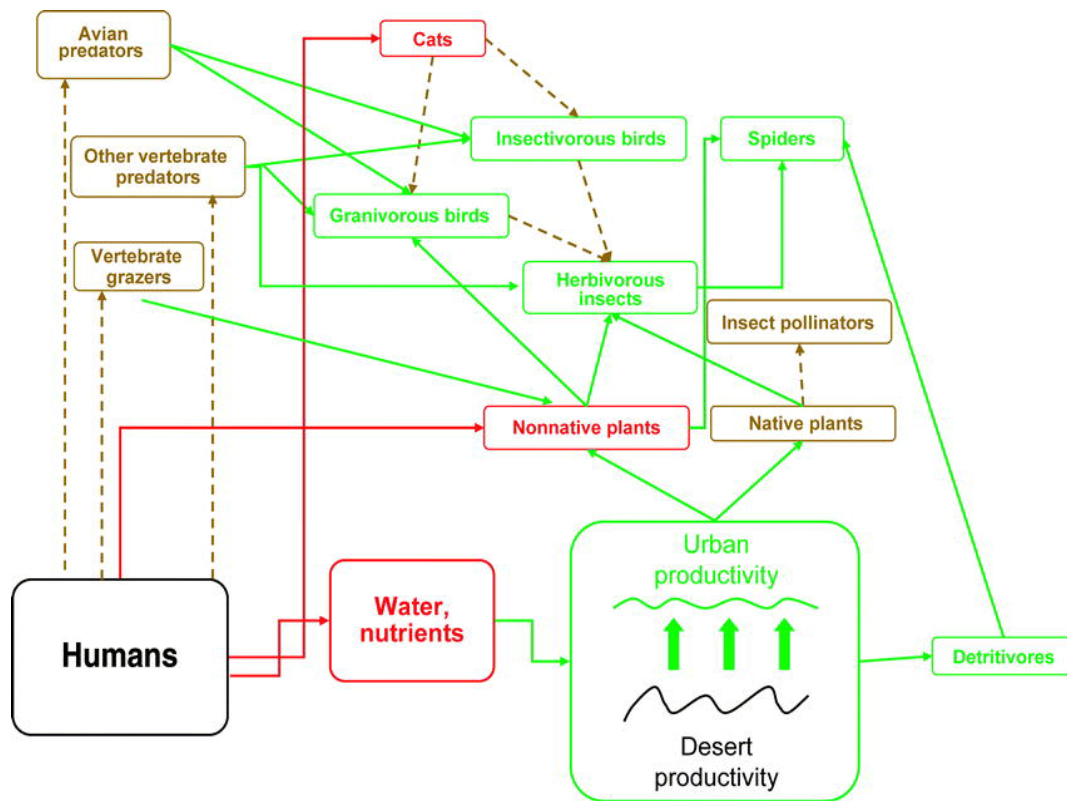
Random	Clumped	Uniform

10. Which of the following factors may influence species distribution? Circle the correct answer.
    a. Predation
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    c. Resource abundance
    d. All of the above

Use the food web on the following page to answer the questions. Red solid arrows indicate increases that are directly caused by humans. Green arrows show indirect increases. Brown arrows show decreases. Example: the brown arrow connecting humans and avian predators shows that human activity has reduced the number of avian (bird) predators and the green arrow connecting avian predators and granivorous (grain eating) bird shows that reduced numbers of avian predators has increased the number of granivorous birds.

11. What effect would tripling the number of cats have on the number of spiders? Circle One (Increase or decrease)

12. What effect would decreasing water and nutrients have on herbivorous insects? Circle One (Increase or decrease)

13. List 3 groups from the diagram below that are on the second trophic level (primary consumers)? Herbivorous insects vertebrate grazers Granivorous birds

14. Suggest a path by which a molecule of water from a sprinkler could end up in a cat (without the cat drinking the water from the sprinkler).

    Water →Native Plant→Herbivorous insect→Insectivorous bird→Cat

Avian predators

Cats

Insectivorous birds

Spiders

Other vertebrate predators

Granivorous birds

Vertebrate grazers

Herbivorous insects

Insect pollinators

Nonnative plants

Native plants

Humans

Water, nutrients

Urban productivity

Desert productivity

Detritivores

Forest and Desert Ecosystems

15. What are the major primary producers of forests? ___Trees___

16. What proportion of the earth's land surface is covered by forests? ___1/3rd___

17. Forests contain approximately ___70___% of carbon stored in living organisms on land.

18. How might the destruction of forests contribute to climate change?

Forests remove carbon dioxide, a greenhouse gas, from the atmosphere and cycle it through the environment. Destruction of forests disrupts this cycle leader to a net increase of carbon dioxide in the atmosphere that would otherwise be sequestered in the terrestrial environment. Carbon dioxide is a greenhouse gas.

19. If a forest is cleared/destroyed for agricultural purposes, and each year thereafter the farmer grows plants in the field to feed humans, how is this any worse than a natural forest if the crops are photosynthetic organisms much like trees?

Clearing a forest for agriculture destroys a naturally functioning ecosystem creating a high energy demanding land use often requiring fossil fuel inputs, and contributing to global warming. Destruction of forests leads to a decrease in biological diversity, species richness, etc…

Ecologists have identified three general categories of forest that typically occupy different areas of the globe between the equator and the poles. In the figure below, identify each of the three forest types and which color they are represented by. Use the legend at the bottom to place your answer.

World Forests

██ Boreal   ██ Temperate   ██ Tropical
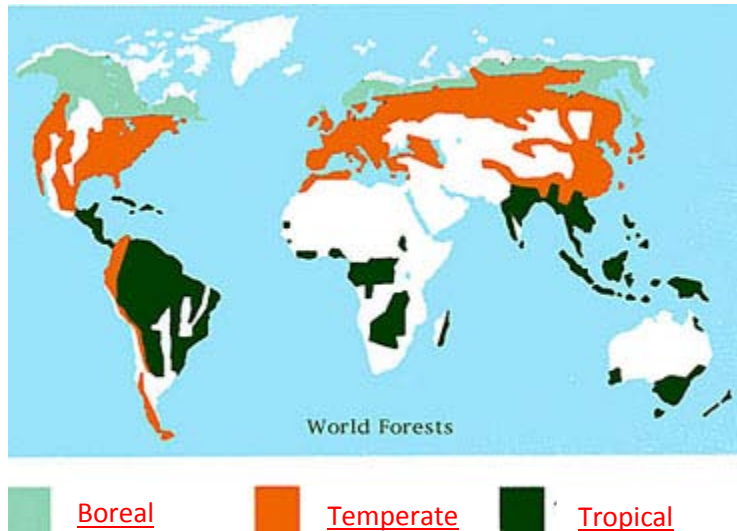
20. There is a clear latitudinal gradient in this map except along the west coast of South America. What abiotic factor may be contributing to this anomaly?

Mountains or altitude

21. How may climate change affect this map?

All forest types are likely to spread away from equator. Boreal forest types may disappear altogether and tropical forests may become deserts if precipitation is altered

22. Why is there a greater abundance of the dark green forest type in the southern hemisphere than in the northern hemisphere?

Greater surface area of ocean waters. Water has a greater retaining heat retaining capacity than land, thus the southern hemisphere is generally warmer than the northern and more humid.

23. What is the most crucial limiting resource in a desert? _____Water_____

24. What proportion of the earth's land surface consists of desert ecosystems? 1/5th

25. Are all desert ecosystems perpetually hot environments? Explain your answer.

No, deserts may be very warm during daylight hours, but temperatures may drop rapidly over night as there is

26. Organisms that inhabit desert ecosystems have evolved to become highly adapted to these environments. Give two example organisms that exhibit evolutionary adaptations that allow them to be competitive in the desert environment and briefly describe the adaptation. Give one flora and one fauna.

    Camel, hump on its back to store water.
    A rodent that burrows beneath ground and forages at night.
    The thick waxy skin of a cactus and other plants.
    Nocturnal behaviors
    Ephemeral plants (i.e. rapid life/reproductive strategies to capitalize water use as available)
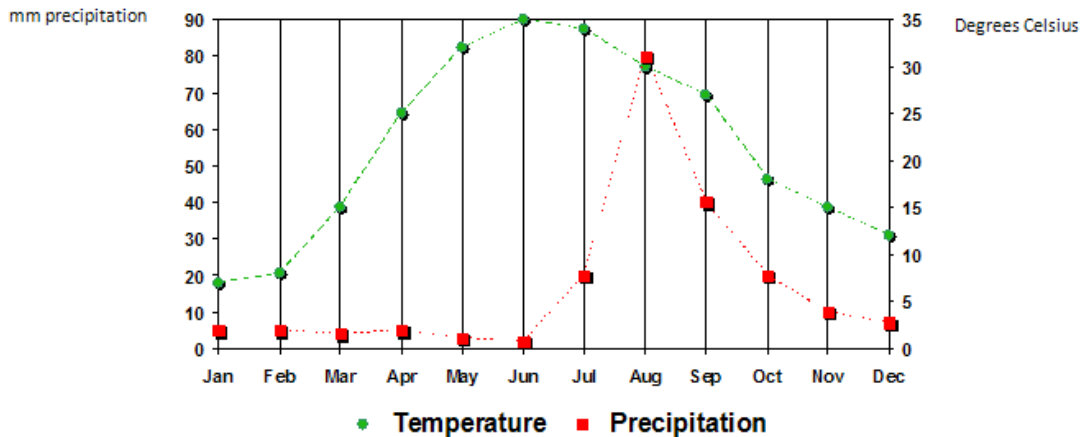   Coloration of animals, lizards
    Appendages as radiators, scales of lizards

27. What is the largest desert ecosystem in the world? ___The Sahara Desert___

28. What continent is almost entirely a desert? ___Australia or Antarctica___

29. Are there any desert ecosystems in the US? If so, than where (generally speaking)?

    The Southwest, Utah, Arizona, New Mexico, California

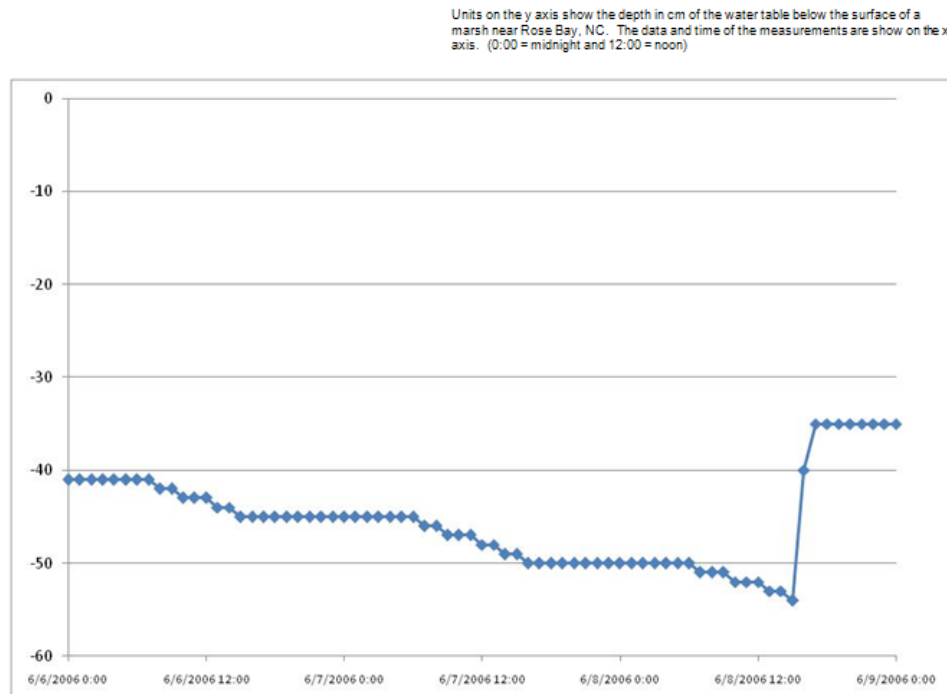Using the data from the desert ecosystem above, answer the following questions:

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32. If 1 inch = 25.4 mm, approximately how much rain fell in August in inches? _3.15 inches_

Units on the y axis show the depth in cm of the water table below the surface of a marsh near Rose Bay, NC. The data and time of the measurements are show on the x axis. (0:00 = midnight and 12:00 = noon)

33. Using the graph above describe what is going on.

The water table is decreasing from -41cm to -54 cm during June 6, 2006 – June 8, 2006. A rainfall must have occurred on or a little after the 8th of June at which time the water table rose to -34 cm.