Hunter College - CUNY
Dept. of Geography & Environmental Science
GEOG 101 Lecture Presentation Summary
Spring 2020

***NOTE**: In the absence of face-to-face lecturing and explanation of the material presented in the lecture slides, I will summarize the content of each lecture presentation stressing the concepts and interrelationships that are essential to an introductory geography course.*

If, after viewing the lecture presentation, the imbedded short videos and hot links to articles, and after reading this summary, you have any questions, would like to contribute a comment or two, need clarification by other examples or would like additional information on the topic, please do not hesitate to email me at agrande@hunter.cuny.edu.

LECTURE 16: Earth Habitat: The Biosphere

- The focus of Lecture 16 is the **Biosphere,** the 4th of the earth's physical systems. Here the focus is life.

- **Slides 4 and 5.** The biosphere is the "zone of life." It exists at the *interface* of air, water and land and is sun dependent. It includes all living things. Plants are the most sensitive lifeforms because they cannot relocate easily or adapt to quick changes.

- **Slide 6** is a map of **world biomes** (or ecoregions) which are zones having unique characteristics of temperature, moisture, elevation, slope and hours of sunshine that support plant and animal life. (Note how it resembles the world climates, natural vegetation and soils maps.) Each major group can be divided into smaller and smaller units (ecozones/ecosystems/niches) depending on local characteristics, as the flora and fauna on the sunny side of a hill or in a wetlands area at the bottom of a valley.

- **Slides 7-11** focus on terrestrial (land) biomes. Here we look are plant (flora) and animal (fauna) communities. Conditions present allows them to survive and thrive. When conditions change (drier/wetter/hotter/colder/less food, etc.), so do the communities since each exist within certain parameters. The necessary components of a biome have to be preserved, recycled and renewed to avoid reaching carrying capacity (maximum life support) and to maintain the quality of its habitat (quality of a habitat for a life form varies with conditions). *BTW, The Wildlife Conservation Society (Bronx Zoo), Audubon Society, Sierra Club and other such organizations employ geographers to study ecoregions.*

- **Slide 8** represents **Northern Hemisphere biomes** as a triangular graph. The bottom line represents the amount of moisture and the left side represents temperature. Four latitudinal zones of are illustrated (Tropical/Temperate/Subarctic and Arctic) and they focus on the major vegetation groups within the constraints of temperature and moisture.
  *Note that moisture decreases from left to right on the graph **(Important: This DOES NOT represent west to east)** in each zone and that temperature decreases from the lower left corner to top corner as latitude increases. Therefore, the lower left corner has the most heat and moisture (equatorial zone = 0°) and supports a tropical rainforest and the top cor-*

ner is cold and dry (Ice cap at 90°N). The lower right corner represents tropical deserts (hot and dry). The boundary between the subarctic and arctic zones is called the ***tree line****. North of this point it is too cold for trees to grow and only tundra vegetation is supported.* This diagram may be inverted and annotated for the Southern Hemisphere

- **Slides 9 and 10: Vegetation Sequence.** The vegetation sequence diagrams represent the temperature (or left) side of the biomes graph. It illustrates the vegetation sequence in more detail incorporating aspects of temperature and moisture. **Refresh your memory of the global wind systems diagram.**
  - We start in the equatorial zone (tropical rainforest) at bottom left, moving northward to the subtropical desert (25°*N* - this would be the Sahara in Africa).
  - Notice how the vegetation changes moving northward from the rainforest; trees become less dense and shorter until you reach seasonal semi-arid areas (savannas) and semi-arid areas (steppes) where it is too dry for trees, which then merges into the desert.
  - Starting around 35°N when rainfall starts to increase the steppe reappears before blending into a Mediterranean-type climate. Continuing northward both rainfall and seasonality increases. The forest returns with deciduous (leaf-dropping) trees, then blends into coniferous (evergreen) trees.
  - The great forests of Canada and Russia, called "taiga", have a limited variety of coniferous tree species (seasonality +cold). Soon it becomes too cold and too short a growing season for all but the hardiest trees to survive. Here the taiga merges with the tundra and the **tree line** is set – too cold for any tree species. The tundra supports grasses, mosses and lichen.
  - Finally, poleward of 80°N permanent snow and ice dominate; too cold for moss or lichen to survive.

- **Slide 11 is a composite of Slides 9 and 10.** Here the vegetation sequence is represented as a continuous line from the equator to the North Pole. (The same diagram may be constructed for the equator to South Pole sequence.) Segments are places in their latitudinal positions on the sides of the triangle.

- **Slide 12** is a very simplified world map of animals. *Zoogeography studies the distribution of animal species past and present in relation to their physical surroundings and also in relation to the human population.*

- **Slide 13** brings us back to soils. It shows the relationship between temperature and moisture working on organic and inorganic (rock) material in soil formation. Cold temperatures and dry conditions both slow the process. That's why deserts and subpolar areas have such a thin soil layer. Conversely, tropical rainforests have thick soils because of the constant breakdown of material. **NOTE:** However, all the heat and water cannot maintain a soil if there is no vegetation to provide organic material. When rainforests are cut down, soil loses its fertility in a matter of decades, whereas it takes thousands of years to create a soil.

- **Slides 14 and 15:** The concept of habitat creation and stability is presented here. **Climax vegetation** is the best species of plant(s) for a particular set of physical circumstances. On a bare surface plants will go through a series of stages where one becomes dominant under a set of conditions. After a major fire, grasses return first, then bushes and shrubs, then sun-loving trees. Taller tree species grow over the sun-loving trees as they try to reach sunlight, eventually killing the shorter trees. This continues until stability is reached and nature is balanced. **Climax community** takes this one step further by bringing in other life forms (mammals, birds, insects, reptiles, fungi) that live in and share this habitat providing for each other: a deer eats grass and its waste fertilizes the ground; the deer provides food for a wolf or mountain lion.

- **Slide 16:** The last part of this lecture deals with **natural controls and cycles**. It seeks to explain why the earth has not run out of things needed for its and our survival. We have already covered temperature controls and the geologic cycle. *Review the material from previous lectures.* Now we will be introduced to the chief parts of the **biogeochemical cycle**: water, carbon-oxygen, nitrogen and nutrient. Everything just listed is interrelated and does not stand alone.

- **Slide 17:** Look over this simplified diagram. Notice the direction of the arrows. Also notice that the atmosphere, hydrosphere, lithosphere and biosphere are part of the cycle. ***View the 5-minute video on the carbon cycle which also incorporates information about the other cycles since they are interrelated*.**

- **Slides 18 and 19** present the **Hydrologic Cycle**, the reason we have not run out of fresh water. Even though most of the water on earth is salty ocean water, evaporation removes the water molecules (H_2O) and leaves behind the dissolved mineral salts that came from the land. That is why the oceans are salty and water in desert areas tends to be salty, e.g., Great Salt Lake in Utah. <u>*Know the 7 parts of the Hydrologic Cycle*</u>. ***View the 6-minute video on the water cycle*.**

- **Slides 20 and 21** present the **Carbon-Oxygen Cycle.** Look over the diagram. Oxygen (O_2) and carbon dioxide (CO_2) are mutually dependent. The processes that create CO_2 depend on oxygen to sustain them. Sunlight-powered **photosynthesis** using chlorophyll in green plants and other organisms uses carbon dioxide as part of its food supply. Oxygen is a byproduct of this process. Unfortunately, CO_2 has very efficient heat-retaining capabilities. Any increase in CO_2 production is greatly magnified and therefore the human-driven global warming from the burning of fossil fuels and reduction of carbon-absorbing processes is contributing to global warming (slide 21).

- **Slide 22** shows the **Nitrogen Cycle**. Nitrogen gas makes up more than three-quarters of the atmosphere, but it is not usable unless converted. The chief parts of the cycle for us are **nitrogen fixation**, **assimilation** (absorption by plant roots), **chlorophyll production**, and **denitrification**. For plants water-soluble compounds of ammonia and nitrate are most important. Plants can absorb them with the water taken up by roots and use them to make *chlorophyll* (green matter) that is important in photosynthesis. Nitrogen-fixing bacteria on the roots of plants, esp. legumes, easily convert nitrogen. Atmospheric nitrogen is converted by the intense electrostatic discharge generated by lightning; the compounds created return to earth in rain and snow and then soak into the ground (recall the hydrologic cycle). Artificial nitrogen compounds can be made by fertilizer manufacturers. Lastly, **denitrification** the term that refers to the return of nitrogen to the gaseous state as the compounds break down. ***Review the carbon cycle video which incorporates information about the nitrogen cycle.***

- **Slides 23-26** focus on the **Nutrient Cycle.** The Nutrient Cycle overlaps with the other cycles and is the basis of soil fertility. It is water and temperature dependent and relies on organic, inorganic, and gaseous elements to maintain a balance.
- **Slide 24:** The three major **sources of organic material** in the Nutrient Cycle come from decomposition of organic material (plant/animal), residue from fire, and deposition from flooding. All mix with inorganic surface material to recharge soil fertility.
- **Slide 25:** Here we look at the **benefits that a forest/grassland fire provides**. Only the rare inferno is 100% destructive – bark protects the tree truck and roots are protected by soil. Nature rebounds from the devastation and is most cases is better than before. The chance of another catastrophic fire is lessened. Dead, old and sick vegetation is removed; insect pests and plant diseases are checked; nutrients are released into the soil; some tree seeds need the heat of a fire to burst their pods; the climax vegetation sequence begins anew, sometimes with greater diversity than before. The illustration and the graph show timelines.
- **Slide 26:** Here we look at the **human impact** on the Nutrient Cycle. The list includes the deterioration of nutrients by the works of people, as well as decision-making that may be environmentally harmful.