Hunter College - CUNY
Dept. of Geography & Environmental Science
GEOG 101 Lecture Presentation Summary
Spring 2021

NOTE: In the absence of in-person lecturing and face-to-face explanation of the material presented in the PowerPoint lecture slides, I will summarize the content of each lecture presentation, stressing the concepts and interrelationships that are essential to an introductory geography course. In essence, it is like giving you a transcript of my classroom lectures.

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

LECTURE 08: Automated Mapping

- The purpose of this lecture is to discuss the use of digital data to create, revise and print maps. Digital data when tied to a software program allows maps to be created by entering data for specific variables within the formats selected.
    - This ends the first portion of the course and Exam 1 follows.
    - **Check the calendar for exam availability.**

- **Slide 2: Digitizing an Existing Map.** Even paper maps can be turned into an electronic data base by the process of "*digitization*." *(This is the same principle of a FAX machine but here the data is not just converted, but stored. When retrieved, the saved data can be manipulated.)* An electronic mesh is assigned to every portion of the scanned paper map. The intersections on the mesh are called "*X,Y coordinates*." **IMPORTANT: This is NOT latitude and longitude.** The finer the mesh, the greater the detail that is picked up. *(Remember the pixel and HD examples from Lecture 7.)* The details from the map are transferred to the mesh and are called "*attributes.*" Many details can be added to each X,Y coordinate, including latitude and longitude: the process is called "*geocoding.*" Attributes may be added and/or manipulated by including new variables. *In Historical Geography, Cultural Geography and Environmental Science, older maps are a useful research tool to study change*.

- **Slide 3: Please differentiate between X,Y coordinates and latitude and longitude coordinates.** They are two different types of grids. Many students confuse the two. In this sense, latitude and longitude are just two variables that **may** be added as attributes.

- **Slides 4-9 look at digitization and the map-making process**. They also explain the difference between raster and vector formats.
    - **Slide 4:** The placement of an electronic mesh over a paper map is illustrated as is the conversion of objects and point locations into attributes.
    - **Slide 5:** To revise a digitized map, we just need to change or update the attribute in question at an X,Y coordinate. We do not have the redraw the entire map or re-enter all the data sets.
    - **Slides 6-7: Vector and Raster Formats.** These formats present electronic data differently. Both have benefits and drawbacks. Look closely at the examples.
    - **Slide 8: Automated Map Making.** This slide shows the sequence of compiling data to make or revise a map. (1) After the paper map is digitized, an electronic mesh with its X,Y coordinates is created. (2) Attributes are added to the X,Y coordinates. (3) Map symbols and words are assigned to the attributes. An added benefit is that once the information is cross-referenced, as changes are made, any linked attributes

will also change as per the software program instructions. The process is called "*automated cartography*."

- **Slide 9: Automated or Computer Cartography.** Automated cartography uses a digital database and software programs (instructions) to compile, design, draw and revise maps. A "digital elevation model (DEM)" is a set of equally spaced land elevation statistics tied to latitude and longitude. DEMs are put together using satellite-generated GPS data that includes time (atomic clock set at GMT). The time factor allows for sequencing and animated maps. For example, the flood zone map illustrates how a DEM can be used to estimate the extent of flooding an area would experience if water rose in certain increments. *Check out the flood map. Find NYC and zoom in to locate your neighborhood.*

- **Slides 10-11: Georeferencing.** This refers to the use of control points to match old maps with current situations or objects seen on imagery with objects on the ground. One needs to select an object that cannot be easily moved or relocated (termed a control point), as a castle on a 13th century map of England or a rock outcrop along the Oregon Trail. We can compare the castle's or rock's location on the old map to a present-day map to see how accurate the original map-maker was in presenting the area or use the castle or rock to field check maps made using imagery. Once both are digitized, they can be placed over each other as electronic tracing paper. This allows features to be matched. The electronic map can be altered to correct errors (transformation georeferencing and rubber sheeting). *View the short georeferencing videos.*

- **Slide 12: Geocoding Address Lists.** Ever wonder how your online shopping service knows where you live? Just about every address in the developed world has been entered into a data base that locates it on the earth's surface and most are cross-referenced to a telephone number and/or email address. Three examples of the use of address-matching are: **a) clustering** – creates a service zone or a target population; **b) routing** – connecting addresses with local dynamics as one-way streets and real-time traffic to get from one point to another or to create a delivery schedule; and **c) finding a service-provider** or the nearest type of activity or land-use within a set of parameters.

- **Slide 13: Portraying Crime Data Using a DEM.** When address matching is combined with a DEM program, special types of maps result. This example locates crimes in San Francisco by address *(all police departments enter the nearest street address when reporting crimes or responding to a call).* This information is entered into the DEM program which then uses the number of instances associated with the address *(instead of landform elevation)* to create these visually striking maps.

- **Slides 14-16: 3-D Maps and Animations.**
  - **Slide 14:** Because digitization allows us to assign many attributes to any X,Y coordinate, we can also add data *(e.g., sun angle, compass direction and time)* that allows for the optical illusion of three-dimensionality and movement. By changing attributes, the computer creates hundreds of unique maps within seconds that when played in rapid succession gives the illusion of movement within a 3-D environment – the animated map. *(Interactive computer games that include movement over a terrain use this technology.)*
  - **Slide 15:** View the short examples by clicking on the hot links. Weather forecast maps are a common use of this technology, but flood prediction, tourist guides, flight simulators and urban planning projects are some other examples.

- **Slide 16** illustrates when combining a digitized map with a digitized photograph or image, a 2-D map becomes a 3-D map. Equal elevation attributes are connected by isolines. *View the video.*

- **Slide 17-20: LIDAR Mapping.** LIDAR was defined in Lecture 7 as a technique that uses laser light to take measurements. The laser-generated image can be processed to appear to either bounce off or penetrate objects, as forest tree top, desert sand, soil layer, bedrock.
  - **Slide 17** shows the mapping of layers of a dense forest.
  - **Slides 18 and 19** show the exploration of the tropical forest of Guatemala for Mayan ruins. Notice how well the ruins at the archeological site are depicted by LIDAR when they are compared to the area after it was located and cleared by a ground team.
  - **Slide 20** has images taken from the Washington State Dept of Natural Resources LIDAR Portal and its Bare Earth project.

- **Slides 21-22. Biodiversity Mapping.** When multiple remote sensing techniques are combined and linked, a detailed survey of an area difficult to reach may be done. Here LIDAR is able to penetrate sea water and assist in the mapping of coral reefs. Spectral signatures assess the health of the reef.

- **Slide 23: Computer Cartography.** While mapping using computer programs may seem easy, it is a complicated process that needs a trained individual to "tell" the computer what to do so that a readable, useful map is prepared.

- **Slide 24: Geographic Components of Reality.** When we look at an area of the world from an overlook or view a picture of a place, all we see are the combinations of surface components. Each of them is unique and the combination of all of them creates a unique landscape. Since the world is composed of many geographies that are linked on the earth's surface by points of latitude and longitude, geographic research using electronic data sets can separate them, yet maintain their correct proximity to each other. <u>This is the role of Geographic Information Systems (GIS) studied within the field of Geographic Information Science</u>. The GIS World Model illustrates the different layers (or geographies) that are found on earth.

- **Slides 25-26: Geographic Information Systems (GIS).** GIS goes beyond automated cartography because it is designed for data management and analysis as well as data mapping. *View the GIS video.* The world is composed of many layers of geographic information and <u>a GIS is able to look at each one separately or in any combination the researcher wishes to see</u>. Layers can be added or removed and "What If?" layers that do not presently exist can be added to test a theory or hypothesis.

- **Slides 27-31: Features of a Geographic Information System (GIS).** A GIS is a unique tool because it allows data to be <u>manipulated</u>, it is <u>interactive</u>, it helps us to create <u>standardized models</u> and it allows us to use these models to create <u>geographic simulations</u>, the "*Smart GIS*."
  - **Slide 28: Data manipulation** – allows us play with data, poses "What if…?" questions, and creates specialized maps
  - **Slide 29: Interactive component** – since everything is linked, when any variable changes, all linked attributes are readjusted automatically according to pre-programmed instructions.
  - **Slide 30: Modeling -** creation of standardized capability and suitability models that can be stored and retrieved. Why reinvent the wheel when models can be created to

handle “normal” or “usual” situations and to recognize when the situation is not normal or usual.

- **Slide 31: “Smart GIS”** feature - creates simulations that can be remotely recognize conditions from afar, initiate a reaction based on the sensed data, and send out instructions to deal with the situation. *Example: the GIS in a car yelling at you to make a U-turn because a scheduled action (as a highway entrance ramp) was missed.* Through latitude and longitude, the GPS device knows where you are and the location of the entrance ramp so it knows when you missed it!

- **Slide 32: FIRST EXAM COVERS LECTURES 1-8.** Review the instructions and study guide when they become available, including the place names (with maps) for Europe and Africa.