

# The Dot Density Map

- **Slide #2: Dot density maps are quantitative maps**
- Information pertaining to density and distribution is gained by visual inspection of the spatially arranged symbols to arrive at relative magnitudes
- Although any symbol can be used, it is customary to use dots
- **Slide #3:** In a single map, the **size, shape, color** does not change but the **frequency of dots** changes from area to area in proportion to the number of objects being represented
- The technique works best for data that are tabulated in enumeration areas as totals, and has been **used extensively for mapping agricultural production data and population data**
- **Slide #4: See figure 7.1, p. 120**
- GIS and mapping software that support this technique **randomly place the symbols** within the respective enumeration units

- Dot locations are approximate, at best
- If additional data is available to further position dots more closely to where the phenomena actually occur, then the map's quality improves

## Advantages and Disadvantages of Dot Density Mapping

### Advantages

- **Slide #5:** The rationale of mapping is easily understood by the map reader
- It is an effective way of illustrating variations in spatial density
- GIS and mapping software that support this technique allow the cartographer to quickly view and evaluate many dot value and size combinations with relative ease

## Possible Disadvantages

- **Slide #6: Reader perception of dot densities is not linear.** A person viewing an area with 10 times the number of actual dots compared with another area will usually not estimate values in those two areas in the same proportion as depicted by the dots on the map
- GIS and mapping software typically randomize dots within enumeration units, resulting in dots that may not be close to the phenomena they represent
- Ancillary data layers or imagery should be used in controlling dot placement, but in many cases this is not possible.
- Large ranges in data values make it very difficult to select a single dot value that is visibly acceptable across areas of highest and lowest density
- When the map has been designed for optimum portrayal of relative spatial density, it is practically impossible for the reader to recover the original data values

## Slide #7: The value of dot mapping according to Michael Coulson (1990):

*“It is not the dot size, or value, or even placement, that give the real power to the dot map – assuming some reasonable decisions have been made. Rather, the power of the dot map is in the overall pattern of the distribution that is revealed”*

## Data Suitability

- Slide #8: As with a choropleth map, this technique is used extensively for data that are tabulated in enumeration areas
- Unlike the choropleth map, where some sort of derived data is generally desirable, totals or non-derived quantities are used in dot mapping
- **Common examples include:**
  - **Agricultural production data such as:**
    - **Crops**
    - **Crop productivity (in bushels or tons)**
    - **Numbers of livestock or farms**
    - **Population totals**

- In these cases, one dot may represent 500 bushels of harvested wheat, or 1,000 persons
- **Slide #9:** Density is visually inferred by the distribution of the dots *instead of by using derived tabulated data*
- Using derived or ratio data, particularly ratios involving area, cannot be interpreted accurately by the map reader and should be avoided for this technique
- **Slide #10:** Data with **extremely large ranges** make setting a dot value and dot size that is visually satisfactory for both highest and lowest density areas of the map quite difficult
- **For example**, many state population maps are made from county enumeration units with huge differences in rural and urban population totals
- If the dot value is set so that the distribution is clearly seen in urban areas (a dense pattern of just coalescing dots), the rural areas will become vacant
- If the dot value is adjusted to see the pattern in rural areas, the urban pattern becomes a solid fill of indiscernible dots

- **Slide #11: See figure 7.3, p. 122**
- Large data ranges can be a problem in other map types but mechanisms not used in dot mapping, such as classification, or changes in visual variables such as color, can assist the cartographer in dealing with data extremes in other map types

## Size of Enumeration Unit

- **Slide #12: Under most conditions, the smaller the enumeration unit in relation to overall size of the map, the greater will be the relative accuracy of the final dot distribution**
- Smaller enumeration units mean a smaller territorial domain for each dot, reducing the chance for locational error
- **Slide #12: Large scale maps require small statistical units**

- In fact, it's often found that common units used for enumeration data (block, tract or county-sized units) are too large for dot mapping at large scales
- Therefore, cartographers use intermediate to small scales for dot density mapping
- **Slide #12:** The enumeration unit boundaries in which the data are collected should **not** be displayed on the map
- **For example**, in a state map of corn production, county level data might be used in the dot map procedure, but only the state outline would actually be shown
- **Slide #13:** See figure 7.6, p. 124

## Dot Value and Size

- **Slide #14:** Closely related to map scale is the determination of **dot value** – the numerical value represented by each dot
- **Slide #15:** See figure 7.7, p. 125

- The **dot value and size combinations** affect the map reader's impression and understanding of the map
- Dots that are **too small** don't always stand out as proper figures relative to the rest of the map
- When dots become **too large** the map takes on a crude appearance, especially if the dot value is too low
- Dot values that are too high give the impression that the dots have been precisely placed, which is not the goal of dot density mapping

### **General Guidelines for Dot Values and Size**

- Choose a dot value that results in **two or three dots** being placed in the statistical area that has the least mapping quantity
- Choose a dot value and size such that the dots just begin to **coalesce** in the statistical area that has the highest density of the mapped value

- **Slide #16: See figure 7.8, p. 125**
- When the symbols begin to **overlap**, the perceived concentration of symbols will be increased
- It is preferable to select a dot value that is easily understood.
- **For example**, 5, 500 and 1,000 are better than 8, 49 or 941
  
- Several different dot maps can result from identical data because the selection of dot value and size is subjective
  
- **Slide #17: See figure 7.9, p. 126**

# Dot Placement

- **Slide #18:** Since dot maps are created from enumeration unit area totals, it has always been understood that the dots **do not** mark an exact spot where the geographic phenomena exist
- The dots are a **spatial proxy** for data that exist somewhere in the vicinity
- The ideal is to locate the dots as close to the real distribution as possible, usually using the center of gravity principle
  
- **Slide #19: See figure 7.11, p. 127**
  
- **Slide #20:** Because each dot is a **spatial proxy**, it must be located so as to best represent the underlying data
- This can require considerable knowledge of the real distribution
- If ancillary information is not used, then the dots are randomized within the enumeration unit areas

- **Slide #21:** See figure 7.12, p. 128
- Using randomization dots can cause dots to be placed where there is not data in real life
- For example, dots representing people may be clustered in the Mojave Desert or dots representing harvested wheat may find their way into lakes or urban areas