Announcements

- **Check in on map tutorials**
  - First map tutorial write-ups are due by 2:00 PM Mountain Time
    - Wednesday, February 7 for Wednesday lab
    - Thursday, February 8 for Thursday lab
  - Turn in your map tutorials using the Microsoft Form on the Map Tutorial assignment page
- **Readings now up on schedule for remainder of semester!**
  - Also on content pages for each week
  - Additional resources may be posted with lecture slides
- **First Voices of GIS guest next Thursday!**
  - Lee Macholz of Missoula City GIS

Scales of Measurement

Kyle Bocinsky

FORS350 / GPHY488
(Forestry) Applications of GIS
University of Montana
WA Franke College of Forestry & Conservation

Scales of Measurement

The scale indicates the data summarization and statistical analyses that are most appropriate. It determines the amount of information in the data.

Scales of measurement include:

Qualitative

- Logical
- Nominal
- Ordinal

Quantitative

- Interval
- Ratio

Scales of Measurement

Today, we will explore scales of measurement by creating choropleths using data from the Montana Department of Revenue.[1]

Qualitative versus Quantitative data

Data can be **qualitative** or **quantitative**.

The appropriate thematic map depends on whether the data for the variable are qualitative or quantitative.

Qualitative Data

Qualitative data indicate what kind.

- Labels or names used to identify an attribute of each element. E.g., Black or white, male or female.
- Often referred to as categorical data
- May use either the nominal or ordinal scale of measurement
- Can be either numeric or non-numeric

Quantitative Data

Quantitative data indicate how many or how much.

- Discrete, if measuring how many. E.g., number of 6-packs consumed at tail-gate party
- Continuous, if measuring how much. E.g., pounds of hamburger consumed at tail-gate party
- Quantitative data are always numeric.
- Ordinary arithmetic operations are meaningful for most quantitative data.

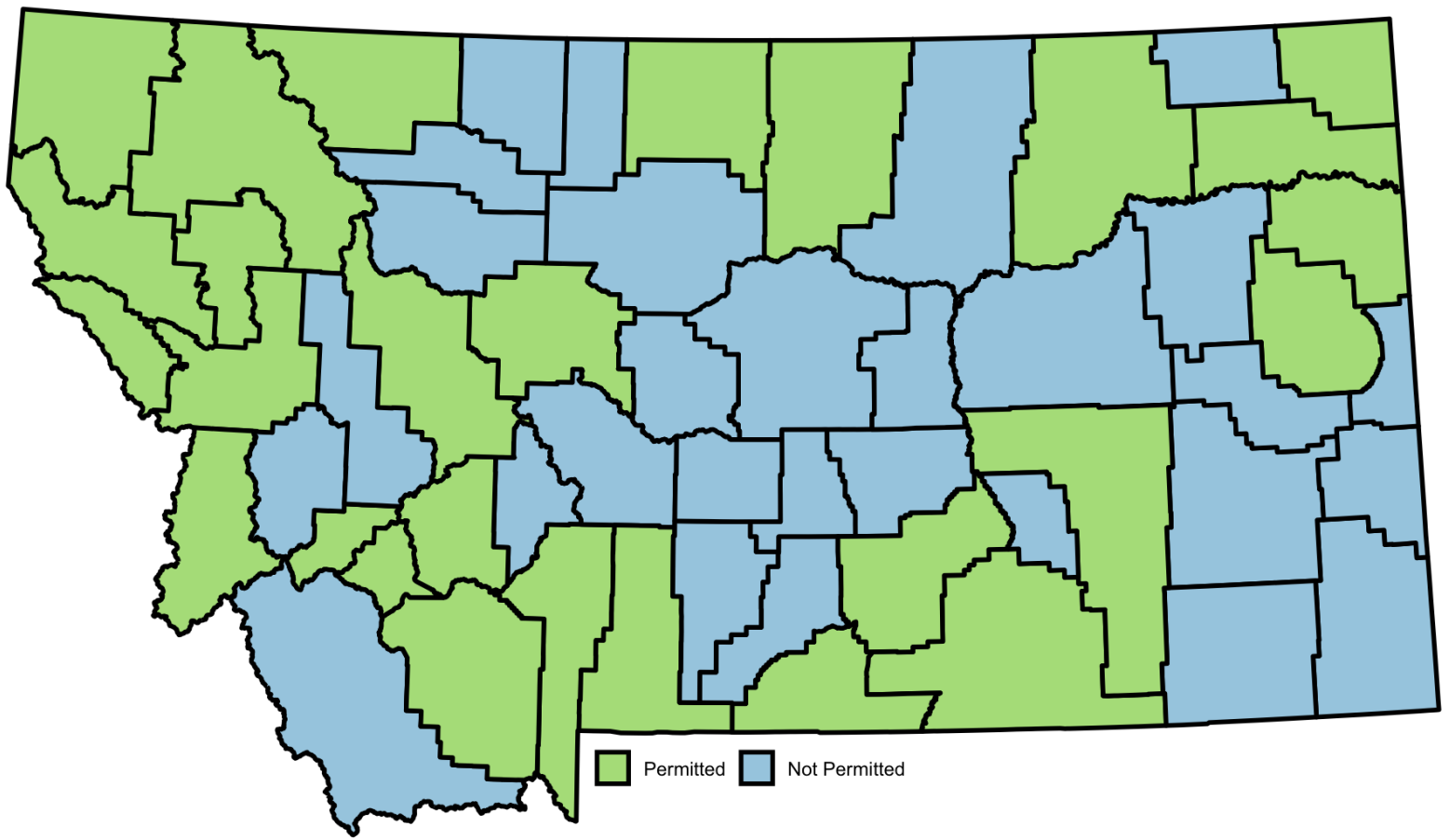
Logical

Logical data are True/False; it is a binary form of nominal data (see next slide!).

- A non-numeric label (true/false) or numeric code (1/0) may be used to represent logical data.
- Many statistical tests, when performed on logical data, yield proportions. For example, taking the mean of a logical variable (with 1 representing true, and 0 representing false) will reveal the proportion of the sample that is “true”.

Cannabis in Montana

Recreational Sales, December 2023



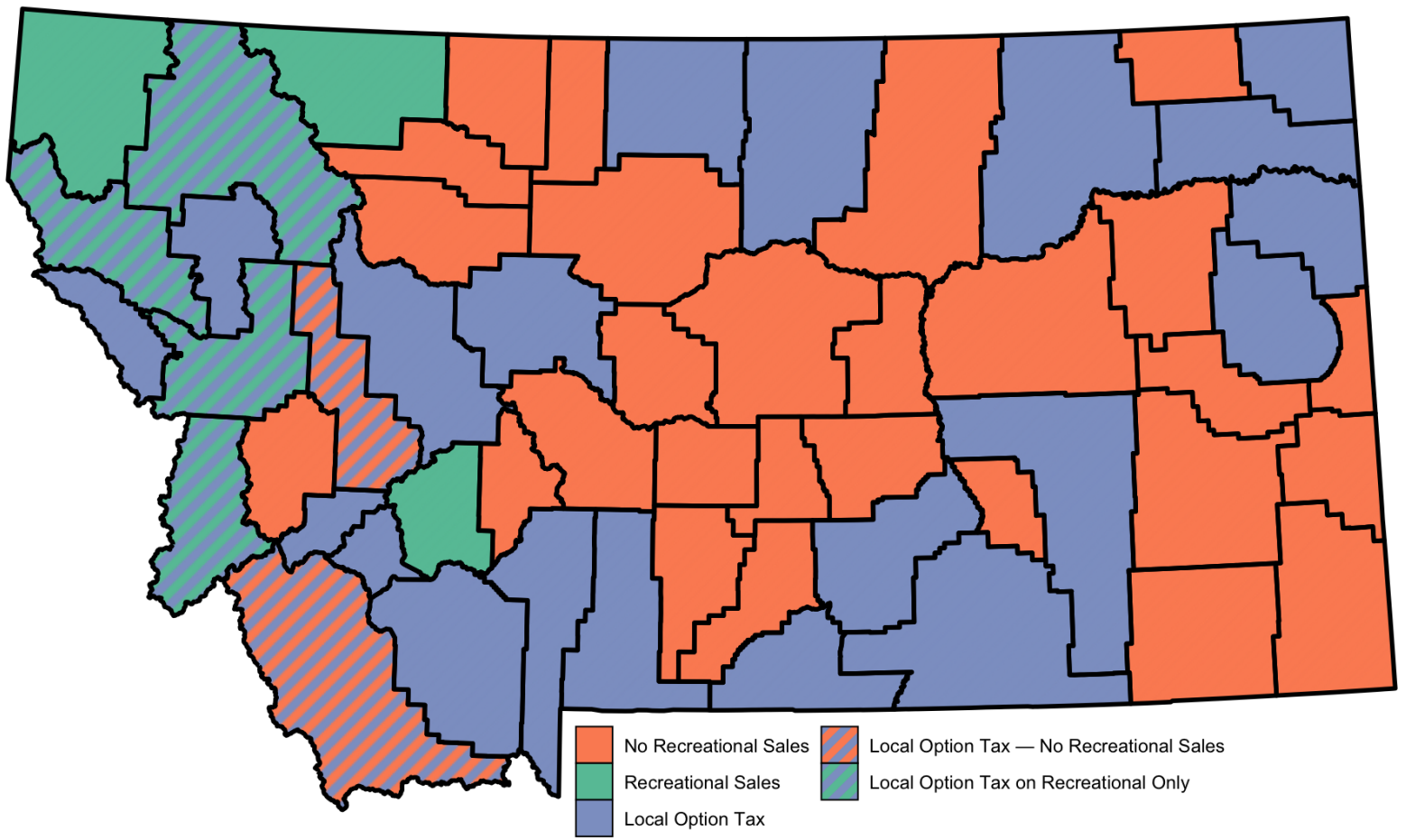
Nominal

Nominal data are categorically discrete data such as the name of a country visited, type of ground-cover, or the name of a biome.

- This one is easy to remember because nominal sounds like name (they have the same Latin root).
- A non-numeric label or numeric code may be used for nominal data.

Cannabis in Montana

Local Option Tax Status, December 2023



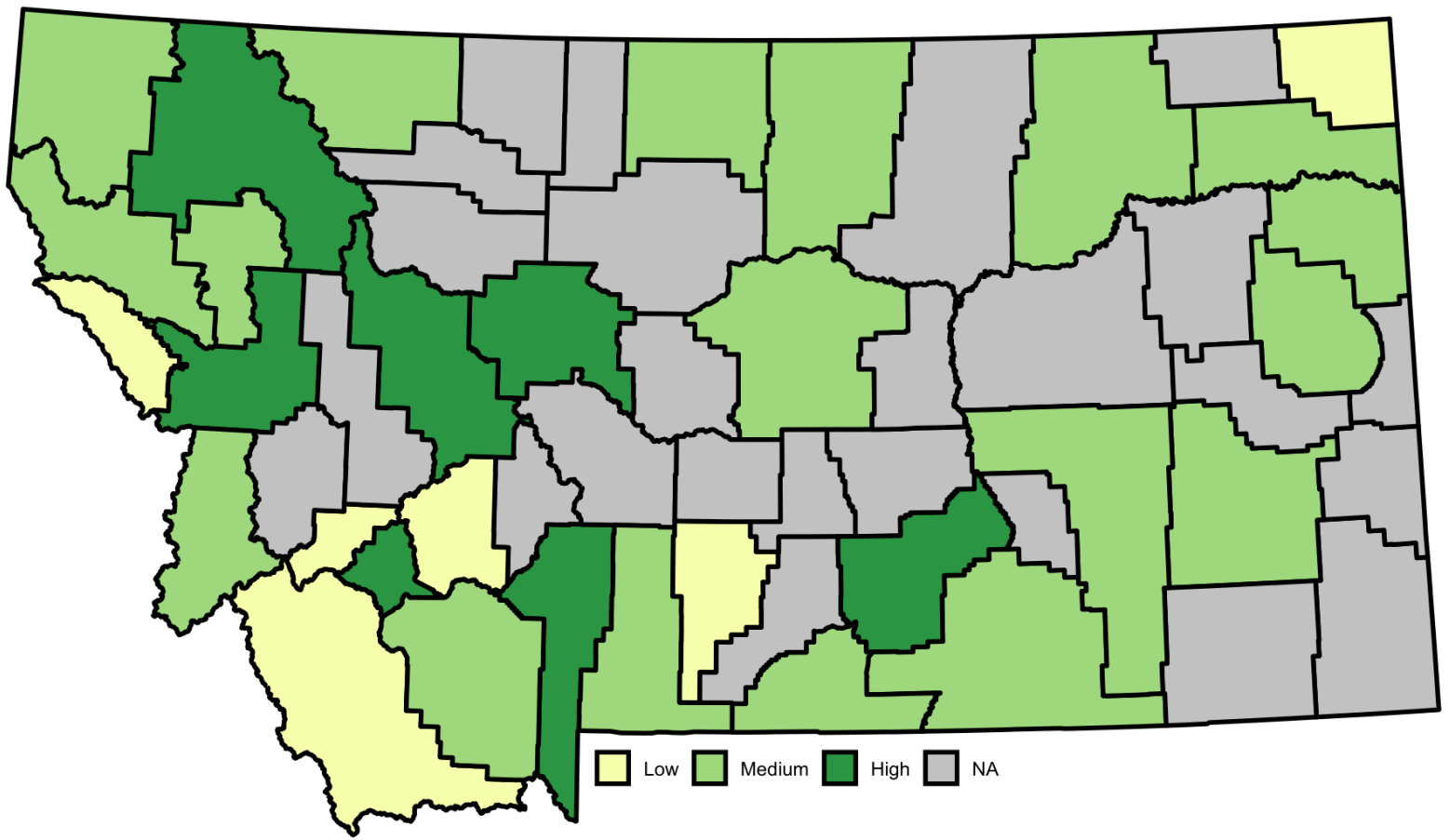
Ordinal

Ordinal data are nominal data where the order or rank of the data is meaningful. However, the distance (interval) between categories is unknown or irregular.

- A non-numeric label or numeric code may be used.
- For example: freshmen → sophomore → junior → senior.

Cannabis in Montana

Estimated Total Sales, December 2023 (Ordinal)



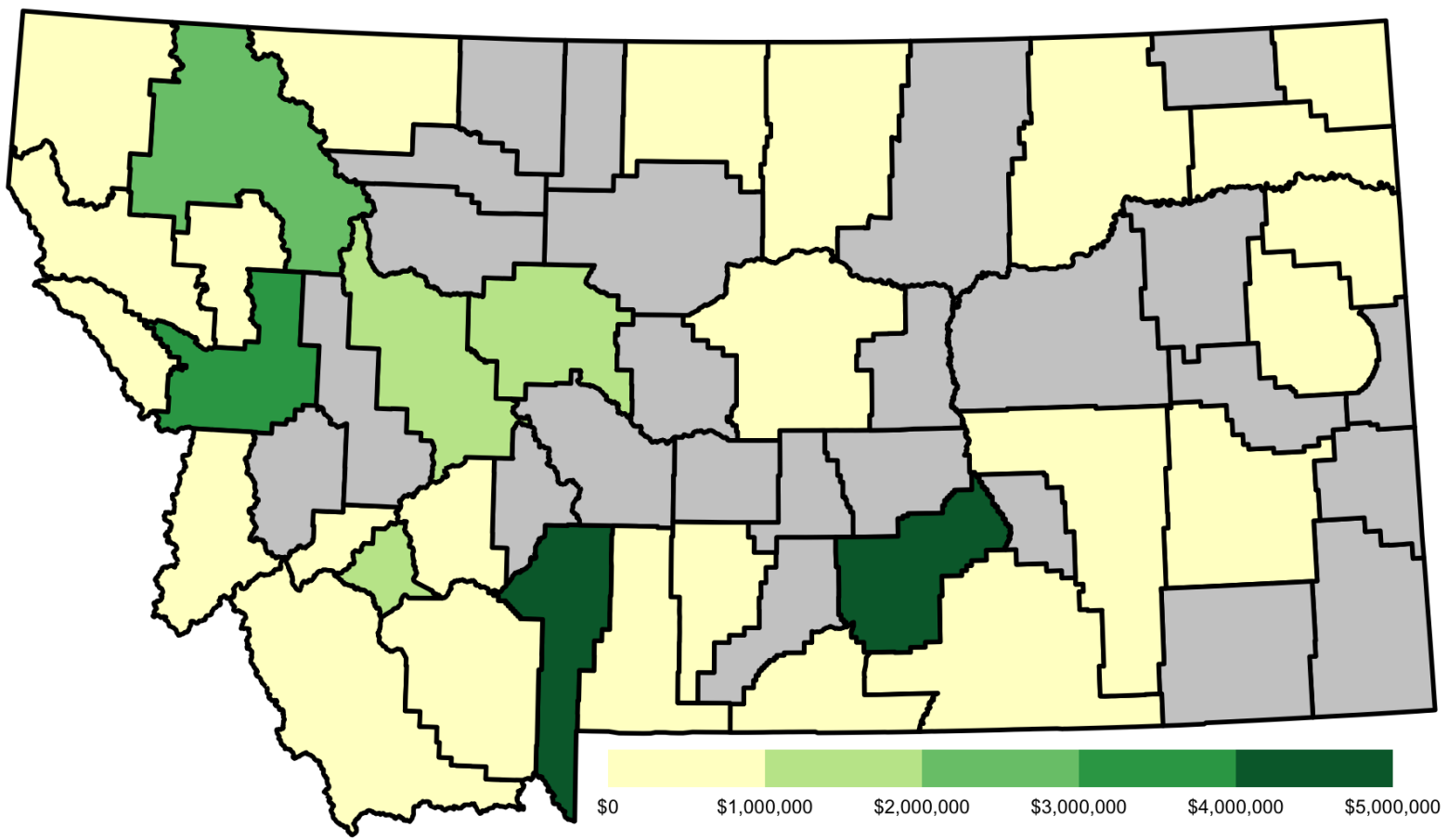
Interval

Interval data have the properties of ordinal data, and the interval between observations is expressed in terms of a fixed unit of measure.

- Interval data are always numeric, and may be continuous or discrete.
- Interval data often do not have a zero that represents nothingness; temperature in the Celsius or Fahrenheit scales are examples of Interval data.
- You can add or subtract interval data, but you shouldn’t multiply or divide them.

Cannabis in Montana

Estimated Total Sales, December 2023 (Interval)



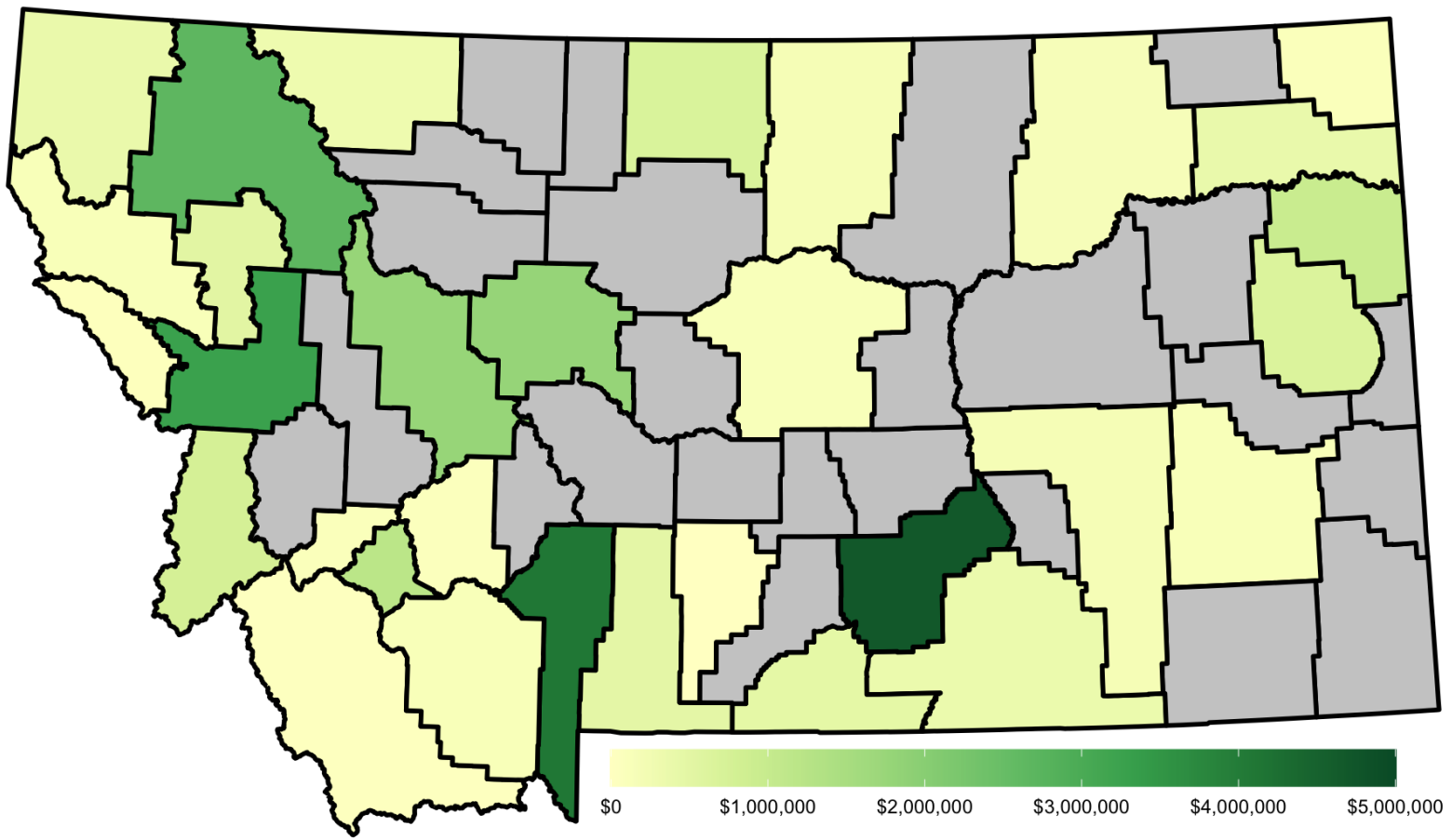
Ratio

Ratio data have all the properties of interval data and the ratio of two values is meaningful.

- Ratio data are always numeric, and may be continuous or discrete.
- Ratio data must contain a true zero value that indicates that nothing exists for the variable at the zero point.
- Variables such as precipitation, temperature in degrees Kelvin, distance, height, weight, and time use the ratio scale.
- You can add, subtract, multiply and divide ratio scale data.

Cannabis in Montana

Estimated Total Sales, December 2023 (Ratio)



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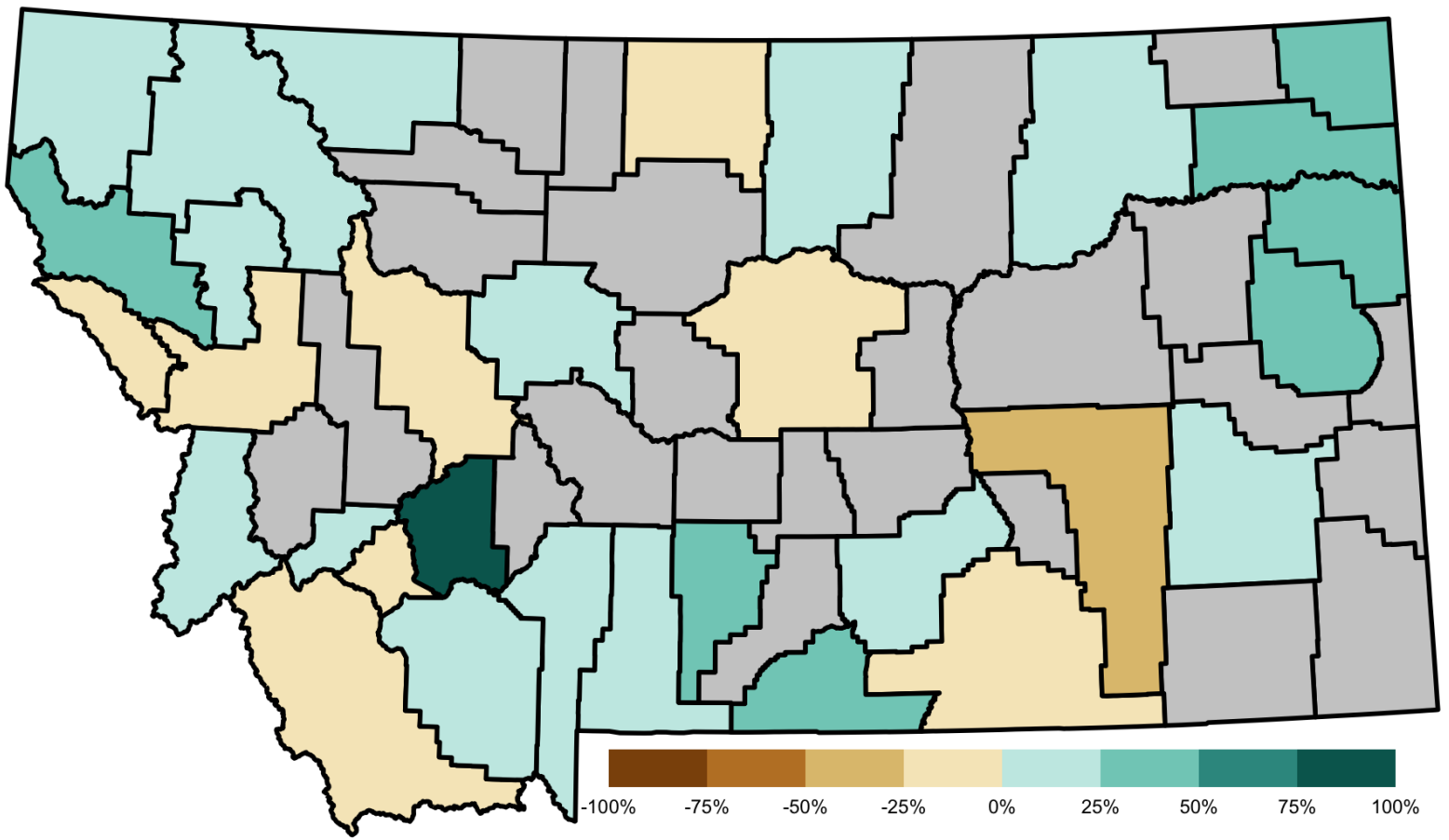
% Change, December 2022 to December 2023



Cross-sectional Data

Cross-sectional data are observations across individuals at the same point in time, or aggregated over the same time period.

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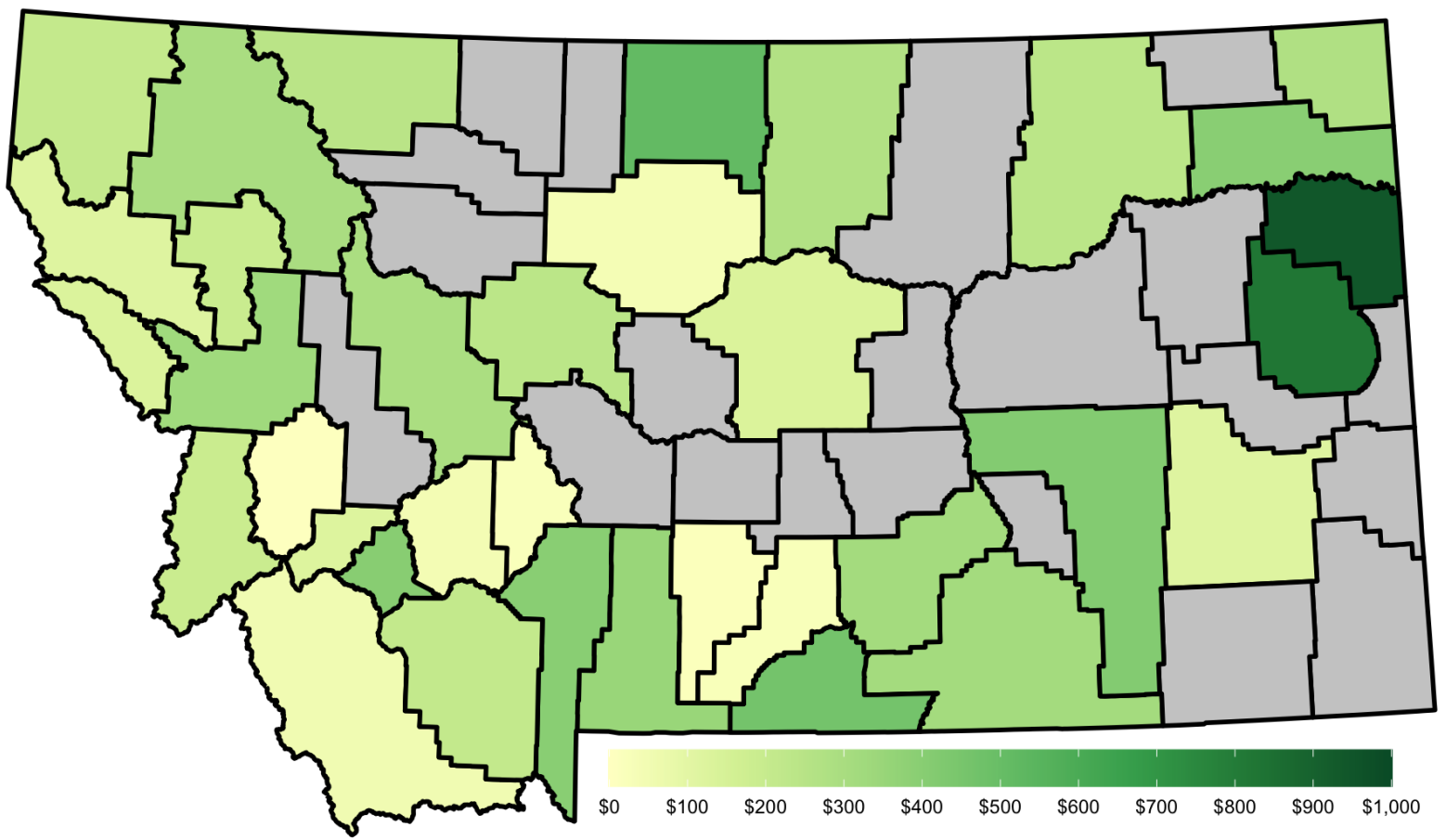
Estimated Sales per Capita, 2023



Time Series Data

Time series data are collected over several time periods.

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Estimated Monthly Total Sales, 2022-01-01