EDS 223: Geospatial Analysis & Remote Sensing
Week 2

Welcome!

- **Recap on week 1**

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- **Recap on week 1**
- **Spatial data models**

Welcome!

- **Recap on week 1**
- **Spatial data models**
- **Vector data models**

Welcome!
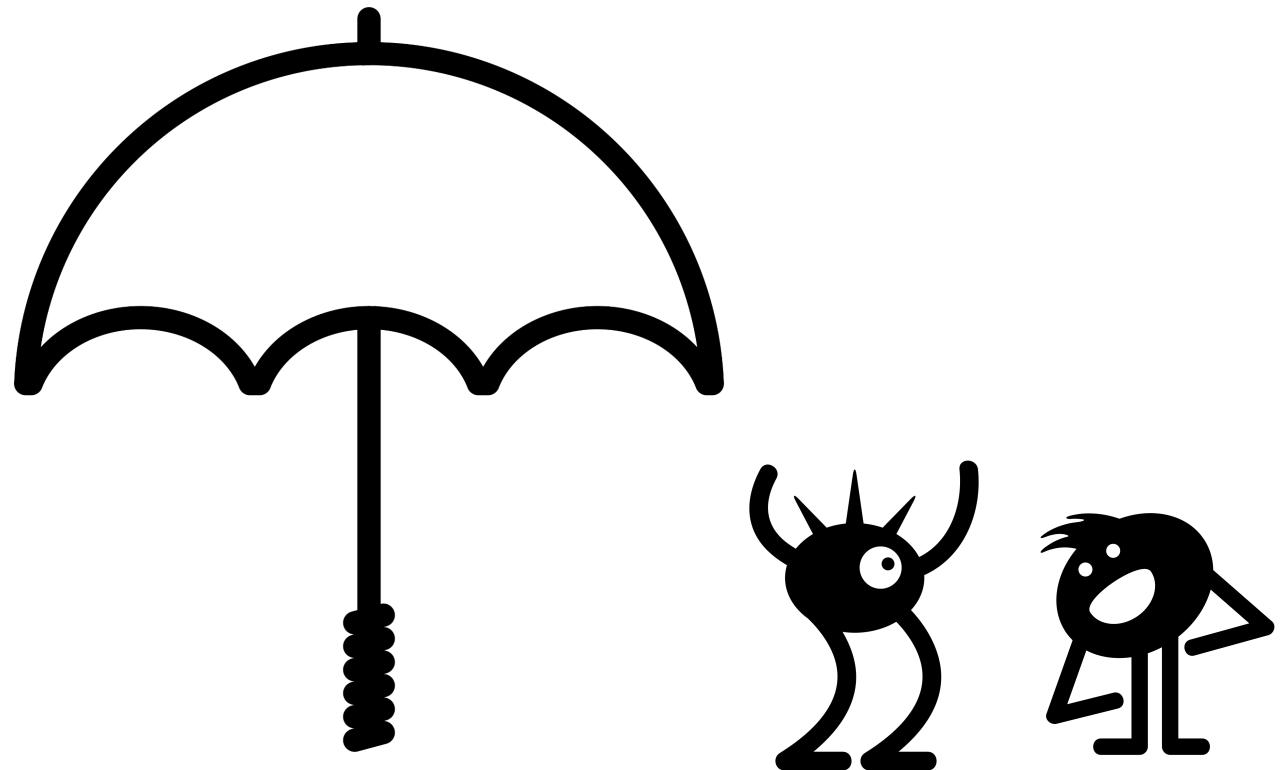
- **Recap on week 1**
- **Spatial data models**
- **Vector data models**
- **Intro to 'sf'**

Welcome!

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- **Intro to 'sf'**
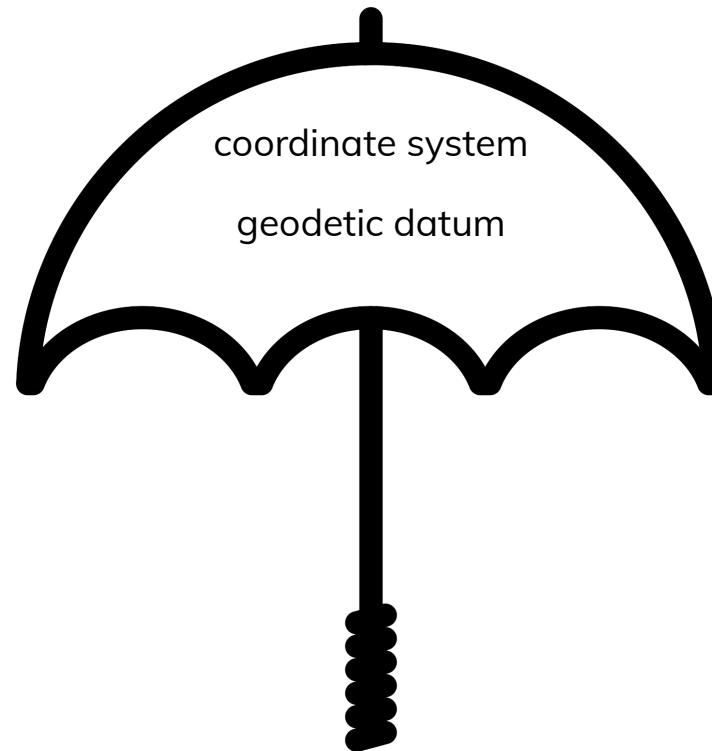
Week 1 recap
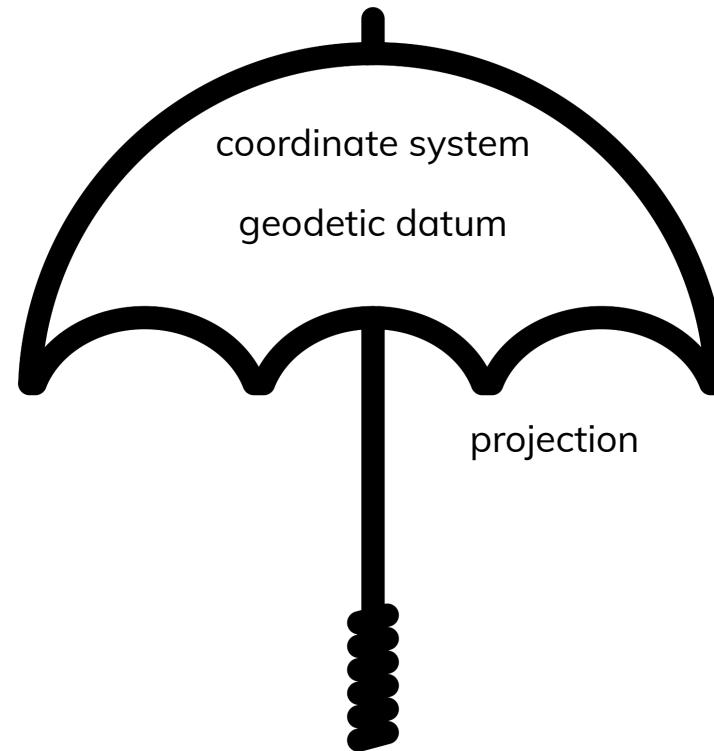
Coordinate reference systems

Week 1 recap

Coordinate reference systems

coordinate system

geodetic datum

Week 1 recap

Coordinate reference systems

coordinate system

geodetic datum

projection

Week 1 recap

Coordinate reference systems

coordinate system

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projection

geographic
coordinate system

projected
coordinate system

Week 1 recap

Coordinate reference systems

coordinate system — **Language for describing locations**

geodetic datum — **Working model of Earth**

projection — **Translation from 3D to 2D**

geographic coordinate system

projected coordinate system

Week 1 recap

Coordinate reference systems

coordinate system — Language for describing locations

geodetic datum — Working model of Earth

projection — Translation from 3D to 2D

Can't make maps   **geographic** coordinate system   **projected** coordinate system   Can make maps
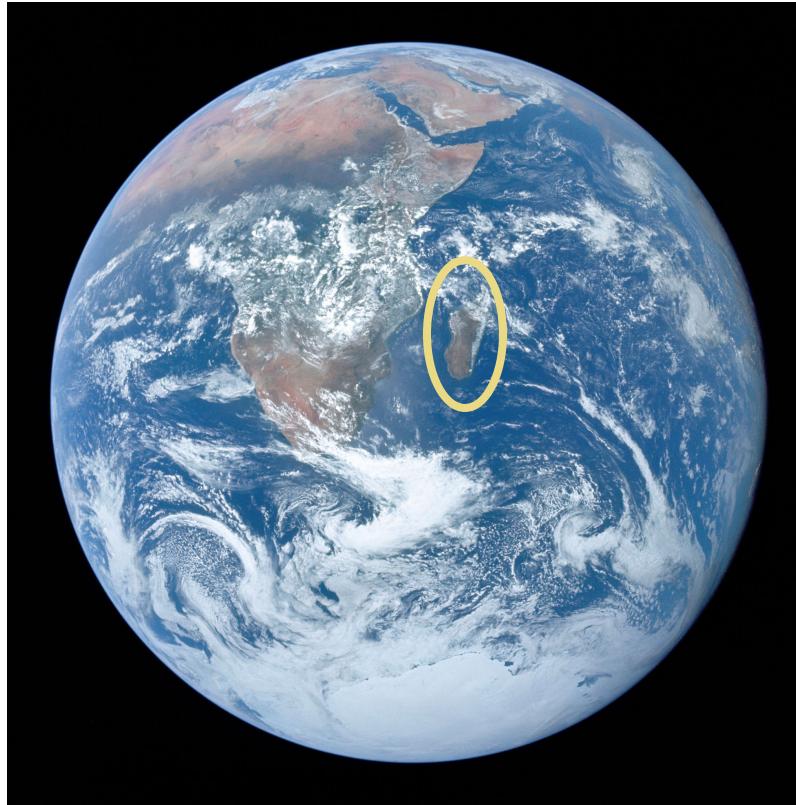
Spatial data models

# Spatial data models
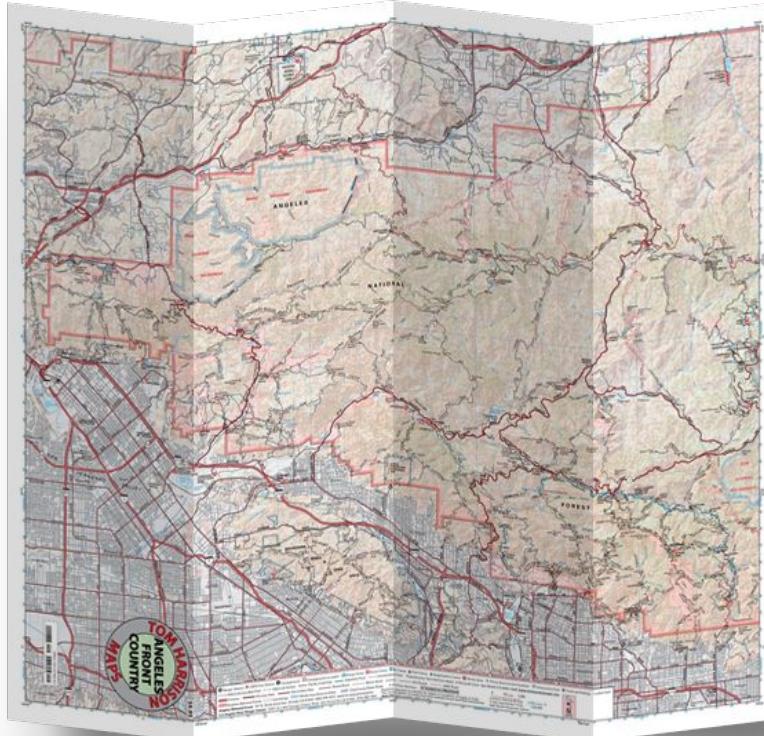
Spatial data models
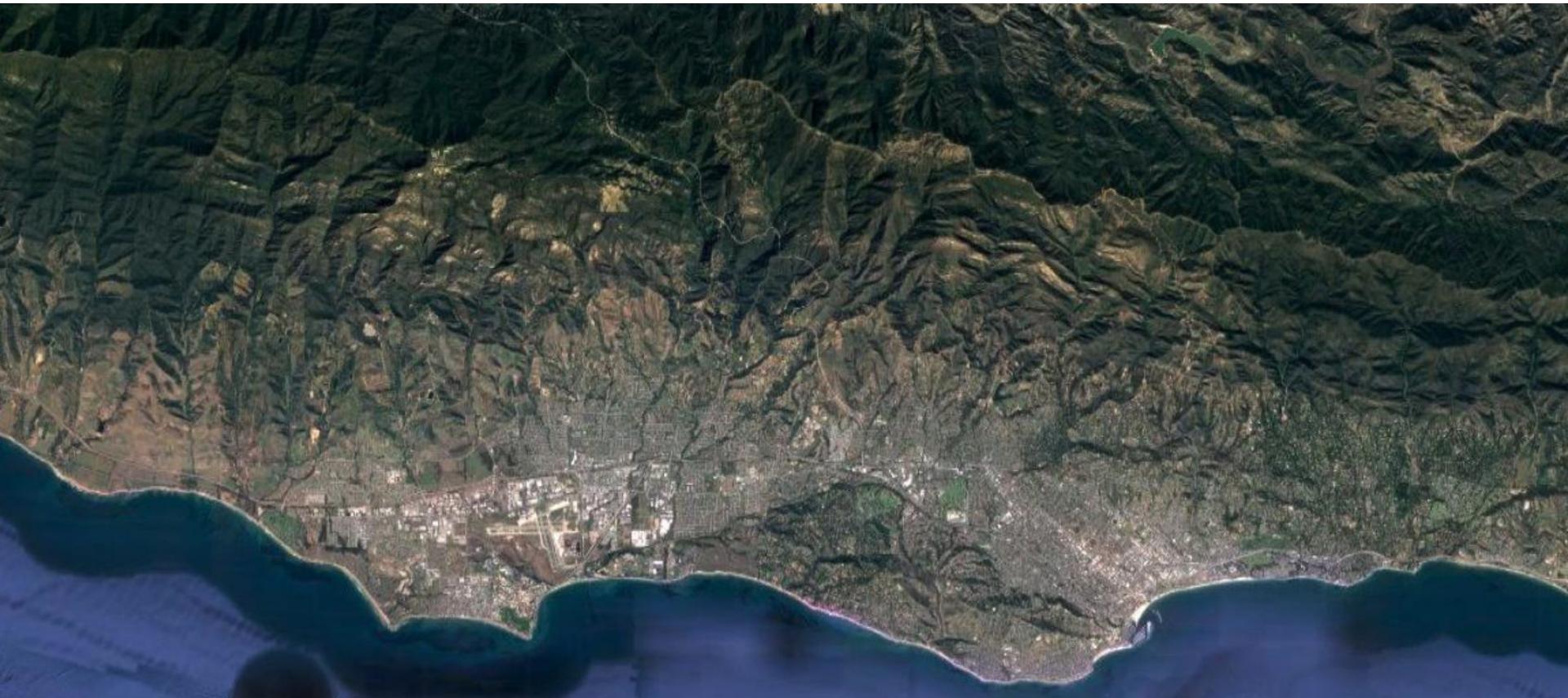
All models are wrong, but some are useful.

- George E.P. Box
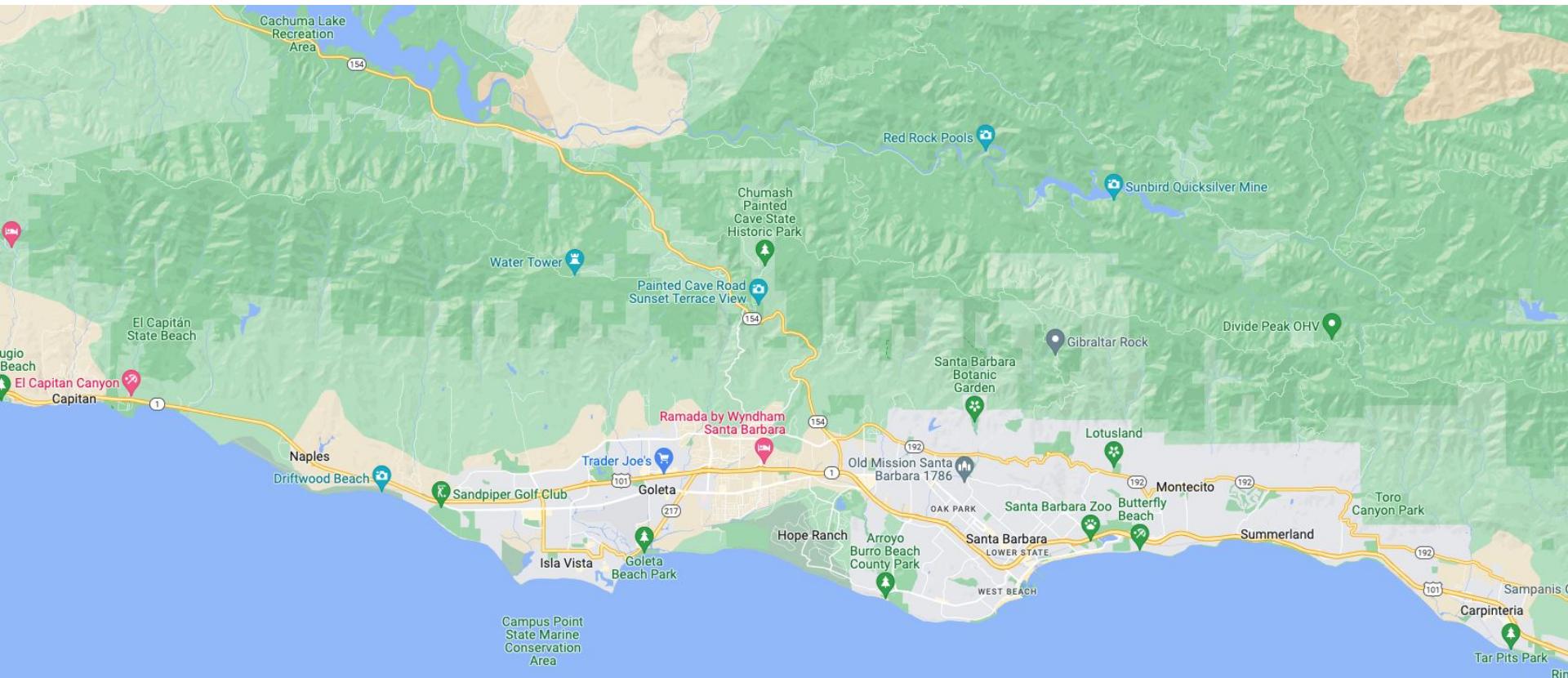
Maps are models!
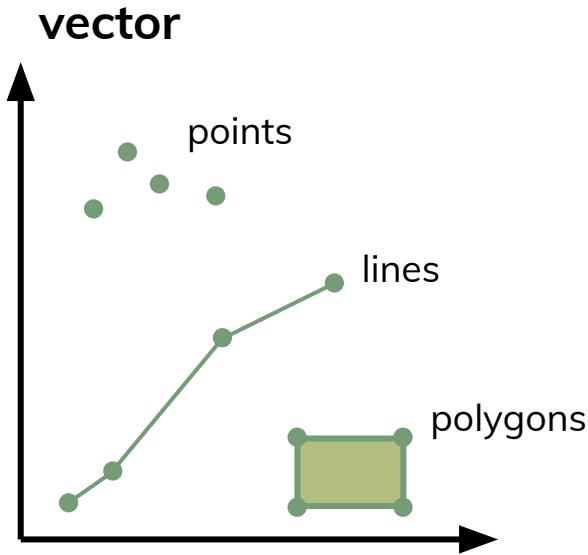
Spatial data models
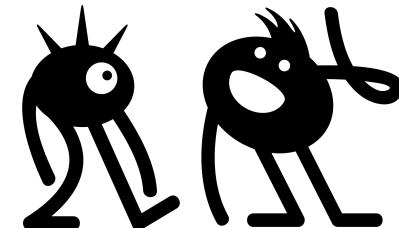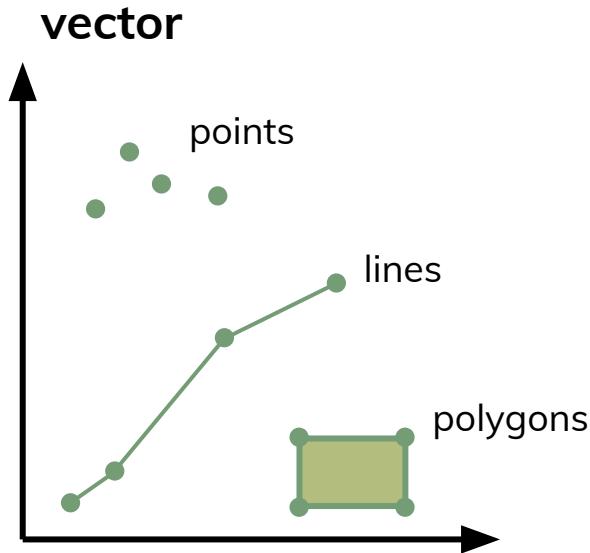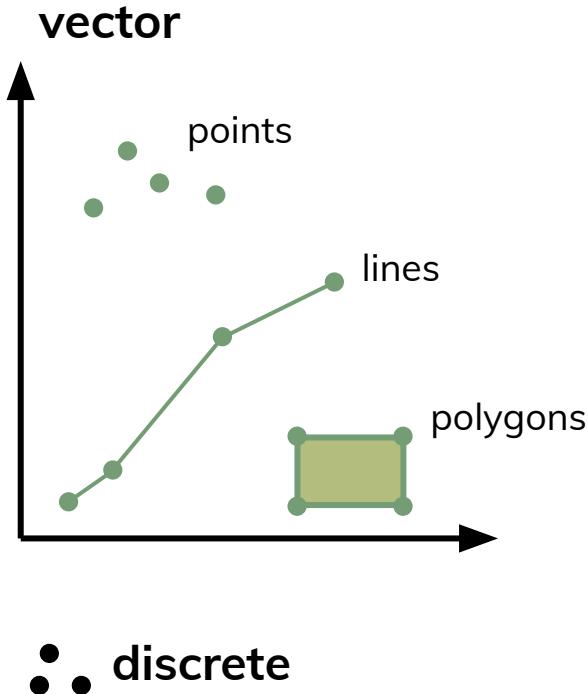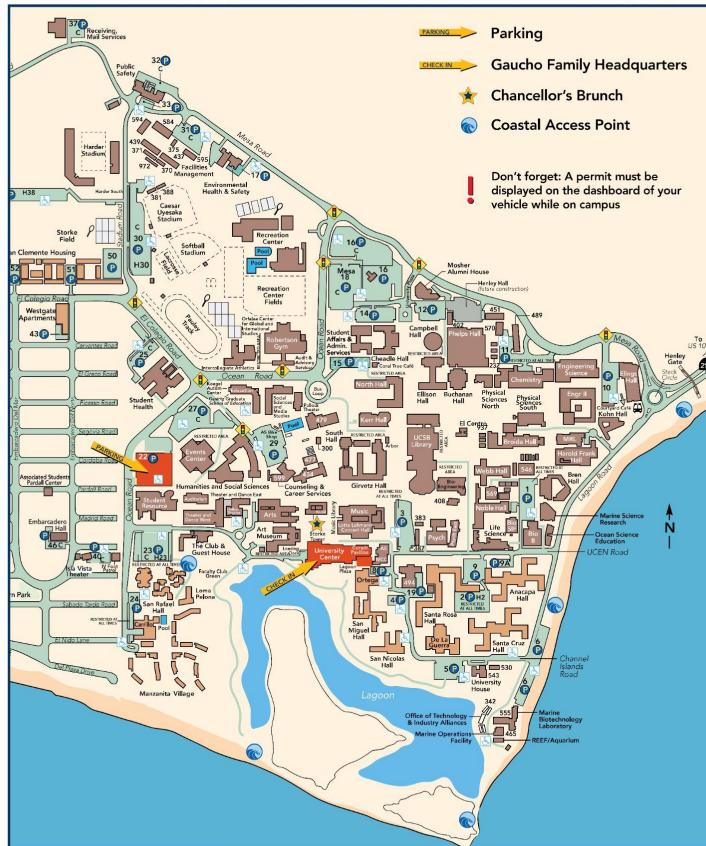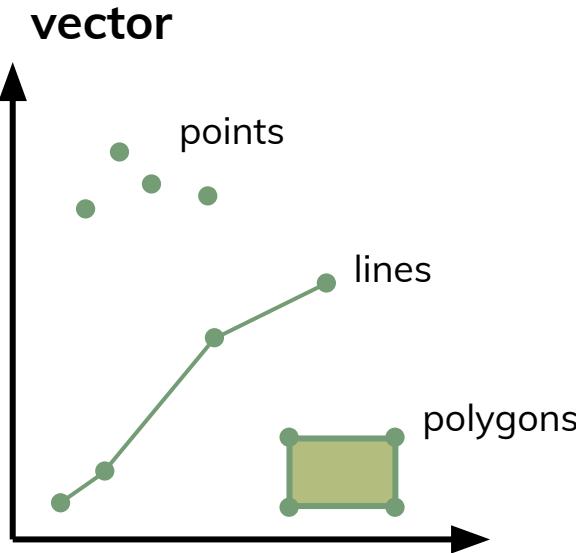
Spatial data models

Spatial data models

vector

points

lines

polygons

Spatial data models

vector

points

lines

polygons

Spatial data models

vector

points

lines

polygons

discrete

Spatial data models
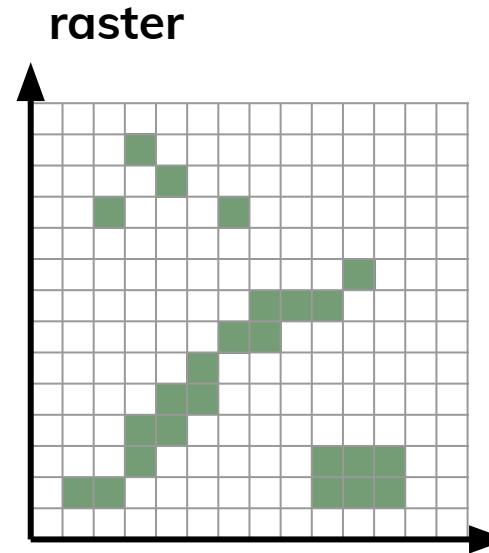
Spatial data models

vector

points

lines
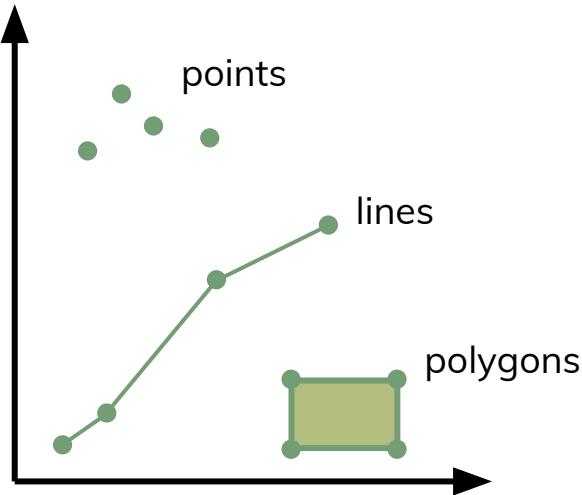
polygons

raster

discrete

Spatial data models
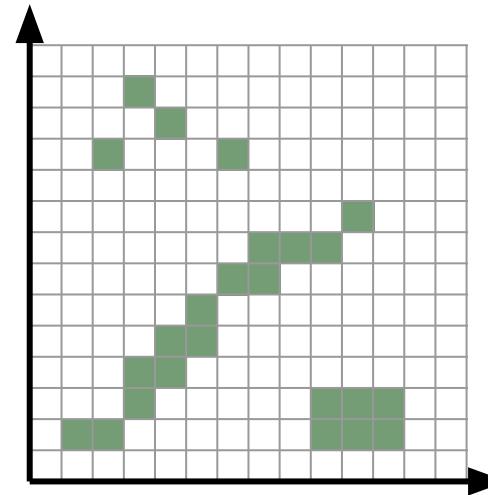
vector

points

lines
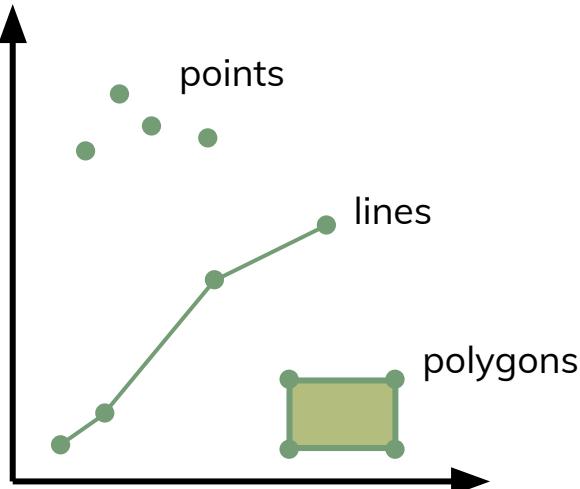
polygons

discrete

raster

continuous

Spatial data models
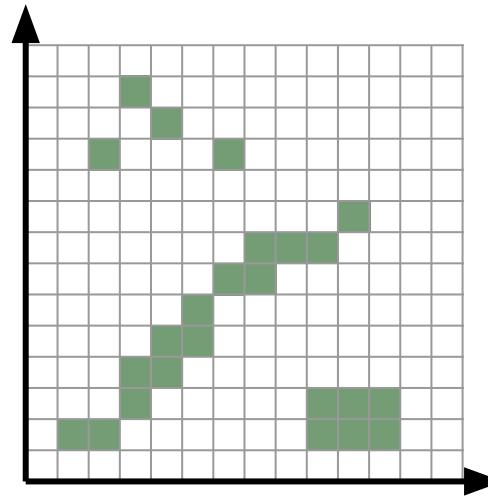
vector

points

lines
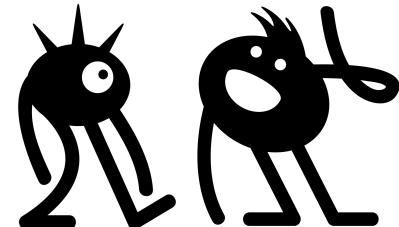
polygons

discrete
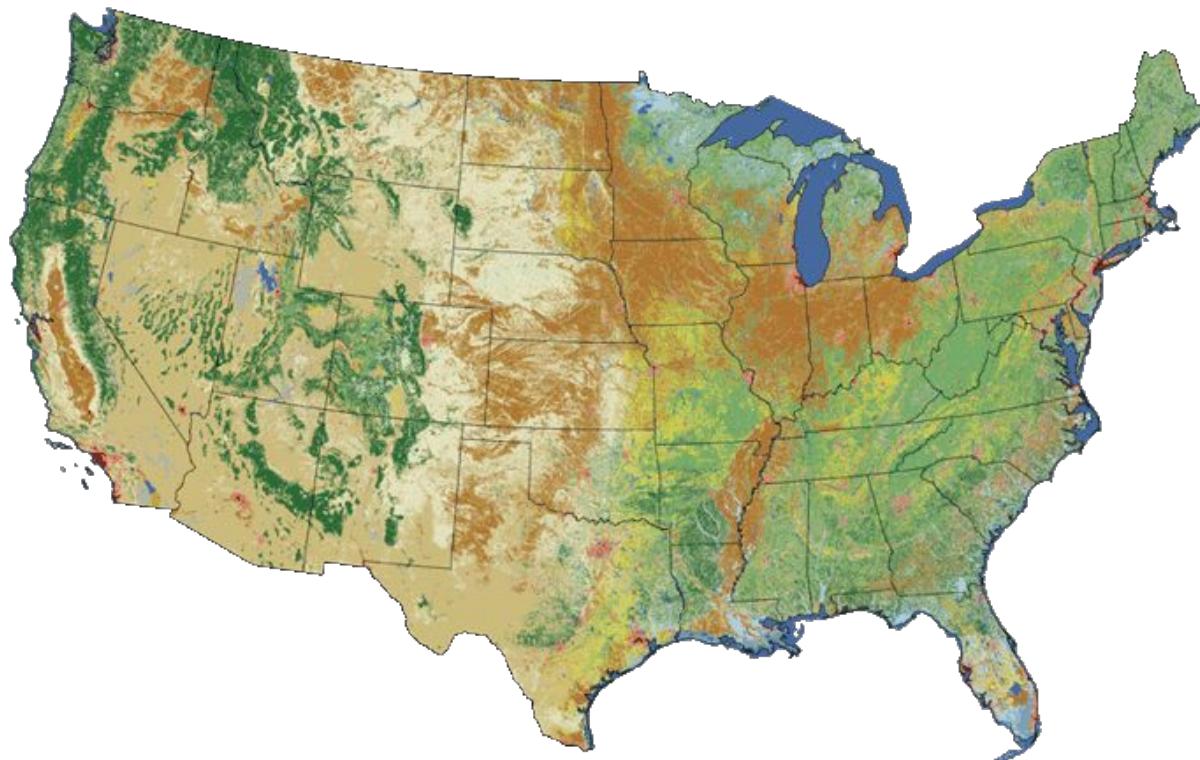
raster

continuous
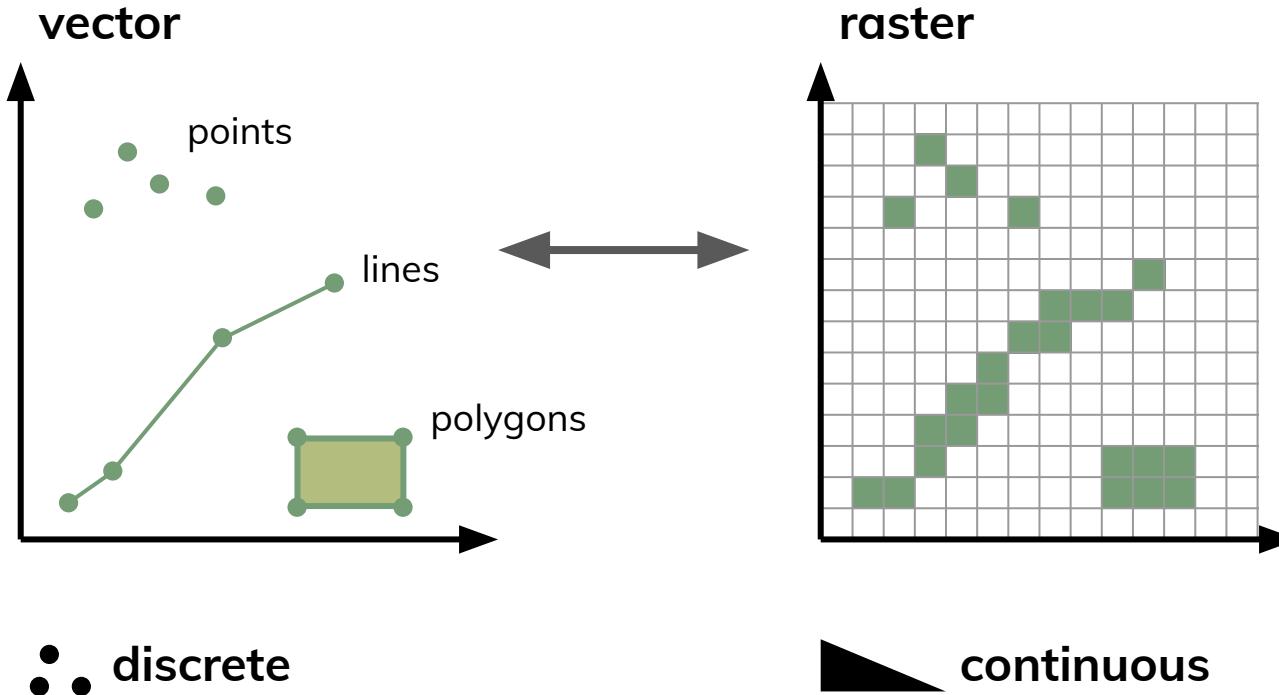
Spatial data models

Source: Multi-Resolution Land Characteristics Consortium

Spatial data models

Modified from: GIS Fundamentals, Paul Bolstad
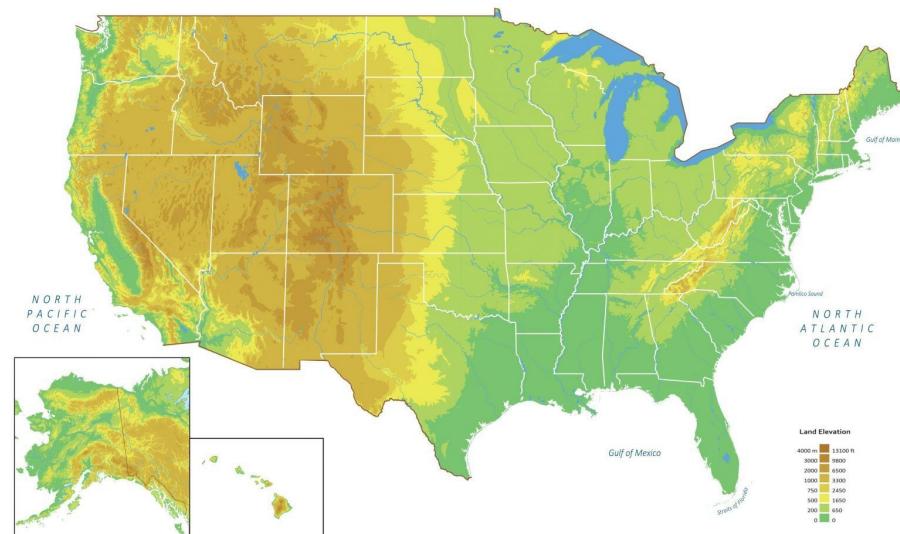
Spatial data models
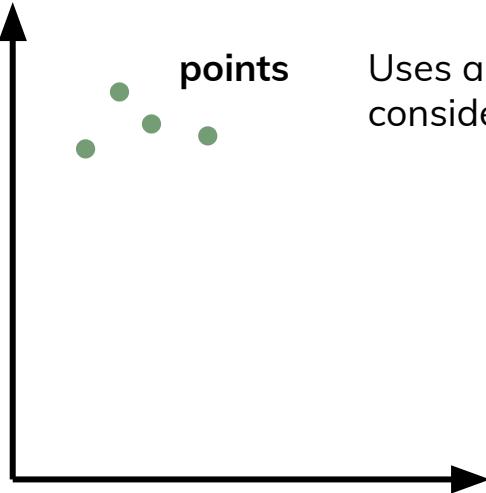
vector

raster
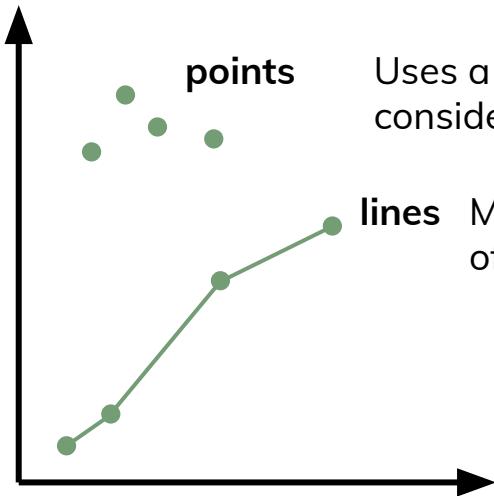
Vector data models

points Uses a single coordinate pair to represent the location of an entity that is considered to have no dimension.

Vector data models
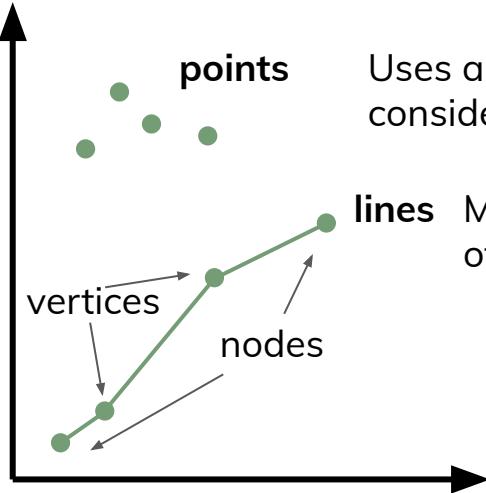
points   Uses a single coordinate pair to represent the location of an entity that is considered to have no dimension.

lines   Made up of line segments that run between adjacent, ordered sets of coordinate pairs.

Modified from: GIS Fundamentals, Paul Bolstad
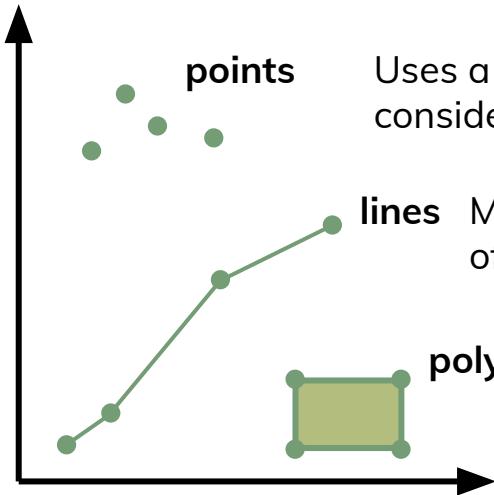
Vector data models

points   Uses a single coordinate pair to represent the location of an entity that is considered to have no dimension.

lines   Made up of line segments that run between adjacent, ordered sets of coordinate pairs.

vertices

nodes

Vector data models

points   Uses a single coordinate pair to represent the location of an entity that is considered to have no dimension.

lines   Made up of line segments that run between adjacent, ordered sets of coordinate pairs.

polygons   Formed by a set of connected lines.

Vector data models

Modified from: GIS Fundamentals, Paul Bolstad

Vector data models

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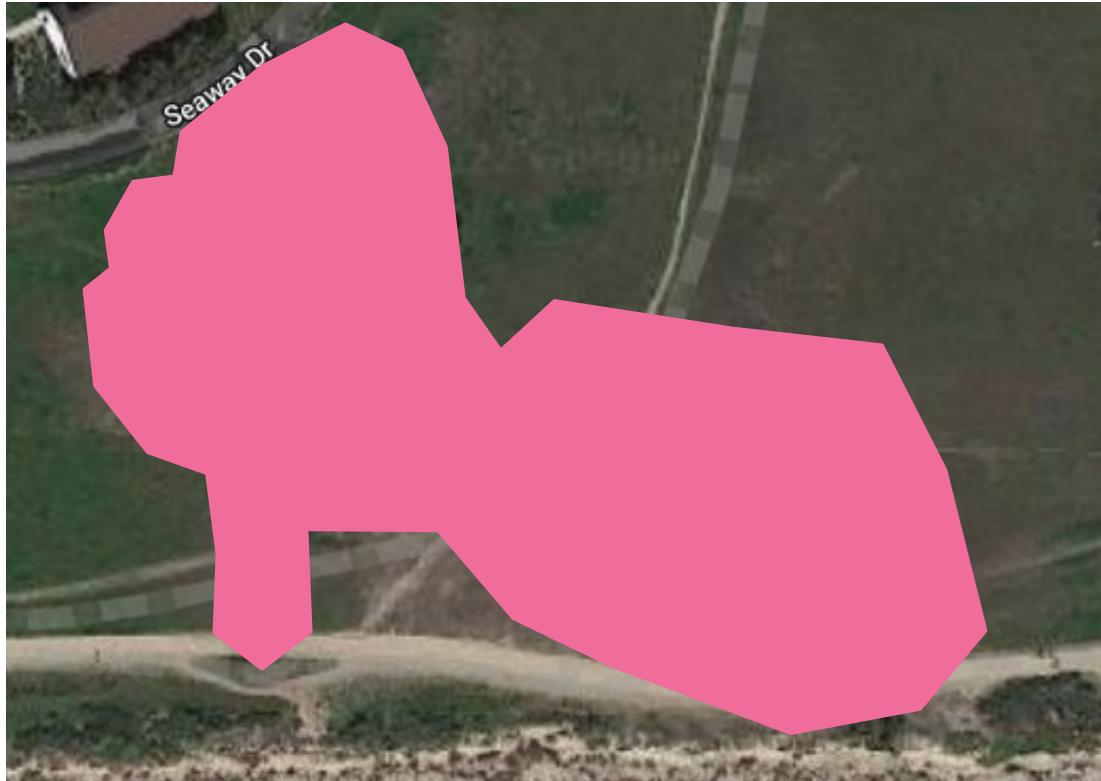
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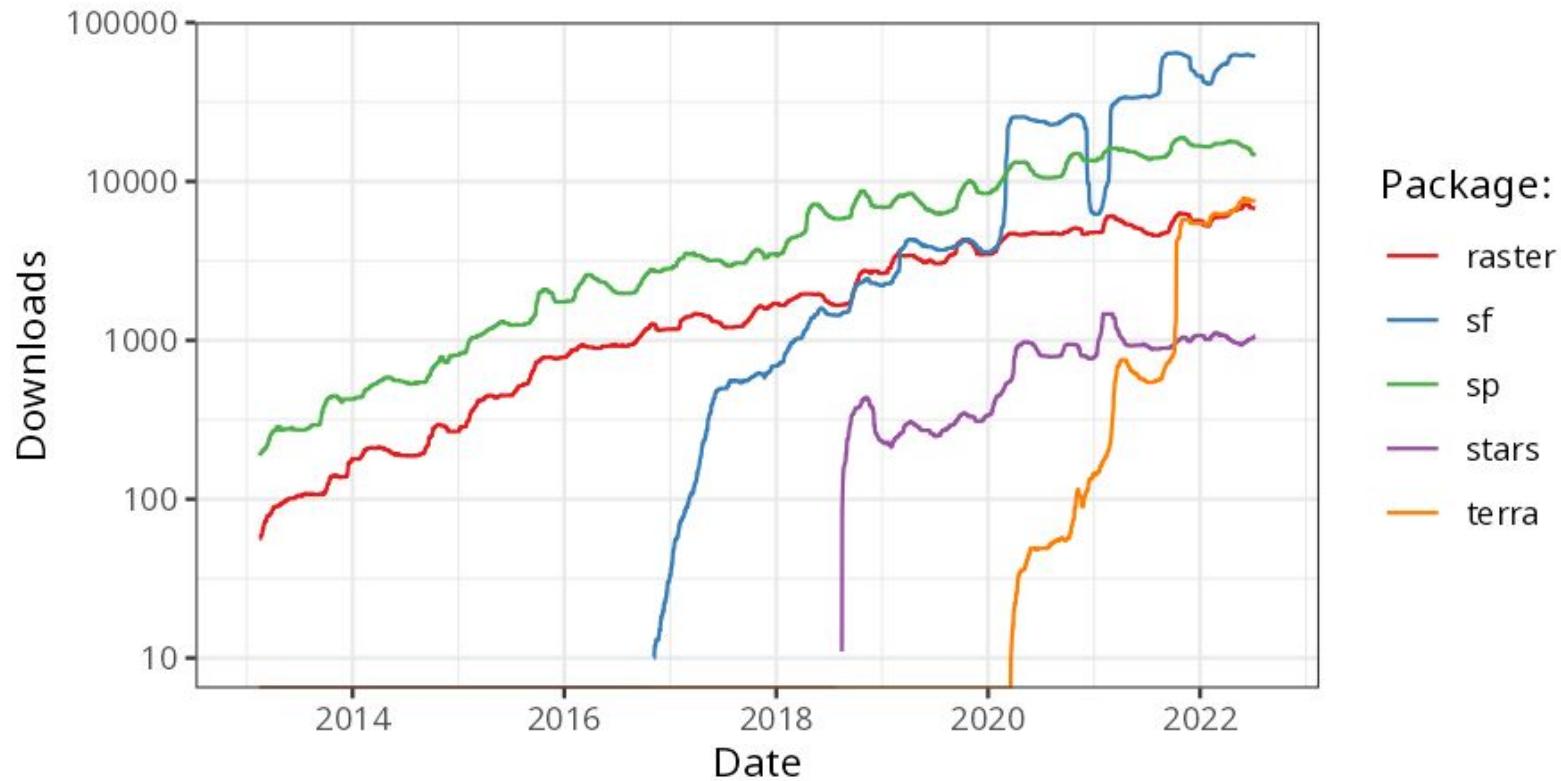
Spatial tools

Spatial analysis with R

R's spatial ecosystem

Simple features: sf

Advantages of **sf**

- **Fast data reading and writing**

Advantages of **sf**

- **Fast data reading and writing**
- **Enhanced plotting performance**

Advantages of **sf**

- **Fast data reading and writing**
- **Enhanced plotting performance**
- **Consistent function names**
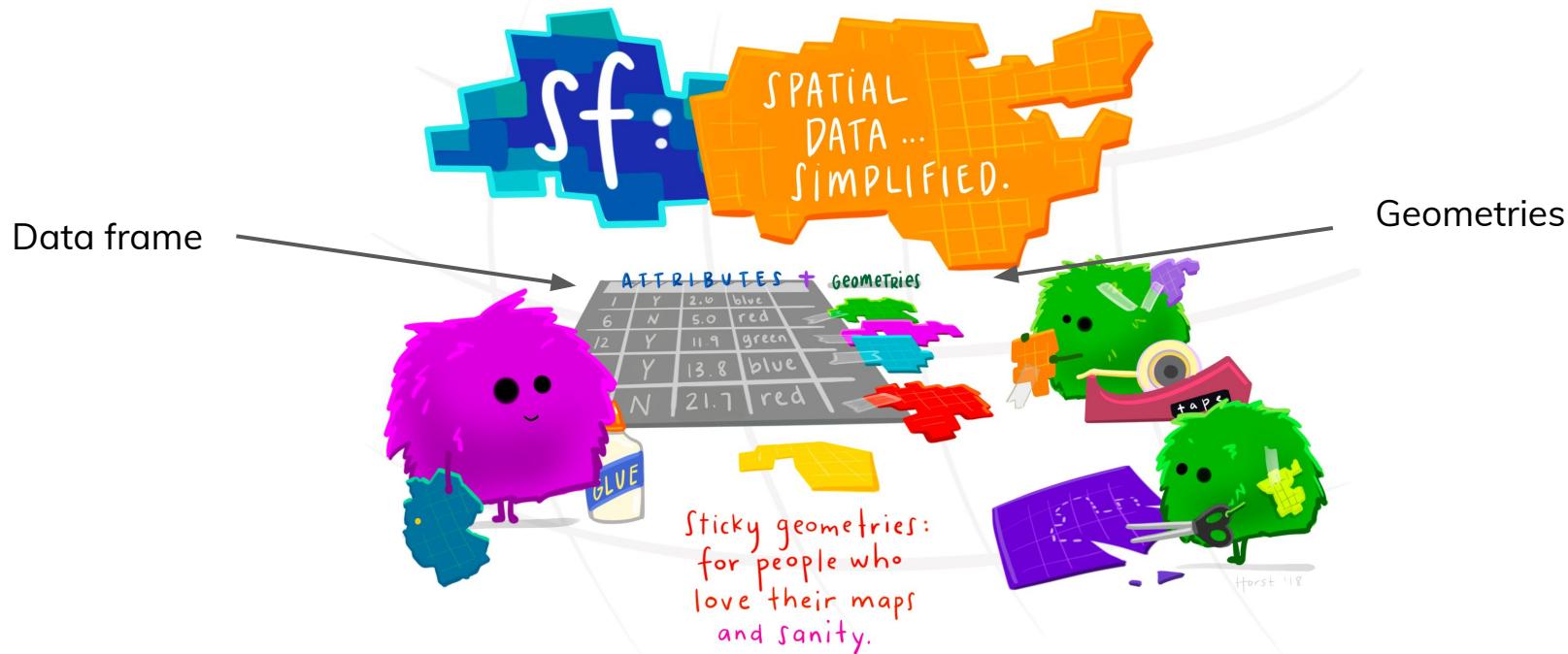
Advantages of **sf**

- Fast data reading and writing
- Enhanced plotting performance
- Consistent function names
- Behave like data frames
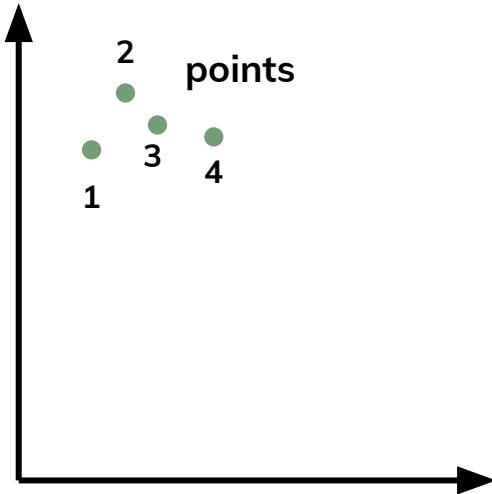
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Simple features: **sf**
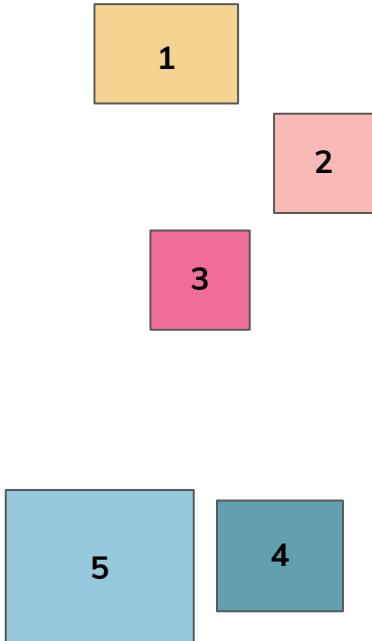
Vector data models

ID	Species	Age
1	Poplar	11
2	Oak	2
3	Beech	12
4	Cedar	15

Single vs. multi-part features
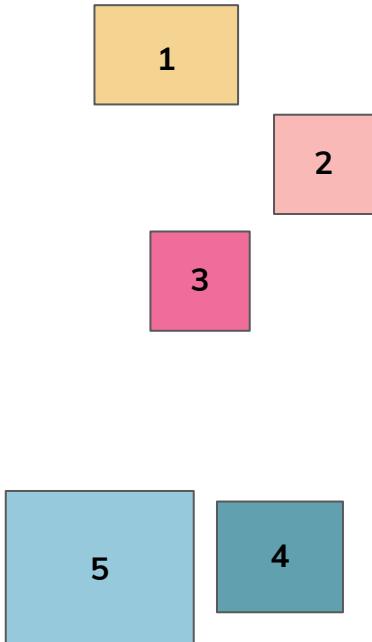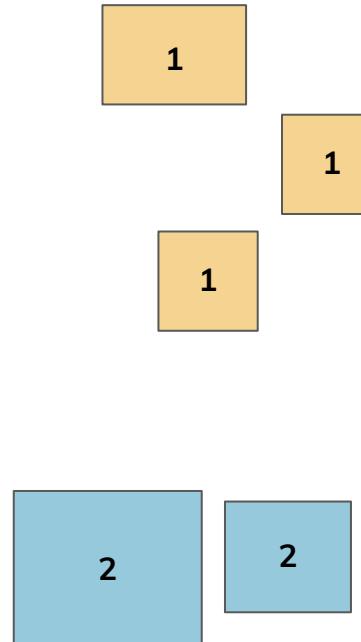
single-part

ID	Building
1	A
2	B
3	C
4	D
5	E

Modified from: GIS Fundamentals, Paul Bolstad
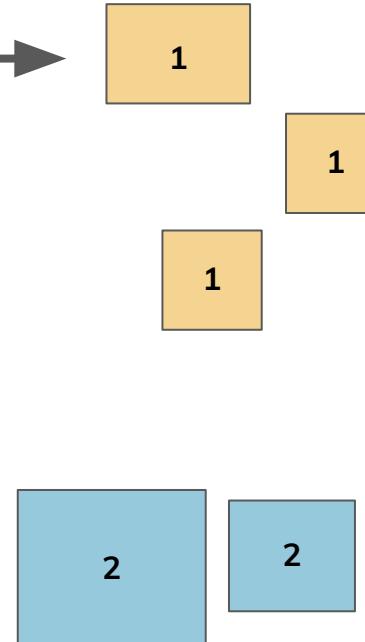
Single vs. multi-part features

single-part

ID	Building
1	A
2	B
3	C
4	D
5	E

multi-part

ID	Campus
1	Main
2	Downtown

Single vs. multi-part features

single-part

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single-part

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Modified from: GIS Fundamentals, Paul Bolstad
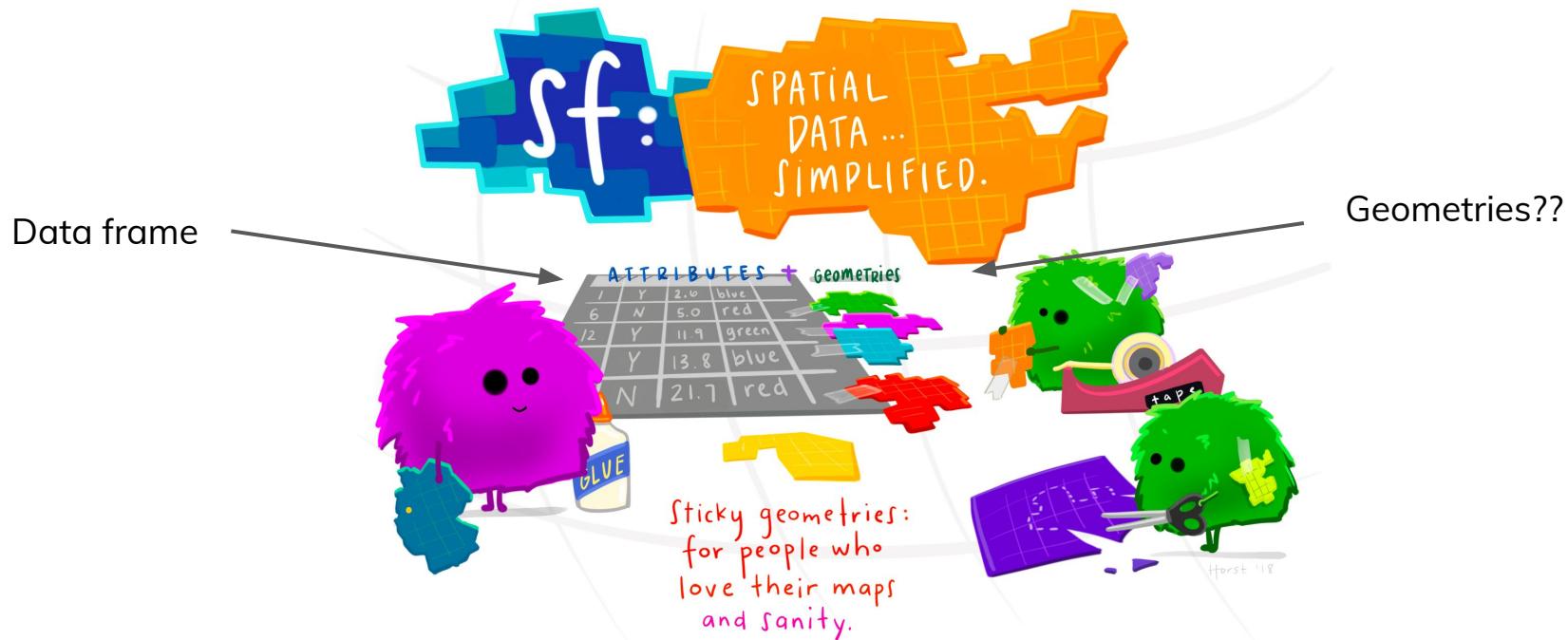
Polygon inclusions

ID	Cover type	Species
1	Tree	Oak
2	Tree	Eucalyptus
3	Tree	Eucalyptus

Modified from: GIS Fundamentals, Paul Bolstad

Simple features: **sf**

Data frame

Geometries??

Sticky geometries: for people who love their maps and sanity.

Simple features: **sf**

Simple feature geometry ● (-36, 68)
(sfg object)

Simple features: **sf**

Simple feature geometry ● (-36, 68)
(sfg object)

Simple feature geometry column ● (-36, 68)
(sfc object) NAD38

Simple features: **sf**

Simple feature geometry
(sfg object) ● (-36, 68)

Simple feature geometry column
(sfc object) ● (-36, 68)
NAD38

Simple feature
(sf object) ● (-36, 68)
NAD38

ID	Name	State
1	Toolik Field Station	Alaska

Advantages of **sf**

Advantages of **sf**
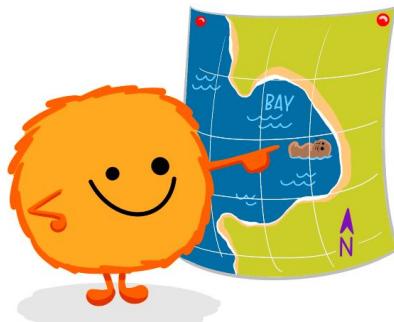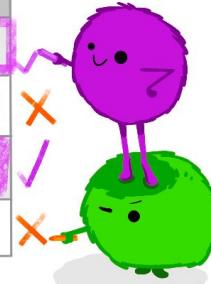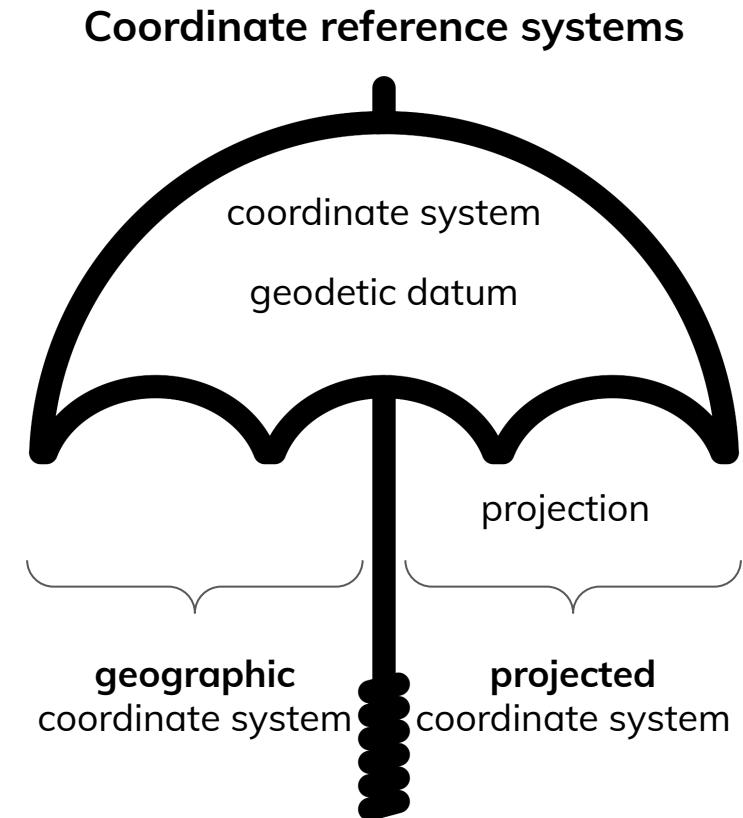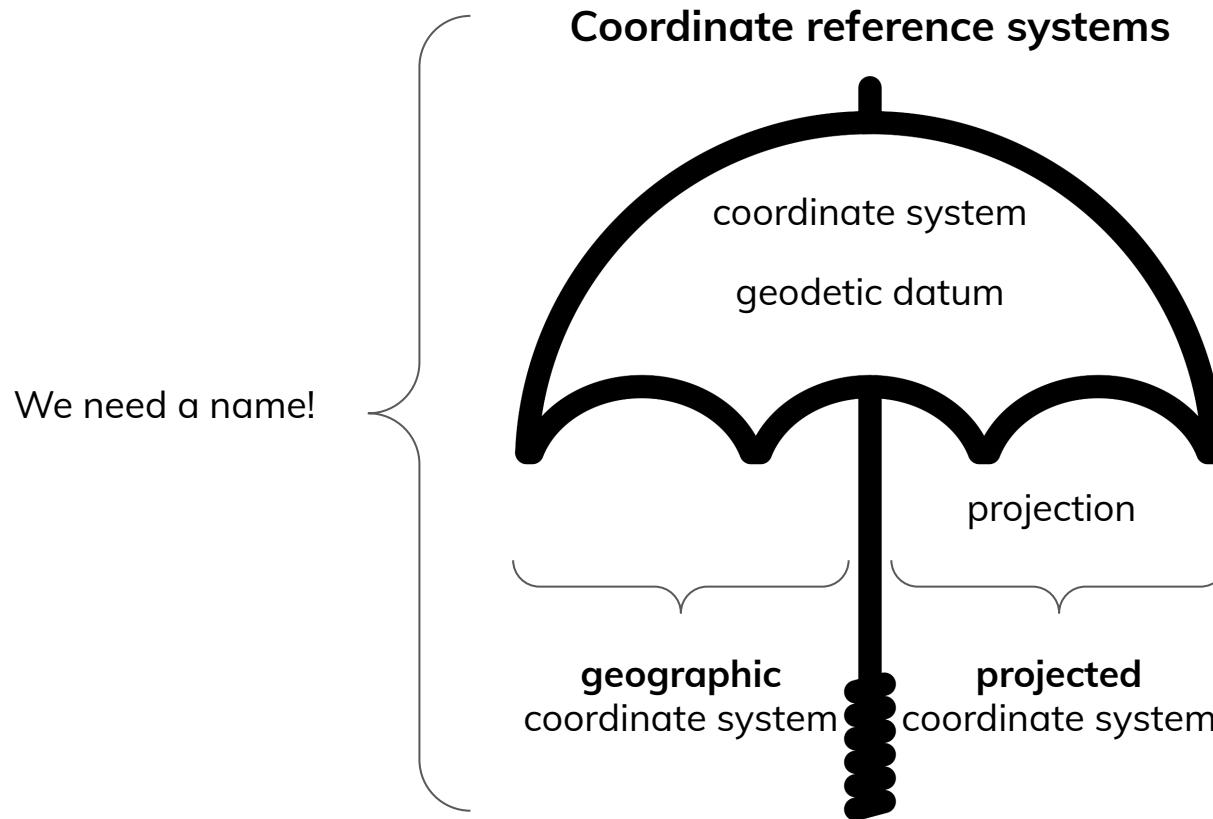
Advantages of **sf**

Advantages of **sf**

Coordinate reference systems

Coordinate reference systems

coordinate system

geodetic datum

projection

geographic
coordinate system

projected
coordinate system

Coordinate reference systems

Coordinate reference systems

coordinate system

geodetic datum

We need a name!

projection

geographic
coordinate system

projected
coordinate system
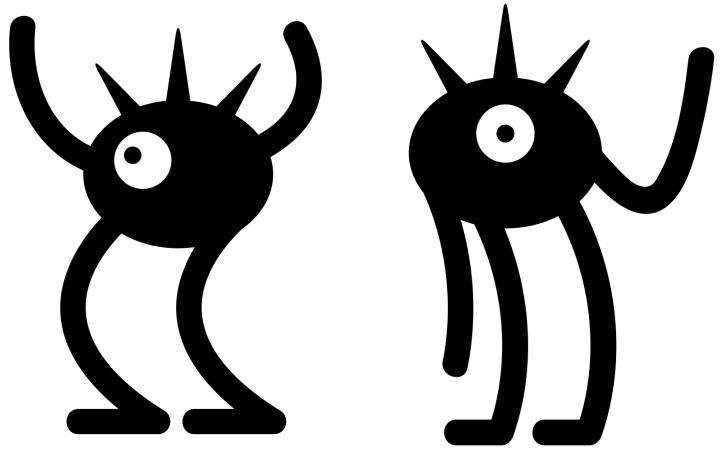
Coordinate reference systems
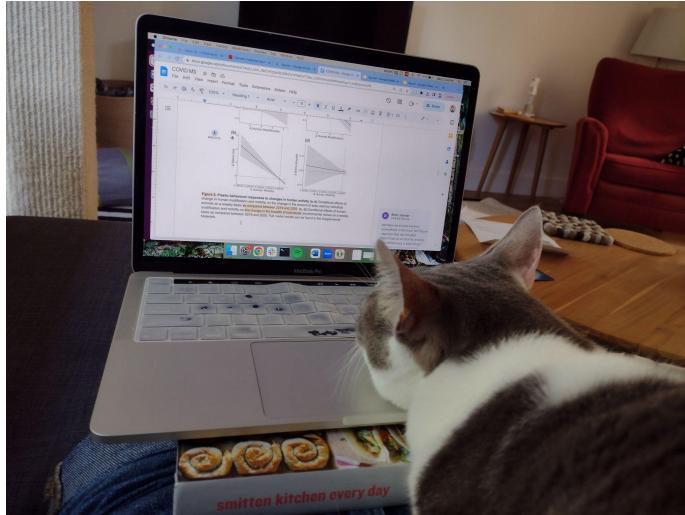
CRSs can be described using the following:

1. **Simple, yet ambiguous statements, e.g. "it's in lat/long coordinates"**
   a. Won't work in R!
2. **Fromalized, but outdated "proj4 strings"**
   a. `+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs`
3. **With an identifying "authority:code" text string**
   a. `EPSG:4326`

BREAK

Welcome back!

Mouse "Code Hero" Oliver
Code Reviewer