Welcome to the IGIS workshop on ArcGIS Pro

We will get started at 1:05!

IGIS

University *of* California
Agriculture and Natural Resources | Informatics and GIS Program
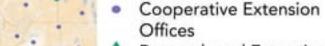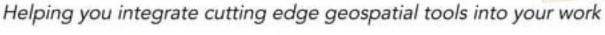
Who we are: UC ANR Informatics & GIS Team

Presenters

Maggi Kelly

Sean Hogan

Shane Feirer

Behind the scenes support

Andy Lyons

Robert Johnson

IGIS

http://igis.ucanr.edu/

Who you are

In the chat:

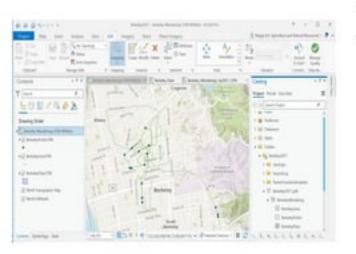- your name

- what you hope to learn from this workshop

- experience with ArcGIS Pro:

1=beginner

5=expert

Plus our friends from Europe!

Why ArcGIS Pro?

You might want to:

- Produce publication quality maps with control over design & cartography
- Maintain tight control over projections
- Perform advanced analysis:
  - Image processing with remotely sensed imagery
  - Spatial modeling e.g. site suitability modeling, hydrologic modeling,
  - Work with multiple data types e.g. UAV and Lidar
  - Work in a reproducible way
  - Work in a coding environment

Things that ArcGIS Pro does not do well:

- Can be a steep learning-curve to work with completely
- Some of the more advanced reproducibility work requires coding
- It is not the most nimble of software
- It is not free!

ArcGIS Pro: Outline

- Introductions
- ESRI: ArcGIS Pro & ArcGIS Online
- What we plan to do today at LREC
- The basics of GIS
  - Data
    - Formats - raster/vector
    - Types - imagery, lidar, GIS layers
    - Sources
  - Workflow
  - Projections
  - Design/cartography
- On to the workshop!

Workshop
- Orientation to ArcGIS Pro
- Orientation to the workshop data
- Create a new map
- Load and visualize data
- Access ESRI's online repositories of spatial data
- Create new features and export them as shapefiles
- Join data
- Query attribute tables
- Interpolate points

ESRI Software: Pro and AGOL

Cloud: ArcGIS Online

Local: ArcGIS Pro

esri

Strengths
Create web maps, web apps
Link to loads of apps (like Field Maps)
Simple analysis (*more on the way!*)
Speed
Intuitive
Browser-based

Both: Access LOADS of data!

Strengths
Cartography
Projection control
Advanced analysis:
- Image processing
- Spatial modeling
- UAV, Lidar
- Reproducibility, coding

NOTE: Requires organizational license, and desktop computer

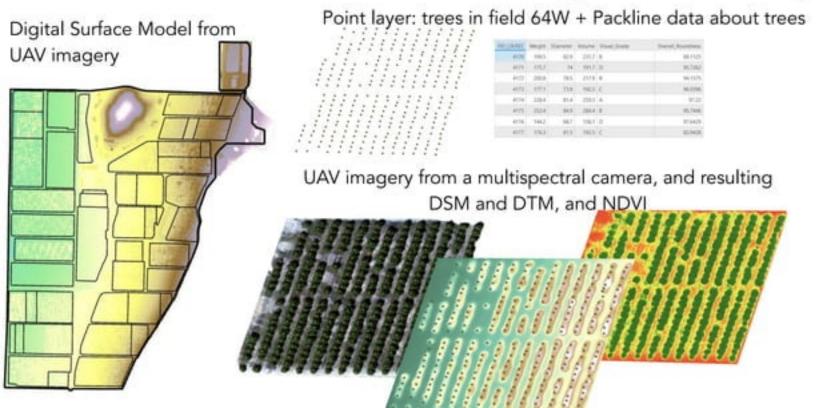University of California, Division of Agriculture and Natural Resources

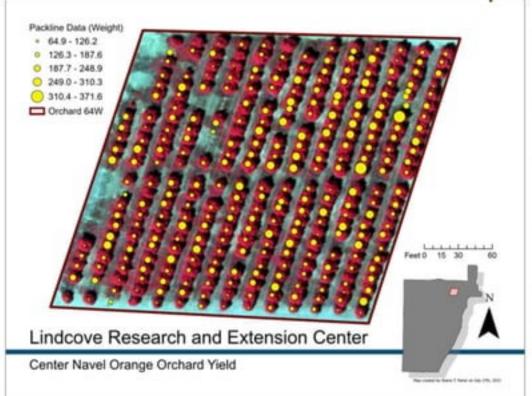# Lindcove Research and Extension Center
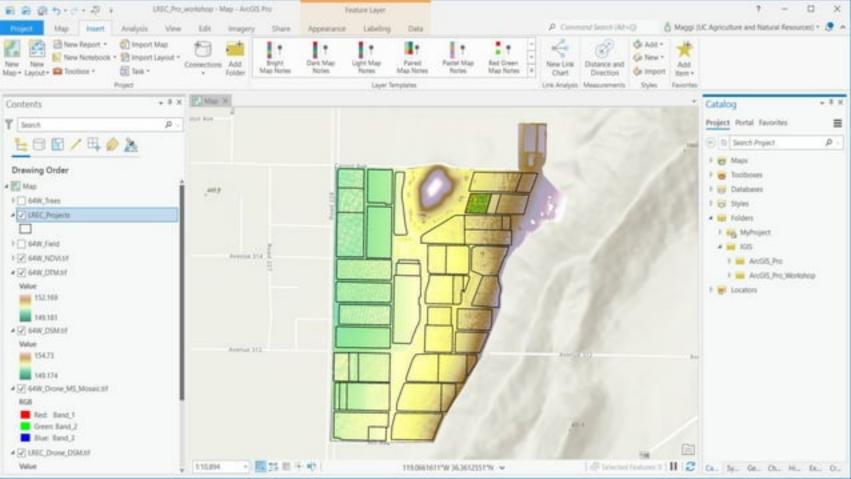
GIS data we will be working with today

Digital Surface Model from UAV imagery

Point layer: trees in field 64W + Packline data about trees

UAV imagery from a multispectral camera, and resulting DSM and DTM, and NDVI

GIS tasks we will be completing today

- Find & load data (local & cloud)
- Play around with data
- Join tabular + spatial data
- Query attribute tables
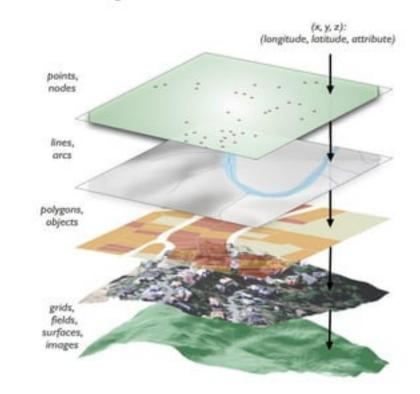- Interpolate points
- Make fancy maps

Geographical Information Systems (GIS) Basics

Geographical Information Systems are systems for acquisition, management, analysis, and dissemination of geospatial data.

Made possible (and powerful) from the coincidence of spatial data features: *georeferenced data.*

Spatial data are a *representation* of reality.

(x, y, z):
(longitude, latitude, attribute)

points, nodes

lines, arcs

polygons, objects

grids, fields, surfaces, images

Essential GIS Analysis Workflows

Data tasks

Collection: GPS, field, digitization; cloud, APIs, portals, mobile

Formats: raster, vector

Wrangling: Joins & queries

Data quality, projections, metadata

Data wrangling: editing, georeferencing, conversions (raster-vector; vector-raster)

Raster analysis

Aggregation, smoothing, resampling

Topography: slope, aspect, hillshade

Hydrological modeling: creating watersheds & hydrology

Site suitability or risk mapping

Remote sensing: Image classification, change detection; ML

Least cost paths, cost surfaces

Finding pattern in data

Vector analysis

Overlays; Geocoding; Geoenrichment; Networks; Topology; Buffers; Interpolation
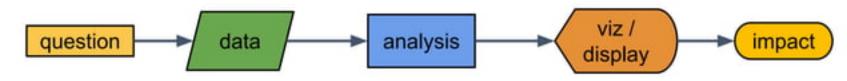
Cartography, design, visualization

Make maps, web maps, and web apps!

The GIS workflow

Problem: geographic inquiry process: what is the problem to be solved...

Data: Field, cloud, local, APIs, Public Domain...

Analysis: What are the key geospatial process steps that need to be accomplished...

```
question  →  data  →  analysis  →  viz / display  →  impact
```

Display: Best practices for creating maps & web maps...

Impact: How did the work make a difference...

GIS data: Vector & Raster
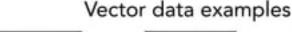
Vector Basics:

Location-based: (x,y) or (x,y,z)
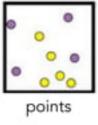
Points are used to build more complex features

Spatial information is *explicit*, i.e. it is attached to each point, and linked to a coordinate system
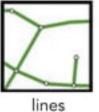
Spatial information is linked to attribute table in tables or relational databases

Vector data examples
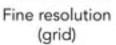
points

lines

polygons

Raster data examples

5	5	5	5
5	5	10	5
5	10	10	10
5	10	10	10

Fine resolution (grid)

| 5 | 6.25 |
| 7.5 | 10 |

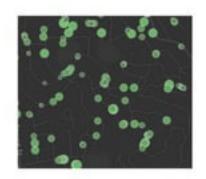Course resolution (grid)

Raster Basics:

A raster dataset is organized into one or more bands. Each band consists of an array of pixels (cells), and each pixel has a value.
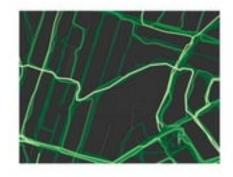
A raster dataset has at least one band.

Spatial information is *implicit*, it is relative to origin and cell size

IGIS workshop: ArcGIS Pro. Apr 15 2021

Data: Vector data examples

Points:
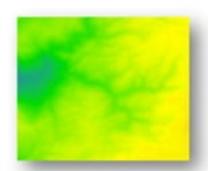Sample locations, trees, centroids, addresses, point clouds

Lines: transportation, TIGER/Line files hydrography, contours, transects, tracks, paths, borders
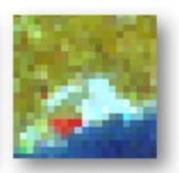

Polygons:
Land Use & Land Cover, census, fire perimeters, soil, states, counties, ownership, parcels, HUCs
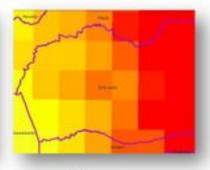
Data: Raster data examples

DEM: Digital Elevation Models Resolution: 1m-1km

Remote Sensing: Resolution: 10cm - 1m - 1km

Land Use & Land Cover (raster) Resolution: 30m-1km

Climate Downscaled Resolution: 270m-12km

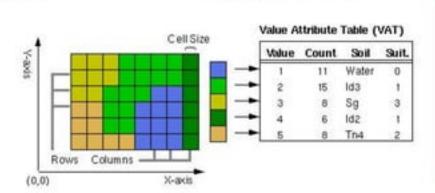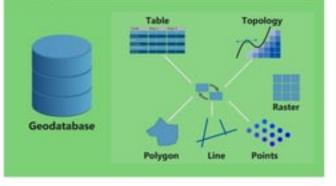Also: Digital Raster Graphics (DRGs); Scanned imagery; Scanned maps

Data: Local File Formats

Name	Date modified	Type	Size
shapefile.CPG	7/26/2015 8:46 AM	CPG File	1 KB
shapefile.dbf	7/26/2015 8:46 AM	DBF File	25 KB
shapefile.prj	7/26/2015 8:46 AM	PRJ File	1 KB
shapefile.sbn	7/26/2015 8:46 AM	SBN File	1 KB
shapefile.sbx	7/26/2015 8:46 AM	SBX File	1 KB
shapefile.shp	7/26/2015 8:46 AM	SHP File	239 KB
shapefile.shp	8/26/2015 7:57 PM	XML Document	156 KB
shapefile.shx	7/26/2015 8:46 AM	SHX File	1 KB

Local Spatial Data File Formats:

- Shapefile
- Geodatabase
- Grid
- …

Value Attribute Table (VAT)

Value	Count	Soil	Suit.
1	11	Water	0
2	15	Id3	1
3	8	Sg	3
4	6	Id2	1
5	8	Tn4	2

Data: Cloud File Formats in ESRI

Cloud data are stored as downloadable data (in all the formats we discussed earlier), or as readily useable *layers (data + symbology)* & *services (instructions on use)*.

Spatial data in the cloud:
Layers + Services

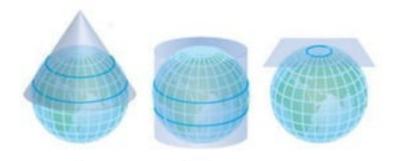# Data: Cloud File Sources

Cloud data are stored as downloadable data, or as readily useable *layers (data + symbology)* & *services (instructions on use)*.

Data: Projections

Projection. The mathematical transformation of 3D coordinates into 2D coordinates (x^s and y^s). All projections distort reality.

There are 1,000s of projections worldwide. Web maps typically use something called "web mercator", which isn't good for analysis. California has several standard projections.

On the web, Projections are assigned a code to distinguish them: UTM=29610; Web Mercator=102100; etc.
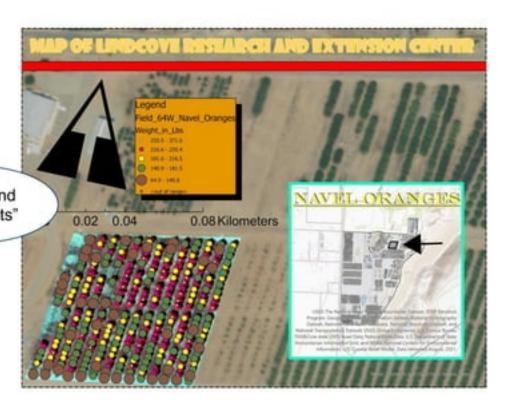
Key projections for California

- Geographic: Longitude = X value and latitude = Y value. *Not good for analysis.*
- California (Teale) Albers: California-specific projection optimized for area calculations, making it popular to map statewide resources. *OK to work in.*
- UTM (Zones 10, 11): A worldwide coordinate system based on the Transverse Mercator projection. *Good for analysis*
- State Plane (6 zones): commonly used by surveying professionals and within local municipalities. *Good for analysis, but native units are feet.*
- Web Mercator. For web mapping. It is optimized for world maps on the web because of a unique data tiling system. *Use with caution for analysis.*

GIS Cartography & design

This is where ArcGIS Pro shines, and you can really dig into the design elements of your map to make them useful & gorgeous.

"Go beyond the defaults"

Subtle, legible legend (don't need to add "Legend")

Overall balanced use of space

Overall focus on the content, not the background

Imagery as backdrop with intuitive information displayed

Good clear title, font same throughout

Subtle north arrow, informative scale bar

Nifty inset map

Packline Data (Weight)
- 64.9 - 126.2
- 126.3 - 187.6
- 187.7 - 248.9
- 249.0 - 310.3
- 310.4 - 371.6

Orchard 64W

Feet 0   15   30   60

N

Lindcove Research and Extension Center

Center Navel Orange Orchard Yield

On to the Workshop!

During the break: Check your emails for messages from the team.

If you are having trouble with any of this reach out in the chat window.