Why spatial analytics?

• Site selection
• Routing
• Territory Design
• Business decision support system
• Environmental modeling
  - Identifying critical source areas of pollutant emissions from non-point source pollution modeling
  - Spread of invasive species
Spatial Analysis Utilities

**UI**
- ArcGIS Pro
- ArcGIS Insights
- ArcGIS Online
- Enterprise Portal

**Scripting**
- ArcPy
- ArcGIS r-bridge
- ArcGIS API for Python
- ArcGIS Notebooks
Data Pre-processing

- Cleaning data
  - Evaluating missing data in fields
  - Encoding categorical data
- Normalizing or standardizing data
  - Normalize attribute of a data cut
  - Standardizing attribute data
- Pivot tables
  - Statistical summary of complex dataset (distill data)
- Aggregate
  - Bucket data into specific cuts for analysis
- Feature extraction
- Summarize
Data Engineering in ArcGIS Pro

• Spatial statistics analysis
  - Regression
  - Classification
  - Cluster mapping
• Spatial Autocorrelation
• Geographically Weighted Regression
• Machine learning analysis
  - Training/Testing
  - Decision Tree
  - Random Forest
  - Density based clustering

Random Forest graph representing splits of a dataset in a scatter plot.

Random Forest high level overview workflow.
Spatial Relationships

- Patterns
  - Hot spot analysis
  - Clustering
  - Linear Regression
- Colocation analysis
- Kernel Density Estimator
- Interpolation methods
  - Inverse distance weighted (IDW)
  - Kriging

Kernel Density Estimator for grocery store locations within a city
Kernel density estimator for populations within a city
Exploratory Data Analysis (EDA) Utilities

- Spatial Stats Toolbox
- GeoAnalytics or Geostatistical Toolbox
- ArcGIS R-bridge
- Python virtual environment
- ArcGIS Notebook
- Jupyter Notebooks Access
R-ArcGIS Bridge

- ArcGIS Pro → Options → Geoprocessing
  - Point to R executable program on local machine
  - Install arcgisbinding
- Jupyter Notebooks R analysis
  - Call package arcgisbinding
- Run notebook in ArcGIS Pro
R in Jupyter

**Cell 1**
```
install.packages("rgdal", type = "source")
library(rgdal)
library(arcgisbinding)
library(fda)
library(raster)
library(rts)
```

Next, you will use the R-ArcGIS Bridge to read in the time-series mosaic that contains the predicted temperature profiles. Note that, you will need to convert a time field to a R time field.

**Cell 2**
```
## INITIALIZE CONNECTION WITH ARCGIS PRO
arc.check_product()
## Define the location for GDB containing rasters
r <- arc.open("C:/ClimateAnalysis/p20/Default.gdb/temp.time_series")
## Read In Time Series MOSAIC Times
forecast_times <- arc.select(r)
forecast_times <- as.Date(forecast_times$StdTime)
```

Next, using the `arc.raster` function of the R-ArcGIS Bridge, you will bring create a 3-D Raster Stack in R. Note that we are using `LockRaster` as the method to get one raster at a time. We read every time slice in a loop and create our Raster Stack.

**Cell 3**
```
## DEFINE EXTENT FOR RASTERS
extent <- c(-125, 25, -70, 50)
nrow = 200
ncol = 100
## Read All the Rasters into One List
rlist <- list()
for (i in 1:length(fo)) {
    ras <- arc.raster(r, extent = extent, nrow = nrow, ncol = ncol, nodata = -999, mosaic = list(method = "LockRaster", LockRaster)
    rlist[[i]] <- ras
}
```

Install and initiate packages

Check ArcGIS Pro connection and point to GDB

Define environment variables (raster extent)
Python

- Python virtual environment
  - Creating virtual env in ArcGIS Pro
  - Versioning control
- Packages & Libraries
- Clone versioning
  - ArcGIS Pro environment with added libraries
- ArcGIS Notebook Python
Python EDA in ArcGIS Notebooks

- Geospatial data analysis
- Build raster datasets
- Linear and multi-linear regression analysis
  - Surface predictions for temporal data
- Network analysis and modeling
Results Visualization

- **Infographics**
  - Business location summary
  - Demographic information
  - Tapestry segmentation information
- **ArcGIS Pro**
- **Insights**
- **ArcGIS Dashboard**
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11:30a.m.- 12:00 p.m.

**Esri Session #5:**
Rapid Field Data Acquisition with ArcGIS Quick Capture
*Presenter: Mark Scott*

Using ArcGIS Quick Capture, you can rapidly record field observations.