



# XXVII FIG CONGRESS

11-15 SEPTEMBER 2022  
Warsaw, Poland

Volunteering  
for the future –  
Geospatial excellence  
for a better living

## Operationalizing the LADM Valuation Information Model in ArcGIS

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# How Can GIS Support Property Valuation?



COLLECTING NEW DATA  
IN THE FIELD



GEO-ENRICHING  
PROPERTY ATTRIBUTE  
DATA



SPATIAL OBSERVANCE  
OF DATA PATTERNS



GEOSPATIAL MASS  
APPRAISAL MODELING



MEASURING  
ACCURACY,  
UNIFORMITY, AND  
EQUITY OF PROPERTY  
VALUES



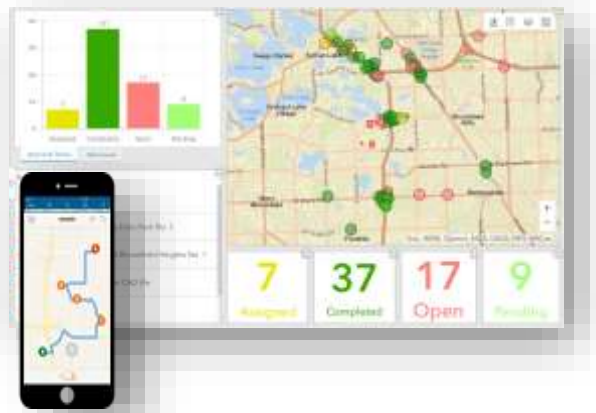
STREAMLINING  
TAXPAYER APPEALS



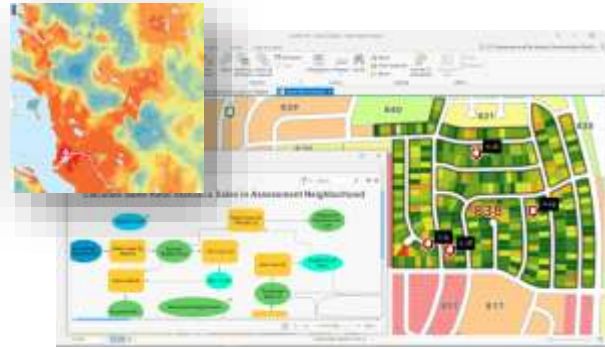
IMPROVING TAXPAYER  
AWARENESS AND  
INFORMATION ACCESS

# GIS and Property Valuation In Practice

Field Data Capture



Spatial Statistical Modeling



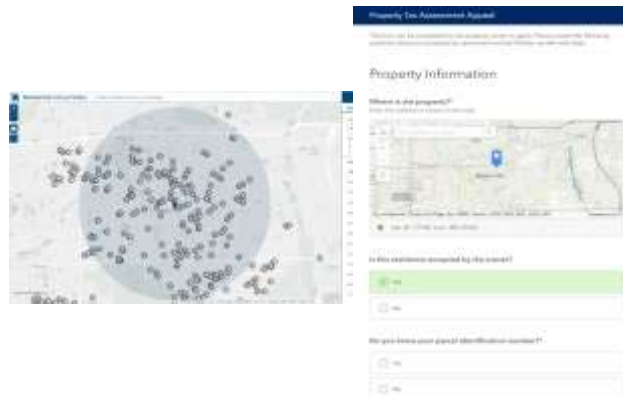
Data Exploration



Change Detection & Feature Extraction



Appeals Defense



Public Data Access



# Data types used in value prediction modeling

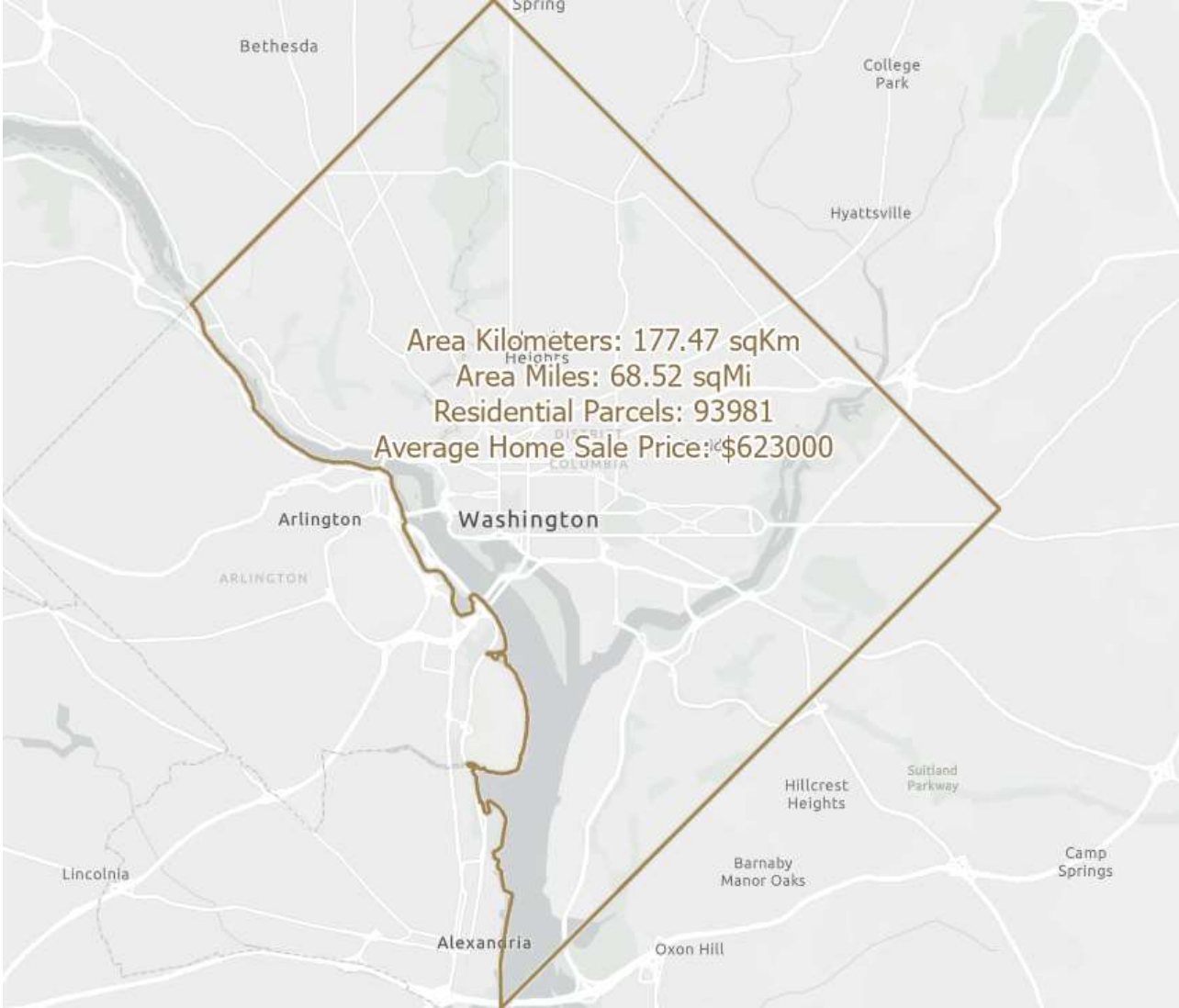
## Property Characteristics

- Quantifiable characteristics (ex. sq meters)
- Subjective characteristics (condition)
- Local characteristics
- Geographic characteristics (walking distance to transportation)

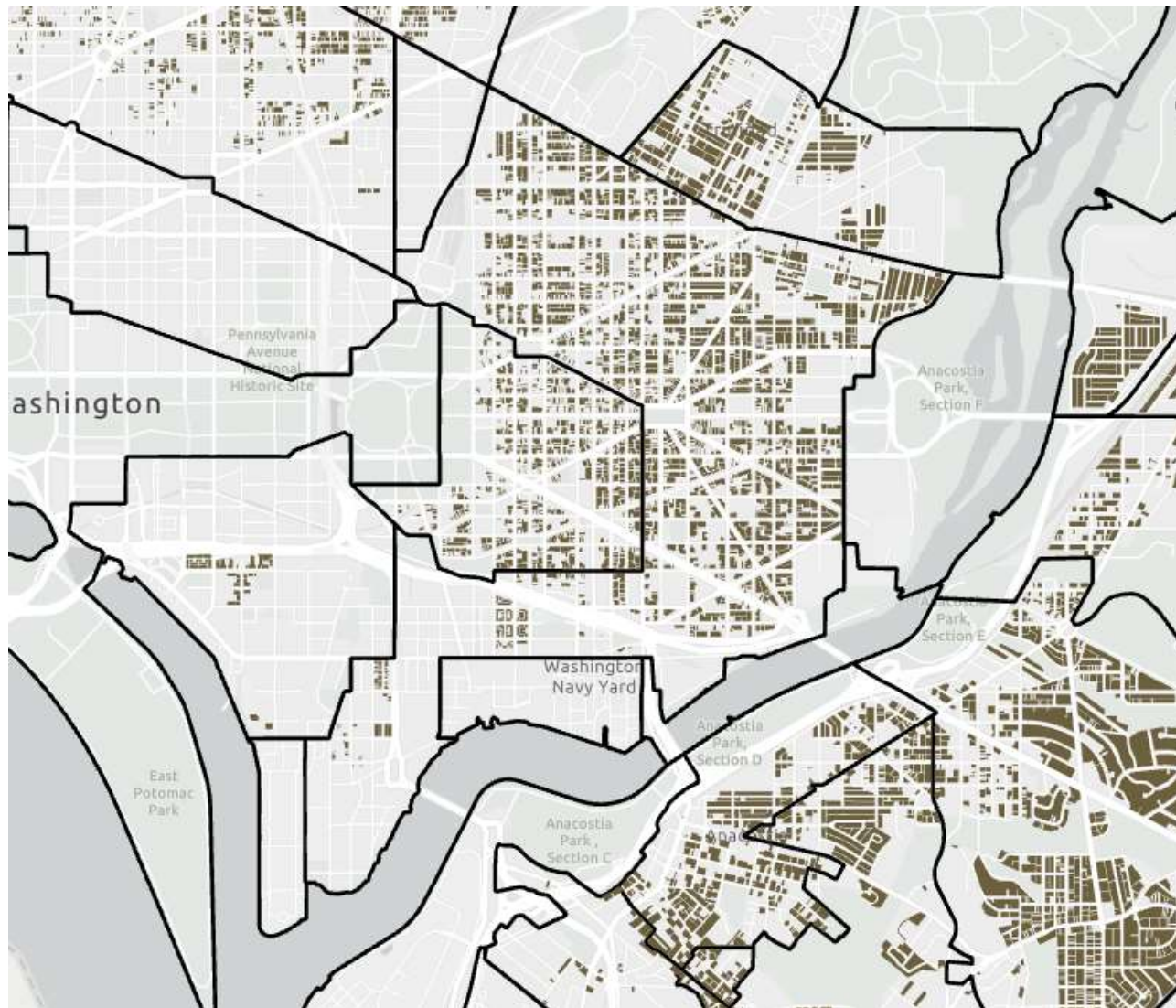
## Sale Price

## Assessed Value

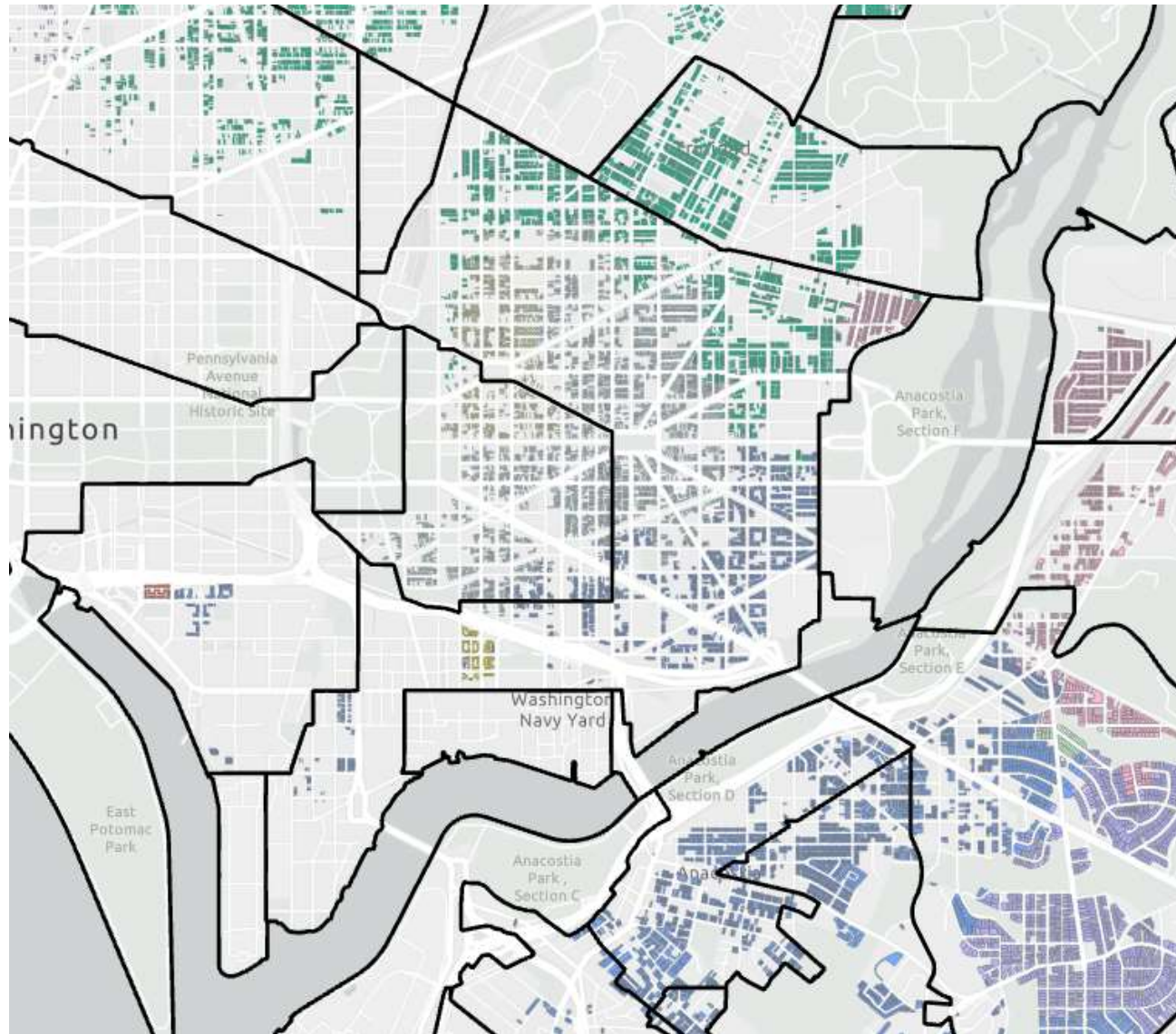
# Washington, DC A Proof of Concept



# Valuation Neighborhoods



# Valuation Neighborhoods Analysis



### Spatially Constrained Multivariate Clustering

Parameters Environments

Input Features  
DCResidentialSingleFamilyLotsCAMA

Output Features  
DCResidential\_SpatiallyConstrainedMultivariateClustering1

Analysis Fields Select All

- STRUCT
- GRADE
- CNDTN
- EXTWALL
- ROOF
- INTWALL
- KITCHENS
- FIREPLACES
- Shape\_Length
- Shape\_Area

Cluster Size Constraints  
None

Number of Clusters

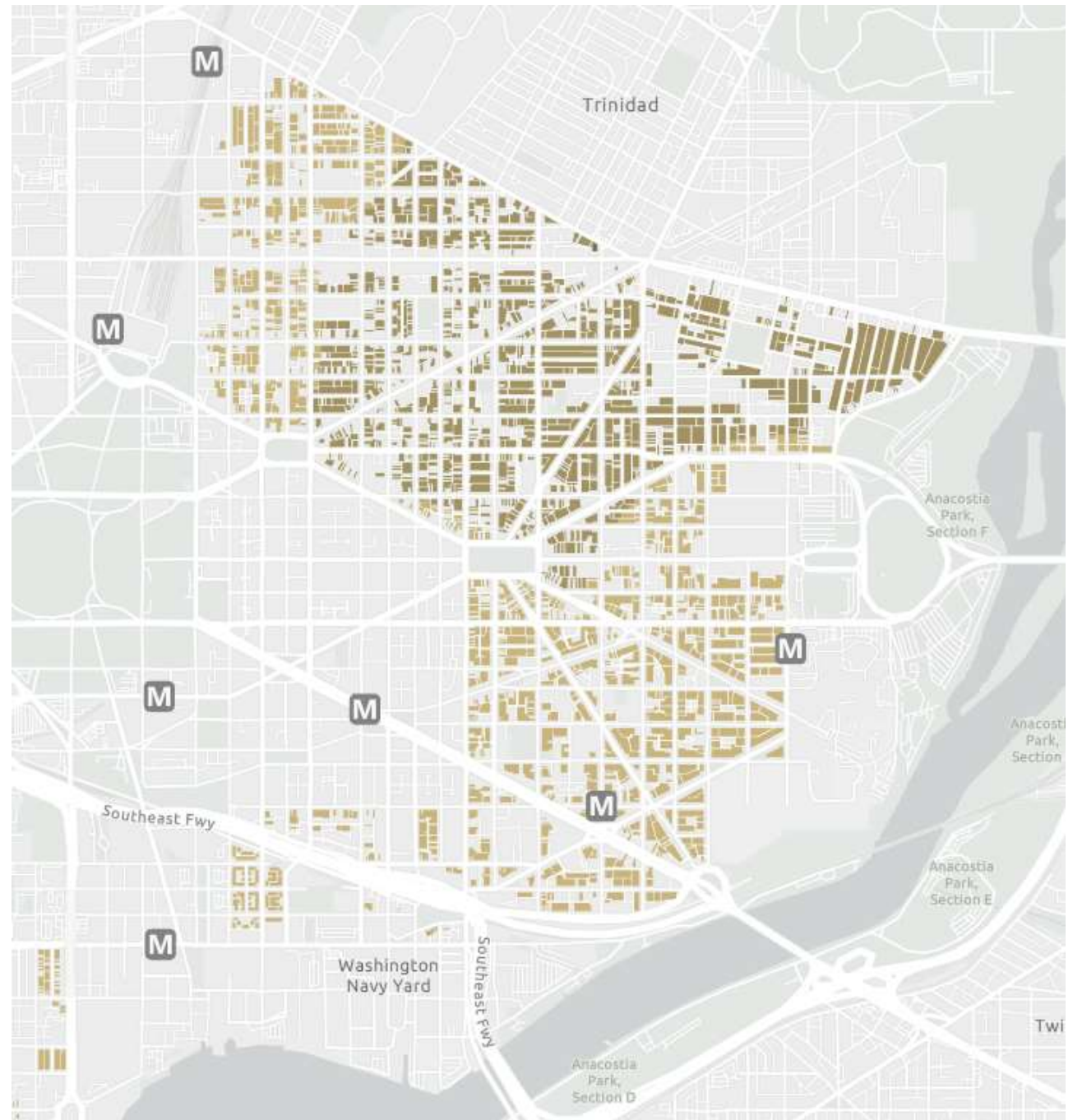
Spatial Constraints  
Trimmed Delaunay triangulation

Permutations to Calculate Membership Probabilities

Output Table for Evaluating Number of Clusters  
DC\_SpatiallyConstrainedNeighborhoods1

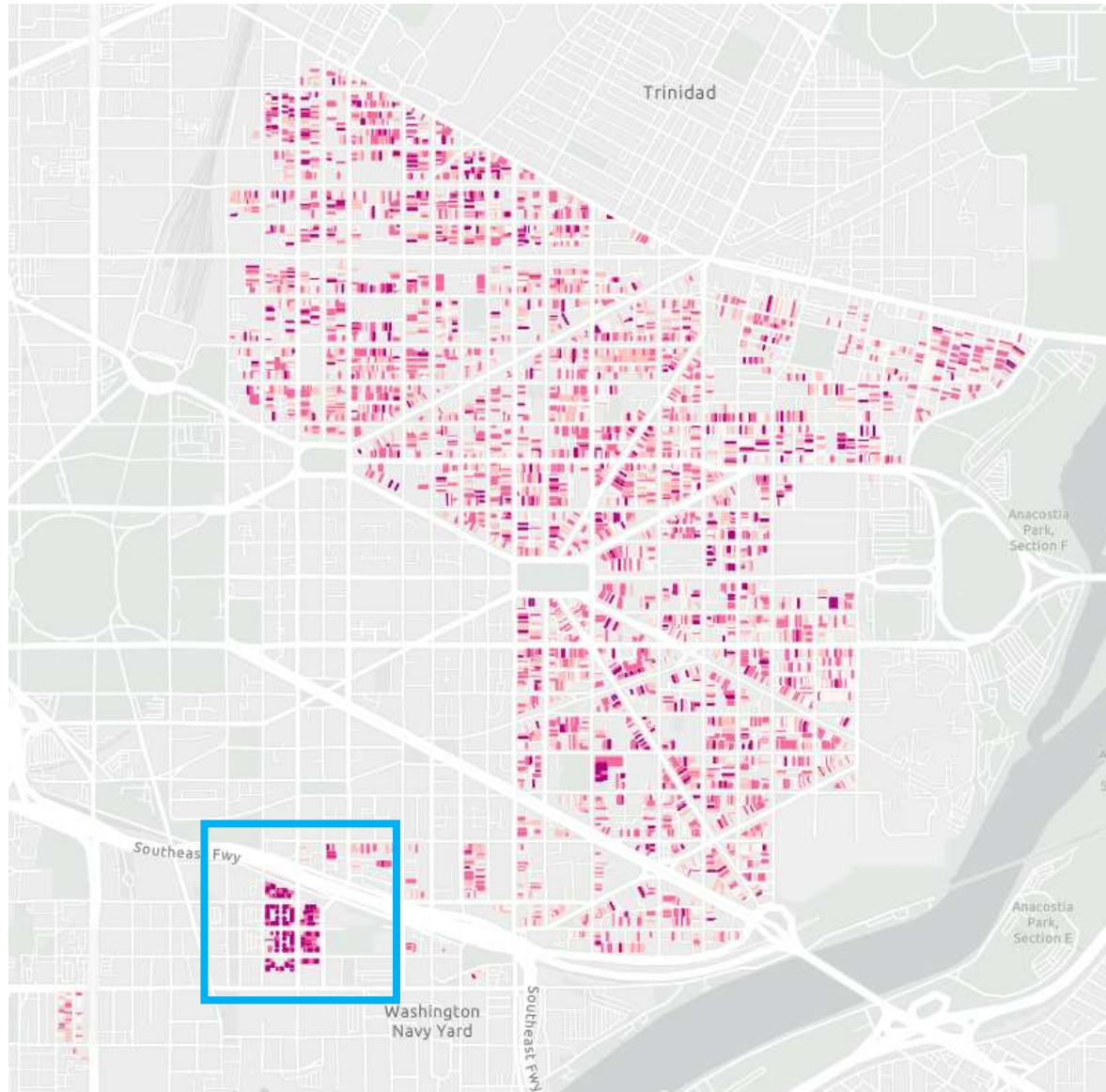
# Spatial Property Characteristics

## Distance to Metro





# Predicted Sale Price



The screenshot shows a software interface for "Forest-based Classification and Regression". At the top right, there is a blue refresh icon. The interface has two tabs: "Parameters" (selected) and "Environments". A help icon (?) is also present. The "Parameters" section includes:

- Prediction Type: Train only
- Input Training Features: Neighborhood 39
- Output Trained Features: Neighborhood\_39\_Trained1
- Variable to Predict: SalePrice
- Treat Variable as Categorical
- Explanatory Variables: A list of variables with a dropdown arrow next to the header.

Variable	Categorical
AYB	<input type="checkbox"/>
Condition	<input type="checkbox"/>
DistanceToMetro	<input type="checkbox"/>
NumBathroom	<input type="checkbox"/>
NumBedrooms	<input type="checkbox"/>
NumFireplaces	<input type="checkbox"/>
RecordArea	<input type="checkbox"/>
Roof	<input type="checkbox"/>
	<input type="checkbox"/>

At the bottom, there are three expandable sections:

- > Additional Outputs
- > Advanced Forest Options
- > Validation Options





*VM\_ValueType*  
«codeList»  
**TR\_VM\_ValueType**  
+ taxValue = 1

*VM\_ValuationUnitType*  
«codeList»  
**TR\_VM\_ValuationUnitType**  
+ condominiumProperty = 2  
+ parcel = 1

*VM\_ValuationUnitGroupType*  
«CodeList»  
**TR\_VM\_ValuationUnitGroupType**  
+ district = 2  
+ street = 1

*VM\_CostType*  
«CodeList»  
**TR\_VM\_CostType**  
+ reproductionCost = 1

*VM\_ConstructionMaterialType*  
«codeList»  
**TR\_VM\_BuildingConstructionType**  
+ steelFramework = 1  
+ concreteFramework = 2  
+ stone = 3  
+ stoneFrame = 4  
+ timber = 5  
+ shanty = 6  
+ sunDriedMudOrBrick = 7

«codeList»  
**TR\_LegalStatusType**  
+ legal = 1  
+ illegal = 2

«codeList»  
**TR\_BuildingQualityType**  
+ luxuryConstruction = 1  
+ firstClassConstruction = 2  
+ secondClassConstruction = 3  
+ thirdClassConstruction = 4  
+ simpleConstruction = 5

*LA\_BuildingUnitType*  
«CodeList»  
**TR\_LA\_BuildingUnitType**  
+ condominiumAccessoryType = 2  
+ condominiumMainPart = 1  
+ jointAccessFacility = 3

*VM\_BuildingUseType*  
«CodeList»  
**TR\_VM\_CondominiumUseType**  
+ residential = 1  
+ office = 3  
+ retail = 2

*VM\_AccessoryPartType*  
«CodeList»  
**TR\_VM\_AccessoryPartType**  
+ coalCellar = 2  
+ garage = 1  
+ waterTank = 3

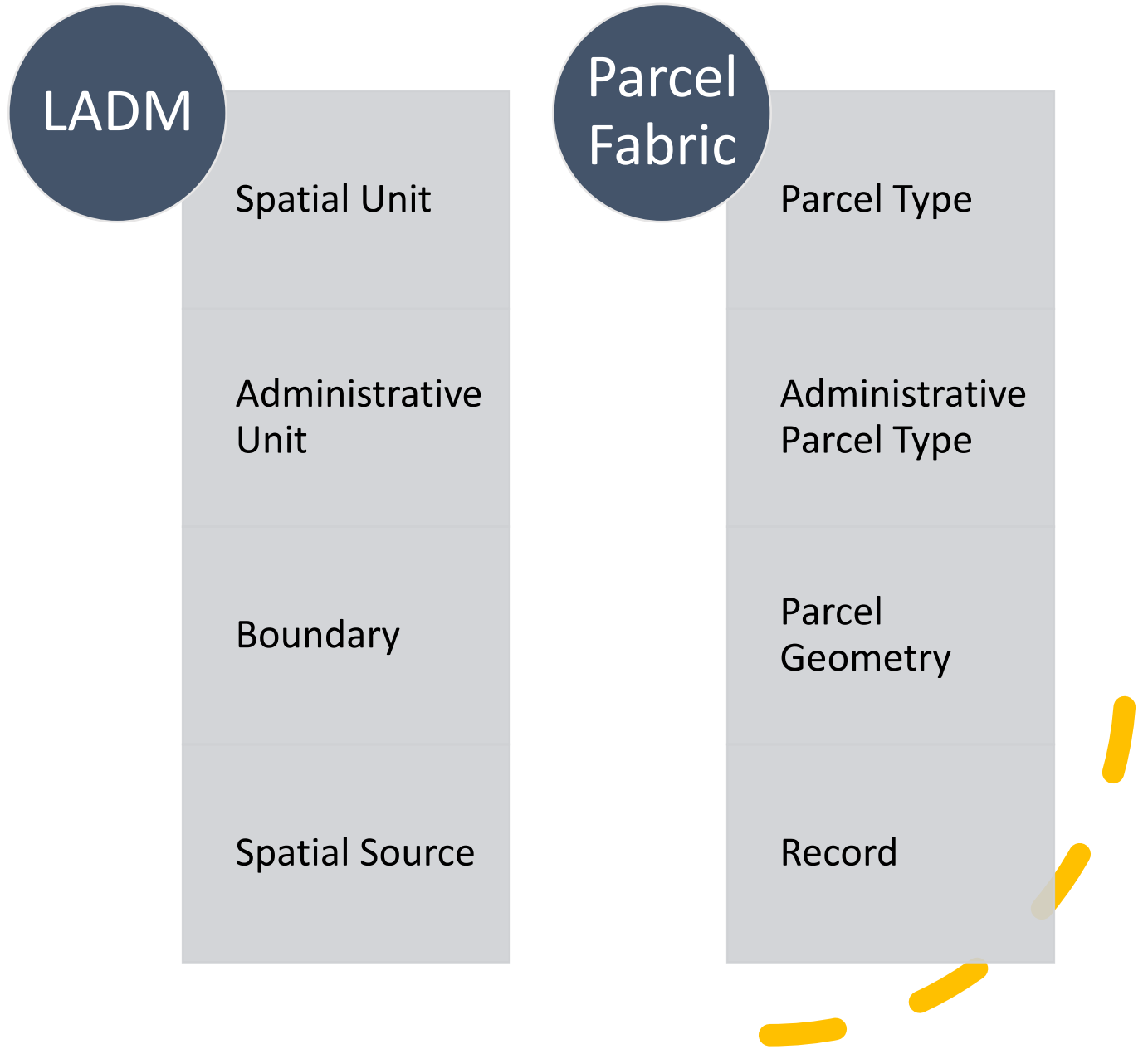
*VM\_BuildingAreaType*  
«codeList»  
**TR\_VM\_BuildingAreaType**  
+ totalFloorArea = 1

«codeList»  
**TR\_ParcelUseType**  
+ barrenLand = 2.1  
+ bottomLand = 2.2  
+ wetland = 2.3  
+ urbanLand = 1  
+ ruralLand = 2  
+ other = 3

*LA\_PartyRoleType*  
«codeList»  
**TR\_LA\_PartyRoleType**  
+ localValuationCommission = 1  
+ taxpayer = 2  
+ internalValuer = 3  
+ externalValuer = 4  
+ qualifiedValuer = 5

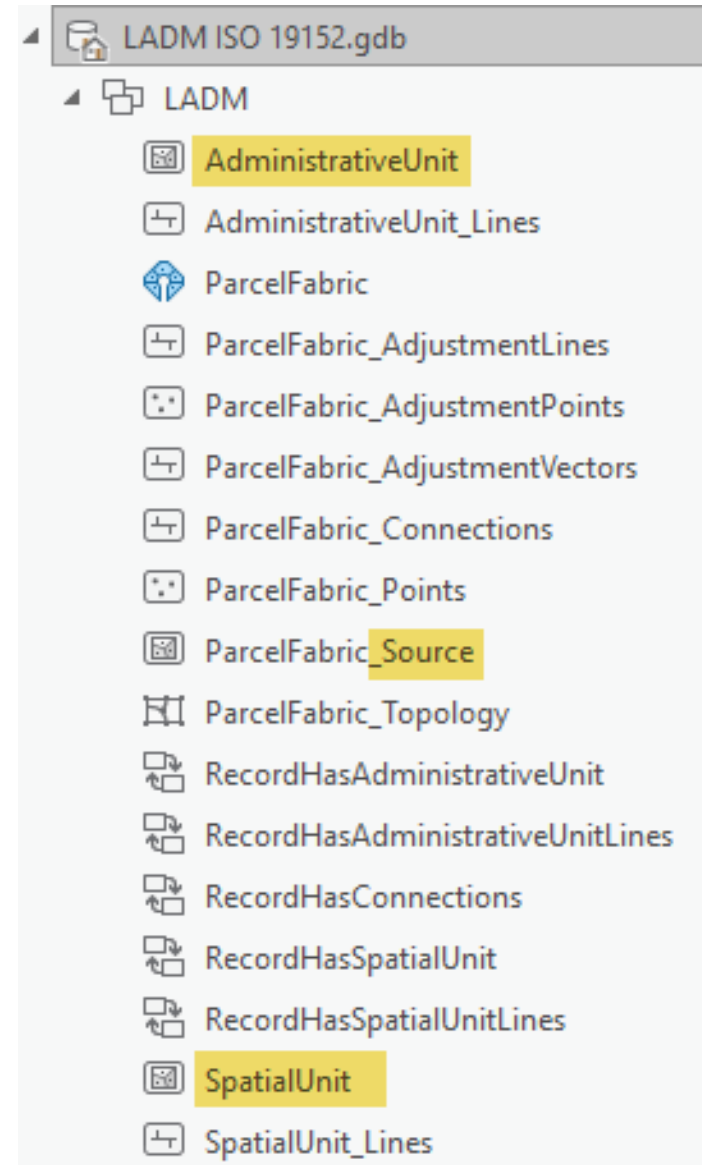
# LADM Ontology in Parcel Fabric

Supports Any  
Language



# LADM in Parcel Fabric: Ready to Use

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# Conclusion



LADM Valuation extension is complimentary to spatial analysis



One recommendation for implementation: after collecting data, join all information into one table for ease in analysis