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## Understanding ArcGIS Domains

### Introduction

Domains are geodatabase components designed to make GIS editing tasks faster and more accurate ensuring integrity of your database and reliability of all products derived from that data. Domains also “transfer” to ArcGIS Online (**AGOL**) providing field data collection (through **ESRI Collector**) with the same benefits as desktop operations.

This document discusses domains in sufficient detail to illustrate their importance, and describes a workflow using ArcCatalog and ArcToolbox for domain creation, editing, and management that eliminates the need to maintain separate Excel or DBF files for that purpose.

Using domains in ArcMap is not difficult, but it can be confusing.

Four easy steps!

- Create and describe a domain
- Set domain parameters or enter the codes and descriptions; geodatabase tables, DBF files, or Excel worksheets can be useful in this step
- Assign the domain to an attribute in your feature class
- Domain created and defined is used when adding and editing data in attribute tables

Notations in this document include:

A series of tool and/or menu operations indicated with the connection symbol “=>”; e.g.

**ARCCATALOG=>[RIGHT CLICK ON FGDB NAME]=>RENAME.**

Dialog buttons are indicated as (e.g.) OPEN or NEXT.

Attribute names are indicated as (e.g.) **DESCRIPTION**.

Table names are indicated as (e.g.) **SPECIES\_LATIN**.

A few document caveats:

- The terms **GEODATABASE TABLE** and **FGDB TABLE** are synonymous.
- In the discussion that follows, references to file geodatabase (FGDB) tables are different than references to domain tables. However, those two types of tables can be related via ArcToolbox for the creation and management of domains.
- This document uses urban forestry data examples.
- Domain subtypes are **NOT** discussed in this document. See [Use Geodatabase Subtypes and Attribute Domains](#) for an introductory tutorial.

Appendix II is a short glossary of GIS terms used in this document that are specific to ArcGIS and its geoprocessing components.

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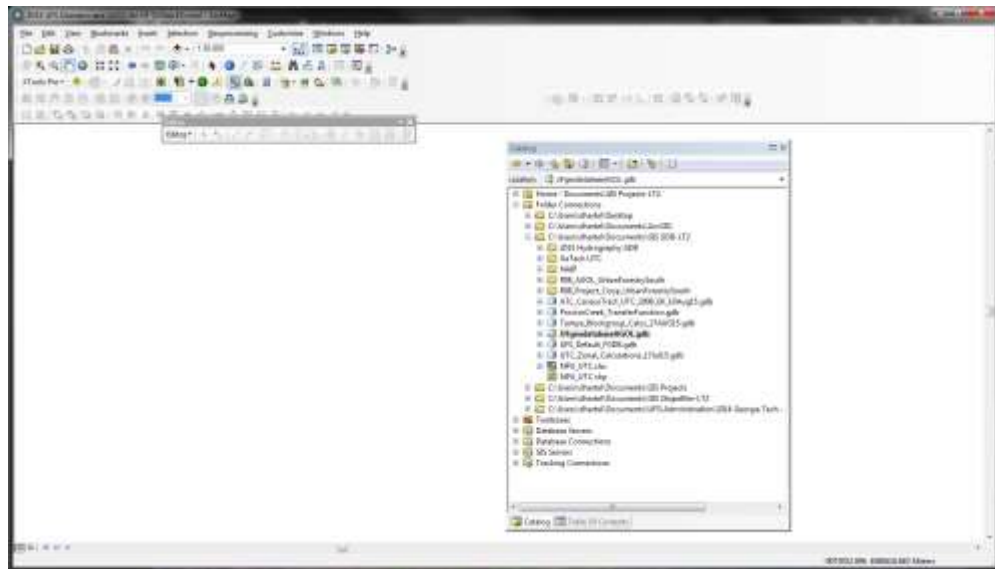
GIS Processing Environment – Standard Practices for Consideration

When creating or opening a map document (e.g. [2015 UFS DOMAINS AND AGOL FOR UF \(11SEP15\).MDX](#)) you should set (or verify) global environment variables that can make your dialog entry for geoprocessing tasks easier.

For additional discussion and setting the map and geoprocessing **environment** see ESRI’s on-line help for your version of ArcMap <http://arcg.is/20gaQ43>.

**A) Start by setting the default geodatabase:** In ArcCatalog

- (1) From within ArcMap, start ArcCatalog



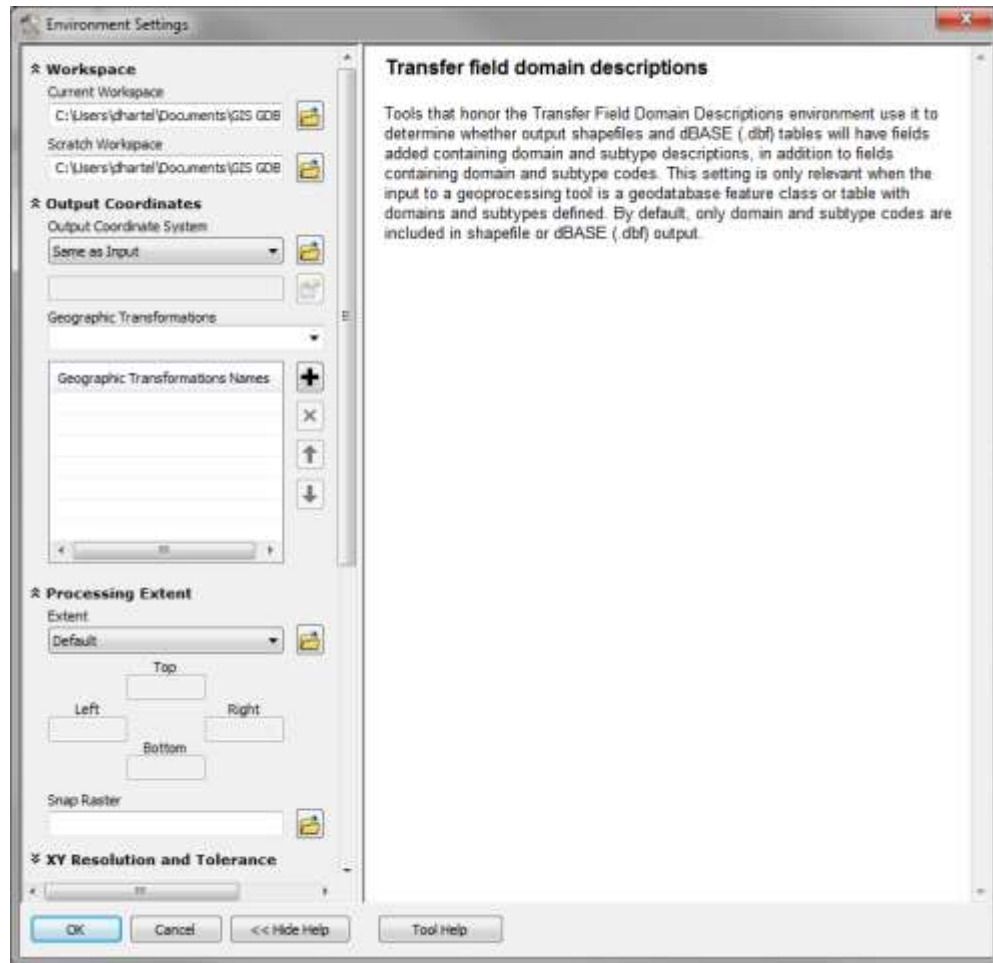
- (1) Create a file geodatabase for this map document **AND/OR** locate the desired geodatabase
- (2) Right-click on the geodatabase name and click on **Make Default Geodatabase**
- (3) Save the map document

**B) Setting the geoprocessing environment at the application level (i.e. map document):** In ArcMap

- (1) Start ArcMap
- (2) Open or create a map document



- (3) From the ArcMap standard toolbar, **Geoprocessing=>Environments...** to display the Environment Settings dialog.



At a minimum, you may wish to set:

- (1) **Workspace(s)**, current (for new output feature classes) and scratch (temporary files)
  - a. If you create, use, and set the default file geodatabase (see preceding), the workspace(s) will correctly point to the geodatabase (**Current** for output feature classes); you may wish to reset the scratch workspace to a folder or another geodatabase (e.g. **DEFAULTGDB**)
- (2) **Output Coordinates**
- (3) **Processing Extent** (when you are working a known, defined area)



If you are using domains, then also set

**(4) Fields**



Check  **Transfer field domain descriptions** so that exported data will include domain code AND descriptions.



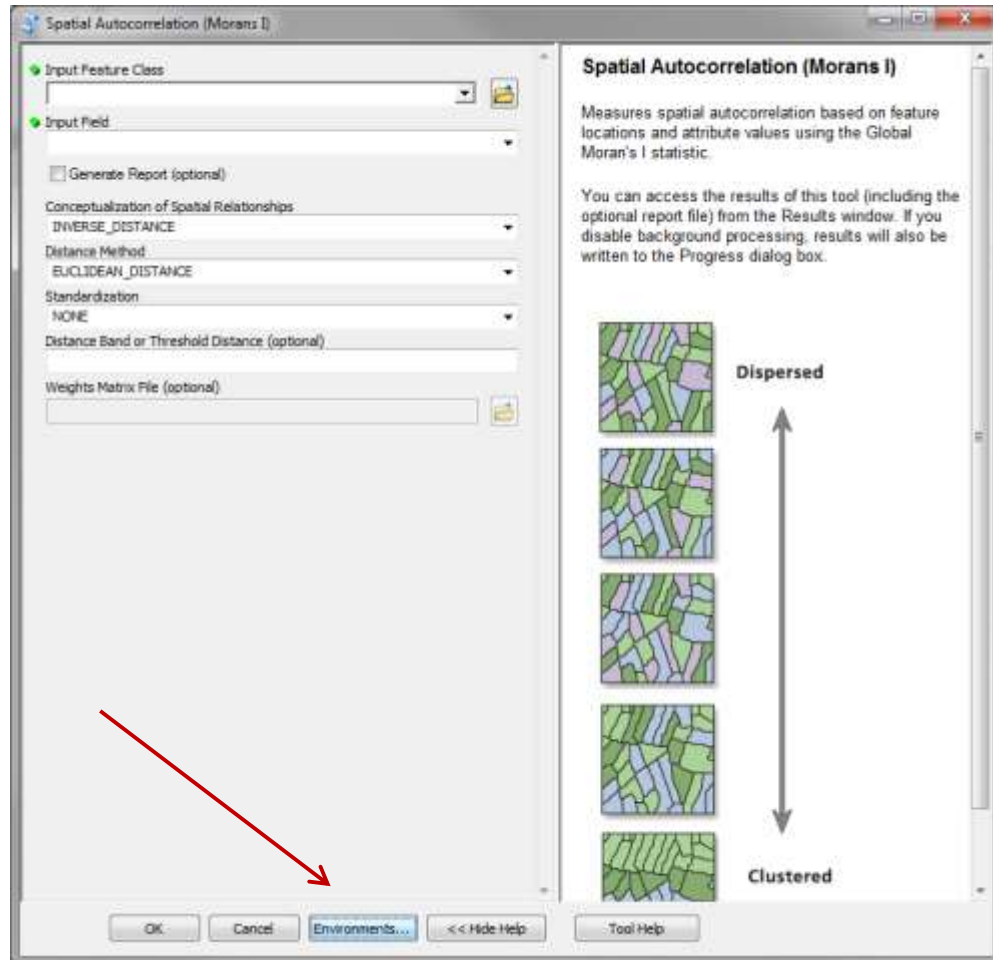
**C) Setting the geoprocessing environment at the tool level:** In ArcMap

- (1) In ArcMap, open the ArcToolbox and expand the dialog menu as needed
- (2) Open the tool dialog by double clicking on the tool name (e.g. **Spatial Autocorrelation**)



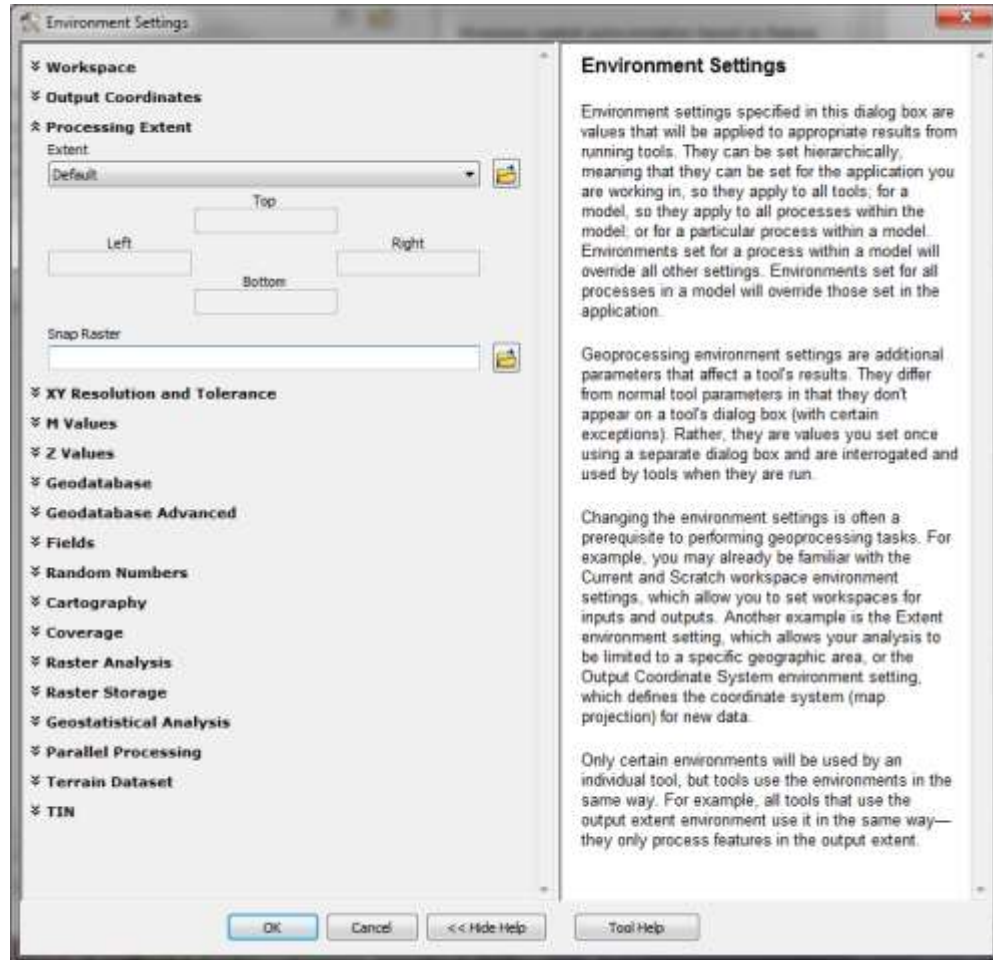


- (3) Set tool parameters as needed (e.g. input, output)
- (4) Click on **Environments...** at the bottom of the dialog





- (5) Set override environments for this tool or process (e.g. **Processing Extent**)



## Domains

A domain is a declaration of acceptable attribute values. (Note: ArcGIS feature classes and geodatabase tables have attributes). Whenever a domain is associated with an attribute field, only the values within that domain are valid for the field. In other words, the field will not accept a value that is not in that domain. Using domains helps ensure data integrity by limiting the choice of values for a particular field.

Attribute domains can be shared easily **ACROSS** feature classes and tables **within a file geodatabase (FGDB)**.

Domains can be shared **BETWEEN** geodatabases using ArcToolbox components or by merely sharing (i.e. **COPY & PASTE**) the FGDB tables from within ArcCatalog and then transferring the table (using ArcToolbox) to the domain.

When creating or modifying a domain for a geodatabase, you must edit the following properties:

- **Domain name and description**





- **Domain type**

When you create a domain, you must specify which type of domain you want to use.

There are two types of attribute domains:

- ✓ Range domains—A range domain specifies a valid range of values for a numeric attribute. When creating a range domain, you enter a minimum and maximum valid value. A range domain can be applied to short-integer, long-integer, float, double, and date attribute types.
- ✓ Coded domains—A coded value domain can apply to any type of attribute—text, numeric, date, and so on. Coded value domains specify a valid set of values for an attribute.

- Domain codes and code descriptions; the coded domain table might look like this for Consequence of Failure and Impact (COFI) as a short integer code:

0	< Select COFI >
1	Negligible
2	Minor
3	Significant
4	Severe

- **Field type**

The field type is the **type of attribute field** in the geodatabase with which the domain can be associated.

The field type can be set to any of the following:

- Short—Short integers (-32,768 through 32,767)
- Long—Long integers (-2,147,483,648 through 2,147,483,647)
- Float—Single-precision floating point numbers
- Double—Double-precision floating point numbers
- Text (Coded domains only)—Alphanumeric characters
- Date—Date and time data

For coded domains (see above) SHORT INTEGER and TEXT codes are the most useful for typical urban forest inventory attributes like: species, condition, risk, or management recommendations. For range domains, to support data like DBH, height, or crown width, real numbers (i.e. data type = FLOAT) may be required or desired.

Note: For i-Tree Eco compatible processing of species/genus, set the **CODE** attribute as an 8 character text data type and enter the USDA Plants database ID. You can use either Latin or common names in the **DESCRIPTION** attribute for the drop-down list.

Once the field type is set, the name of the domain will appear in the domain drop-down list for any field of that type in the attribute Properties dialog box.

Domains defined in file geodatabases published as **Map Services** for ArcGIS Online use will become the drop-down selections for data entry in the **ESRI Collector** on iOS and Android smart devices. Both range and coded domains can be used in the ESRI Collector.



Proposed Workflow:

Editing tables in an ArcMap session is as easy as editing in Microsoft Excel<sup>1</sup>. So by creating your domain tables directly in ArcCatalog, ArcToolbox, and/or ArcMap you will avoid some peculiar Excel to ArcMap conversion problems.

In addition, by having the domain table as a “native” geodatabase table it will be easy to join the table back to the feature class and when shapefiles are exported the CODE and DESCRIPTION (and any other attributes) will be included in the shapefile DBF.

A FGDB **DOMAIN** can be created by following Step B.

**Step B** is used to create a domain **AND** enter **DOMAIN** table data (Step B6) from ArcCatalog. This is the direct approach to creating domains and is used for creating **RANGE** domains, or appropriate for **CODED** domains that have short lists.

Coded **DOMAIN** tables can be created and filled using other tools by following Step C, and Step D where a FGDB table provides codes and descriptions. Using FGDB tables provides the most flexibility for coded domains when the lists change often, are lengthy (i.e. they can be edited in the FGDB table format and then transferred again to update the domain), or when a domain table is to be created by appending various FGDB tables. A good example in urban forestry is the management of species lists for field data collection.

**Step C** is used to create a FGDB table **AND** load data into that table from an Excel worksheet or DBF file. However, data types are difficult or impossible to control if using Excel.

**Step D** is an alternate method for populating a FGDB table that was created in ArcCatalog.

Steps C & D then require a second process to transfer the FGDB table into the selected **DOMAIN** in the geodatabase.

**A) Creating a File Geodatabase (FGDB):** In ArcCatalog

Create a FGDB if necessary

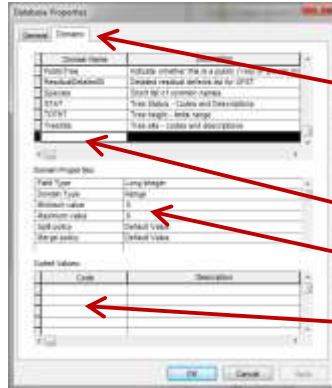
- (1) Open ArcCatalog
- (2) Select a folder
- (3) **ARC\_CATALOG=>[RIGHT CLICK ON FOLDER]==>NEW=>FILE GEODATABASE**
- (4) Rename the default **NEW FILE GEODATABASE.GDB** to the desired FGDB name (**ARC\_CATALOG=>[RIGHT CLICK ON FGDB NAME]==>RENAME**)

<sup>1</sup> See Appendix I for Microsoft Excel tips.



**B) Creating the Domain: With ArcCatalog**

- (1) **ARCCATALOG=>[RIGHT CLICK ON FGDB NAME=>PROPERTIES**
- (2) Select the **DOMAINS** tab



DOMAINS TAB

ENTER NEW DOMAIN NAME IN THE LIST

SET PROPERTIES FOR THE NEW DOMAIN HERE

DOMAIN TABLE: ENTER CODES & DESCRIPTIONS HERE

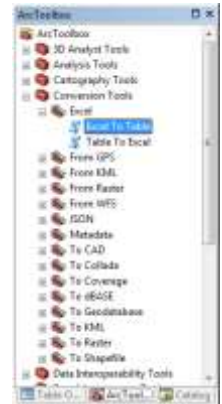
- (3) Scroll to the bottom of the list of domains
- (4) Type in the new domain name and describe it
- (5) Then highlight the new domain name in the list, and enter the appropriate properties in the center dialog
- (6) **And Adding Data to the Domain Table: With ArcCatalog**
  - a. If a **RANGE** domain, the range properties are set in Step B5
  - b. If a **CODED** domain, then proceed to the lower dialog box (the table)
  - c. Enter the codes and code descriptions; the descriptions will be the drop-down menu list in *ESRI Collector*
  - d. The codes and code descriptions can be the same if desired

**C) Creating the FGDB Table & Adding Data to the FGDB Table: With ArcToolbox**

- (1) **ARCTOOLBOX=>CONVERSION TOOLS=>EXCEL=>EXCEL TO TABLE**
- (2) Select Excel spreadsheet
- (3) Name the new table in the FGDB
- (4) Select the worksheet to use

Note: This is a good way to load particularly long lists from Excel spreadsheets.

- (5) Restructuring the Table to Correct Data Types (Optional but recommended)
  - a. **XTOOLS PRO=>TABLE OPERATIONS=>TABLE RESTRUCTURE.**
  - b. Output
    - i. Type: Table
    - ii. Path: Select geodatabase
    - iii. Name: Use desired permanent name (e.g. *xCONDITION\_BASIC* becomes *CONDITION\_BASIC*)



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- iv. Type: File and Personal Geodatabase tables
- v. NEXT
- c. For each attribute:
  - i. Set type and properties
  - ii. Name attributes as necessary (e.g. xCode becomes Code)
  - iii. Enter alias if desired (e.g. Code has an alias of Eco ID)
  - iv. NEXT
  - v. FINISH
- (6) Open the new FGDB table and verify that changes have been made
- (7) Delete the original FGDB table that was created with the Excel conversion tool in ArcToolBox (optional)

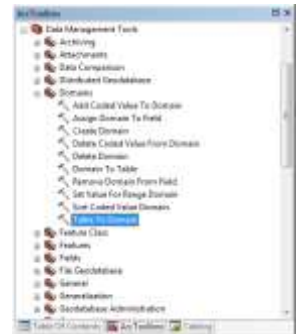
**D) Adding Data to the FGDB Table: In ArcMap**

- (1) Open the map document (if not open from previous work)
- (2) Add the newly created table (if not already done from previous process)
- (3) Right-click on the table name and OPEN
- (4) Start an ArcMap editing session (**XTOOLS PRO=>START EDITING SELECTED LAYER OR ARCMAP=>EDITOR=>START EDITING**)
- (5) Enter the domain code and description values desired (and other attributes if needed)
- (6) Save Edits and close editing session

**E) Transferring a FGDB Table to the Domain: With ArcToolbox**

This step transfers geodatabase table data to a new or existing domain in the FGDB.

- (1) **ARCTOOLBOX=>DATA MANAGEMENT TOOLS=>DOMAINS=>TABLE TO DOMAIN**
- (2) Select the input table (e.g. a FGDB table)
- (3) Select the Code and Description attributes from that table (this will be the **ESRI Collector** drop-down menu list)
- (4) Select the workspace (this is your file geodatabase where you want the new domain)
- (5) Enter the domain name (new or existing); add or update the description



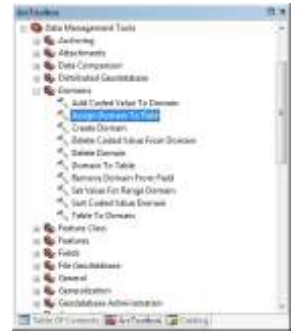


- (6) You can then choose to either REPLACE an existing domain or merely APPEND additional domain items to an existing domain; if appending you may want to make certain that you have an attribute for easy sorting.

**F) Assigning the Domain to an Attribute:** With ArcToolbox

Now assign the domain to specific field (attribute) in the feature class.

- (1) **ARCTOOLBOX=>DATA MANAGEMENT TOOLS=>DOMAINS=>ASSIGN DOMAIN TO FIELD**
- (2) Select your feature class
- (3) Select the attribute in the feature class
- (4) Select the domain
  - i. Only domains that have **CODE** data types that match the attribute selected in Step 3 will appear
- (5) Click **OK**
- (6) You're done!



Note: Alternatively, you can assign a domain from ArcCatalog ...

- (7) **ARCCATALOG=>[RIGHT CLICK ON FEATURE CLASS NAME=>PROPERTIES=>FIELDS TAB**
- (8) Click on any attribute name
- (9) In the **FIELD PROPERTIES** dialog select the domain from the dropdown menu



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(10) In this example screen capture, the domain for attribute Species is being changed from **EcoSPECIES\_PIEDMONT** to **EcoSPECIES\_GEORGIAUFST**.

### G) Trust but Verify

Now open the feature class attribute table, start an editing session, and test the ranges and drop-down menu(s) specified in the **DOMAIN** by entering some sample data. When you double-click in a field the drop-down arrow ↓ should appear at the right edge of the table cell.

## Managing Domains Across Geodatabases

To use a **DOMAIN** that exists in one geodatabase in a new or different geodatabase:


- (1) You can copy an entire FGDB with all feature classes, tables, layers, and domains; and then edit as needed (this is useful if there are multiple tables and **DOMAINS** that you would like to use), or...
- (2) In ArcCatalog you can copy feature classes from one FGDB to another which will also copy any associated **DOMAINS**.
- (3) If the corresponding FGDB table does **NOT** exist, it is necessary to export the **DOMAIN** using ArcToolBox components and then copy that FGDB table to the new geodatabase (ArcCatalog) and then transfer it to as domain (using ArcToolBox), or...
- (4) If the FGDB table does exist, then in ArcCatalog copy the FGDB table and then paste it into the desired FGDB (listed in ArcCatalog); then use ArcToolbox to transfer the FGDB table to the domain in the new geodatabase.

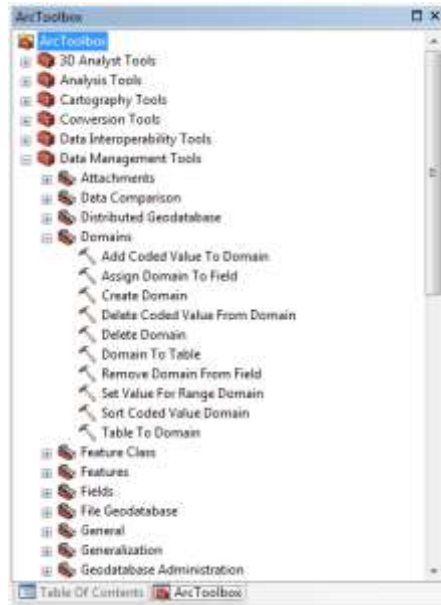


Domain Tools

**A. ArcToolbox**

ArcToolbox offers some capabilities (tools) not available from the **DATABASE PROPERTIES** dialog in ArcCatalog.

The ArcGIS Toolbox has 10 tools that provide management and editing of domains. From either **ArcMap** or ArcCatalog the Toolbox can be opened by clicking on the Toolbox icon ; the tools are available from: **ARCTOOLBOX=> DATA MANAGEMENT TOOLS => DOMAINS .**



**Figure 2:** ArcToolbox Domain Tools

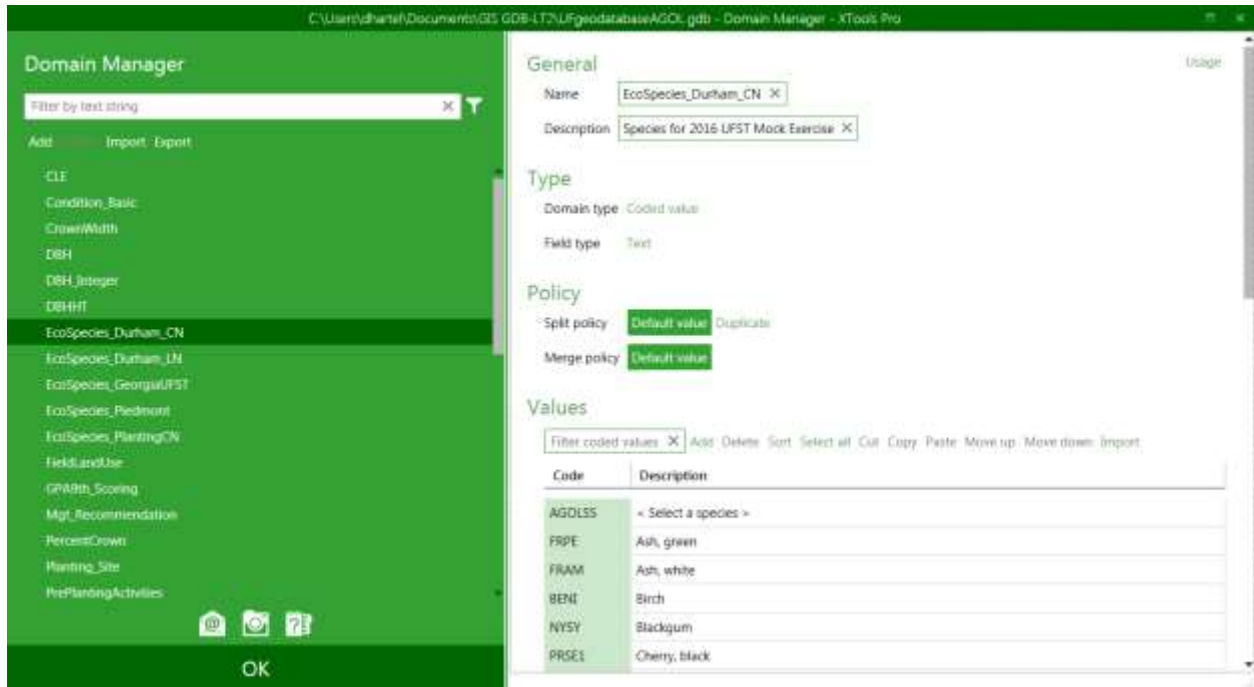
The tools are self-explanatory based on the tool name; the sequence would normally follow:

- Create Domain
- Add Coded Value to Domain (multiple calls; once for each value needed in the domain list)
- Assign Domain to Field



**B. XTools Pro v10.1 (and higher)**

A domain manager is now part of XTools Pro for ArcGIS Desktop beginning with v12.



The XTools domain manager offers tools for creating, deleting, importing, and exporting domains; and, within any domain, tools to add elements, move, and sort the order of the domain elements (and subsequently the order in the **ESRI Collector** drop-down menu lists).

An Urban Forestry File Geodatabase (FGDB)

The file geodatabase, **UFGEDATABASEAGOL.GDB** contains five example feature classes for urban forestry, many FGDB tables (25), and several defined **DOMAINS** (GaTech’s 9 Eco domains & another 24 UF domains) that can be used with these example feature classes or any new feature classes that you wish to create.

The map document, **2015 UFS DOMAINS AND AGOL FOR UF (11SEP15).MDX**, uses the example file geodatabase, feature classes, tables, and domains. The datum and projection for the feature classes are: WGS84 and Web Mercator Auxiliary Sphere (EPSG 3857).

Note: When creating new feature classes, the attribute data type **MUST** match the desired domain table data type for the table attribute **CODE**.

Feature Classes:

BasicEco

The minimum required attributes to calculate ecosystem services in iTree Eco. Based on the Georgia Tech file geodatabase management system for i-Tree Eco 100% inventories.

Primarily **RANGE** domains with **CODED** domains for: Crown Light Exposure (**CLE**), Field Land Use (**FIELDLANDUSE**), Tree Status (**STAT**), Tree Site (**TREE SITE**), and Species (**SPECIES**).

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BasicInventory	An example tree inventory that includes Guide for Plant Appraisal tree condition (8 components), ISA Tree Risk BMP Level 1 (enhanced) risk assessment, complete crown dimensions (i.e. Eco), and primary and secondary management recommendations.
BasicTreePlanting	An example feature class to collect data for tree planting site location and evaluation.
RiskLevel1e	A basic Level 1 (enhanced) tree risk assessment. Primarily <b>CODED</b> domains.
UFSTdata	The current Urban Forest Strike Team data collection feature file (i.e. data dictionary) that includes a Level 1 (enhanced) risk assessment. Primarily <b>CODED</b> domains.

FGDB Tables and Corresponding Domains:

The following geodatabase tables (and their corresponding domains) are specific to the Urban Forestry Strike Team’s current data collection protocol and use a **CODE** data type of **SHORT INTEGER**.

<u>Worksheet</u>	<u>FGDB Table and Domain<sup>2</sup></u>
UFST – Public .....	UFST_Public
UFST – Part Assessed .....	UFST_PartAssessed
UFST - FEMA Guide .....	UFST_FEMAGuide
UFST – LOF.....	UFST_LOF
UFST - LOFnp.....	UFST_LOFnp
UFST - LOI .....	UFST_LOI
UFST - LOInp .....	UFST_LOInp
UFST - COFI .....	UFST_COFI
UFST - COFInp .....	UFST_COFInp
UFST – Risk Mitigation .....	UFST_RiskMitigation
UFST – Residual Defect.....	UFST_ResidualDefect
UFST – Residual Defect Detail .....	UFST_ResidualDefectDetail
UFST - Hangers .....	UFST_Hangers

The following species and genus FGDB tables (and domains if created) use i-Tree Eco (USDA Plants DB) ID’s as the **CODE** with a data type of text and 8 characters; there are two descriptive attributes for most FGDB table, Common and Latin that can be selected as desired during the **ARCTOOLBOX=>DATA MANAGEMENT TOOLS=>DOMAIN=>TABLE TO DOMAIN** step.

Most current spreadsheet: UFS FGDB Tables for Domain Support (10Mar16 v1.08 Durham).xls (10mar16).

Species worksheets/FGDB tables:

<u>Worksheet</u>	<u>FGDB Table and Domain<sup>2</sup></u>
Species – Common.....	Species_Common
Species – Latin .....	Species_Latin
EcoSpecies – Arkansas UFST-CN .....	EcoSpecies_ArkansasUFST

<sup>2</sup> Not all domains were created. Final table name after restructuring; x<Table Name> is the initial imported name using the methods described.

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EcoSpecies – Coastal-CN.....	EcoSpecies_Coastal
EcoSpecies – Durham .....	EcoSpecies_Durham
.....	EcoSpecies_Durham_CN
.....	EcoSpecies_Durham_LN
EcoSpecies – Georgia UFST-CN .....	EcoSpecies_GeorgiaUFST
EcoSpecies - Ohio UFST-CN.....	EcoSpecies_OhioUFST
EcoSpecies – Piedmont-CN.....	EcoSpecies_Piedmont

Species worksheets/FGDB tables (all with common and Latin name columns):

<u>Worksheet</u>	<u>FGDB Table and Domain<sup>2</sup></u>
EcoSpecies – All Elms-CNLN.....	EcoSpecies_AllElms
EcoSpecies – Common Elms-CNLN.....	EcoSpecies_CommonElms
EcoSpecies – All Maples-CNLN.....	EcoSpecies_AllMaples
EcoSpecies – E. Maples-CNLN.....	EcoSpecies_EasternMaples
EcoSpecies – All Oaks-CNLN.....	EcoSpecies_Alloaks
EcoSpecies – Eastern Oaks-CNLN.....	EcoSpecies_EasternOaks
EcoSpecies – Western Oaks-CNLN .....	EcoSpecies_WesternOaks
EcoSpecies – Planting List.....	EcoSpecies_Planting

Additional worksheet to build custom FGDB tables and domains:

Eco – All Genus & Species<sup>3</sup>

The following are examples of other urban forestry related tables and domains that use a **CODE** data type of **SHORT INTEGER**.

Condition worksheets/FGDB tables:

<u>Worksheet</u>	<u>FGDB Table and Domain</u>
Condition - Basic .....	Condition_Basic
GPA9th - Scoring .....	GPA9th_Scoring <sup>4</sup>
Site Utility – Limitations .....	SiteUtility_Limitations
Preplanting – Activities.....	PrePlantingActivities
MGT – Planting Site.....	Planting_Site
MGT – Recommendation.....	Mgt_Recommendation
Risk – Primary Target .....	Risk_PrimaryTarget

Following the **ARCTOOLBOX=>CONVERSION TOOLS=>EXCEL=>EXCEL TO TABLE** tool use, temporary tables have been created (e.g. **xCondition\_Basic**). In the following screen shot, **SPECIES\_COMMON** and **SPECIES\_LATIN**

<sup>3</sup> New attributes (i.e. columns) have been added for Latin Name (= genus & “ ” & species) as text. The first three columns can be copied to a standard worksheet setup for **CODE**, **COMMON**, and **LATIN**. Common name editing may be desirable to control order in the dropdown lists.

<sup>4</sup> Guide For Plant Appraisal – 9<sup>th</sup> Edition; Table 4.3

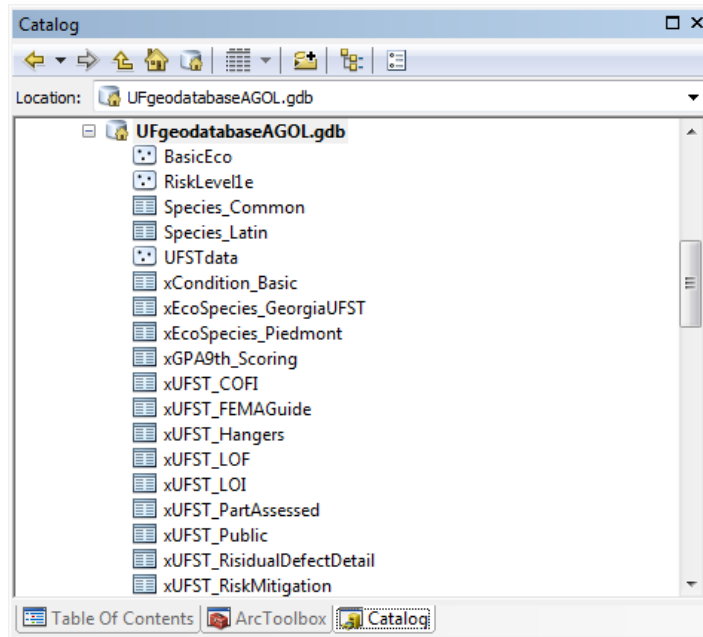
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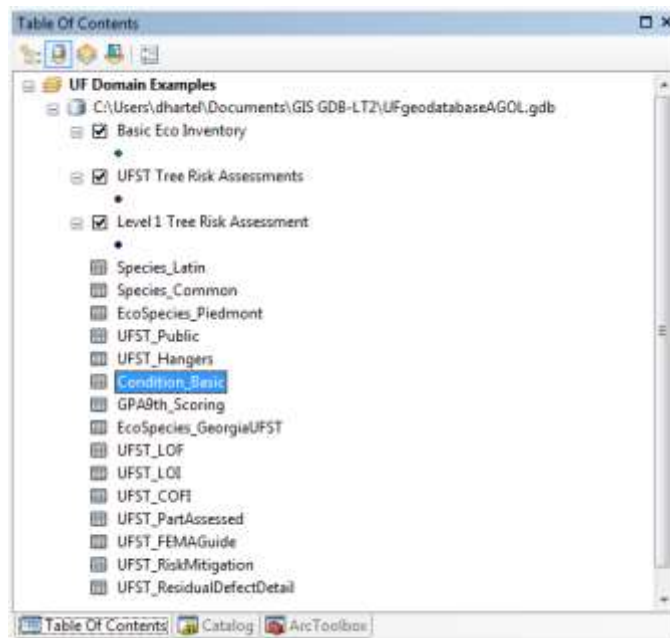
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have already been restructured for a **CODE** data type of **TEXT** (8 characters) and **DESCRIPTION** of **TEXT** of 24 characters and have been renamed without the prefix “x”.



The file geodatabase following restructuring and renaming with all FGDB tables ready for **DOMAIN** definition (see **ARCTOOLBOX=>DATA MANAGEMENT TOOLS=>DOMAINS=>TABLE TO DOMAIN – Proposed Workflow E1**):



All of these tables originated from the Excel file **UFS FGDB TABLES FOR DOMAIN SUPPORT (09SEP15 v1.07).XLS**.

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Urban Forestry South  
ArcGIS Domains for ArcGIS Online (AGOL) Using ArcCatalog and FGDB Tables

March 10, 2016



This spreadsheet also contains a worksheet with the entire i-Tree Eco (version 5) species and genus tables that were originally developed from the USDA Plants database.

To create custom species lists, corresponding FGDB tables, and desired domains users can copy entire worksheets, and then delete species not needed; and/or copy additional species from any worksheets or necessary codes and descriptions from the **ECO – ALL GENUS & SPECIES** worksheet.

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## Python Code for AGOL

### Risk Rating Calculation

The three components of risk assessment (LOF, LOI, and COFI) can be used to calculate the risk rating using a Python script in the field calculator or a tool based on that script.

Attribute table field types and domain code types for Likelihood of Failure, Likelihood of Impact, and Consequences of Failure and Impact are **SHORT** (integers) that support the code integers 0, 1, 2, 3, and 4.

```
#!/usr/bin/env python
# code used in ArcGIS field calculator
# the function returns a maximum of 8 characters
#
# use "add field" to create the attribute RiskRating as 8 character text in your feature class table
#
# from the field calculator the function is called with...
#     RiskRating = ClassRisk(!FailureLOF!,!ImpactLOI!,!ConseqCOFI!)
#     the attributes passed in the "call" are the three (short integer) risk components of LOF, LOI, and COFI
#
def ClassRisk(LOF,LOI,COFI):

    if (LOF == 0 or LOI == 0 or COFI == 0):
        return "Not Rated"

    M1 = LOF * LOI

    if (M1 <= 6):
        M1 = 1
    elif (M1 >= 8 and M1 <=9):
        M1 = 2
    elif (M1 == 12):
        M1 = 3
    elif (M1 == 16):
        M1 = 4

    M2 = M1 * COFI

    if (M2 <= 4):
        return "Low"
    elif (M2 >= 6 and M2 <=8):
        return "Moderate"
    elif (M2 >= 9 and M2 <=12):
        return "High"
    elif (M2 == 16):
        return "Extreme"
```

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Python Code to Toggle Export of Domain Descriptions to Shapefiles

When exporting data as a **shapefile** from a file geodatabase using **TOC=>[RIGHT CLICK ATTRIBUTE TABLE]=>DATA=>EXPORT DATA**, the domain **Code** is exported (the ArcGIS default) into the shapefile **DBF** not the domain **DESCRIPTION**. Joining or relating a table for that domain to the shapefile via the **CODE** will make the **DESCRIPTION** available when using shapefiles. However, Python code can be used to “toggle” the operation of the export operation to include **DESCRIPTION**. The highlighted code is the “toggle”.

```
#!/usr/bin/env python
# Name: exportToShapefile.py
# Purpose: Export a geodatabase feature class to a shapefile, include domain and subtype descriptions
# Import system modules
import arcpy
from arcpy import env

# Set environment settings

env.workspace = "C:/data"
env.transferDomains = True
# the equivalent with a keyword is
# env.transferDomains = "TRANSFER_DOMAINS"

# Set local variables
inFeatures = "Habitat_Analysis.gdb/vegtype"
outLocation = "Shapefiles"
outName = "Vegetation.shp"

arcpy.conversion.FeatureClassToFeatureClass(inFeatures, outLocation, outName)
```

Export Geodatabase to Shapefile from ArcCatalog (with Domain Descriptions)

When exporting data as a **shapefile** from a file geodatabase use **ArcCatalog=>TOC=>[RIGHT CLICK ATTRIBUTE TABLE]=>DATA=>EXPORT TO=>SHAPEFILE** select the folder and enter a shapefile name (include the .SHP); then click on the **ENVIRONMENTS...** button at the bottom of the dialog and select **FIELDS**; then check  **TRANSFER FIELD DOMAIN DESCRIPTIONS**.



Also see: Setting the geoprocessing environment at the application level (i.e. map document): **In ArcMap**.

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Guide for Plant Appraisal Condition Rating Calculation<sup>5</sup>

Eight components are combined to create the Guide for Plant Appraisal, 9th Edition tree condition rating. All of the components use the same **DOMAIN**, GPA9th\_Scoring; these condition components include:

- Roots\_Structure
- Trunk\_Structure
- Scaffold\_Structure
- Roots\_Health
- Trunk\_Health
- Scaffold\_Health
- Branches\_Health
- Foliage\_Health

All attribute table field types and domain code types are **SHORT** (integers) that support the code integers 0, 1, 2, 3, and 4; with 1 = Extreme problems thru 4 = No apparent problems; 0 = < Select score > and indicates that scoring was NOT made for the attribute.

```
#!/usr/bin/env python
# code used in ArcGIS field calculator
# the function returns a real number
#
# use "add field" to create the attribute CondRating as a short integer
#
# called with...
#     CondRating = CondCalc(!Root_Structure!,!Trunk_Structure!,!Scaffold_Structure!,
#                           !Root_Health!,!Trunk_Health!,!Scaffold_Health! !Branches_Health!,!Foliage_Health!)
#     the attributes passed in the "call" are the eight (short integer) structure & health components (listed above)
#
def CondCalc(R_S,T_S,S_S,R_H,T_H,S_H,B_H,F_H):

    CalculatedCondition = -1.0
    if (R_S == 0 or T_S == 0 or S_S == 0 or R_H == 0 or T_H == 0 or S_H == 0 or B_H == 0 or F_H == 0):
        return CalculatedCondition

    CalculatedCondition = ((R_S + T_S + S_S + R_H + T_H + S_H + B_H + F_H)/32) * 100

    return CalculatedCondition
```

---

<sup>5</sup> Not tested.



**Appendix I –Excel Worksheets**

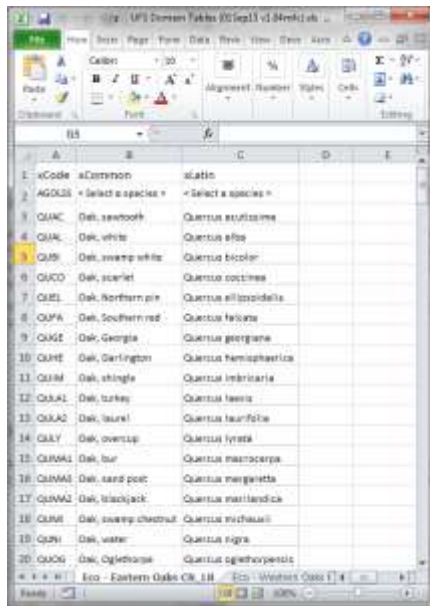
Setting Up an Excel Spreadsheet:

Often the use of Microsoft Excel is needed to capture some domain information that is predefined by others (e.g. USDA Plants database). The workflow defined and discussed includes the initial import of Excel worksheets into a geodatabase table and then assumes that domain table management from that point forward is handled within ArcToolbox and ArcMap.

However, when importing Excel worksheets (I suspect DBF files are better, but have not tested this) the numeric data types usually come in as DOUBLE (I did get a LONG INTEGER once, somehow!), and the TEXT data type defaults to 255 characters. This may or may not be desirable for your project!

If the definition of data types is important for your project and data collection application (e.g. character length for Text, and Integer vs. Double) then the following Excel steps may be helpful:

- (1) Name all attributes (i.e. Row 1) temporarily since later type conversion and editing in ArcMap will be required; in this example xCode, xCommon, and xLatin will become Code, Common, and Latin in the ArcMap restructuring steps explained in **Proposed Workflow Step C**.



- (2) When using **ARCtoolbox=>CONVERSION TOOLS=>EXCEL=>EXCEL TO TABLE**, create the table with a temporary name so that following table restructuring you will have the desired table name; e.g. **xSPECIES\_LATIN** would become **SPECIES\_LATIN** when data types were corrected.

While Excel can be used for initial creation and loading of FGDB tables for conversion to domain tables, it is recommended that once the FGDB table is created (and restructured if necessary) that all editing from that point forward be accomplished from within the FGDB table or in the domain created from that table.





**Appendix II - Glossary**

Glossary<sup>6</sup>

- ArcGIS Online ..... A Web-based system for sharing, finding, and using maps, layers, and services. ArcGIS Online includes a set of base maps, map layers, and tools published by ESRI for use inside ArcGIS products. The ESRI collector for smart devices is one of those tools. (also AGOL)
- Attribute ..... Nonspatial information about a geographic feature in a GIS; usually stored in a table and linked to the spatial feature. (also Feature attribute)
- Data model..... In ArcGIS, a set of database design specifications for objects in a GIS application. A data model describes the thematic layers used in the application (e.g. trees, roads, and counties); their spatial representation (e.g. point, line, or polygon); their attributes; their integrity rules and relationships (e.g. counties must nest within states); their cartographic portrayal; and their metadata requirements.
- Domain ..... A list of acceptable attribute values that is associated with an attribute. Stored (as a table) in the geodatabase. Also referred to as a domain table. Domains are created in ArcCatalog.
- Field ..... (see Attribute)
- File geodatabase..... A geodatabase stored as a folder of files. A file geodatabase can be used simultaneously by several users, but only one user at a time can edit the same data. (see Geodatabase) File geodatabases are created in ArcCatalog.
- Feature..... A representation of a real-world object on a map. Also: line feature, multipart feature, multipatch feature, multipoint feature, point feature, polygon feature, polyline feature.
- Feature class ..... In ArcGIS, a **collection** of geographic features with the same geometry type (such as point, line, or polygon), the same attributes, and the same spatial reference. Feature classes can be stored in geodatabases, shapefiles, or other data formats. Feature classes allow homogeneous features to be grouped into a single unit for data storage purposes. For example, highways, primary roads, and secondary roads can be grouped into a line feature class named "roads."
- Feature dataset ..... A collection of feature classes stored together that share the same spatial reference; that is, they share a coordinate system, and their features fall within a common geographic area (extent). Feature classes with different geometry types (e.g. point, line, polygon) may be stored in the same feature dataset. Feature datasets are created in ArcCatalog.

---

<sup>6</sup> Extracted from: <http://support.esri.com/en/knowledgebase/Gisdictionary/browse>



- GaTech Eco Data Model..... An urban forestry data model developed by the Center for Geographic Information Systems at Georgia Tech<sup>7</sup> to support the USDA Forest Service *i-Tree Eco* ecosystem services model, Campus tree inventory, and tree management within an industry standard file geodatabase.
- Geodatabase ..... A database or file structure used primarily to store, query, and manipulate spatial data. Geodatabases store geometry, a spatial reference system, attributes, and behavioral rules for data. In ArcGIS only file geodatabases support domains. Neither personal geodatabases (Microsoft Access databases) nor shapefiles support domains and their inherent benefits. (also File geodatabase)
- Layer ..... In ArcGIS, a reference to a data source, such as a shapefile, geodatabase feature class, or raster, that defines how the data should be symbolized on a map. Layers can also define additional properties, such as which features from the data source are included. Layers can be stored in map documents (.mxd) or saved individually as layer files (.lyr). Also: A layer that references a set of feature data. Feature data represents geographic entities as points, lines, and polygons.
- Map Document ..... In ArcMap, the file that contains map (s), the map layout, and its associated layers (features and feature classes), tables, charts, and reports. Map document files have a .mxd extension.
- Map Service..... A type of Web service that generates maps. ArcGIS Online can access and use map services.
- Metadata ..... Information that describes the content, quality, condition, origin, and other characteristics of data or other pieces of information. Metadata for spatial data may describe and document its subject matter; how, when, where, and by whom the data was collected; availability and distribution information; its projection, scale, resolution, and accuracy; and its reliability with regard to some standard. (see GaTech Eco Data Model)
- Python..... An open-source interpreted, object-oriented programming (also referred to as scripting) language that can be used with ArcGIS using the ArcPy site package (modules, classes, and functions).
- Schema ..... The structure or design of a database or database object, such as a table, view, or index. The schema defines the tables, the fields in each table, the relationships between fields and tables, and the grouping of objects within the database. In ArcGIS geodatabase schemas may be exported to include both the structure and the data.
- Shapefile ..... A vector data storage format for storing the location, shape, and attributes of geographic features. A shapefile is stored in a set of related files and contains one feature class. (see Geodatabase)
- Table ..... A database or tabular file containing information about a set of geographic features, usually arranged so that each row represents a

<sup>7</sup> Project Lead: Ramachandra Sivakumar, Research Engineer See: <http://cgis.gatech.edu/>

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feature and each column represents one feature attribute. (also Attribute table, Feature Class table, or geodatabase table)

XML..... Extensible Markup Language. A standardized general purpose markup language. XML is a set of rules for creating standard information formats using customized tags and sharing both the format and the data across applications. (see also: Schema)

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