**DEVELOPER’S ADDENDUM**

**for**

LandAdvisor

**A customizable ArcGIS decision support system for conservation assessment, planning, and management.**

*Documentation Version: Little Karoo 3.2.3 beta release*

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***Contact information:***

John Gallo

Center for Landscape Analysis

The Wilderness Society

San Francisco, CA

415-398-1111 X 100

Email: [john\_gallo@tws.org](mailto:john_gallo@tws.org)

<http://landscapecollaborative.org>

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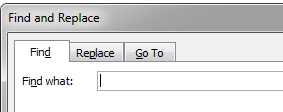
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Document overview

This is an Addendum to the USER GUIDE.

The table of contents is hotlinked to every section, and there is a link at the bottom of every page to return to the table of contents.

There are also hotlinks throughout the document, like this one to [Pre-processing your own data for the analysis.](#preprocessingyourowndata) You can use the back button in your pdf reader to return to where you were, and if viewing the word version, you can but the back button on your toolbar: .

One of the best ways to use this document is with the find function in your .pdf or .doc reader, i.e.: 

This is a living document, so please feel free to make edits/additions using tracked changes and comments to the MS Word version of this document (in your support folder). Send all comments/edits to John Gallo.

To help make this a standalone document, the Introduction, below, is copied from a version of the User Guide.

Introduction

Toolbox Background

This toolbox implements a utility-maximization framework [(Davis et al. 2006).](file:///C:\GIS\Prjcts\LandscapeDST_vX\LandAdvisor_LittleKaroo_v3_0_alpha\support\references\Davis_Costello_Stoms_2006.pdf)  (Note: the hotlinks work if this document is in the support folder of the LandAdvisor directory.) This framework is based on the marginal value approach and return on investment principles that are increasingly prevalent in conservation science. These are discussed at length in the white paper in the support folder (Gallo & Lombard In Revision). The framework was first applied in a real-world case study in 2005 to create the [Regional Conservation Guide](http://www.conceptioncoast.org/projects_rcg.html) for the Conception Coast Project. The geoprocessing of this first application was performed manually. The second application was programmed using modelbuilder in order to make the effort more transparent and transferable. This second application occurred in the Little Karoo of South Africa in 2008, and provided decision support to a land trust and a government agency partnering to purchase and manage land for conservation ([Gallo and Lombard unpublished)](file:///C:\GIS\Prjcts\LandscapeDST_vX\LandAdvisor_LittleKaroo_v3_0_alpha\support\references\Gallo_Lombard_Spatial%20Decision%20Support%20System.pdf) (A complete revision of that paper is in process). The third and fourth applications are underway, one by the Islands Trust Fund of Canada, and the other by the Sonoma County Agricultural and Open Space Preservation District. The modelbuilder toolbox that resulted from the second application has been improved further, bringing us to the present toolbox. Previous names of LandAdvisor that may be present in some documentation include Lorax, BioVision, and LandAdvisor.

This version is released under the General Public License 3.0, with some additional stipulations. This means that the models and scripts are open access, and then improvements by anyone on the models, scripts, and framework are open access too. The details of this open source license are provided at the end of this document.

This version of the toolbox is compatible with ArcGIS 10.0 (ArcView or greater)and requires a Spatial Analyst license. Please see the [minimum specs](http://resources.arcgis.com/content/arcgisdesktop/10.0/arcgis-desktop-system-requirements) for a computer running ArcGIS 10.0

Where to go for Help, Support and to Log Suggestions and Ideas?

For help, the first step is to become familiar with the outline of this document.

Additionally, we have developed an online “collaboratory” (collaborative laboratory) designed to help with the application and further development of this model. It is there that you can download the model, data, the user guide, and then log support questions, interact with other people applying the model, use the project management tool called JIRA, and utilize many other collaborative tools.

The site is called [The Landscape Collaborative](http://landscapecollaborative.org) and embodies a broad mission “to inspire, empower, and assist people in sustaining our natural landscape. We are currently a budding community of scientists and practitioners sharing tools, knowledge and skills in implementing a [Landscape Decision Support Architecture](http://landscapecollaborative.org/display/WEB/Vision).” (Current November 2011)

Modelbuilder

Modelbuilder allows you to “program” models without knowing a command line programming language. You drag and drop commands/tools onto a blank “page”, and connect them with arrows. You can program iterations, loops, and feedbacks too. You can nest models within models, and link them together. There is also a good interface for documenting your work and providing a help file for your model. Please see the [Working with Modelbuilder](#workingwithmodelbuilder) section of this document for more information.

LandAdvisor Details Helpful for Development and Customization

Function of Diminishing Returns

A unique function of diminishing return curve is created for each habitat (two curves can be identical however).

NOTE: See the 2013 publication, in Revision, for an updated version of the following equations.

Given that:

p = the percent of historical distribution of the habitat that is currently “conserved”. This is represented as a decimal. Area protected is equal to a function of the quality of the area protected and quality of the protection. (i.e. the weighted sum of the management weighted area and the condition weighted area, with the default weights = 0.5). This is the X axis.

r = the percent of historical distribution of the habitat that is remaining on the landscape. This is represented as a decimal. If this cannot be estimated for all the habitats in the region (which should have a mean of 100%) then this nuance can be ignored, and the value of 1 can be used for every habitat.

t = the conservation target (i.e. goal) for the species in question (e.g. if we want to protect 30% of the oak woodlands of a region in reserves, then t = 0.3)

Then it is possible to find the relative benefit of conserving the next gridcell of any habitat. The key to all of this is that arctangent is the

From Wikipedia:

Inverse trigonometric functions are useful when trying to determine the remaining two angles of a [right triangle](http://en.wikipedia.org/wiki/Right_triangle) when the lengths of the sides of the triangle are known. Recalling the right-triangle definitions of sine, for example, it follows that

\theta = \arcsin \left( \frac{\text{opposite}}{\text{hypotenuse}} \right).

Often, the hypotenuse is unknown and would need to be calculated before using arcsine or arccosine using the [Pythagorean Theorem](http://en.wikipedia.org/wiki/Pythagorean_Theorem): *a*2 + *b*2 = *h*2 where *h* is the length of the hypotenuse. Arctangent comes in handy in this situation, as the length of the hypotenuse is not needed.

\theta = \arctan \left( \frac{\text{opposite}}{\text{adjacent}} \right).

For example, suppose a roof drops 8 feet as it runs out 20 feet. The roof makes an angle *θ* with the horizontal, where *θ* may be computed as follows:

\theta = \arctan \left(\frac{\text{opposite}}{\text{adjacent}} \right) = \arctan \left( \frac{\text{rise}}{\text{run}} \right) = \arctan \left( \frac{8}{20} \right) = 21.8^{\circ}.

To do that, the following user-defined parameter values are set:

s = "minimum y-intercept"- the y intercept of the CBF graph for the habitat that has the highest percentage of its historical extent still intact.

q = "initial flatline" The x value to which the curve is flat, (expressed as a value between 0-1)

o = "Initial downward Slope factor" - the slope factor for the curve between x = q and x = t;

u = "impact of target"- this factor affects the amount that the curve drops vertically once the target is met. (expressed in values 0-1)

f = "Right side slope" - The scaler affecting the x-intercept of the CBF curve, acceptable values from 0-1, default is 1.

m = the number of map units in a gridcell (for UTM projections, the map unit is a meter)

Then the following variables are derived to make the final equation more manageable:

a = the y-intercept of the FDR curve for the habitat in question = (1-s)(1-r) + s

i = a – t\*tan((π/2)-atan((1-q+f-1)/a)

v = i + (a-1)\*o

Given all of the above, the y value of any habitat on the landscape is determined as follows:

If target < q , then the following statement is followed:

If x < q then:

y = a

otherwise:

y = m\*v-(p-q)\*tan((π/2)-atan((1+f-r-q)/(v\*u))

Otherwise, the following statement is followed:

If x < q then:

y = o

otherwise:

If x<t then:

y = a – (x-q)\*tan((π/2)-atan((t-q)/(a-u))

otherwise:

y = v\*(1-u)-(x-t)\*tan((π/2)-atan((1+f-r-t)/(v\*(1-u)))

Integrating the Connectivity Algorithm From The Islands Trust Effort

The vision of interoperability is coming to light! The Connectivity Algorithm was specified by John Gallo, honed by Randal Greene and John, and was coded by Randal for the Islands Trust Conservation Planning Effort. The steps involved for pasting it into LandAdvisor will likely be the same for future iterations, and are as follows:

1. Paste Connectivity A and Connectivity B scripts into the Scripts folder
2. Add the LandAdvisor ITCP toolbox to the project. Copy the Connectivity A and Connectivity B Script Tools to the LandAdvisor Little Karoo Toolbox.
   1. (Alternatively, just make the Script Tools from scratch)
3. Right click the Script tool/ Properties/ and set the appropriate locations for the inputs to the model.
   1. First, program the Prep for Connectivity Scripts Model and the LandAdvisor Prep to put these inputs into the workspace and scratchworkspace.
      1. Note: it is TRANSIT\_ROADS\_MOT.shp not TRANSIT\_ROADS\_MOT
   2. Create any other requisite items in the LandAdvisor Prep: Put dummies… such as a scratch.gdb Geodatabase, if I remember correctly.
4. Optional: In the Parameter name field of the Sript Tool Properties, # script arguments to start with P22, P23, etc.

The Maximize-short-term-gains accounting system

The sites\_populated shapefile has a column called sequenceA1 that gives the iteration number that a particular property was selected into the solution set. If it is a really small reserve, it is possible that it is not accounted for using this system (there will be a gap in the number sequence). Go into the scratch folder and look for a file named new\_rsrv1\_X where X +1 = the iteration number that is missing. Convert that raster to vector, zoom to polygon, and then overlay it with sites\_populated to see which site it is, and manually enter the iteration number to sequenceA1. The same holds true for ‘sequenceA2’ for the second conservation objective modeled.

There are a set of parameters that may need to be customized for regional applications (Table 3). These are all advanced parameters, and need to be turned on from within the edit window of Model 4 before they will show up as tool parameters.

Table 3: Advanced parameters for linking conservation action to the maximize short term gains heuristic.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter #** | **Short name** | **Default Value (for the Paper)** | **Default Value** | **Description/Notes (Not turned on by default, see text)** |
| 25 | 1/4 cell edge length | 25 | 25 | cell edge length of the sites\_16th grid (1.e. 1/4th of your cell size edge length). |
| 26a; 26b | Management Type Code for Action 1 ; Action 2 | 1 ; 3 | 1 ; 3 | Code of the genrl\_mngmt (management type) being selected as a conservation strategy, that crosswalks with P24 ( In Little Karoo, Private Conservation Areas are type 3) |
| 27a; 27b | Conservation Action Code for Action 1 ; Action 2 | 1 ; 2 | 1 ; 2 | Conservation Action Code (In Little Karoo, 1=Acquisition, 2 = Private Stewardship) |

Table 4: Conservation Action Types for the Little Karoo version of LandAdvisor

|  |  |
| --- | --- |
| Conservation Action # | Conservation Action Type |
| 1 | "Acquisition and management." This is the standard conservation practice of buying the land and then managing it for biodiversity. |
| 2 | "Private Stewardship." This is the practice in which the original landowner maintains ownership of the land, and has made an agreement to manage it for biodiversity and other compatible uses; and they have also agreed to cooperate with an external organization responsible for monitoring the stewardship and providing advice as requested. |
| 3 | not defined for Little Karoo 2.0.0 |
| 4 | not defined for Little Karoo 2.0.0 |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Copying select Models and submodels from one toolbox to another

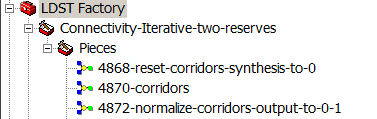
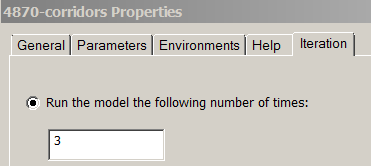
It seems that the key to this task is to do it within Arc Catalogue rather than opening Arcmap, opening the toolboxes, and copying and pasting.

LandAdvisor Factory Toolbox

There is one more toolbox called LDST Factory. This is where you can put partially constructed tools, or tools that worked for you on your data directory structure, but you have not had time to integrate into LandsapeDST. For instance, I pasted the model for running the greedy heuristic that I had going on an earlier prototype of LandAdvisor called Lorax, but did not have time to add into version 1.01. The purpose of including such incomplete pieces is to at least show people the commands that were used, even if the input data and directories are nonexistent.

Iterative Connectivity analysis for two reserves

An example such tool is the one that runs an old version of the connectivity analysis between two cores, and does it for a large number of different cost surfaces. This can be useful when doing sensitivity analyses of cost surfaces, or for doing Monte Carlo analyses in which some of the cost surface data are unknown (example is McClure et. al in production). Some instructions for it are as follows:

* Add the LDST Factory toolbox to your .mxd if it is not there already
  + For instruction on that, see “Pre-processing your own Data”
* As of now (Aug 30) find the three corridors model pieces, as per below:
  + 
  + You are going to run all three of them in sequence.
* As of now, it is modeled to run with three cost layer inputs, a layer in which all cells are 0, and two cores. Their names have to be as follows: core1, core2, region\_is\_0 and cost0, cost1, cost2
  + core1 and core2 need to have the same extent as the cost layers. If the core layers just are the minimum bounding rectangle (the default if you do not set your extent) then the analysis won’t work. See above for setting extent.
* All these need to be in the inputs folder.
* To run it for 100 cost layers, use inputs: cost0, cost1, …. cost99
  + Right click on the model 4870 and click edit model.
    - Right click anywhere in the white space of the model and go down to model properties.
    - Click on the iteration tab, and tell it to run the iteration for 100 times.
  + 

Tips, Tricks, and Suggestions for Using and Customizing LandAdvisor

After a relatively easy learning curve, you will be able to customize and improve the model. For instance, you may want to add additional criteria, or you may want to build link sub-models to the current model.

IMPORTANT: Do not add any of the ESRI tools to the 1\_Favorites folder. John did that once and it was a mistake. An eventual task is to go back into all the models that used such tools and have them instead use the tool from the default ESRI location. That way people willnot have to load the 1\_Favorites toolbox to run the model.

Working with Modelbuilder

Modelbuilder is not an extension, rather, it is included as part of the ArcGIS products. It is available in the ArcView version of ArcGIS (along with the more powerful versions too). You can start using it by right clicking on the toolbox, and “add toolbox” then right click on the toolbox and “add model.”

A great way to quickly learn the modelbuilder graphic user interface (GUI) is through the ESRI Geoprocessing tutorial. In ArcGIS this is in the Help/Getting started/Tutorials section, and it can be viewed online by everyone at : <http://webhelp.esri.com/arcgisdesktop/9.3/index.cfm?TopicName=Geoprocessing_Tutorial> The fifty page document of raw notes has some troubleshooting notes and solutions, and is available upon request.

Tutorials

This document is written for someone who has some familiarity with ArcView 9.3 and Modelbuilder. If these are new to you, then a good place to start is the tutorial in the help contents of ArcGIS 9.3. Go to Getting started/Tutorials. (Or online at <http://webhelp.esri.com/arcgisdesktop/9.3/index.cfm?TopicName=Geoprocessing_Tutorial> ) This will link to a video and .pdf that has a tutorial on Geoprocessing, with many tricks for modelbuilder. You will then understand Modelbuilder pretty well. At the least, please browse the help under “Geoprocessing/UsingGeoprocessing Tools/Automating your work with Models”. Unless otherwise noted, all quoted sections below are from ArcGIS help. There is also a 1 hour free tutorial (video?): <http://training.esri.com/acb2000/showdetl.cfm?DID=6&Product_ID=844> There is one for scripting too: <http://training.esri.com/acb2000/showdetl.cfm?DID=6&Product_ID=815> The full web tutorial is $116 and can be acquired for free with a successful [ESRI Conservation Program](http://www.conservationgis.org/index.html) grant proposal. See also this 20 minute tutorial/intro <http://letters-sal.blogspot.com/2009/10/getting-started-with-arcgis-model.html>

Optimizing RAM usage:

Increasing your Virtual Memory: <http://windows.microsoft.com/en-US/windows-vista/Change-the-size-of-virtual-memory> <http://searchsystemschannel.techtarget.com/feature/Windows-7-virtual-memory-performance-optimization>

Managing tools and Toolboxes

Models are stored in toolboxes. Best to review the Help sections on toolboxes, especially [“Basic Toolbox Management.”](http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Basic_toolbox_management)

ArcToolbox and Modelbuilder act differently within ArcMap and ArcCatalogue:

“The ArcToolbox window can be opened in the four ESRI desktop applications: ArcCatalog, ArcMap, ArcGlobe, and ArcScene. Geoprocessing settings can vary between these applications. If you have two or more of these applications open at once, changes to the geoprocessing settings in one application are not reflected in other currently running applications.” **I found that it was best to do all Modelbuilding interactions from within ArcMap.**

“If you create a new toolbox in ArcToolbox while in ArcMap, ArcGlobe, or ArcScene, the toolbox will not appear in ArcCatalog's ArcToolbox window. You must add it to ArcToolbox the next time you're in ArcCatalog.”

Model Naming Convention

Each Toolset is named with 2 numbers preceding it, and the models within each toolset start with those two numbers, followed by 2 more digits. In general, lower numbers need to be run before higher numbers, or they were when I developed the model. Often, one model needs to be run at least once on your computer before a following model can be run. Once all the sub-models have run once on your computer, the super-models containing many sub-models should run. After this, the parameters of the super-models can be changed as per your particular fancy. Remember, you can add variables and parameters as you see fit. (see ESRI tutorial).

Some background on how to share tools: <http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=An_overview_of_sharing_tools_and_toolboxes>

Relative Pathnames

All tools and .mxds in LandAdvisor should be stored as *relative pathnames*. That means that if you move the .mxd or tool into a different folder, or rename the folder that the data is stored in, it will not work. Important: Relative paths cannot span disk drives. Relative pathnames explained: <http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Pathnames_explained:_absolute,_relative,_UNC,_and_URLhttp://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Pathnames_explained:_absolute,_relative,_UNC,_and_URL>

Arc 9.3 toolboxes can be saved in version 9.2 for distribution to 9.2 users.

Intermediate data

What is it?

* To determine if any data variable contains intermediate data, right-click the data variable—if there is a check mark next to Intermediate, then the data is considered intermediate. If there is no check mark, the data is not intermediate and will not be deleted.

How does it act?

* Intermediate data will only be deleted when:
* You execute the model using its dialog.
* You execute the model from the command line or a script.
* Intermediate data will *not* be deleted if you run the model from the ModelBuilder window. This allows the has-been-run state of the model to be saved between sessions, so each time you open a previously run model in its ModelBuilder window, you will not need to rerun the entire model.
* In ModelBuilder, all derived data elements are automatically flagged as intermediate.
* If you want to delete intermediate data after running a model in the ModelBuilder window, click the Model menu and click Delete Intermediate Data.
* Note: When you run a model from its dialog box, unlike when running the model within the ModelBuilder window, the intermediate data—data referenced by derived data elements that are flagged as intermediate—will be deleted after the model has executed.

Managing Intermediate Data: Where to put it?

The LandAdvisor standard, write all data to a %scratchworkspace% and make sure to mark the data as NOT MANAGED otherwise it will be automatically deleted. I believe that any file that you may want to access again in a later analysis should be marked as NOT INTERMEDIATE as well. That way you can pick up any point in the model.

See Managing intermediate data in shared models in the web help for more information.

If you add a model to a model, the output of the submodel will be marked as intermediate by default. Best to change this.

Checklist for periodic maintenance:

Periodically delete all files in a scratch folder (Any models will have to be run from the start after such a housecleaning)

Checklist for building a model

* Set to relative path
* Make name AND label (for now, make them the same)
* All done in model properties.
* Does it have an output parameter set if you want to link it to another model?

Checklist for commands within a model

* Make sure it is checked as intermediate or not, as appropriate

Making and Renaming new version of the Toolbox

ArcMap is finicky about how you do this, even if all is in relative path. A symptom that you did it wrong is if you open the new version's toolbox and there are some red X's through some of the models. This paragraph will need refinement over time, but for starters, this worked today:

* Copy the entire Folder into a new Folder in your directory
* Open up the .mxd with the Toolbox open
* Rename the toolbox and the Toolbox label from within ArcMap
* Close the .mxd
* Rename the entire Folder the new version of the Toolbox (e.g. from LandAdvisor\_v1\_012 to LandAdvisor\_v2\_0\_0)
* Open it to make sure it works.
* I'm assuming that you can then copyu and paste the entire folder back to the original Folder, so it is alongside the other versions...

Troubleshooting Tips for when you are making new models:

“Data does not exist”or “model has already run”:

If you execute a model with data variables that have been changed, but not been refreshed, you'll get an error message, such as "Input data does not exist". Need to “Validate entire model” first. See [Validation](http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Validation) .

Re-running models with new parameters

Won’t run because input files “do not exist”

The files need to be loaded into the .mxd, or refer to a hard-drive path. That is why it is recommended to use the pre-made .mxds indicated in the methods. Also make sure you ran the Prep model that populates the scratch folder with dummies the first time before the model is run. Finally, make sure that the scratch and workspace are still set correctly. They sometimes reset after an ArcMap crash.

Won’t run because output file already exists

Sometimes models won’t re-run if the output file already exists (even if file overwrite is checked). In this case, manually move the pre-existing file to a temp folder, delete it from ArcMap, and re-run the model. Sometimes even this does not work, because the file is still in memory. I just rebooted both ArcCatalog and ArcMap, and that did the trick. It may be that closing the ArcMap .mxd and opening it might also work.

Creating new joins and calculate does not work

Sometimes this is because the box is checked in geoprocessor settings (general) “maintain fully qualified field names.” Try unclicking. Also, sometimes you can get away with copying the file after the join is made, rather than calculate and then remove join.

Model acts as if it is using the wrong scratch folder

It probably is. Sometimes when a mxd crashes, and you reload it, it puts in a different scracthworkspace and workspace in the options/geoprocessing settings. Even worse, sometimes when you put the computer into hibernate, then pull out the software key, then wake up the computer, then put in the hardware key after it cannot find it, then it also resets the workspace and scratchworkspace. Reset and run..

Problem copying Toolboxes

Note: This problem occurred after I loaded Windows 7 64 bit OS onto my laptop. Problem: when I copy and paste a whole LandAdvisor Folder Structure, then when I open the toolbox up (the one in that new structure) then many of the models are crossed out with red X’s. I dig down to find the problem and find that ArcGIS does not know where to find one of its own commands, like Copy Raster. I point it to the right direction for that particular command, and then have to do it for dozens of others. Note, If I paste the structure next to the other structure, so it has the same path to the ArcToolbox, **then it works.** Goes against my memory of the problem. Maybe it is working now because I am running ArcCatalogue in Compatibility mode (Windows XP SP3) As a test, I pasted

Problem Closing ArcMap:

Sometimes ArcCatalogue will not implement a copy correctly, and it is probably because a file is considered still in use by ArcMap. Close ArcMap, open Windows Task Manager, make sure that it completely closes out. If not, consider using “End Process.”

Some moderately advance tips for building new models

[In-line Variable substitution (click here):](http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=In-line_variable_substitution)

This is a great trick. It is especially useful for when a model needs preliminary outputs in the early part of the model to run. Also, for scratch and working spaces.

[Displaying model data symbology (with color ramps) (click here):](http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Displaying_model_data)

This allows you to have your modelbiulder outputs be in something other than black and white color ramps.

[Feedback an output into a previous input (click here)](http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Iteration_using_feedback)

Working with NoData and Null Values

Merging layers where one has some NoData

Sometimes you will want to merge layers in which one has some NoData and you want the merge to just take the data from the one that has it. This was dealt with in model 2210 and the key is the conditional command: con (IsNull (biodiv2), 0, biodiv2)

Join: Select all except NULL values:

I think I used this when processing the Cadastre layer.

In the SQL statement the OID of the base table must be specifically included: [BaseTable].[OBJECTID] IS NOT NULL AND [JoinedTable].[FieldName] IS NOT NULL

Speeding up the computer processing:

1. Defragment your hard drive;
2. if using Vista, then use any other appearance theme than the default, which is “Aero.” It is a memory hog. Under Personalize/Window Color and Appearance (using the classic windows control panel). A similar rule applies for Windows 7
3. If Vista: Add RAM to your computer by installing more RAM or by designating one of your flash drives as “Ready Boost.” Latest word on the street is that 32 bit vista only can use up to about 3 GB of RAM. Not sure about Windows 7. Performance increase of Ready Boost is under debate.
4. Beware: Installing a 64 bit OS to be able to use more RAM probably won’t work. As of now, ArcGIS only has a 32 bit version, so it is not clear whether a 64 bit system with more RAM would be faster. Also, there are some complaints about running ArcGIS on 64 bit systems.

Documentation of models

If you type in the description of the model, it displays, unless you have put something in the abstract of the model documentation. Then it uses that. The ideal documentaiotn approach is to populate the Model Documentation with the description of the model. When adding stuff to the help file, also put “ Help File Populated” at the end of the description. Then, also open model properties and under description type “see documentation”.

When working quickly, put draft info and notes in the model documentation, and then when documenting it for real, copy and paste this info into the abstract, summary, etc.

Help Documentation File

To Test, then Do: All Help was compiled using the edit documentation function. (It appears that it is stored in the Toolbox itself, so should export with the Root folder. Optional for future: export as .html files, and compile as a compiled help file, and save in the LandAdvisor/LK/Support Folder. Then, each model edited would to refer to that location. Updating of the help file would need to be done on that file, and not in the normal way. For more info see: <http://webhelp.esri.com/arcgisdesktop/9.1/index.cfm?TopicName=Toolbox%20Help%3A%20Referencing%20a%20compiled%20Help%20file>

Dealing with schema lock

Often times you get a schema lock error. This is often because you had to make a feature class layer for some operation such as a join. Even after removing the join the layer will still exist. The next time you go to make a feature class layer of the feature class, it will say there is a schema lock. Thus, after removing the join, you must also delete the feature class layer. Example in the model near the end which selects only the sites that are greater than the mean + standard deviation.

Clues on how to implement eventual advanced options:

Skipping the Connectivity analysis for X number of iterations, or skipping recalculation for X number of interations:

You can set this up by using a branching script See Branching: Implementing If-Then\_Else logic. You can use the Get Count (Data Management) help as a hint.

Naming Multiple iterative outputs:

Iteration Variables: ModelBuilder provides two variables that contain the current iteration number and the current list index.

**%i%**— the current position, or index, in a list variable. The first position is zero.

**%n%**— the current model iteration. The first iteration is zero.

You can use these variables in calculations and pathnames. For example, the pathname of an output dataset might be:

E:/Data/Result%i%\_%n%

Note: It the first file in an iterative sequence is usually 0 not one. i.e. cost0, cost1, cost2 etc.

Programming multiple outputs rather than writing over previous outputs:

From “how to do a sensitivity analysis”  Since one output will be created for each expression in the list all subsequent outputs to the list will be overwritten. To create unique outputs for each output resulting from the changes in the buffer (from the list) each output name should be followed by %i%. Instead of one buffer being created (Roads\_Buffer) and being overwritten with each implementation of the list, three outputs will be created (Roads\_Buffer0, Roads\_Buffer1, and Roads\_Buffer2). Multiple outputs will be created from each process if %i% is added to each of the subsequent processes from the list.

How to create a new workspace folder every time the model is run? How to make automatic?

You can use the tool: create folder (under geoprocessing/workspace). Bu the tool to create workspace [needs an ArcInfo license.](http://resources.esri.com/help/9.3/arcgisdesktop/com/gp_toolref/data_management_toolbox/an_overview_of_the_workspace_toolset.htm)  ☹

You can set a variable called workspace, and make it a parameter. How to link the two together with just one name? Can’t link a variable to a variable.

Possible workaround: Script tool?:

“Scripting languages typically provide a mechanism for accessing arguments passed to the script from the caller. VBScript, for example, provides a comma delimited string of all input arguments, while Python uses its system module. A script must use these mechanisms if it is not the source of a script tool, as shown in the example below:

# Import native arcgisscripting module

import arcgisscripting, sys

# Create the geoprocessor object

gp = arcgisscripting.create()

# Set the input workspace

gp.Workspace(sys.argv[1])

The argument list in Python is zero based, with the actual script call being the first argument. The second argument is the first user-specified value following the script name. Following is an example of how to call the script in the example above, specifying an input workspace:

Clipdata.py "d:\soils\Newfoundland"

References for all sections

Davis, F., C. Costello, and D. Stoms. 2006. Efficient conservation in a utility-maximization framework. Ecology and Society **11**:33.

Gallo, J. A., and A. T. Lombard. In Revision. Increasing the impact of systematic conservation planning: recommendations, a decision support system framework, and a precursory model. .