2016 MGIS Geog564 – Lab 7 GeoDesign for Levee Setback Programs

Assigned date: Feb 22th, 2016

Due date: Feb 29th, 2016

Introduction –

In Lab06 you performed an MCE to determine, from a given perspective, which PLSP would likely produce the most benefit in terms of criteria from the Values Table for a reasonable cost.

In this lab you will tackle a more typical geodesign *programming* decision situation. The conveners of the geodesign study have set program targets: **1,000 households** newly protected, **$600m** worth of commercial property newly protected, and an additional **120 acres** of wetlands to be restored. No single PLSP can meet those goals. A solution - a Design - will combine PLSPs to meet these targets, but you have a budget of only **$125m** to implement all the PLSPs in a given design (again, the cost of a PLSP is the market value of the parcels areas that will be destroyed to make way for the wetlands and riparian cover).

In the sequential design approach, you will first select a set of PLSPs that meet the Households protected targets while staying within budget. Hint: For your first PLSPs, choose those with a high Households protected to PLSPs cost ratio. When you run the [make reports file] (MFR) Tool (run with [Include overlaps] unchecked), it will show your progress to the targets based on the PLSPs included in your current Design. Once your first target (Households protected) is met, you will next refine that design to ALSO meet the commercial target. Refining typically involve adding new PLSPs to meet the next target. But doing that may break your budget, so you may need to drop expensive PLSPs to make room for cheaper PLSPs that are more effective in helping your design reach the next target. Finally you will further refine your Design to ALSO meet the wetlands target. You now have a Design solution that meets the conveners' needs. Save that Design1 as a single multipart feature.

Next, the conveners had given their highest weight to Commercial Values in Lab06. They ask you to perform an additional Commercial (Market) Value-first sequential design. Repeat the sequential design in the order Economics - Safety - Environment. Save that Design2 as a single multipart feature. How does the resulting design differ from the last one? Explain why this is or isn't so.

So far, you have dealt with the PLSPs (and their resultant protected flood zones) as if they are all independent of each other. In the next step, you will take into account their interdependency through the Flood Zones. Very often implementing two PLSPs that are near to each other along the river protects more area than their combined UFZs.

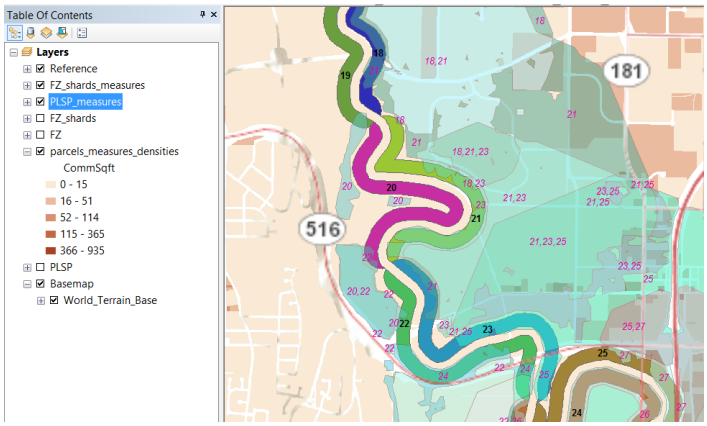


Table 1 There are only 6 areas flooded by three river segments

FZ Shards Measures			PLSP_measures		
allfidtx	ComMV	HsHlds	PLSP_MktVal	PLSP_Wtlnds	ComMV/PLSP_MktVal
11,12,14	528,396,664	4	135,202,161	124.59	3.91
12,14,17	637,770,569	0	112,667,225	125.01	5.66
17,18,21	377,610,684	87	46,101,314	122.80	8.19
18,21,23	359,368,381	147	57,774,437	126.18	6.22
21,23,25	199,639,687	567	90,067,086	125.85	2.22
22,24,26	1,786,767	34	12,640,170	115.11	0.14
25,27,29	312,451,403	722	93,081,088	119.85	3.36

Figure 1 Examples of FZ Shards - no area is flooded by more than 3 river segments

The conveners apologize, but tell you that the budget has been cut to $100m and the target for Commercial Value has been raised to $650m. Repeat the last steps for a new Commercial Value oriented-Design, but use the Program Targets Reporter Tool with [Include overlaps] checked. Hint: From Table 1 above, start with the most cost efficient (in terms of

protecting commercial value) area that is flooded by three river segments (and can only be protected by the corresponding three PLSPs. Save that Design3 as a single multipart feature. How does your new design differ from the first two? Explain why this is so using a map showing the FZ shards measures layer.

Finally, use the [Merge] tool to create a single multi-polygon fc DesignsFC that contains the 3 Designs you have created so far. Then run the MCE Tools using the 3 criteria and cost. Put in weights from 3 different perspectives and look at the relative rankings of designs. If the top scoring design is different for each perspective, how would you reconcile them so that all constituents could buy into a single design? Those who really want to engage on this question should talk with Prof. Nyerges about a capstone project.

Topics

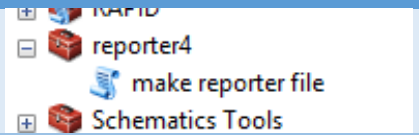
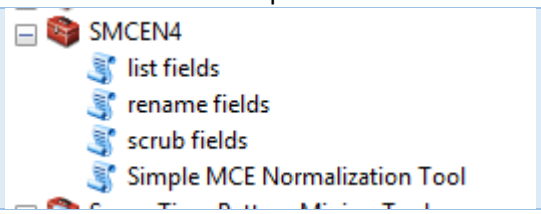
- *Introduce "program targets" for additional household protected, market value of commercial property protected and acres of new wetlands added, while staying within a budget*
- *Introduce the sequential design approach of Steinitz*
    - *Satisfy households protected first, then commercial, then wetlands while staying under budget*
- *Introduce feedback on progress towards program targets while designing*
- *Introduce dependency of sequential design on order of program targets addressed*
- *Using MCE of entire designs as the Decision Model*

Techniques and Tools

Reporter4.zip has two new tools that summarize and graphically report relationships among groups of PLSPs and their flood zones. A user guide is included in the zip. This zip is available on the Lab07 Assignment page on Canvas.

Simple MCE Normalization and WST.py tools **(SMCEN4a.zip)** are also used – get the zip from the Lab06 Assignment page.

Table 2 Tools for Lab07

Tool	Launch Environment	Zip file	Location
Make reporter file (MRF)		Reporter4.zip	Lab07 page
solo_reporter.py (SR)	Run from Windows Explorer folder	**Reporter4.zip**	Lab07 page
Simple MCE Normalization		**SMCEN4a.zip**	Lab06 page
WST2016.py	Run from Windows Explorer folder	**SMCEN4a.zip**	Lab06 page

Environment Prep

A Set geoprocessing to over write

B Set Geoprocessing Environmental Workspace to a new workspace folder

C Create New Lab07 Map

D Import the following Feature classes to start with (this is a minimum, but sufficient set). You will have your own names for the features classes you created in previous labs– but consider exporting features classes from last labs and changing the names to names that better indicate their purpose in this Lab.

Download the Lab 7 data distribution archives from the Class Google Drive: **Lab07PLSPs.zip** and **parcels_measures.zip**

FCs tagged as (ref only) in the table below are not used directly in this Lab, but as explained in the Reporter Tool help file, reporter_help_v2.doc (contained in Report4.zip) were used the create the feature classes you will need.

Table 3 Input Data Layers (all data supplied by Philip and Gene)

Feature Class	Description	Google Drive Source	Your Lab path/layer
duwamish_green_LG	Segmented river layer	hydro.gdb	
wria9_LG	Lower WRIA9 boundary	hydro.gdb	
PLSP	PLSP 7000ft x 300ft (ref only)	Lab07PLSPs.zip	
PLSP_measures	PLSP with OAJ measures from parcel attributes	Lab07PLSPs.zip	
FZ	Flood Zones for each 7000x300 ft PLSP (ref only)	Lab07PLSPs.zip	
FZ_shards	Flood Zones separated into shards flooded by unique sets of PLSPs (ref only)	Lab07PLSPs.zip	
FZ_shards_measures	FZ_shards with OAJ measures from parcel attributes	Lab07PLSPs.zip	
[parcel_measures]	Contains 4 precalculated measures for all parcels. (ref only)	parcels_measures.zip	

Program Targets

Program Target –	Target Orientation	Values Category
1,000 Total Households newly protected	Exceed	Social
$600,000,000 total commercial value newly protected	Exceed	Economic
120 acres of total wetlands newly restored	Exceed	Environmental
Total PLSPs costs to kept less than $125,000,000	Stay below	Economic

Sequential Design Approach (AFGD p57) workflow (variants used in Steps 1, 2 and 3):

- *Select enough PLSPs to meet the Households protected target, while checking the budget, either manually or using the MRF reporter tool (no overlap). Hint: look for PLSPs with high target measure/PLSP Cost.*
- *Continuing with the selected PLSPs from the last step, add/remove a few PLSPS to meet the Commercial protected target, while checking the budget, either manually or using the MFR (no overlap).*
- *Proceed to add/remove a few more PLSPS to meet the Wetlands added target, while checking the budget, using the MFR (non overlapped).*
- *When all targets satisfied, run the Solo Reporter (SR) python script to generate a chart of program targets and how well the Design meets them,*
- *Save your solution using the Dissolve tool to merge your selected PLSPs into a multipart feature in a fc with name of your successful design e.g. Design1FC*

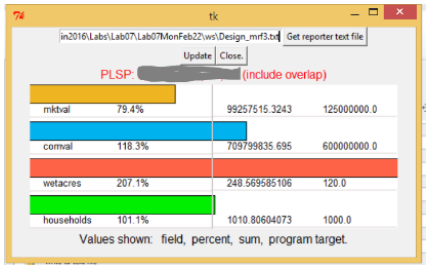


Figure 2 Solo Reporter shows progress towards program targets

Lab Workflow Summary – see Appendix for details on selected Steps

Step	Task	Inputs	Methods/[tools]	Output
Step 0 Setup	Set up environment, assemble and load input fcs, prep PLSPs fc	See Table 1 above	import fcs to your map; add UFZ measures (UFZComMV & UFZHseHolds) to PLSP_measures fc	Updated PLSP_measures fc
Step 1 Generate a Design while ignoring overlaps	Use the Sequential Design approach to generate a solution (Set of PLSPs) that meet all goals, while ignoring flood zone overlaps. Save Design1 as a single multipart polygon.	PLSP_measures, FZ_shards_measures, targets	Follow Sequential Design steps above to design a solution; use [MRF] tool without FZ overlaps (overlap option unchecked); run [SR] to display reports. Dissolve to Design1FC	Design1FC; Map of PLSPs in your Design; Image of the solar_reporter.py screen with targets met
Step 2 Use a different Sequential Order	Repeat Step 1 but in the order Commercial, Households, Wetlands. Save Design2	PLSP_measures, FZ_shards_measures, targets	Repeat but with new sequence of targets to satisfy. Dissolve to Design2FC	Design2FC; Map of PLSPs in your Design; Image of the solar_reporter.py screen with targets met; discuss differences w S1
Step 3 Generate a Design leveraging FZ overlaps	Repeat Step 2 while leveraging flood zone overlaps. Save Design3	PLSP_measures, FZ_shards_measures, targets	Follow Sequential Design steps above to generate a solution; use [MRF] tool with overlaps (overlap option checked); Dissolve to Design3FC	Design3FC; Map of PLSPs in your Design; Image of the solar_reporter.py screen with targets met; Discuss differences from Step1
Step 4 Generate an FC of designs	Join the 3 Designs in a single Design fc	Design1FC, Design2FC, Design3FC	[Merge] the FCs into a single multi-part FC; manually add criteria measure total values from MRF (include overlaps) display or output text files;	DesignsFC fc; Map and Image of Attribute Table of DesignsFC
Step 5 Run an MCE on the 3 designs	Execute an MCE analysis of the 3 designs	DesignsFC fc	Create a New DesignsFC_MCE fc from DesignsFC fc; Use [Simple MCE Normalization] tool to generate the 4 MCEs	DesignsFC_MCE fc; Use the View/Graph capability to create a stacked bar chart of MCE values for each Design. (see Appendix)
Step6 Run MCE decision model with three different weights sets	Calculate the weighted sum for the designs from three different perspectives	DesignsFC_MCE fc	Run [WST2016.py] with 3 different wet sets	3 DESIGN_WST fcs; Create a Ranking comparison table; Discuss how you might reconcile;

Deliverables

- Step 1 Generate a Design while ignoring overlaps – Design1
  - Map of PLSPs in your first Design1 and their unique flood zones;
  - Image of the solar_reporter.py screen with targets met by Design1
- Step 2 Design use a different Sequential Order, still ignoring overlaps – Design2
  - Map of PLSPs in your Design2 and their unique flood zones;
  - Image of the solar_reporter.py screen with targets met;
  - discuss differences with Design1
- Step 3 Generate a Design leveraging FZ overlaps with same sequence as Design2 – Design3
  - Map of PLSPs in your Design3 and their unique (overlapping) flood zones;
  - Image of the solar_reporter.py screen with targets met;
  - Discuss differences with Design2
- Step 4 Generate a multipart FC of designs
  - Image of Attribute Table showing criteria totals for the 3 Design
- Step 5 Generate MCE criteria for the 3 designs
  - Use the View/Graph capability to create a stacked bar chart of MCE criteria values for each Design.
- Step6 Run decision model with three different weights sets representing different perspectives
  - Create a Ranking comparison table;
  - Discuss how you might reconcile different rankings for different stakeholders;

Expectations and grading –

Performance	Credit	Description
No deliverable	0 points (0%)	No deliverable
Minimal engagement	15 points (60%)	Less than four steps attempted OR More than three steps demonstrate misunderstanding of course concepts or lack of effort. OR Less than three maps provided OR No design MCE/WST attempt
Incomplete	20 points (80%)	All six steps attempted, three maps provided and less than three steps demonstrate misunderstanding of course concepts or lack of effort. Design MCE/WST attempted but flawed.
Complete	25 points (100%)	All steps completed demonstrating complete understanding of course concepts Design MCE/WST complete.
Beyond complete	25 points (100%) with up to five future points	Complete with addition of critique, insight or further exploration of course concepts.

Appendix – new stuff

Appendix for Lab07 – Step by Step Methods is a separate document. For the new tools covered in Lab07:

- Using the Reporter Tools – Read the user manual distributed with the reporter tools in Reporter4.zip
- Using View\Graph to create a stacked horizontal bar chart
  - https://desktop.arcgis.com/en/arcmap/10.3/map/graphs/a-quick-tour-of-creating-graphs.htm