LA 494/594 Landscape Planning and Design Studio
Department of Landscape Architecture / University of Oregon
Johnson/Ribe/Mhuireach / Fall 2013

Problem 1 – Using Envision to Explore and Test Alternative Futures

Part A - Running Envision, Getting Output, Analyzing Results
Due: Monday 10/7, beginning of class

In this assignment you will become familiar with the Envision software and learn how to use it, including:

1) Opening and running Envision
2) Viewing maps and quantitative results
3) Downloading and archiving output (e.g., file naming conventions)
4) Analyzing simulation results

The Assignment: Perform the following steps and submit an ~2-5 page write-up that compares and contrasts selected scenarios, based on what you learn from performing the steps outlined below. Include hard copies or digital files of your simulation run outputs, i.e. maps, graphs and tables.

Steps to perform are underlined. Things to write up are in **bold.**

1) Select one scenario for each team member to assess from among the 8 provided that you feel will bracket a wide range of variability in outcomes (see illustration on page 3). ***Briefly explain your choices (1 paragraph).***

2) Perform a single 50-year run of each of your selected scenarios (one run of each). You may do this in several Envision sessions, or in a single session. As soon as the runs are completed, export the following files (or check the "export model outputs" button before you start the runs) for each scenario: Graphs\SWCNH-Pre (file name will be "Model Outputs"); Tables\Evaluative Scores (raw), Summary of Policy Applications & Global Constraints. These files will have somewhat different names if automatically downloaded. For your own records, make sure each filename includes the scenario name (e.g., HCM), date, and your team number, e.g., PolicySummary.hdm.8.22.12.T4.xls. *(Note: on some computers = you may have to replace the .csv extension with .xls to open the file*). Exporting the files first will protect you in case Envision crashes when you explore maps or other outputs. Once the files are downloaded, relabel the folder they are located in to include the date and your team name. This will help ensure you can keep track of your outputs as well as prevent overwriting in a later Envision session.

3) Explore different maps and how the attributes they represent change over time. You can do this by examining different attributes within the same run or the same attribute across different runs. Start by looking at one map at the landscape level to see the attribute's spatial patterns, then zoom into locations that look particularly complex. Next, examine multiple maps at the same time within a single run to look for potential relationships among attributes and locations of interest. Start with 4 selected attributes that you feel are related strongly to key planning issues (e.g., WUI, Manage, Vegclass and flame length). Then zoom into smaller selected areas to examine relationships at finer spatial scales and change over time. When zooming in, you may want to turn on the polygon edges (button to the right of "Post-run results") to see the IDU boundaries. Finally look at the same map across multiple runs to examine differences between scenarios. Take screenshots of each map or set of maps that that you find particularly informative and may want to refer back to later.

Be sure to include two specific explorations of fire:

a) look at the flame length attribute to compare your 4 scenarios over time, as well as the cumulative "FireId" attribute. **Briefly describe what you see when you compare the scenarios.**
b) Within a single high climate scenario, find one or more large fires and zoom in to watch them over time to see how vegetation and housing respond to fire (flame length, disturbance, vegclass, dwelling units) over time. **What specific effects do you attribute to the fire in the short term and the long term?**

Based on these examinations of spatially explicit landscape changes over time within individual runs and among different runs, summarize the key relationships you hypothesize to exist among attributes that create the patterns you see, as well as the similarities and differences you see among your selected scenarios. Use your map screenshots to help illustrate the relationships you see. What are the biggest differences you see among the scenarios?

4) Build deeper understanding of scenario contrasts and change over time by shifting from mapped output to quantitative output. Using the Excel spreadsheet templates provided by the instructors, or ones of your own making, create tables or graphs to show the following comparisons *across* your selected scenarios.

a) Use the evaluative metrics (raw) files compare the wildfire metric and oak metrics over time in your selected scenarios. The wildfire metric is based on a 5-year running average of the number of houses threatened by wildfire (houses without defensible space on IDUs that experience a surface fire or houses on any IDU experiencing a mixed severity or stand-replacing fire). The oak metric is the ratio of the ha of restored prairie, savanna and oak woodland and the 1851 ha of prairie and savanna. Both serve as "scarcity" metrics that influence agent decision propensities. The wildfire metric also affects the proportional allocation of funds for incentivized policies to either restoration or fuels treatment policies.

b) compare the budget allocations of each model run in terms of total $ allocated to incentivized policies for fire hazard and restoration as well as the total amount spent for each category over a 50 year run. *The budgets are found in both the Global Constraints file and the SWCNH-pre, but the money spent is only in Global Constraints.* **Describe the relationships you see over time within and among scenarios for the two evaluative metrics and the budget allocation.**

c) Using the policy summary table as a base, calculate the number of policy applications and the total ha (actual area + expansion area - converted from m^2 to ha) affected by each of the incentivized policies. **Based on this, described which incentivized policies had the most effect on the landscape (1 para). Highlight those policies in the table.**

d) Now use the model outputs files to compare the following for each scenario: 50 year totals for the different types of fire (surface fire, mixed severity 1 and 2, and stand-replacing fire), the numbers of residences threatened by fire, and the numbers of new dwelling units. **Describe the differences you see among scenarios for these outputs. You may choose to compare other graphs from this file as well.**

Finally, summarize what new understandings you gleaned based on the quantitative outputs of the processes driving the mapped simulation results? Summarize your findings and speculations.

5) Finally, as a team, perform a multiple run comprised of 5 runs of a single scenario that you find particularly interesting. ***Compare the between-run differences in up to five attributes (be sure to include fire-related variables) as a way to begin to scope among-run variability within a single scenario.***

Two analytical frameworks for constructing and exploring alternative future scenarios

In alternative futures scenario analysis, researchers often refer to assessing a "range of plausible futures". The two analytical frameworks below illustrate different ways to think about and examine the results of multiple, contrasting future scenarios. In our NSF-CNH project, we developed a set of eight scenarios organized in 3-D (Fig. 1) as a 2 x 2 x 2 arrangement of contrasting pairs so that the scenarios pairs directly above/below, right/left or in front/in back of each other differ by a single policy pair, while holding the other scenario dimensions constant. For instance, the upper four scenarios represent the high climate impacts scenarios, while the lower four represent the low climate impact scenarios. The scenarios in the front left upper and lower quadrants are the HCC and LCC scenarios, respectively. Through this framework, an investigator can analyze the effects of each scenario dimension across each of four contrasting scenario pairs. A less comprehensive, but equally useful approach is to select a small number of scenarios that bracket very different futures. For example, imagine the eight scenarios arranged so that ones with more similar results are closer together (Fig. 2) for some selected metrics of interest. One could choose to compare three scenarios that were "furthest apart" rather than the full suite of eight – in this case LCC, HCM and HDC, since define the circumference of the enclosing circle.

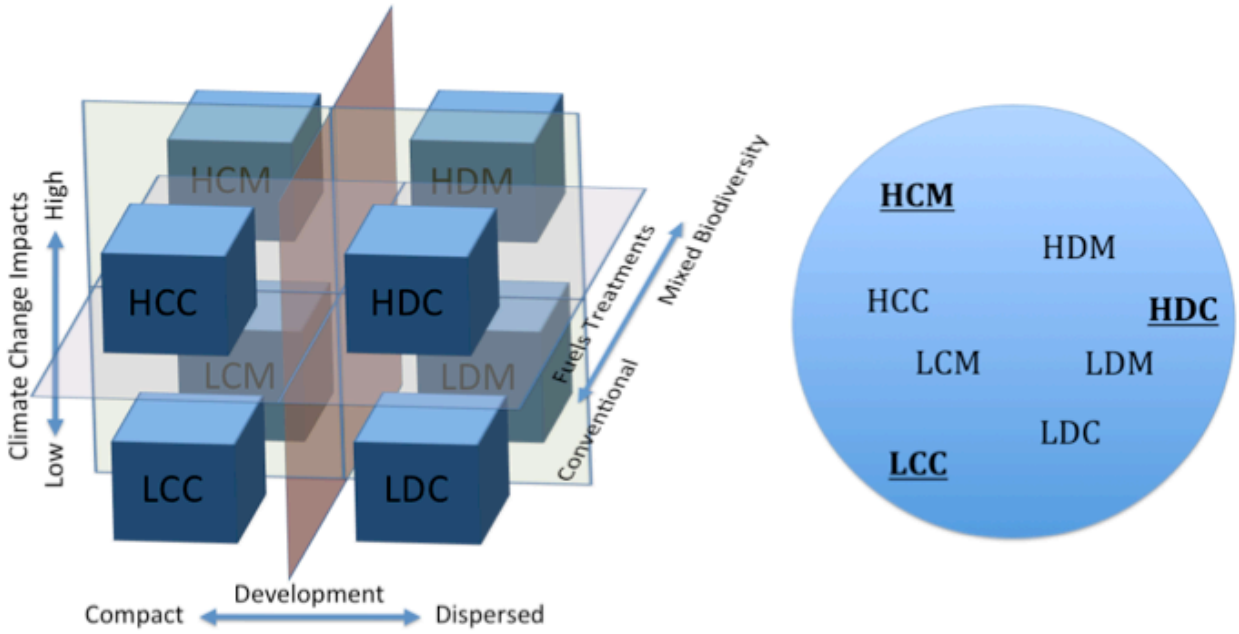

Fig. 1. Two analytical frameworks for examining alternative future scenarios. a) Fully Crossed Eight Scenarios Analytical Framework. b) Range of Plausible Variability Analytical Framework. The first letter represents the climate scenario (L = Lower climate impacts, H=higher climate impacts), the second letter represents the development scenario (C = compact development, D = dispersed development) and the third letter represents the fire hazard management scenario (C = conventional fuels treatments, M = mixed conventional/biodiversity-based fuels treatments).

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Problem 1 Part B –Developing and Testing Policies and Scenarios
Due: Friday, 10/11

1. Develop a suite of site attributes that will be used to identify IDUs suitable for new rural residential development via zoning changes in two different rural contexts: a) land currently zoned for agriculture, and b) land currently zoned for forestry. In addition, you may wish to distinguish site attributes for two types of housing: single family residential and rural cluster housing.

The current policy set contains 6 rural residential policies:

RR1D. Conversion of AGRICULTURAL lands to rural residential (Dispersed)
RR2D. Conversion of FOREST lands to rural residential (Dispersed)
RR1C. Conversion of AGRICULTURAL lands to rural residential (Compact)
RR2C. Conversion of FOREST lands to rural residential (Compact)
RR7-AG-Cl AGRICULTURAL lands to CLUSTERED rural residential
RR8-FOR-Cl FOREST lands to CLUSTERED rural residential

Step 1. Review the list of Envision attributes to identify those that seem important for specifying good places for new rural housing. Consider qualities that may be good for housing as well as those that may be undesirable.

Step 2. Prioritize a small number of attributes for further specification.
This will require you to look at the attribute and its categories or units and then to define the specific characteristics you want to use. Write these out in English, one item per line.

For instance, you can identify:
- IDUs with attribute values equal to or not equal to, or greater than or less than some value.
- IDUs that are next to or within a specified distance of other IDUs with a specified attribute
- IDUs whose surroundings (within a specified radius) include a specified proportion of that area with a defined set of values (e.g., 20% of the area within a radius of 100 m of the target IDU is in an agricultural vegclass)

You are only required to modify site attributes but may modify other policy characteristics in consultation with the instructors.

Step 3. Implement these site attributes in Envision policies. See *Problem 1B Supplement Modifying the Rural Residential Policies* at the end of this document for specific directions on how to implement your modified policies.

You'll need to install an XML editor. We recommend either Notepad++ (PC) or Text wrangler (Mac). Open the policies.xml file provided by the instructors and work with them to implement your site attributes for each policy.

First, however, write site attributes and outcomes for each of your rural residential polices in English and then in Envision code as shown in the example below to check that your intentions are being carried out in Envision. Then implement your site attributes and any other changes in the Envision code of the policies.xml file.

Public Lands Restoration Policy

Policy assumptions and intentions:

Assumes more willingness and better ability to restore habitat on public lands. Such lands do not include those with substantial infrastructure such as schools, city parks or public buildings.

	Site Attributes	Policy Outcome
Evoland syntax	Dist_Str < 1000 and Is_Public = 1 {Public Lands} and Lulc_A != 4 {Forest} and Is_Devable = 2	LULC_C= 87{Shrubland} and Conserv= 1:50
English	The site must be less than 1,000m from a stream, publicly owned, not in forested land cover and not suitable for development	The new LULC will be shrubland which will age over time to forest. 50% of the time, the site will become permanent conservation land.

Table 3. Example of policy expression in Evoland. Site attributes must be met for a policy to be considered for application at a particular site; policy outcome states the changes that will occur if the policy is applied.

Step 4. Test your policies in Envision.

It may take several rounds of debugging to get your policies to work.

a) Initialize Envision with your new policy set. Check for error messages. If there are none, conduct short runs of different scenarios (e.g. compact v. dispersed development) to make sure the policies are working. Check the Summary of Policy Application table, as well as maps and other diagnostic tools the instructors show you.

b) Once they're working, check to make sure they're working as intended by viewing maps and quantitative output.

c) Finally, create output for the four scenarios you selected previously and examine them alongside your original results in the Excel spreadsheets to how they behave as part of the policy set. As part of this, check to make sure you that you are still accommodating amounts of new rural housing consistent with your scenario descriptions. If not, you may wish to modify rural residential policy adoption rates. Rates that are too low will reduce the number of residences below that specified in the scenario. Rates that are too high may have unintended consequences, such as allowing greater numbers of agent changes than warranted by new rural housing. It may take several rounds of testing if you need to adjust adoption rates.

Step 5. Submit the following (HC = hard copy, DF = digital file) products to the instructors:

1) a finalized set of English/Envision descriptions as in step 3 above (HC/DF)
2) a policies.xml file that includes your team number and date, e.g. policies.T1.10.5.12.xml. For each rural residential policy include a narrative in the file (DF).
3) Quantitative comparisons of your policy sets with your new RR policies to your prior results for the same set of scenarios run with the initial policies (HC summary, DF of all results). *Note: if possible, run your new scenarios in the same order as your original model runs so that Envision uses the same firelists and random number seeds for each scenario. This will reduce the effect of the probabilistic variability in wildfire on your assessment of how your RR policies changed the simulation results.*

LA 494/594 Landscape Planning and Design Studio: **Sustainable Human Settlements**
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Problem 1B Supplement

Modifying the Rural Residential Policies

See file: policies.RR.xml
- Rename using your team number and the date (e.g. Policies.RR.T4.10.1.12.xml)
- Open the file in an XML editor. Set the view to soft wrap text if available

1) Add your names to the originator list near the top of the policy

2) Insert the site attributes for the parent IDU where it says:
{INSERT SITE ATTRIBUTES FOR PARENT IDU}

3) For each outcome, repeat as appropriate the site attributes to be used to expand from the parent IDU (these can be different than the parent IDU attributes but will likely be the same or very similar) where it says:
{REPEAT SITE ATTRIBUTES AS APPROPRIATE FOR EXPAND FUNCTION IDUS}

4) In some cases "taxlot = @taxlot" has been left in the expand function and may be retained, deleted or added depending on whether you want the policy to be contained within a single taxlot.

5) You may change the outcome probabilities to increase or decrease the overall probability that a policy will be implemented or to change the proportions of different zoning types.

6) You may change the maximum size of the expand function (in m2: divide by 10000 to get ha). The current maximum is just over the minimum lot size (e.g. 0.8 ha for a RR 2 ac. minimum)

7) Add a narrative to explain your policy intentions and logic in several short sentences, including an If: xxxxxxx Then: xxxxxx statement of site attributes and outcomes

8) You may modify policy scores but we recommend you hold off on that unless you discuss with the instructors. Be careful not to make inadvertent changes to the policy syntax.

9) Open the Eugene.envx file and redirect Envision to your new policies file by modifying the line:
<policies file='\envision\studyareas\eugene\Policies.xml' />