Employing an Automated Design Module (ADM) in Wildlife Corridor Design

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What can we do to “design” these modeled “voids”?

How do we design these linkages in an efficient way?
Linkage Modeling
More to Linkage Modeling

- A modeled corridor by itself is NOT a design, but rather a planning mechanism that can be consulted and used to guide decision making. It is a very helpful and necessary first step.

- Design requires attention to site specific characteristics, functions, and even qualitative variables such as aesthetics. These variables are not easily captured in corridor modeling and require additional refinement.

- What do we know about landscape patterns and their effect on connectivity? Can we borrow from other disciplines and integrate this knowledge into the design of modeled corridors to enhance how they function?
Meta-Analysis: Urban Linkages
Meta-Analysis: Landscape Pattern
Edge Conditions
Edge Conditions
Edge Conditions
Edge Conditions and Ecotones
Edge Conditions and Ecotones
Meta-Analysis: Landscape Pattern

### Extensions:
- Fragmented Condition:
- Designed Condition to Enhance Connectivity:

### Gap Fences:

### Stepping Stones:
Meta-Analysis: Landscape Pattern

Fragmented Condition:

Cap Termini:

Cap Fingers:

Ball & Socket:

Designed Condition to Enhance Connectivity:
A Way Forward: GeoDesign
Pattern Integration
What About Automation?

Here, we illustrate the development of an Automated Design Module (ADM).

- Utilizes landscape characteristics to develop capability surfaces for native vegetation.

- Vegetation requirements are parameterized per focal species requirements and modeled corridor characteristics.

- The module generates vegetation density, heterogeneity, and aspects of pattern such as linearity and cohesion per user defined criteria.

- Corridor outputs are then populated with suitable vegetation arranged in spatial patterns which promote connectivity, mitigate edge effects of surrounding land uses, and promote desired landscape patterns.
**Native Vegetation Library**

**Species:** Blue Palo Verde, *Parkinsonia florida*

**Size:** 15’

**Elevation:** 0 – 4,000’

**Soil:** Well drained, alkaline

**Aspect:** Full sun

**Slope:** Bottomland

**Hydrology:** Drought Tolerant, prefers riparian edge

**Min Temp:** 18°F

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Size</th>
<th>Elevation</th>
<th>Soil</th>
<th>Aspect</th>
<th>Slope</th>
<th>Hydrology</th>
<th>Temp (threshold)</th>
</tr>
</thead>
<tbody>
<tr>
<td>blue palo verde</td>
<td>Parkinsonia florida</td>
<td>15ft</td>
<td>0 - 4,000ft</td>
<td>well drained, alkaline</td>
<td>full sun</td>
<td>bottomland</td>
<td>drought tolerant, prefers riparian edge habitat</td>
<td>18°F</td>
</tr>
<tr>
<td>velvet mesquite</td>
<td>Prosopis velutina</td>
<td>30ft</td>
<td>0 - 4,800ft</td>
<td>well drained, alkaline, deep soil</td>
<td>full sun</td>
<td>all</td>
<td>prefers deep water table</td>
<td>10°F</td>
</tr>
<tr>
<td>white thorn acacia</td>
<td>Acacia constricta</td>
<td>18ft</td>
<td>0 - 4,500ft</td>
<td>sandy, caliche type, sandy loam, limestone soil</td>
<td>full sun</td>
<td>all</td>
<td>arid</td>
<td>10°F</td>
</tr>
<tr>
<td>cat claw acacia</td>
<td>Acacia greggii</td>
<td>10ft</td>
<td>0 - 5,000ft</td>
<td>sandy, caliche type, sandy loam, limestone soil</td>
<td>full sun</td>
<td>all</td>
<td>arid</td>
<td>0°F</td>
</tr>
<tr>
<td>ironwood</td>
<td>Olynaea tesota</td>
<td>30ft</td>
<td>0 - 2,300ft</td>
<td>sandy/gravelly soil</td>
<td>full sun</td>
<td>bottomland</td>
<td>arid</td>
<td>20°F</td>
</tr>
<tr>
<td>creosote</td>
<td>Lamea tridentata</td>
<td>8ft</td>
<td>0 - 4,000ft</td>
<td>sandy, sandy loam, medium loam, caliche type</td>
<td>full sun - part shade</td>
<td>bottomland - med slope</td>
<td>arid</td>
<td>0°F</td>
</tr>
<tr>
<td>triangle leaf bursage</td>
<td>Ambrosia deltoidea</td>
<td>3ft</td>
<td>1,000 - 3,000ft</td>
<td>sandy, sandy loam, alkaline</td>
<td>full sun</td>
<td>all</td>
<td>arid</td>
<td>18°F</td>
</tr>
<tr>
<td>cacti</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>saguaro</td>
<td>Cylindropuntia gigante</td>
<td>50ft</td>
<td>0 - 4,000ft</td>
<td>sandy, sandy loam, alkaline</td>
<td>full sun - part shade</td>
<td>Southern slopes at higher elevation</td>
<td>all</td>
<td>arid</td>
</tr>
<tr>
<td></td>
<td>Opuntia engelmannii</td>
<td>5ft</td>
<td>1,000 - 6,500ft</td>
<td>all</td>
<td>full sun</td>
<td>all</td>
<td>arid</td>
<td>10°F</td>
</tr>
<tr>
<td></td>
<td>Ferocactus echinocarpus</td>
<td>5ft</td>
<td>0 - 4,500ft</td>
<td>sandy or gravelly</td>
<td>full sun - part shade</td>
<td>all</td>
<td>arid</td>
<td>10°F</td>
</tr>
</tbody>
</table>
Landscape Capability Models: Native Vegetation
Pattern Generators & Rules-Based Design Filters
Pattern Generators & Design Filters

Cohesion:

Density & Heterogeneity:

Linearity:
Current Vs. Proposed
Corridor Interior Populated
Pattern Integration and Editing
Traditional Corridor Design?
Improved Corridor Design?
Closing Thoughts

- We need to do a better job translating science into terms and concepts that land use planners and designers can readily integrate and implement.

- Modeled corridor outputs require additional specificity within urban landscapes in order to be implemented, thus, more detailed planning and design is needed to fill in the voids of modeled corridors and guide decision making towards implementation.

- We need better ways to design large swaths of the landscape (i.e. modeled corridors) through maximizing efficiency, integrating data as the foundation upon which designs are based to increase function, and through integrating patterns known to enhance connectivity. We believe tools such as ADM may help.
Thank You

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