What is LUCIS?

- A strategy that identifies, through GIS analysis, areas most suitable for:
  a) Single land-use types (opportunities)
  b) Multiple land-use types (conflicts)
Brief History:

- Strategy developed by Paul Zwick & Margaret Carr (University of Florida), who wrote 2 books on the topic.

“Smart Land-Use Analysis: The LUCIS Model” (2007)

“Advanced Land-Use for Regional Geodesign” (2015)
Raster: a grid of pixels, each pixel contains a specific value. Commonly used in GIS to model continuous surfaces.
Raster: a grid of pixels, each pixel contains a specific value. Commonly used in GIS to model continuous surfaces.
GIS “primer”

Pixel values in this raster are green or white. These values can be used to represent land use features. (steep slopes, natural resources, urban development, agriculture…).
Multiple rasters can be combined to determine suitability for a specific feature.

Woodlands

Steep Slope Features
Suitability Analysis

Dark green pixels have a higher “suitability” for natural protection because they contain both Woodlands and Steep Slopes.

Woodlands + Steep Slopes = Most Suitable for Natural Protection
Questions?
LUCIS Analysis

Combines **multiple** suitability layers (**natural protection, agriculture preservation, development**) of differing land use types to help determine “opportunities” and “conflicts” or “competing” land uses.
Conceptual Example

Natural Protection Suitability Layer

Development Suitability Layer

Agriculture Preservation Suitability Layer
Most suitable for both Development, Natural Protection and Ag. Preservation. “3 Conflicts”

Most suitable for Development. “Opportunities”

Most suitable for both Development and Natural Protection. “2 Conflicts”

Most suitable for both Development and Ag. Preservation. “2 Conflicts”

Most suitable for both Natural Protection and Ag. Preservation. “2 Conflicts”

Most suitable for Ag. Preservation. “Opportunities”
Next Steps

- Policies can be developed for different pixel “classes”.
- These policies can reflect community values/input.
Questions?
Policy Examples

Opportunities

Natural Protection:
• Encourage easement acquisition.
• Restrict “high impact” uses.

Development:
• Encourage infrastructure to support increased density.
• Incentivize desired development types/uses.

Agriculture Preservation:
• Encourage Agriculture Easements.
• Restrict non-compatible uses.
Policy Examples

Conflicts/Competing Land-Uses

- Natural Protection* and Development:
  - Based on community consensus
  - Environmentally Sensitive Development

- Agriculture*, Natural Protection* and Development:
  - Based on community consensus
  - Environmentally Sensitive Agriculture and Development

- Natural Protection and Agriculture*:
  - Based on community consensus
  - Environmentally Sensitive Agriculture

* For areas not already restricted or protected
Rock, Paper, Scissors

Hand Graphic created by Josie Schultz from the Noun Project
Rock, Paper, Scissors

Agriculture Preservation

Natural Protection

Development

Hand Graphic created by Josie Schultz from the Noun Project
“Rules” can be changed based on community consensus.
Rock, Paper, Scissors

Scenarios can be developed based on different “Rules”.

Graphic created by Josie Schultz from the Noun Project
Scenario Example

1. Natural Protection
2. Agriculture Preservation
3. Development
Scenario Example

Highly suitable for both Development and Natural Protection. “2 Conflicts”

Natural Protection “wins”
Scenario Example

Highly suitable for both Development and Natural Protection. “2 Conflicts”

Natural Protection “wins”

Highly suitable for both Natural Protection and Ag. Preservation. “2 Conflicts”

Natural Protection “wins”
Scenario Example

Highly suitable for both Development and Natural Protection. “2 Conflicts”

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Ag. Preservation “wins”

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Natural Protection “wins”
Scenario Example

Highly suitable for Development, Natural Protection and Ag. Preservation. “3 Conflicts”

Natural Protection “wins”

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Natural Protection “wins”

Highly suitable for both Development and Ag. Preservation. “2 Conflicts”

Ag. Preservation “wins”

Highly suitable for both Natural Protection and Ag. Preservation. “2 Conflicts”

Natural Protection “wins”
Scenario Example

Scenarios can be “customized” based on a development strategy.

• “Corridors”
  - Development “wins” along designated corridors but “loses” elsewhere*.

• “Centers”
  - Development “wins” in designated centers but “loses” elsewhere*.

* For areas not already restricted or protected
Questions?
Proximity to Ag. Easements
Proximity to Ag. Security Areas
Proximity to Ag. Land Cover
Prime Ag Soils
Statewide Significant Soils
Soil Relative Value (Lehigh County)

Agriculture Suitability
Agriculture Suitability Layer

Proximity to Ag. Easements
Proximity to Ag. Security Areas
Proximity to Ag. Land Cover
Prime Ag Soils
Statewide Significant Soils
Soil Relative Value (Lehigh County)
Natural Heritage Inventory (NHI) Core Habitat
NHI Supporting Landscapes
Local Natural Areas
  Woodlands
  Interior Woodlands
  Steep Slopes
  Hydrography
  Riparian Buffers
  Floodplains
  Wetlands
  Hydric Soils

Natural Feature Suitability
Proximity to Sewer Service
Proximity to Water Service
Proximity to Major Roads
Road Density
Intersection Density
Existing Building Footprint Density

Development Suitability
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LUCIS
Land Use Conflict Identification System

- Development Opportunity
- Natural Feature Opportunity
- Agriculture Opportunity
- Medium Conflict Areas (2-way conflict)
- High Conflict Area (3-way conflict)
Develop and Apply Scenario

1. Natural Features
2. Agriculture
3. Development
1. Natural Features
2. Agriculture
3. Development
Develop and Apply Scenario

1. Agriculture
2. Natural Features
3. Development
1. Agriculture
2. Natural Features
3. Development
Develop and Apply Scenario

1. Development
2. Natural Features
3. Agriculture
1. Development
2. Natural Features
3. Agriculture
Other Scenarios

1. Agriculture 1. Natural Features 1. Development
Customizing/
Fine Tuning Scenarios

- Address result combinations differently.
Other Scenario Options

- Limit “wins” to “HIGH” Value Areas
- Keep “MEDIUM” and “LOW” Areas as “rural”
Other Scenario Options

- “HIGH” Value Natural Feature Areas win.
- All other combinations Development-Natural Features-Ag
Customizing/ Fine Tuning Scenarios

• Change rules based on geography or desired development pattern.
West of 100
1. Natural Features
2. Agriculture
3. Development

East of 100
1. Development
2. Natural Features
3. Agriculture
Additional Steps

- Add/Remove areas that can’t change (easements, regulated natural areas)
“Restricted” Lands
Additional Steps

- “Mask” out already developed areas and apply development suitability to these areas in and recommend differing intensity of development/redevelopment.
Development “Mask”
Next Steps

- Recommend “Development Types” for infill and redevelopment.
- Clean up random pixels, smooth boundaries…
Land-Use Conflict Identification Strategy (LUCIS)
April 26, 2016