Environmental Stress Analysis

Areas in a particular region or county that contain natural, agricultural, and cultural resources are under pressure from future development. This pressure can be measured by the likelihood of development occurring within or near a resource's geographical boundaries. In terms of LEAM model simulations, as the development probability in one cell increases, so too do the probabilities in adjacent and nearby cells, yet to a differing degree based on other variable parameters assigned to those cells (i.e., slope, zoning, terrain, current state of development).

Using development probability, we can differentiate between impacts of different land use patterns on resource areas. Low-density suburban development may not have a great impact on wetlands or threatened and endangered species in a particular area, but it is likely to stress prime farmland, watersheds, and aquifer recharge areas to a great degree.

There are four types of stress analysis we conduct, each providing a different perspective on how a resource may be stressed by future development:

- inter-regional stress - how stressed is the resource relative to the whole county/region?
- inter-resource – in which locations throughout the county/region is a particular resource most at risk?
- inter-temporal - which resources will be stressed most in the near term?
- inter-scenario - how does resource stress vary in different development or policy scenarios?

Examples of resource stress analyses conducted include, but are not limited to: ecologically-significant areas, threatened and endangered species habitat, watersheds, aquifer recharge areas, high quality streams, prime farmland, and wetlands.

Another analysis combines the results of the stress analysis for an entire set of resources and identifies the resource "hot spots" - areas in the county/region that have many different types of important resources that are under considerable pressure from future development. These "hot spots" may be the areas that local stakeholders want to focus on protecting.

Even if the quantitative differences are not very significant, differential impacts across space mean that two land use patterns can be qualitatively different. In comparing different future land use scenarios, tradeoffs may have to be made based on the impacts on different resources and their relative importance to the community. As growth occurs, it becomes increasingly important for regions to consider the impacts of their decisions across time and beyond their borders as well as within them.
Our environmental stress analyses provide insight into the nature of the impacts of various development patterns on natural, economic, and social systems. Stress analyses allow stakeholders to anticipate potential problems resulting from various policy options,

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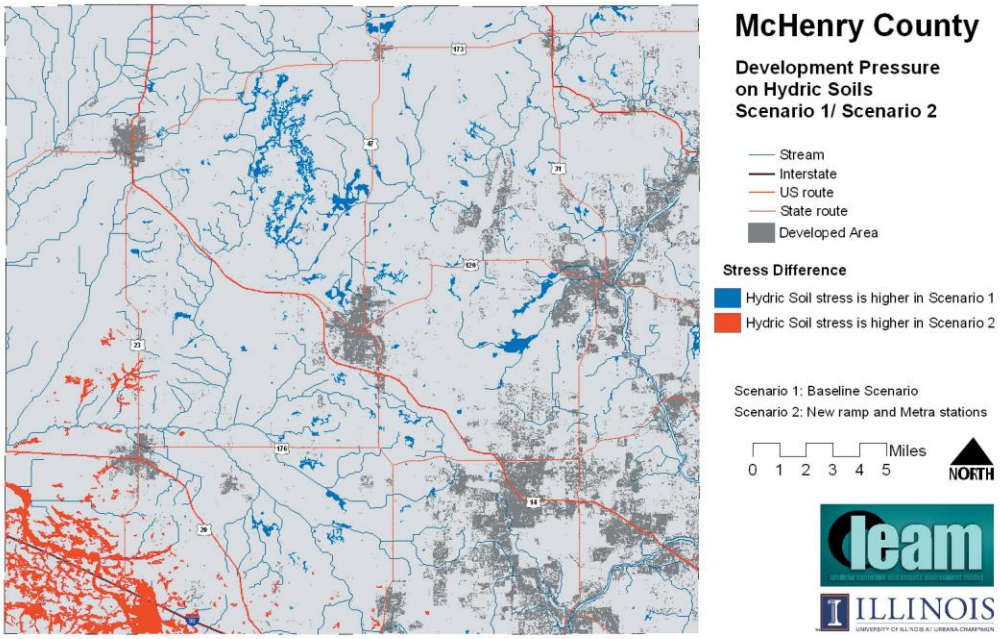
and to make more informed policy choices from the beginning of the development process, and regarding where and how policies or incentives will be best implemented.

Stress Analysis Methodology

To quantify the stress on resources from development, we assess the likelihood that development will occur where these resources are located. In LEAM, the probability that any one 30m x 30m piece of land (or cell) will develop is computed for all development scenarios on an annual basis.

For a given scenario, the cells that make up any given resource area will thus possess a range of probability values, and so the 75th percentile of these values is used as an index to represent the probability range. (The 75th percentile, the value that has 75 percent of cells with probability less than it, is used because it gives a sense of both the maximum value and the range of probabilities.)

The set of resource areas is then sorted, based on each area's probability index, into four quartiles. The top quartile, those areas that have the highest 25 percent probability values, represents the resource areas most under stress from likely future development.



Each of the lower quartiles represents resource areas that are less and less under stress. When the land use change in the associated LEAM simulation is overlaid on resource areas, the resulting picture gives a relatively complete depiction of the stress on resource areas across the county/region.

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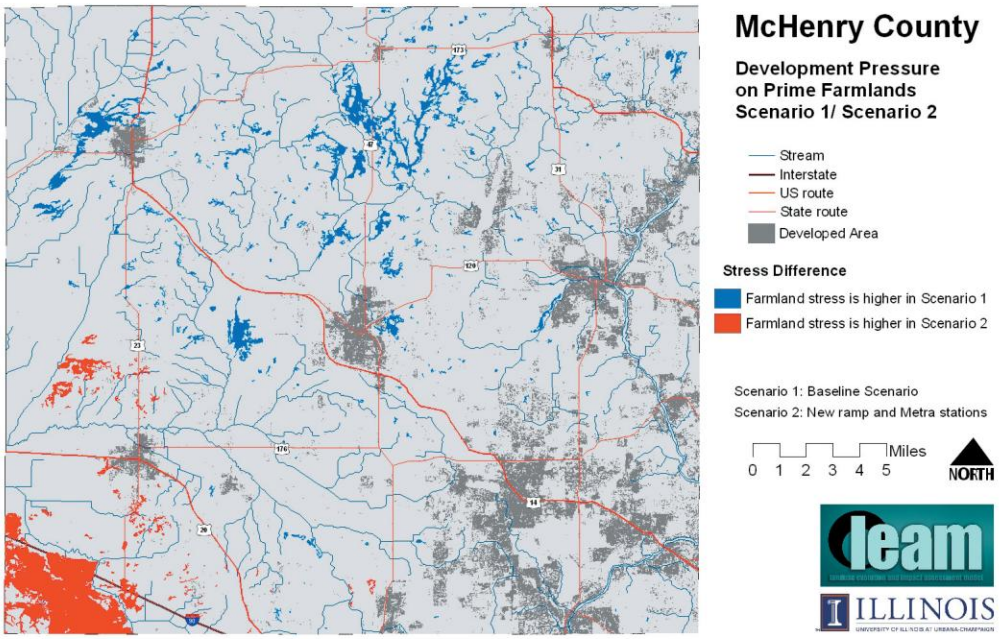

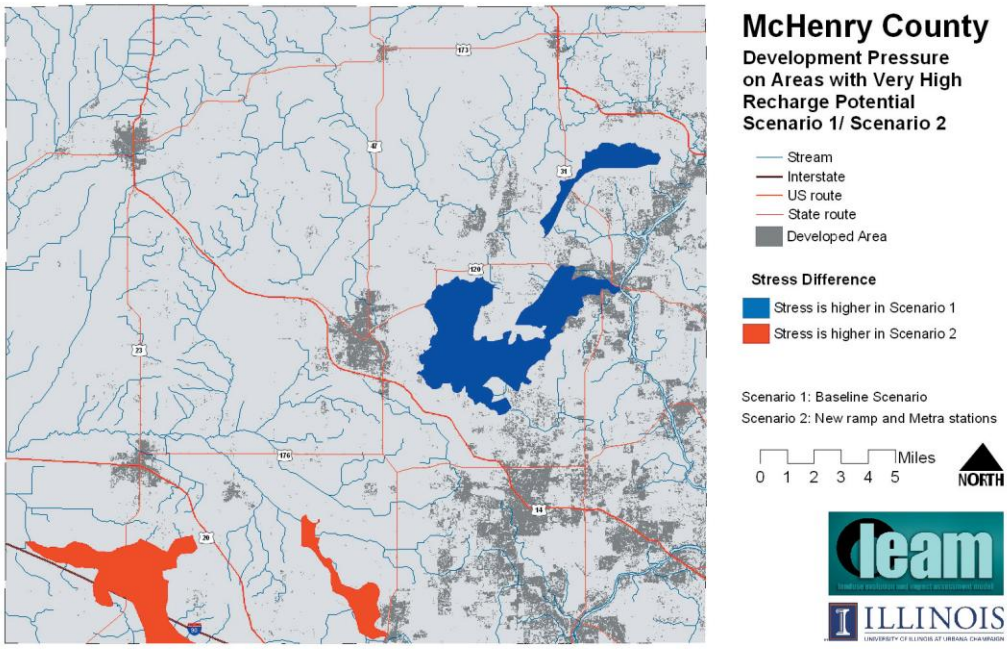

The resulting stress maps indicate the location of natural areas that are potentially stressed by new development. These patterns and levels of stress on resources are likely to be diverse based on the parameters set by the different development or policy scenarios and the location of resources within the region.

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