The Project

Land use planning at the watershed scale is important for maintaining the health of our streams. Through Envision Tomorrow Plus (ET+), municipalities can analyze the impacts of future land use plans on their natural resources while also considering social and financial implications like population, employment, tax revenue and more.

The Question

How will future development in the Blue River Watershed impact the health of the Blue River?

Blue River Watershed: Street Trees, Green Space Preservation and Green Infrastructure Tools

Envision Tomorrow (ET) provides simple estimation of financial feasibility of development projects, comparison among multiple land use or development scenarios, and many environmental, social and financial outcomes. New additions to ET let users explore options for enhanced environmental project design. Users can estimate the capacity, costs, and benefits from preservation of green space.

The street tree module allows users to estimate street tree capacity and determine the percentage of street frontage that could be lined by street trees. It also monetizes and calculates the total net value per tree from energy savings, carbon sequestration, air quality improvements, stormwater managements, and aesthetic/cultural value.

The first step in planning a change in land use, particularly of an undeveloped area, is to determine appropriate levels and locations for preserving existing natural land cover. The tool provides a summary of protected natural land cover based on areas selected by 1) direct selection of areas on a map, 2) preservation of a percentage of the development area, in proportion to the total land cover present, and 3) preservation of a percentage of the development area, using priorities set by user to each land cover class.

The green infrastructure module allows users to estimate the capacity, costs, and benefits from green infrastructure features that can be added to or green space/landscaping areas, such as green roofs, rainwater harvesting, biofiltration, and rain gardens. Cost per gallon of stormwater handled by the systems is provided, as well as the amount of reduction in pollutant loads.
ET+ was used to analyze compiled future land use plans for the Blue River Watershed. Building prototypes were created to reflect current development in Greater Kansas City. As the upper watershed develops, agricultural and vacant lands are expected to become predominantly single-family residential. Approximately 18,000 of the 185,000 acres of current vacant and agricultural land in the Blue River Watershed are predicted to develop by 2040, adding 35,000 households and 37,500 new jobs. Another 10,700 acres are expected to redevelop by 2040, adding 22,500 households and 30,000 jobs. This analysis considers full development of the Blue River Watershed, wherein all 40,000 acres of current vacant and agricultural land is developed.

With the addition of new buildings, sidewalks, roads, and parking lots the impervious surface coverage of the watershed increases. The percent of a watershed covered in impervious surfaces can be a reliable indicator of stream health at the sub watershed scale (Synder et al., 2005). Percent impervious surface coverage remains a reliable and important indicator of future stream quality (Schueler et al., 2009). A fully developed Blue River Watershed would be approximately 40 percent impervious surfaces. In “Assessing Urban Forest Effects and Values: the Greater Kansas City Region” (Nowak et al., 2013) an analysis of the Blue River Watershed estimated that increasing the impervious coverage to 40 percent would increase total flow another 53.7 percent or 1.46 billion cubic feet during a 6.5-month period. Without the use of best management practices the increase in impervious surfaces would likely increase flooding, reduce water quality and degrade stream health.

An estimated 2,800 new lane miles would be built to service the new development. This is a significant increase of impervious surface, but if new roads are planted with street trees the canopy coverage increases and providing an estimated total annual net benefit of $10 million in ecosystem services.

In the Blue River Watershed analysis in “Assessing Urban Forest Effects and Values: the Greater Kansas City Region” Nowak et al. concludes that increasing tree cover will reduce stream flow, but the dominant cover type influencing stream flow is impervious surfaces—increasing impervious cover had 32 times greater impact on stream flow relative to tree cover.

New lane miles in the fully-developed scenario cost an estimated $6 billion. Redevelopment and infill can leverage the existing transportation network without the cost of new roads.

An infill and redevelopment scenario using intensive green infrastructure, including green roofs on 50 percent of the roof area of all future development, reduces the impervious coverage of the watershed. The “Redevelop Green” scenario assumes that vacant/agricultural land is not developed. Using the existing transportation network and the use of green roofs were key to reducing impervious coverage in the “Redevelop Green” scenario. If only impervious surface coverage is considered, the Redevelop Green scenario is the most likely to predict fair stream health.
Parking lots are a significant contribution to the impervious surface coverage of the Blue River Watershed. This analysis did not consider changes in development practices of parking lots. Parking lots represent a distinct opportunity to influence the percentage of impervious surfaces in the Blue River Watershed.

Land use decisions are complex and ET+ allows planners to weigh the cost and benefits of including green infrastructure into future development and analyze the impacts at the watershed scale.

Analysis continued