Summary:

Prioritizing brownfields for development: a GIS tool and indexing scheme for environmental, socioeconomic and smart-growth factors
A key step to promoting smart growth in urban environments is the reclamation of dilapidated, underutilized or abandoned contaminated urban sites, also known as brownfields. Brownfield redevelopment promotes smart growth because it involves land reuse in urban areas, and subsequently leads to economic and community vitality. Brownfields commonly occur within an urban context where basic infrastructure, workplaces and other amenities are already in place. Brownfield redevelopment therefore can be planned in such a way that leads to creation of walkable neighborhoods, favor public transportation, and revive local markets.
Prioritization of brownfields for redevelopment has become important because according to the US EPA estimates, there are approximately 450,000 brownfields in the United States. With the substantial number of brownfields and limited amount of funding, decision makers face the question- which project can be completed with the available funding sources and which projects need to be waitlisted? The lack of decision support tools for prioritization of brownfields for redevelopment is one of the impediments in obtaining maximum benefits from the available funding resources. This research explores a prioritization scheme for brownfield redevelopment using Geographic Information Systems (GIS) implemented to visualize socioeconomic factors, smart growth and environmental attributes of brownfield sites and their surrounding areas. Because socioeconomic, environmental and smart growth related factors tend to be considered when evaluating the benefits derived from brownfield redevelopment, these parameters were chosen as the basis of indexing scheme. Its application to the City of New Haven, Connecticut as a case study demonstrates a general prioritization scheme that can be used by urban planners and public agencies to pinpoint smart growth and environmentally sensitive locations that can be set as priority areas for funding. The indexing approach attempts to consider all the three factors (socio-economic, smart-growth related and environmental) in such a way that they are independent of the end-use, and do not require any site specific environmental investigation aggregation.
Environmental factors for the prioritization scheme were based on rough assessment of the environmental sensitivity and potential environmental risk of a brownfield site. Six environmental variables – site’s past use, zoning (proximity to residential areas), proximity to water bodies, proximity to sensitive receptors (parks, habitats and biodiversity areas), floodplain categorization, and underlying soil type were chosen to assess environmental risks. An Environmental Index Map based on the proximity of the brownfields to the sensitive receptors was generated. Based on the levels of risk brownfields were categorized into three color codes- red, yellow and brown. High risk brownfields were designated by a red code indicating brownfields with industrial past uses that are at a distance of less than 0.25 miles (based on LEED ND) from water bodies and natural diversity areas. Yellow Code indicates moderate risk and represents brownfields with industrial past uses that are at a distance of more than 0.25 miles from water bodies and natural diversity areas. Brown code represents sites with commercial and unknown uses that would need further assessments to assess environmental risks. Also, based on the available zoning
information a mixed use potential map was generated representing brownfields with industrial past uses that are at a distance of less than 0.25 miles from industrial, commercial and residential zones intersection.

Smart growth location mapping is based on transportation and land use variables determined by the Leadership in Energy and Environmental Design for Neighborhood Development (LEED-ND) Rating System. The variable selection process yielded 6 variables - intersection density, presence of utilities, job housing balance, bus transit, rail transit and the potential for transit. All variables were classified into three classes - high, medium and low depicting a variable's value range that will have the strongest, moderate, and no positive influence on an areas capacity to support smart growth development. Indicators of smart growth were scored from 0 to 2. 0 corresponds to a low indicator for smart growth, 1 to medium and 2 to maximum potential for smart growth.

Finally, smart growth locations were grouped into two categories - Smart Growth Area 1 with a score ranging from 0.8-1.4 depicting a comparatively lower smart growth potential than Smart Growth Area 2 - the score for which ranges from 1.4- 2 and implies higher smart growth potential.

The incorporation of socio-economic factors into a general prioritization scheme presented the biggest challenge in terms of selection of variables and data acquisition. Depending on the town and state policies, it may be desirable to use various types of demographics to target distressed municipalities for redevelopment; therefore the type of variables should be determined at the discretion of the authoritative decision makers.

The results of smart growth location mapping for New Haven suggested that 74.1% (14.1 sq. miles) of the town contains the necessary infrastructure and other location specific features that would best accommodate smart growth development. Most of the high and moderate risk brownfields along with brownfields exhibiting mixed use potential in New Haven are already located in smart growth locations. This implies that these brownfields have the potential to be accessible to markets, suppliers, employees and the local labor pool. Also, brownfields representing higher risks are indicative of the environmental sensitivity pertaining to the location of brownfields and possibly urgency to address them. These brownfields are deemed to be areas of concern and exhibit potential redevelopment priority for the city of New Haven.

The goal of this project was to enable, through our visual tool and mapping index, the state government and other public agencies to prioritize brownfields for redevelopment and make decisions that would focus limited funds and other resources on the more promising remediation projects in terms of environmental and smart growth criteria. This constitutes a significant departure from previous decision support tools that aim at assessing the suitability of a particular end use for a brownfield site or to estimate the smart growth potential of a specific project.

Application of the GIS tool to the City of New Haven with the available data showed that a brownfields with high environmental sensitivity and smart growth potential could be a potential target area, while the isolated brownfields with mixed use potential could be transformative if redeveloped. At present the major limitation in the application of this GIS tool is the availability of data. Additional data would help in quantifying the potential risks associated with the sites and help in the creation of more refined areas of concerns.