

**Dr. Esra Ozdenerol**

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**A New Chapter for recycling: Using Geographic Information Systems (GIS) and mixed-methods approach to improve the market development and transportation of recycled materials.**

Improving the market development of recyclables in Memphis is a complex and challenging task. This proposed project attempts to demonstrate mixed-methods approach and how a GIS can be used to help meet this challenge.

GIS has far-reaching potential as an analytical tool, particularly in the recycling domain. As more data becomes available, the number of GIS applications will grow indefinitely, hindered mainly by the user's imagination. However, there are limits to what can be accomplished through GIS since certain information is difficult to represent spatially and may not be available. Such as Public's attitude towards recycling is an information can be derived from mixed methods approach and coupled with GIS to be visualized.

**Mixed-methods approach (qualitative angle of the project)**

Mixed methods approach includes a questionnaire directed to processors, manufacturers, private and public collectors of recyclables and non-profit organizations (Clean Memphis, Project Green Fork) who are stakeholders in the Memphis area. Interviews will be made with restaurant owners, other commercial sectors, apartment complex managers, private collectors as long as public works employees to learn more about the current infrastructure of recycling in the city. Federal and state solid waste officials, economic development specialists, in-house GIS experts, and trade associations will be consulted to determine the types of recycling data that exists for Western Tennessee and the social economic and technological limitations will be retrieved.

Then, A section of an area where public recycles and a section where no recycling happens will be chosen and questionnaire will be administered to find out how efficiently public recycles and find out the non-recycler's attitudes and factors leading to that.

Using quantitative recycling data, transportation data and qualitative data retrieved from questionnaires and interviews, a technology-based solution will be proposed along with a conceptual diagram of an ideal recycling infrastructure for the city, given the current actors.

**Transportation angle of the project**

A prototype GIS project will be applied for a private collector to help determine the most efficient and cost-effective route from a processor to a manufacturer. I will choose the transportation route that accumulates the lowest total cost value. A GIS can be used to determine "least distance" or "least cost" routes to collect recyclables from given locations, scanning the hauler time and money. Specific information about the tons handled by recycling facilities, the flow of recyclables, and the amount generated by commercial sector is difficult to collect. This project serves as an initial demonstration of how a GIS can be used for the commercial sector and determining optimal transportation routes for a private collector. Dr. Esra Ozdenerol has contacted with a private collector and has company's support to retrieve their data and apply GIS analysis.

For the city, public works, complementing city's in-house GIS, I would like to put together an impressive initial proof of concept and produce a reliable map showing a 35-minute drive-time boundary using real GPS data from its waste collection vehicles to get their average speeds at different times of the day. Idea is that Unacceptable travel distance could add up to more \$\$ per mile, so when annual mileage, vehicle numbers, staff and overtime are all taken into account, the total annual avoided cost could be a lot. By restricting the drive-time area, the number of trips the trucks can potentially do will increase, increasing efficiency. This means they get more value for money from the contract – it means that trucks aren't stuck in traffic, or travelling for as long as they would be otherwise. So that saves the residents money, gives them a better service, and also potentially cuts down on litter.

### **Esra Ozdenerol - Bio**

Esra Ozdenerol has been an associate professor in the Department of Earth Sciences of the University of Memphis since 2003. She is the director of the GIS Certificate Program at the University of Memphis. She directs Spatial Analysis and Geographic Education Laboratory. She was also the associate director of Benjamin L. Hooks Institute for Social Change of the University of Memphis from 2010 till 2013. She obtained her doctorate degree in geography in 2000 and her master of landscape architecture degree in 1996 from the Louisiana State University. Before joining the University of Memphis, she was an assistant professor of architecture of the Florida International University from 2000 to 2003. Dr. Ozdenerol specializes in geographic information systems and has served as a technical consultant to various public, government, and international agencies. Her current research interests entail use of the geospatial technologies (including geographic information, remote sensing, cartographic and geostatistical analyses) in a diverse range of public and environmental health issues. Her latest book "Spatial Health Inequalities: Adapting GSI Tools and Data Analysis" involve studies about the spatial health inequalities. In her spare time, she writes children books, and travel. She is also active in sports.