

Introduction

One of the big challenges local institutions have to deal with is without any doubt solid waste management (SWM). Especially in low and middle-low income countries, SWM represents a big issue, which seriously affects both human health and the environment. A huge limit to the improvement of solid waste management systems, in many cases, is the economic burden, due to the lack of funds. Between the different stages a SWM system is divided into, waste collection and transport is one of the most expensive in terms of money, and has an environmental impacts in terms of fuel consumption and pollution. For these reasons, it is important to find strategies to optimize this and other stages of SWM.

Geographical information systems (GIS) can be a useful tool for this purpose. Their importance was explained very well, among other authors, by Chalkias and Lasaridi, with reference to waste production and distribution, route optimization, and proper siting of waste treatment facilities and landfill sites. Nevertheless, most of the presented case studies are based on the use of proprietary software, and this can represent a limit with reference to the accessibility of the software itself. Free Open Source Software (FOSS) has been consequently identified as a tool which can be easily accessed, with no costs, and capable to be modified to fit the needs of the local context. The potential of FOSS, which is linked to the freedom given to the user to modify and share, and includes also its most evident characteristic which is being free of charge, has been widely discussed in literature, together with its points of weakness (Cámara and Fonseca, 2006). Of course, some difficulties have been found in the implementation and use of FOSS (Øverland, 2010) in low income countries, and issues mentioned in literature should be taken into account. Nonetheless, the last years have seen a considerable improvement in the potential and usability of GIS open sources, which should be acknowledged.

The procedure has been consequently developed with an open source and open data approach. QuantumGIS is the software chosen, taking advantage of its powerful tools, included the Processing Modeler to concatenate subsequent analysis. Relevant importance has been given also to the accessibility of geographical information, for example considering OpenStreetMaps (OSM) (and not only) as a relevant tool.

Case study:

the province of Tyre (Lebanon)

In the South of Lebanon, the Union of Tyre Municipalities, a public authority, is doing a big effort to make effective the SWM. Each Municipality is managing waste by itself, with shortage of funds, no appropriate disposal points exist, and a few facilities are starting their operation. In this framework, 8 Municipalities and the city of Tyre (Sour) have been involved in a project promoted by INTERSOS and funded by AICS (Italian Cooperation), with the technical support of Politecnico di Milano. Beside raising awareness and targeting other issues, the project aims to introduce the separate collection and provide the Municipalities with a SWM plan. This represents the fertile humus in which this research is being developed.

Disclaimer! On-going research. Comments and suggestions will represent an appreciated contribution!

METHODOLOGY: THE GIS CONCEPT APPLIED TO SWM IN SCARCITY OF RESOURCES

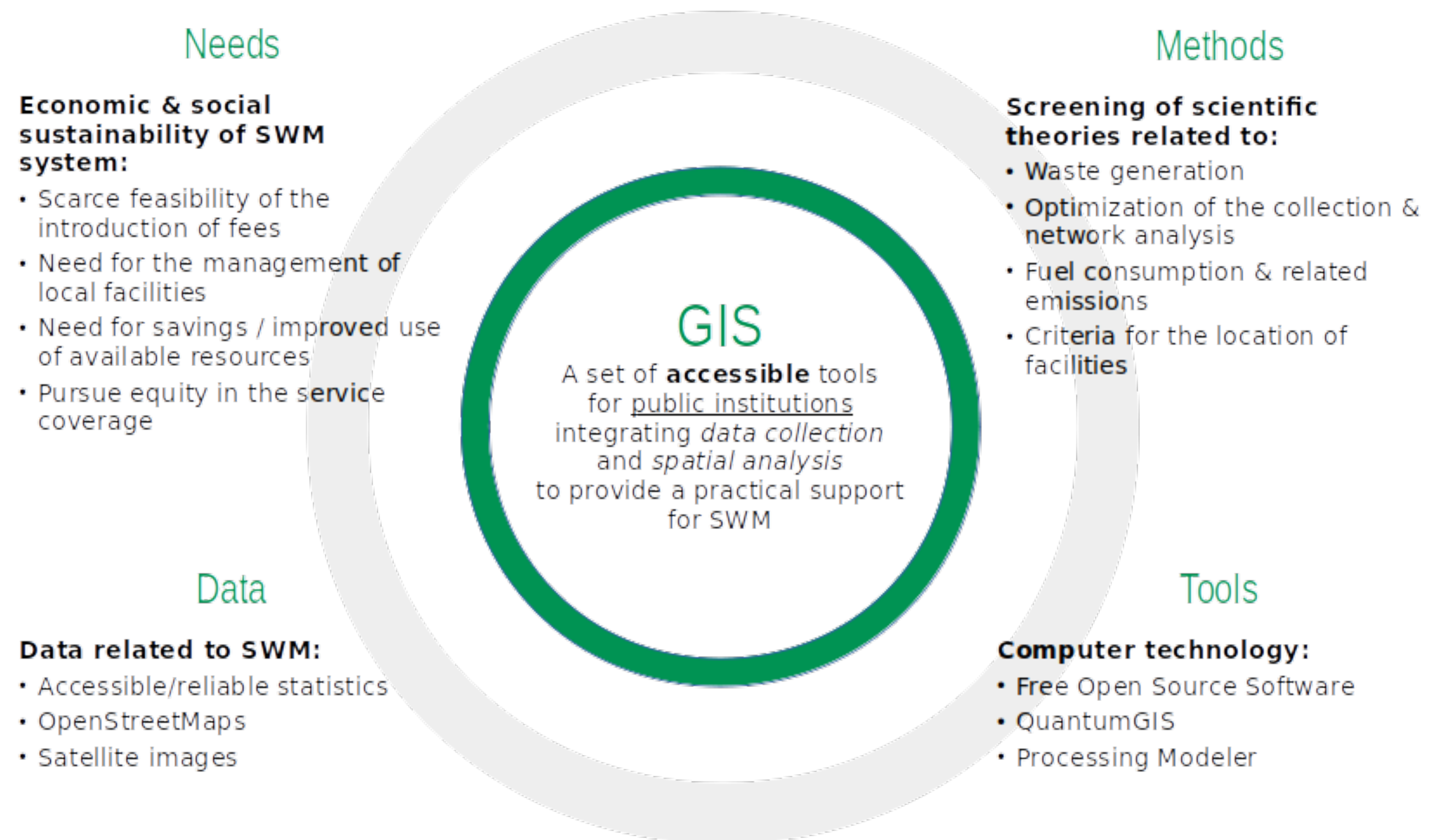
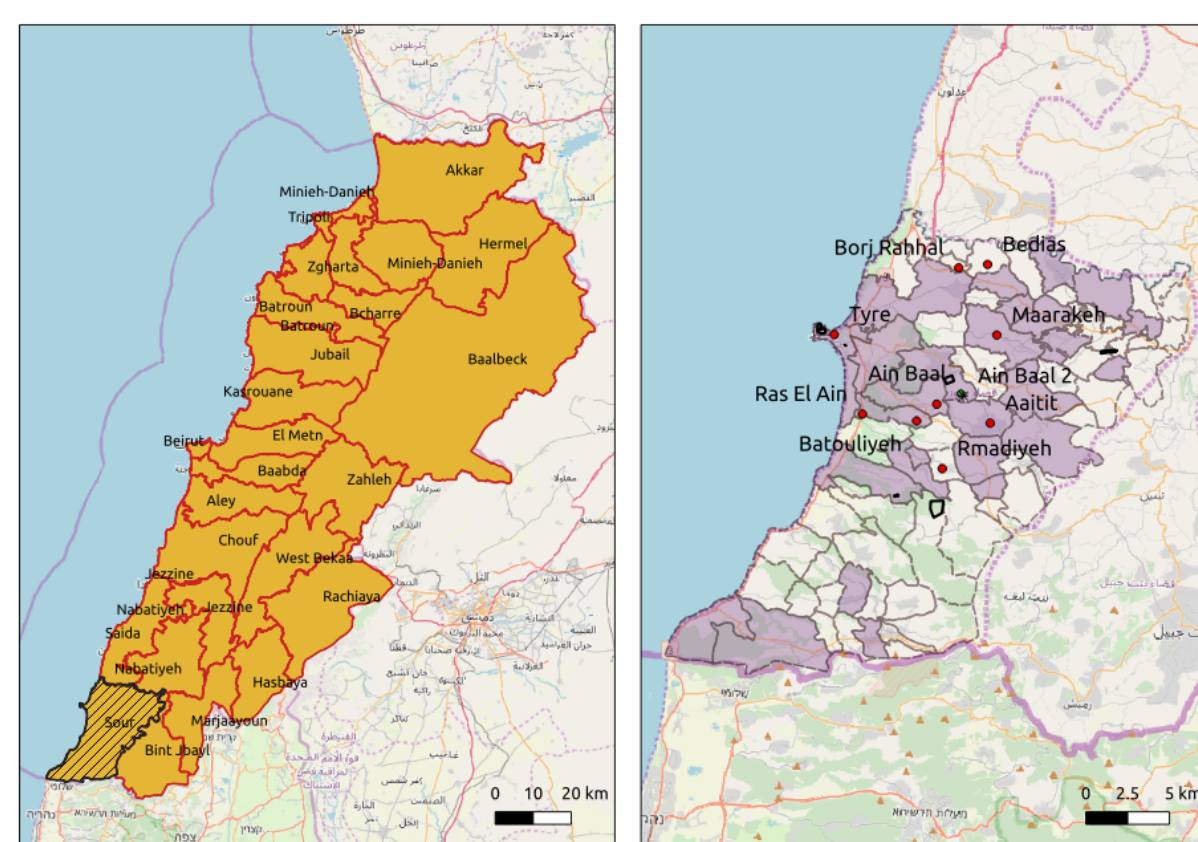


IMAGE 01 - Personal elaboration based on "Parts of a Geographic Information System (Mitchell, 1999)

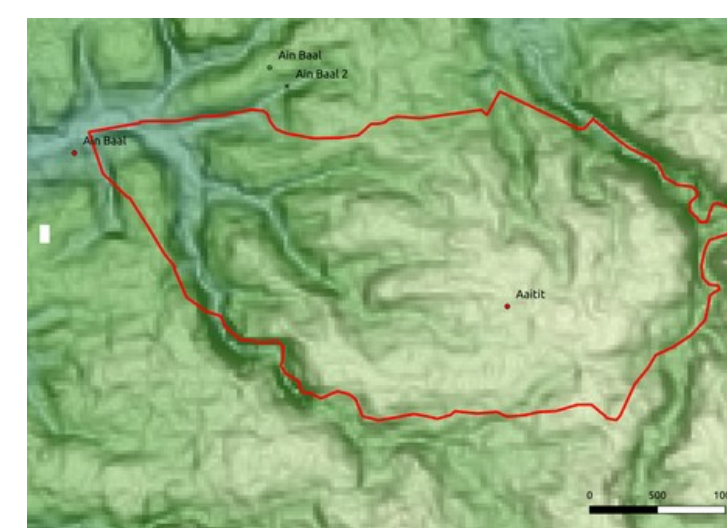
APPLICATION

the Province of Tyre



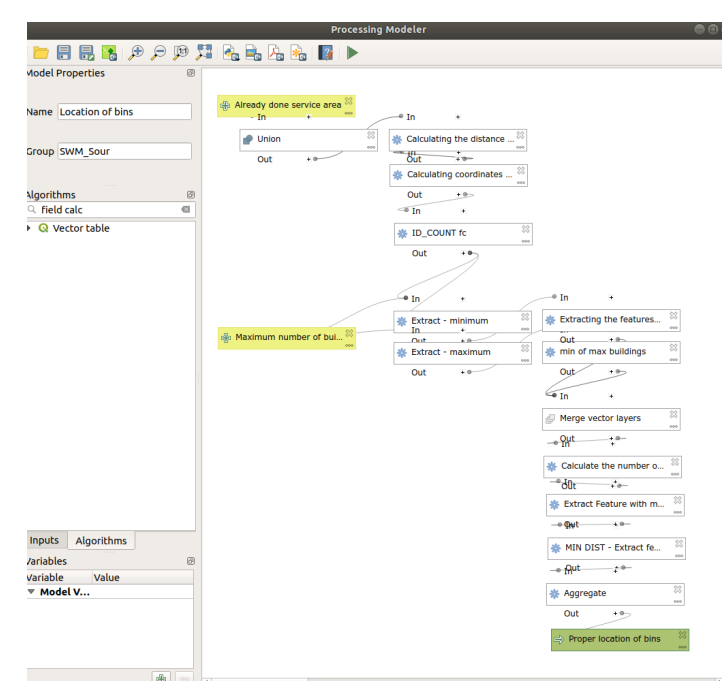
(a) Slope analysis

- Slope analysis: moving from a public DTM and the street network by OSM, slopes have been calculated as a first step towards the creation of optimized routes for waste collection.



(b) Location of bins

- Location of bins: bins are a "limited resources" and their location should be appropriate, since it impacts on the organization of the collection



FOLLOW-UP

