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ECONOMIC ASPECTS ON MINING OF WASTE FROM OLD LANDFILL SITE MANAGEMENT

ANALYSIS OF RELEVANT PARAMETERS AND THE RELEVANCE OF A SPECIFIC MANAGEMENT TOOL

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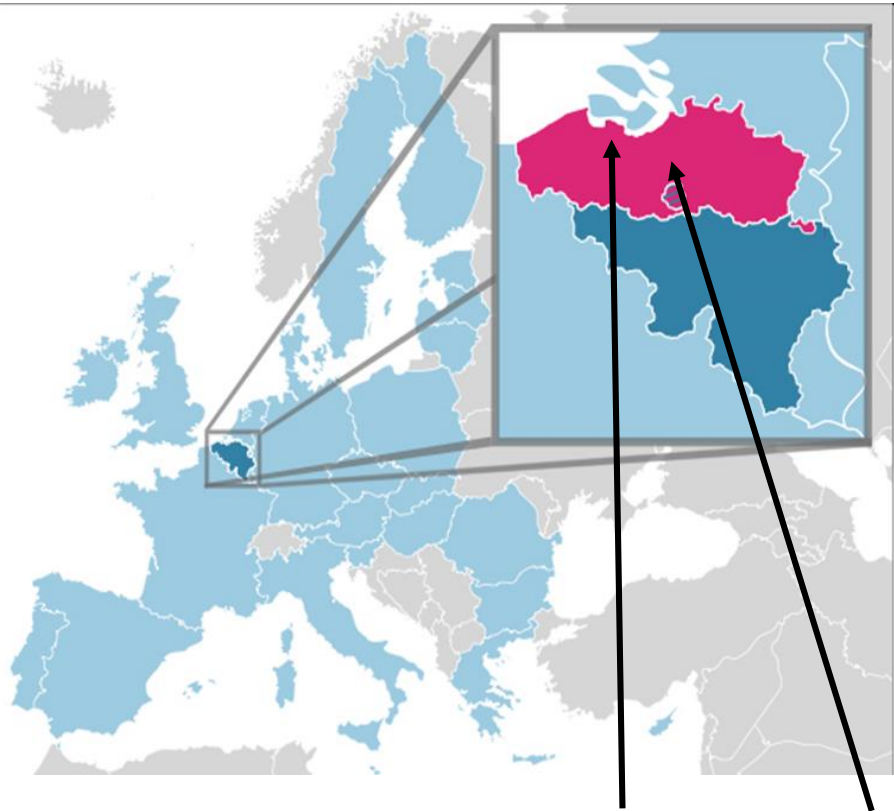
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ECONOMIC ASPECTS ON MINING OF WASTE FROM OLD LANDFILL SITE MANAGEMENT

- ▶ Flanders
- ▶ OVAM
- ▶ Waste -> Sustainable resource management
- ▶ Flaminco model
- ▶ MCA
- ▶ ELFM² - Spatial component
- ▶ General conclusions

Flanders



Ghent

Mechelen

General information :

- Population : 6,4 M inhabitants
- Surface : 13.599 Km²
- Densely populated : 472 inhab./Km²
- Highly industrialised
- Regional policies
- Important harbours (connections to NW- and central Europe)
- Limited natural resources

Mechelen

33,71 Km²

82.000 inhab.

2.400 inh/Km²

Ghent

156

260.000

1650



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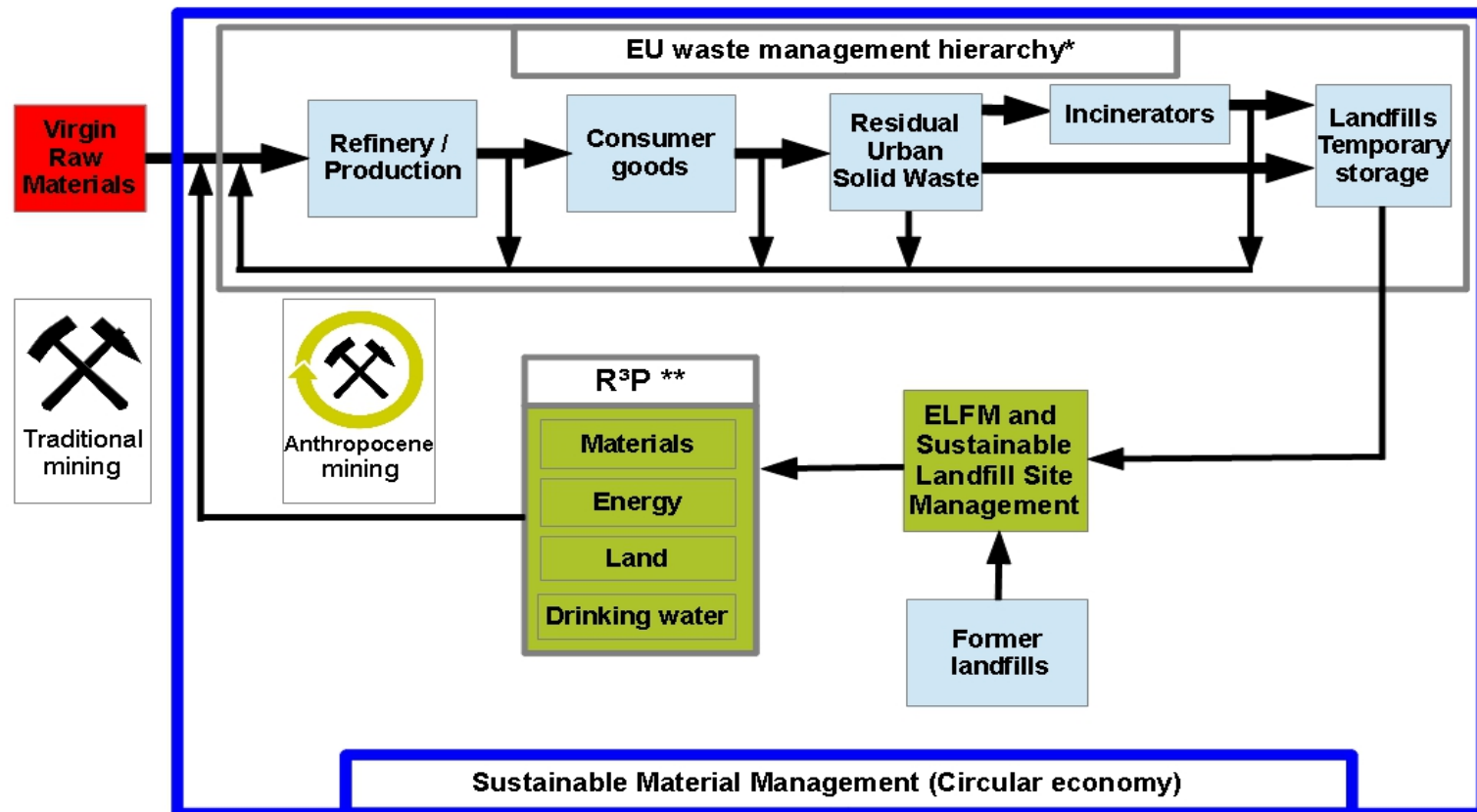
OVAM

OVAM

- Public Waste Agency of Flanders
- Environmental Agency headed by the Flemish Minister of Environmental Affairs
- Established in 1981 (State reform of 1980)
- Competent Authority for:
 - Waste Management;
 - Sustainable Material Management;
 - Soil Remediation.
- Staff: approx. 310 FTE
- Offices : Mechelen – Belgium
- www.ovam.be



Transition from Waste to Sustainable Resource Management



*Prevention (Ecodesign, dematerialisation,...), Reuse/ Recycling, Incineration, Landfilling (EU Waste Framework Directive)

** R³P = Recycling of Materials, Recovery of Energy, Reclaiming of Land, Preserving Drinking water supplies

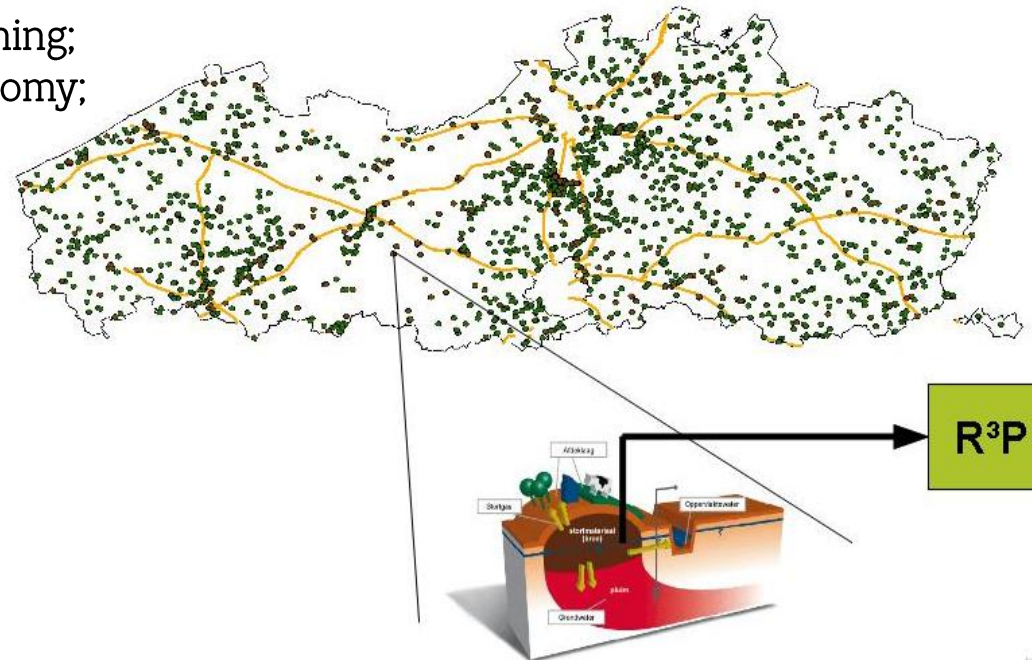
ELFM – part 1

OVAM's Action plan on ELFM:

- decision board of directors: dec 2011;
- programme 2012-2015;
- basic principles: Mapping-Surveying-Mining;
- reintroducing Landfills in circular economy;
- developing innovative concepts;
- supporting innovative technologies;
- study on economic and legal aspects;



Mapping – Surveying – Mining



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ELFM – part 1

Mapping :

inventory of landfill sites on the level of the Flemish Region (general characterization of the site and the surrounding area). These data are introduced into the Flaminco-tool, delivering a ranking of landfills more or less suitable for ELFM.

Investigated sites (31.12.2013):

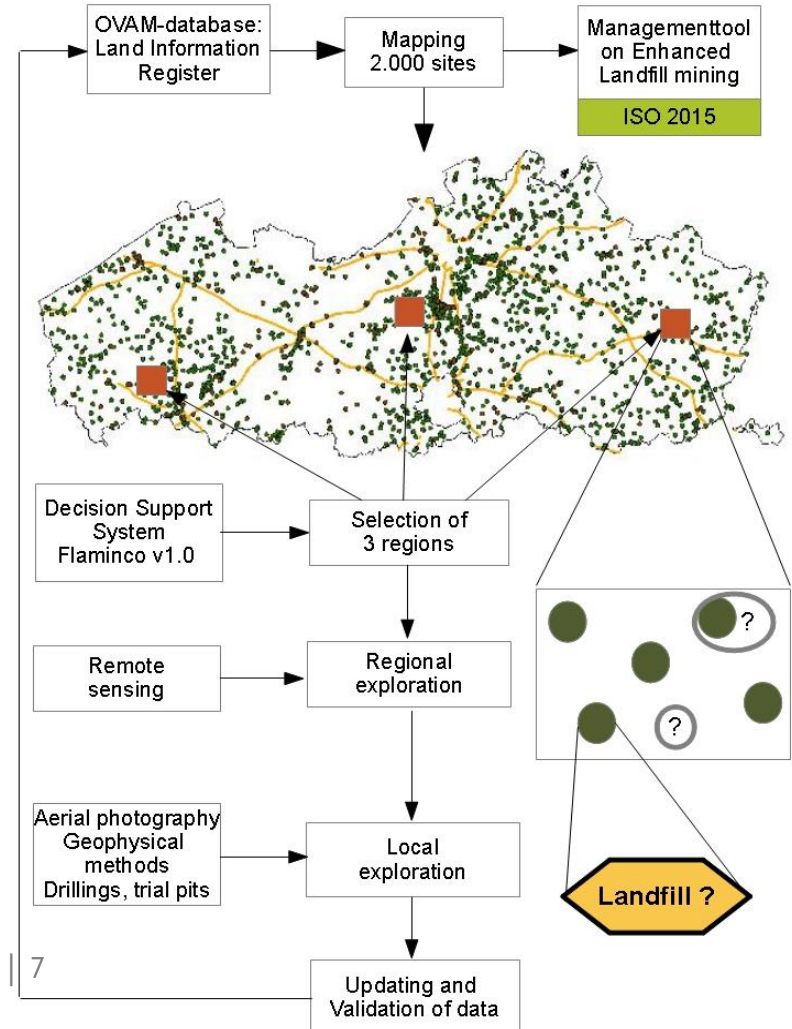
- 34.176 investigated sites;
- 2.059 landfill sites detected;
- total surface area: ~ 80 km²

Mapping

→ large scale prospecting

Surveying

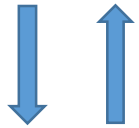
→ exploration on local level (individual landfill)



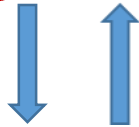
Resource Management version 2.0

Enhanced Landfill Management & Mining (ELFM²)

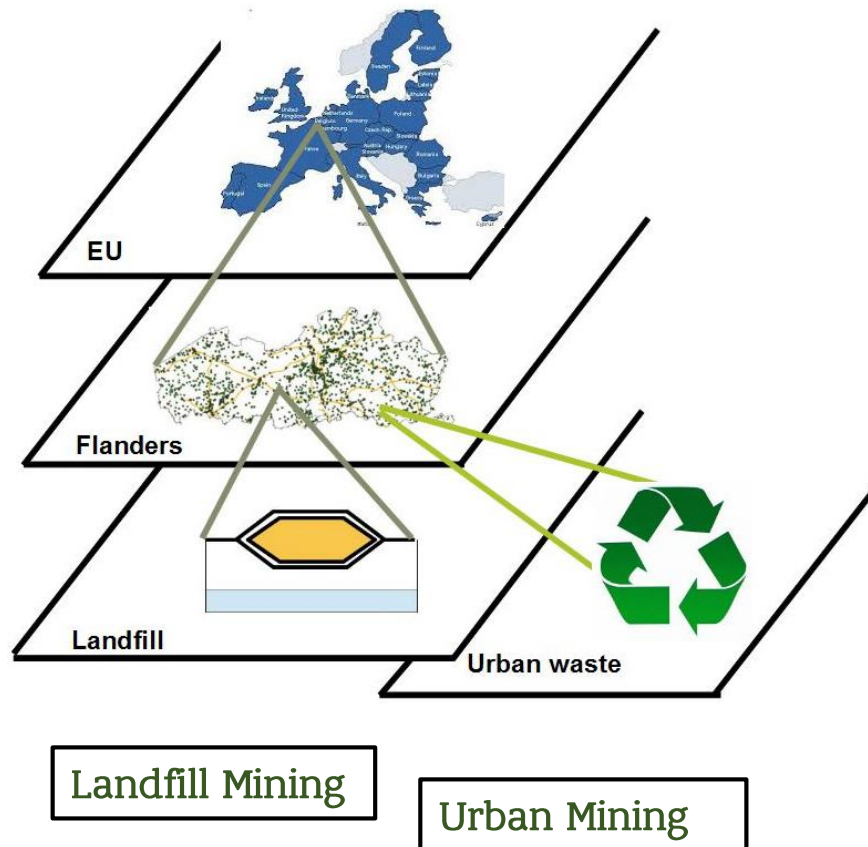
Conceptual
European Model



Conceptual
Regional Model



Conceptual
Site Model



- Analysis of provided information; vision and policy development on waste and sustainable materials management;
- Data aggregation and processing; delivering information on antropogenic resources and reserves;
- Data collection on waste production and landfills.

Methodology for prioritization of ELFM

Flaminco 1.0

- ▶ Goal : easy and flexible tool based on different parameters and the objectives of OVAM (sustainable material policy and soil conservation – remediation)
- ▶ Combination of 2 different methodologies
 - Determination potential of ELFM
 - Determination of need to remediate (Starting point = Conceptual site model)
- ▶ Flaminco (Flanders Landfill Mining, challenges and opportunities)
- ▶ 2 kinds of weighing factor
 - criteria to evaluate LFM-potential
 - characteristics of the individual landfill

Determination ELFM – potential

► 4 LFM aspects

- Waste to Energy (WtE)
- Waste to Materials (WtM)
- Waste to Land (WtL)
- Resource Management – Temporary Storage (RM)

► 6 criteria

- Type of landfill
- Period of landfilling
- Volume of landfill
- Landuse of landfill
- Distance to roads, waterway, railway
- Proximity of other landfills

Determination ELFM – potential – Flaminco tool

The screenshot shows the FLAMINCO model interface in Microsoft Excel. The interface is divided into several sections: 'Type stortplaats' (Waste to Material), 'Doelstelling' (Waste to Material), 'Criterium 1' (Weighted criterion 1), 'Criterium 2: Ouderdom' (Weighted criterion 2), 'Criterium 3: Volume' (Weighted criterion 3), and 'Criterium 4: Gebruik' (Weighted criterion 4). Each criterion section contains a table with 'Ondergrens', 'Bovengrens', and 'Gewicht' (Weight). The 'Criterium 4: Gebruik' section includes a table for 'Aanwezigheid bebouwing' (Presence of buildings) with 'Ja' (Yes) and 'Nee' (No) options. The right side of the interface features a 'HANDLEIDING' (Manual) section with instructions on how to use the tool, including a note about the 'Gewicht per criterium aanpassen' (Adjust weight per criterion) button.

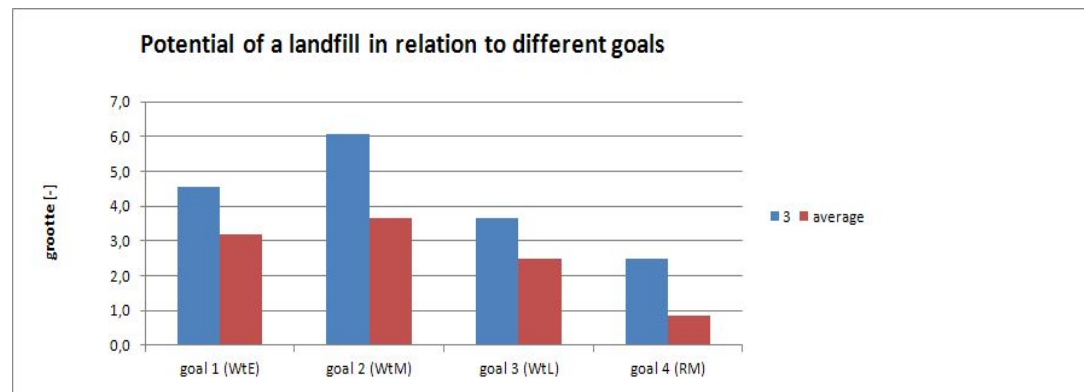
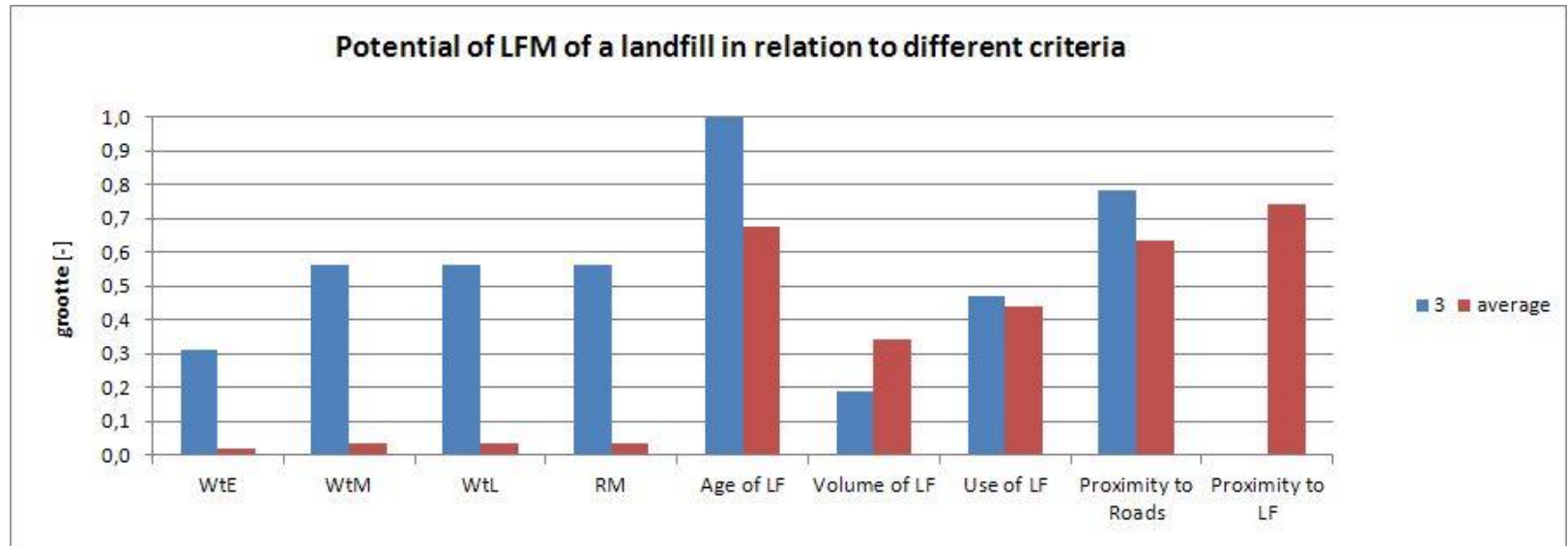


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Determination ELFM – potential – results



Estimation need to remediate – criteria (1/2)

- ▶ Starting point = Conceptual site model
- ▶ CSM = defining
 - Source – landfill
 - Different pathways (routes and exposure)
 - Receptor
- ▶ Source & receptor → criteria
- ▶ Routes & exposure → 2nd fase : soil investigation

Estimation need to remediate – criteria (2/2)

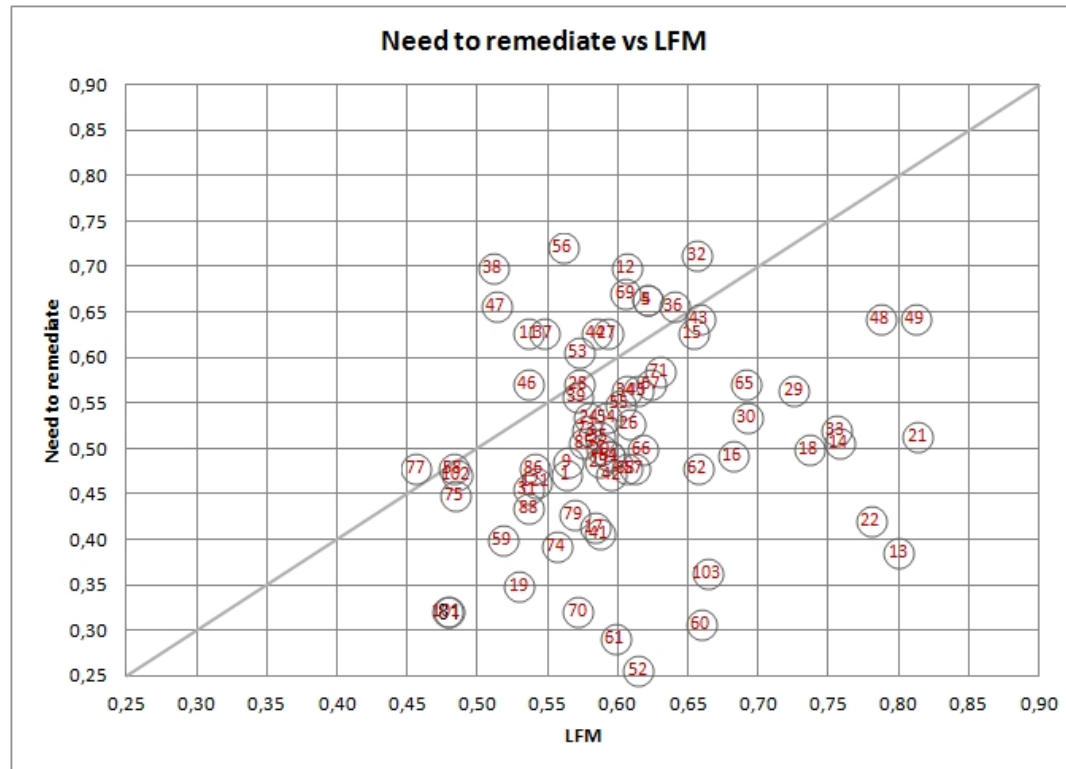
▶ Source

- Kind of landfill
- Period of landfilling
- Size of landfill

▶ Receptor

- Position of landfill vs residential, agricultural, industrial, recreational and ecological valuable area
- Vulnerability of groundwater
- Position of landfill vs surface water, water wells and flooding area

Results Flaminco 1.0



Problem : lack of economic data

- ▶ Van Passel et al. (2012)
- ▶ From remediation perspective
- ▶ Interviews
- ▶ MCA -> management tool
 - Methodology
 - Parameter selection
 - Conclusion

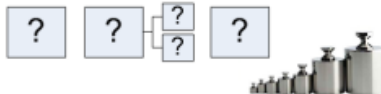
A. Methodology (MCA)

"Which one is the best?"

Step 1 : define the question



Step 2 : define alternatives to rank



Step 3 : define and weigh evaluation questions/criteria

?	3%	8%	2%	15%
?	1542	127	8	2624
?	high	medium	high	very low
?	yes	yes	no	no

Step 4 : Answers on evaluation questions/criteria

1	2.7	0.7	5
2.9	0.2	0.0	5
2	3	2	5
5	5	0	0

Step 5 : normalise the answers

↑
 D (4.0)
 B (2.8)
 A (2.6)
 C (0.9)

Step 6 : make weighed sums and rank

A. Methodology

- ▶ Development of a computerised management model
 - which assesses the economic feasibility of an ELFM project at a specific site
 - through multi criteria analysis (MCA)
 - via a set of socio-economic parameters
- ▶ Goal of the MCA:
 - calculating a single indicator for socio-economic feasibility,
 - enabling a ranking and benchmarking of case-by-case landfills

B. Parameter selection

- ▶ The evaluation questions/criteria in step 3 of the MCA consists of 21 socio economic parameters.
- ▶ The parameters are organized into 7 categories:
 - economic relevance,
 - social relevance,
 - project uncertainties,
 - environmental impact,
 - political and stakeholder support,
 - technical aspects and
 - time aspects.

B. Parameter selection

- ▶ Example of parameters within category 1 'economic relevance'
 - Economic relevance of material reuse
 - Economic relevance of energy recovery
 - Economic relevance of land reuse
 - Monetary cost benefit ratio
 - Quality indication of materials
 - Difference in value between current land use and use after mining
 - Accessibility
- ▶ For each parameter, a calculation method for estimating the parameter value is proposed.
- ▶ Based on normalized parameter values and on weights representing the importance of each criterion for a local situation, multi-criteria analysis can be applied.

C. Conclusions concerning management model

- ▶ Conclusions on the feasibility of ELFM projects are highly case specific and difficult to generalize
- ▶ Although a ranking of the site typologies learn which types are the most eligible.
- ▶ Sites can be divided into:
 - highly profitable,
 - viable and
 - non- viable sites
- ▶ Both in the current situation as for the future.
- ▶ Mainly for the viable sites, (financial) support should be offered by the government, as the highly profitable landfills will probably be taken up by the market itself (?)

C. Conclusions concerning management model

- ▶ Relevant sites requiring remediation are mainly:
 - landfills located in a residential zone and
 - used for household waste in the period 1950-1985.
- ▶ Relevant sites not requiring remediation are mainly:
 - landfills with more recent operation and
 - situated near natural, agricultural or recreational areas

Final use – interim use ? -> ELFM²

- ▶ Energy
 - Landfill gas
 - Solar parks
 - Windmills
 - Energy crops
- ▶ Surrounding
 - Nature, forest
 - Recreation (hicking, golf, ...)
- ▶ Residential (?)
- ▶ Industry (?)

ELFM² in Flanders



- ▶ **The outcome of the 2011-2015 EFLM-program ⇒ OVAM-concept note : Sustainable Resource Management of Landfills a.k.a. Enhanced Landfill Management and Mining (ELFM²) aims at a sustainable long-term management of landfill sites, including interim use and the valorization of both its content and its surface.**
- ▶ **Conditions of implementation :**
 - fitting into existing governmental budgets;
 - detection of common element with other policy initiatives;
 - following existing policy guidelines and similar initiatives;
 - fitting into current legislation as much as possible;
 - maximum cooperation and integration with external partners.
- ▶ **The long term strategy (50+ years) for EFLM²:**
 - impact approach : how to reduce or eliminate the possible negative effects of the landfill on its surroundings
 - resource approach : how to manage the resources of the landfill

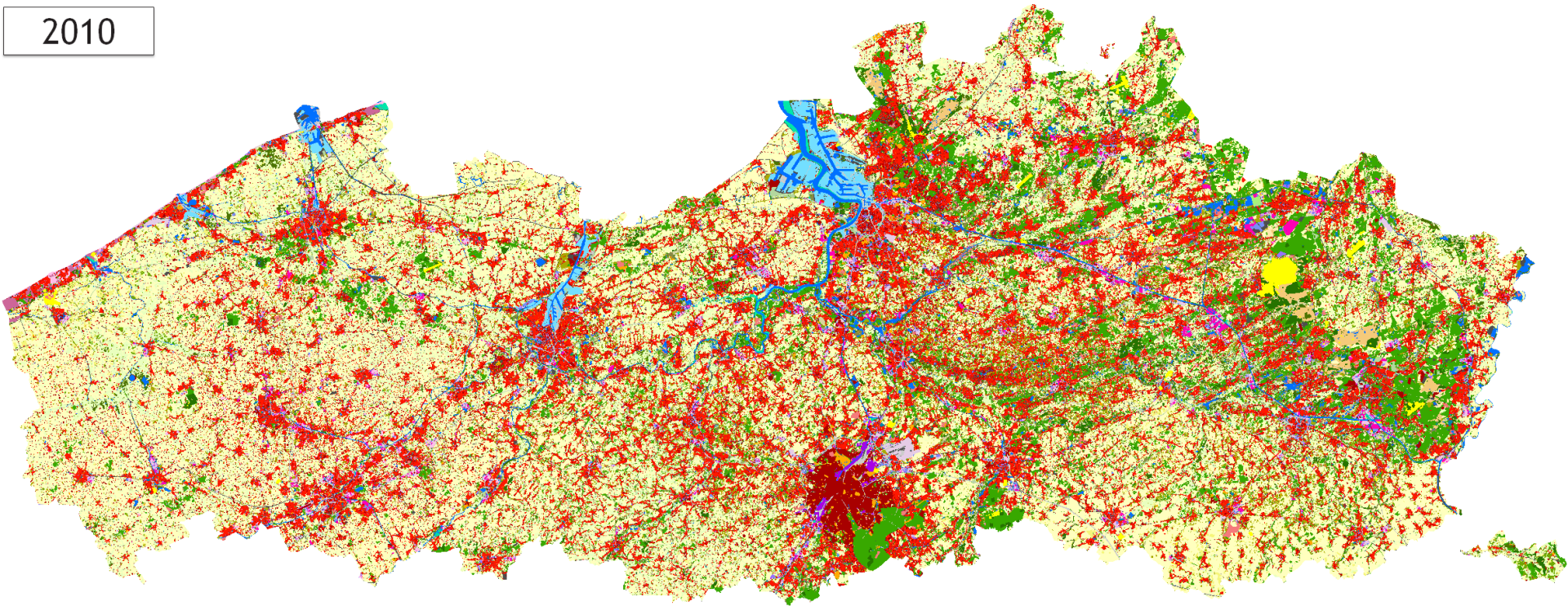
ELFM² and FLAMINCO

- ▶ **Mapping-part ELFM (3 step approach) : 2061 landfill sites**
- ▶ **Prioritisation is needed =**
 - FLAMINCO & other criteria
 - × Brownfield development
 - × Protecting water extraction zones
 - × Collaboration major cities
 - × Soil investigation in major residential areas
 - × Redevelopment need (VITO – Spatial model Flanders)
 - × Quick-wins
 - × Site-approach
 - × Creation of social added value
 - Short-term investigation
 - Other sites : monitoring & long term resource management

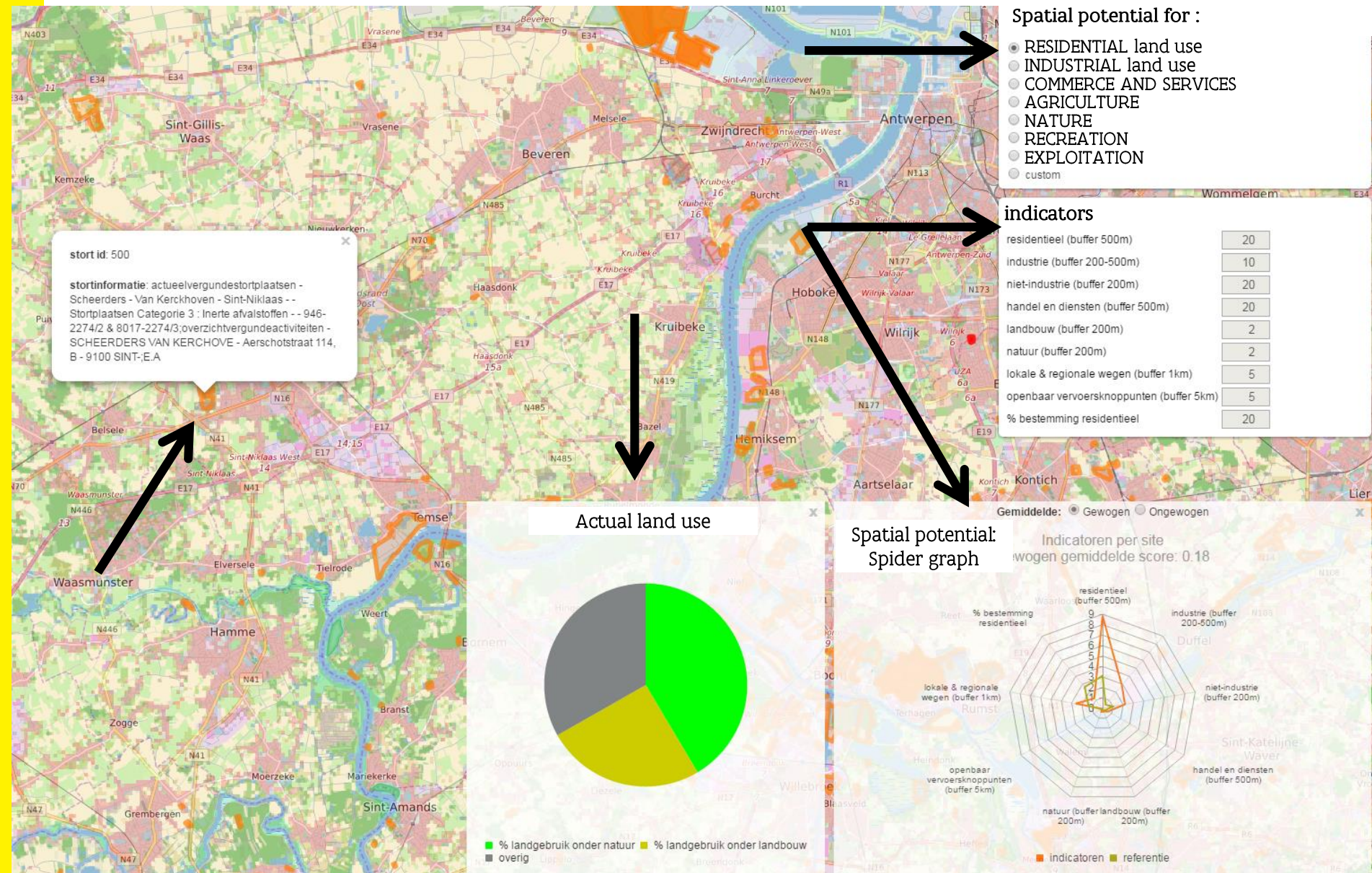
Decision support tool : SPIDER TOOL

- Spatial pressure in densely populated & constructed Flanders region

2010



SPIDER TOOL: webapplication



CONCLUSIONS

- ▶ **Combination of the decision support tool Flaminco and a special monitoring tool such as the *Ruimtemodel Vlaanderen* leads to interesting results :**
 - assessing the potential of a landfill site (interim and future use)
 - timing possible mining
 - timing redevelopment
- ▶ **Flaminco to v2.0 combining with an economic and technological aspect other tools** (material flow analysis (STAN), resource classification (UNFC), transportation and distribution (LAMBIT),...)
 - can provide extra information
 - better support for a sustainable resource management of landfill sites.
- ▶ **Sustainable interim use is an interesting option to consider for landfill sites where mining isn't feasible yet and when there are no environmental risks.**
- ▶ **Implementation of the sustainable landfill site management:**
 - more investigation and pilot cases
 - financing? collaboration with private partners

Thanks for your attention

Are there any questions?

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