

Diffuse soil contamination in Flanders

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Diffuse soil contamination in Flanders

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Diffuse soil contamination is high on the agenda



Why?

→ **Risks** for health of humans & ecosystems

Policy & legislation on soil contamination



In Flanders: **Soil Decree** (1995) – based on ‘*polluter pays*’ principle

The focus is on contamination ~ well-known point sources / risk activities

→ **Diffuse soil contamination** is not well covered

What is it? (working definition)

Diffuse soil contamination

≈ by **small activities** in the past

≈ from **dispersed** sources: atmospheric deposition, agricultural inputs, floods, ...

≈ covering **large areas**, difficult to demarcate, ...

Policy & legislation on soil contamination



Diffuse soil contamination causes problems in practice

- **legal uncertainties & unexpected costs, ...**

- excavation works



- soil investigations

Content



Introduction - Timeline

1. Results from an inventory study
2. Translation into policy proposals
3. Measuring campaign roads and railways
4. Maps & tools

Conclusions - Way forward

An aerial photograph of a rural landscape. A paved road curves through the scene, bordered by a grassy ditch on one side and a line of trees on the other. The surrounding fields are lush green, and the sky is filled with soft, white clouds. A large yellow triangle is overlaid on the left side of the image, containing the text.

Introduction Timeline

What have we done sofar?



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2013
Workshops
at OVAM



2018-2021
Inventory
study &
Roadmap



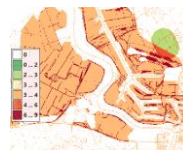
2023
Information
& Soil
certificate



2015 - Tool
« Healthy
from our
own soil »



2022-...
Tools &
maps



2024
Measuring
campaigns:
Roads &
railways;
Agriculture;

...



1. Inventory study



Overview



A policy study with 4 parts:

1. **inventory** all existing data:
 - possible sources / substances of diffuse contamination
 - available measurement data
 - supporting data (e.g. emission data, cartographic data)
2. estimate the potential **impact**
3. overview of European policies
4. **proposal for a policy** in Flanders, including a prioritization

Inventory

- confirmed relation (in literature)
- possible relation
- no relation



1. Sources and substances

	Natural sources	Transport	and livestock farming	construction materials and infrastructure	Households and services	Industry	Energy	waste	other
substances	weathering of minerals and ores volcanic eruptions space dust and meteorites sweetening of groundwater raw fossil fuels wildfires biogenic not specified run off (recycled) car tyres leaded petrol exhaust fumes guardrails brakes shipping aviations trams railways agrochemicals animal anure fertilizer compost/ vegetable fertilizers aquaculture general Building shells roofing coatings tar-containing asphalt (production of) paint embankments pipes high voltage pylons foundation of rouds concrete and cement wood preservation synthetic turf fields greenmaintenance private use of pesticides woodstoves and backyard barrel coal ashes utensils electical appliances plastics personal care products crematoria disease control recycling of batteries metallurgic industry galvanisation scrap-processing general industry hair cutting plants textile industry (petro)chemical industry cement, glass, brick and asphalt production of asbestos paperindustry chipboard production mining phosphate industry production of pesticides burning of fosil fuels electrical installations solar cells waste incineration waste water landfills/illegal dumping sites irrigation or fertilizing with waste fires								
metals	■								
PAH	■	■		■	■				
Mineral oil		■							
Pesticides									
PCPP									
PCDD and PCDF	■	■		■					
PCB's		■		■	■				
Flame retardants		■		■	■				
Plasticizers		■		■	■				
PFAS		■		■	■				
Asbestos	■	■		■	■				
nano- en microparticles		■		■	■				
Radionuclides		■		■	■				

Inventory

2. Measurement data

- Direct data
 - × Database soil studies, groundwater monitoring, scientific studies
- Indirect data
 - × International studies, studies about fertilizers, surface and wastewater, biota, air, humane biomonitoring,
- Maps
 - × Flanders: Spatial Model, use of agricultural land, railroads,...
 - × Emission data: environmental reports, studies about tier wear, antibiotics,...

Which data exist?

Are the data available?

Can we learn something from this data about diffuse soil pollution?

Inventory



3. Qualitative assessment of impact

▶ Qualitative impact: Large – moderate –limited

▶ Criteria:

- Expected soil/groundwater concentrations
- Potential affected area
- Potential effects of substances
- Potential exposure of receptors

▶ Sources divided into categories:

transportation	industry
agriculture and livestock	energy
Building materials/ infrastructure	waste
households and services	secondary sources

▶ For each source: in which area could we expect an impact of which substance?

Conceptual site model

Primary source

Pathways

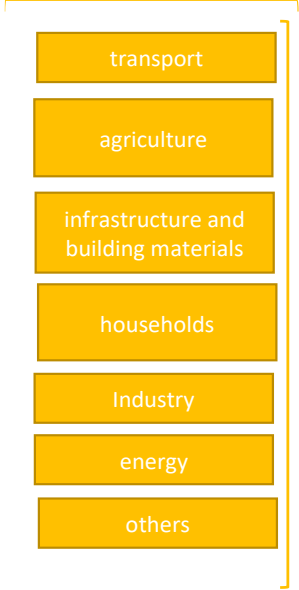
Suspected areas

Secondary sources

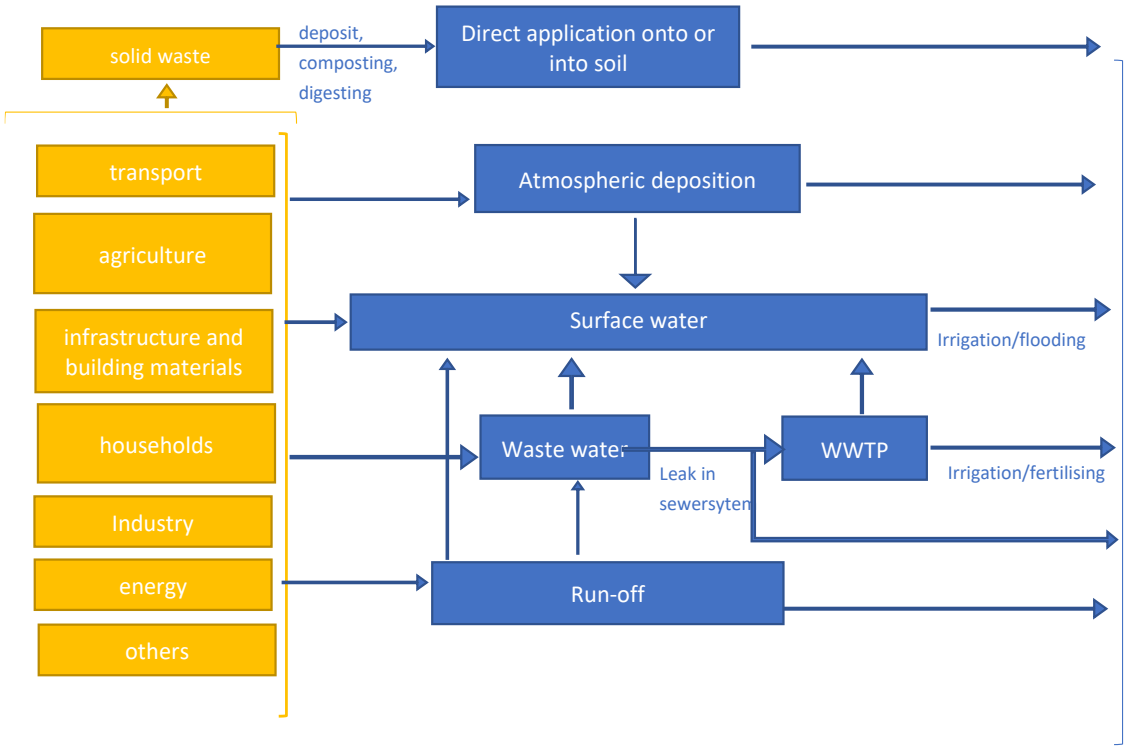
Conceptual site model



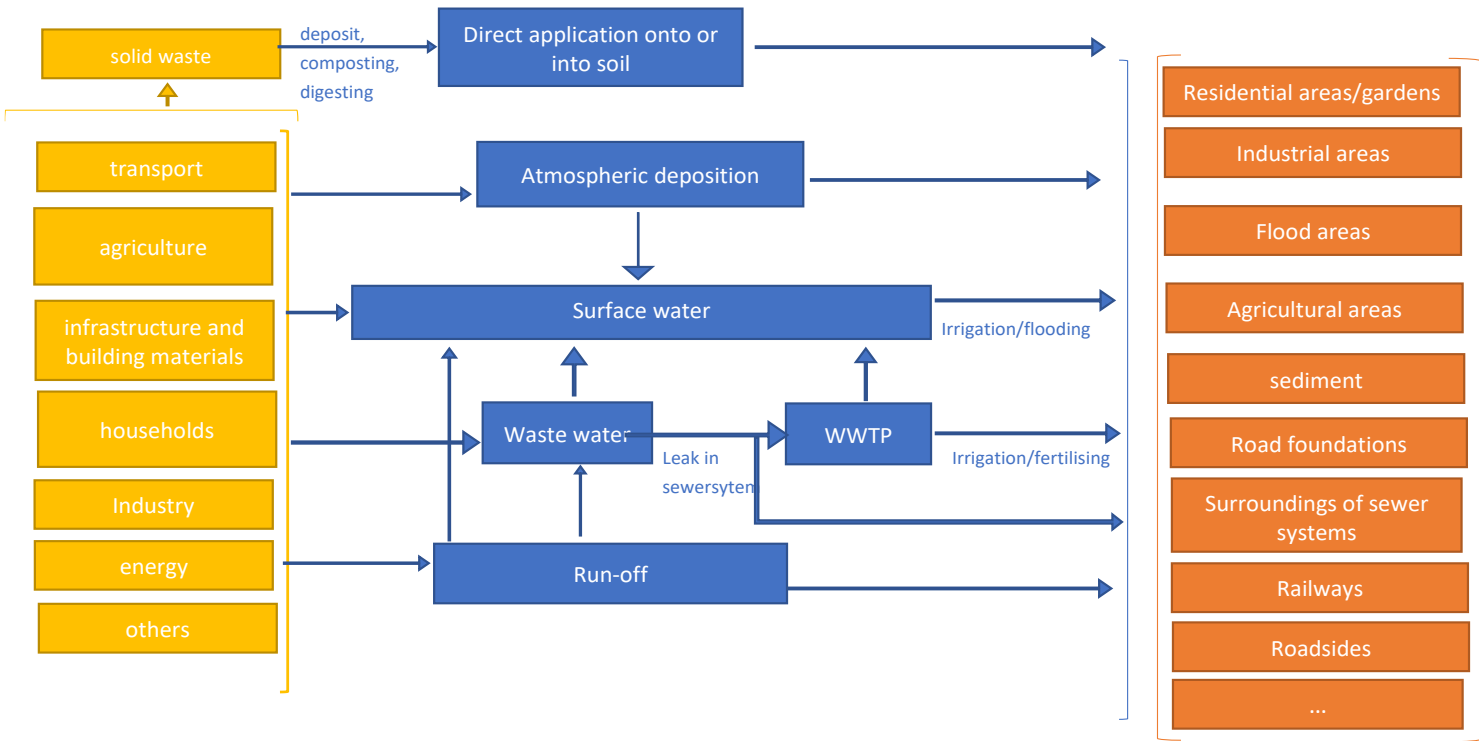
solid waste



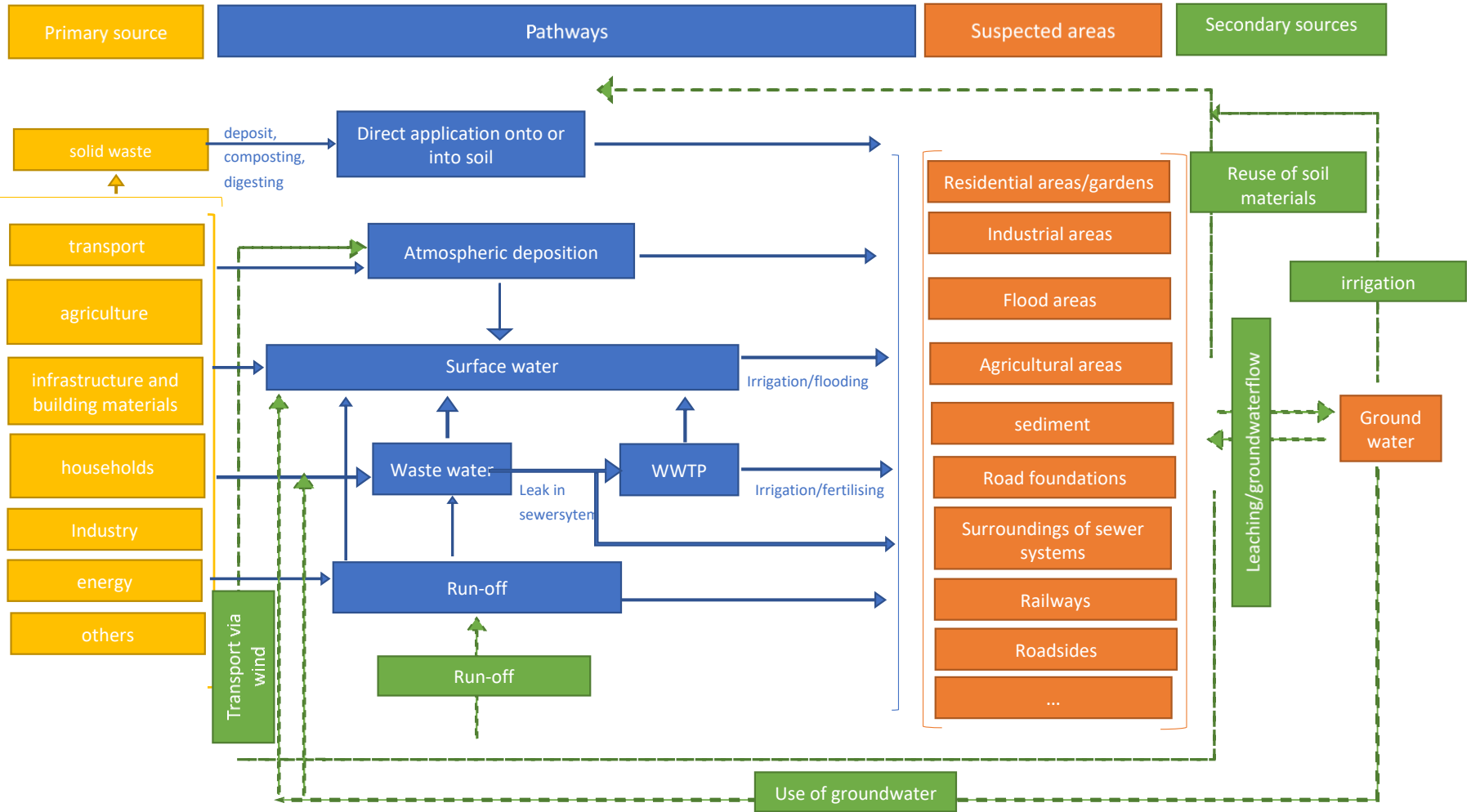
Conceptual site model



Conceptual site model



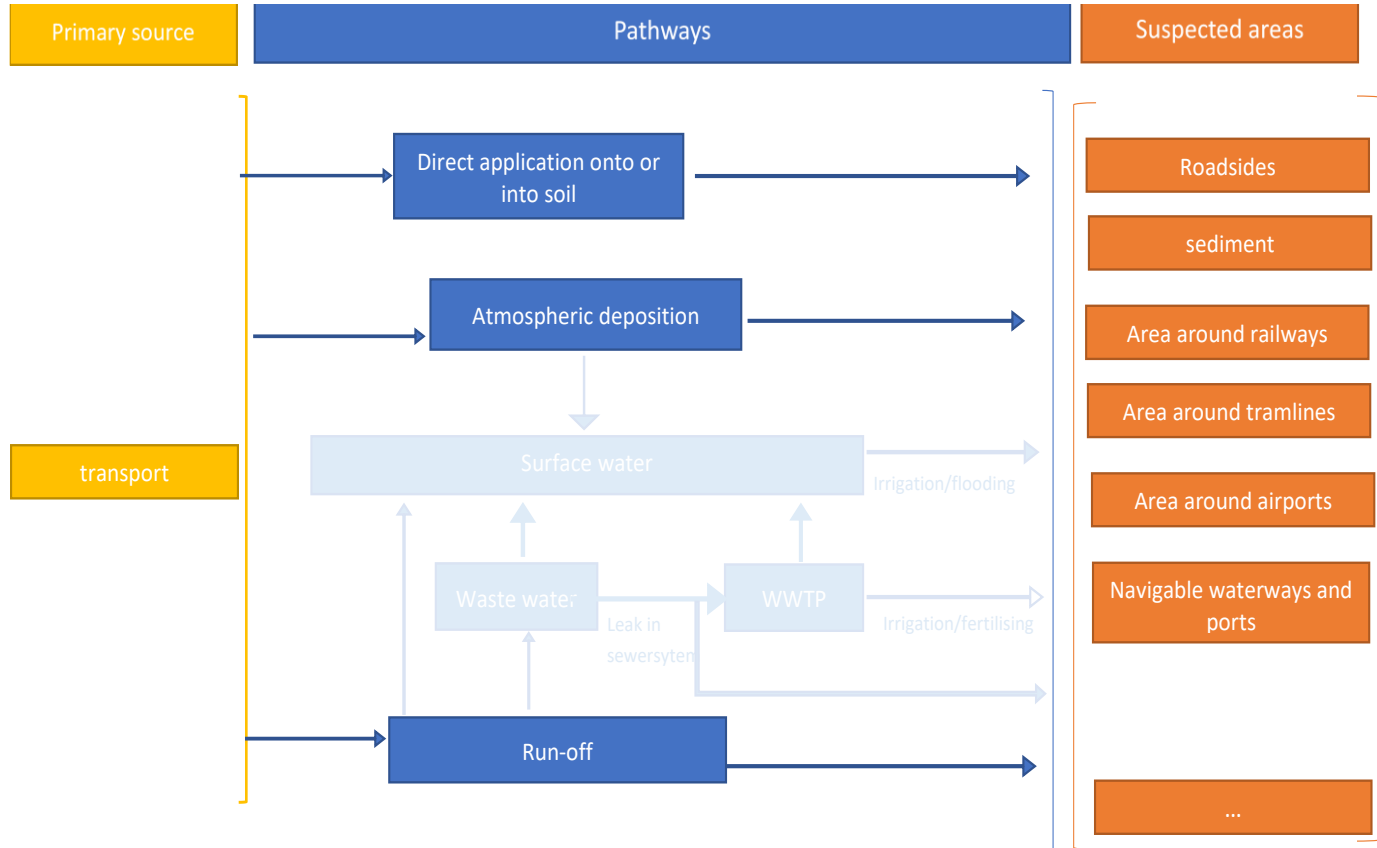
Conceptual site model



Inventory

3. Qualitative assessment of impact

Conceptual site model for each **category** - e.g. transport



Inventory

3. Qualitative assessment of impact



Table with detailed information for each category

Suspected area	Substances	Most important sources	Impact	Motivation	Possible gaps or uncertainties	Possibilities for supporting evidence of the impact
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Suspected area	Substances	Most important sources	Impact	Motivation	Possible gaps or uncertainties	Possibilities for supporting evidence of the impact
Building surroundings	Heavy metals	Paint (lead), gutters (zinc, copper)	Moderate	Multiple references in the literature. Flanders covering, but rather a local problem, near the building	Difficult to determine exactly which buildings are suspect. Rather considered Flanders-wide	<ul style="list-style-type: none"> Further delineation of suspected buildings based on year of construction. More recent buildings should no longer contain asbestos, lead-based paint or PCBs. Ongoing study mapping asbestos roofs Analysing data available data gardens (zoderr is gezonder project)
	PCB	seals	moderate	Multiple references in the literature, concentrations up to 34 mg/kg dw, Rather local effect near the building	Difficult to determine exactly which buildings are suspect. Rather consider Flanders-wide	
	Asbestos	Roofs and exterior cladding (slates)	moderate	drip zones - known problems local effect	Difficult to determine which buildings are suspect. Materials containing asbestos have not been inventoried centrally.	
	Plasticizers	Plastic joinery and roofing	Limited	Theoretical link, emissions from plasticizers are estimated to be low	Difficult to determine exactly which buildings are suspect. No measurement data	
	Flame retardants	Plastic joinery and roofing	limited	Theoretical link, emissions for flame retardants are estimated to be low	Difficult to determine exactly which buildings are suspect. No measurement data	
Vicinity of solar cells	metal/metal nanoparticles	Run-off/weathering of solar panels	limited	If there is an impact: rather local.	very little measurement data, no link confirmation for the heavy metals.	/
Area around high voltage pylons	Zinc	High voltage pylon	Moderate	Literature data range from 200 to 17,400 mg/kg. Across Flanders, but rather local at the pylons.	Measurement data in literature are quite old (1980s).	/
Area around fences	Heavy metals	Metal or galvanized fences	limited	Across Flanders, but expected impact very local at the posts/fence	Difficult to locate	/

Inventory

Summary qualitative assesment of impact (theoretical)

Source Category		Location with possible large impact
Transport	▶	Roadsides, railroads, waterways
Agriculture and livestock	▶	Agricultural land
Building materials and infrastructure	▶	Regions where asbest was processed, reuse of demolition material
Households and services	▶	Gardens and public green spaces, building heating, open fires
Industry	▶	Surroundings of industrial areas
Waste (water)	▶	Sediments and banks, floodareas, agricultural areas
Reuse of Soil	▶	Levelled land and reused soil

2. Translation into policy proposals



Policy

3 pillars for improvement/optimisation

1. **Gain more insight in sources and substances causing diffuse soil pollution**

- Improve data accessibility: use existing data more efficient
- Use and expand existing monitoring networks
 - Groundwater monitoring networks
 - Surface water monitoring
 - Sediment monitoring
- Optimise use of existing management and control systems
 - Reuse of sediments, soil, manure, compost,... on land
- Specific measuring campaigns
 - Usefulness of a soil monitoring network?
 - Validation of impacts, evolution, etc

Policy

3 pillars for improvement/optimisation

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2. Fill gaps in instruments of the existing policy

- Evaluate the need for specific legislation/guidelines/investigation and remediation strategies to deal with diffuse pollution (versus point source pollution)
- Optimise existing instruments to deal with diffuse pollution (f.e. Soil Certificate)

3. Raise awareness and inform citizens on diffuse pollution

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Policy

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Aim of the new policy:

- provide essential **information** to owner / user / buyer / ...
to verify that a site is **fit for the intended use**
- provide **tools / solutions** to deal with diffuse soil contamination
(**risk management** and **awareness raising**)

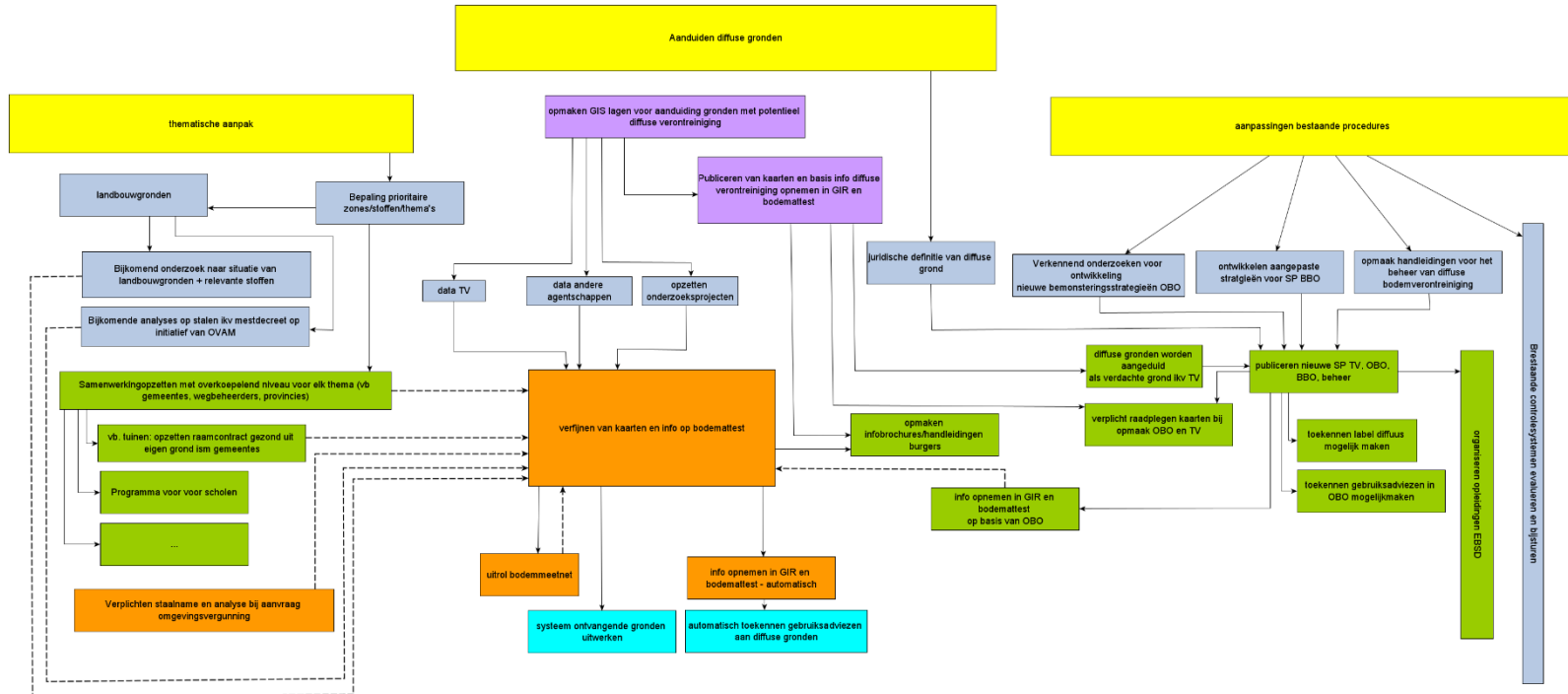
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Policy



Different scenarios for implementation
Workshops with stakeholders
Resulting in roadmap, including prioritization



Policy

Focus

- Identification of “diffuse polluted soils” (= soils with potential presence of diffuse pollution)
- Optimisation or clarification of existing procedures and guidelines to include the investigation of diffuse pollution (f.e. atmospheric deposition)
- Thematic approach
 - Prioritize themes (source categories/sectors)
 - sensitive uses (residential, recreational, agricultural)
 - Develop specific strategies per theme
 - Area oriented approach (f.e. municipality, railways,...) (versus parcel approach)

3. Measuring campaign roads and railways

Exploratory measuring campaign

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Aim of the study

- Gain more insight in diffuse contamination along roads and railroads
 - Do we find diffuse contamination?
 - For which compounds – including emerging contaminants (microplastics, tire additives,..)?
 - How far from the road/railroad?
 - How deep?
- Estimate the extent of the problem and impacted areas

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Exploratory measuring campaign



Method

- Literature review and review of existing data
 - Identify relevant compounds and their importance – including emerging contaminants
 - Identify pathways to soil
 - Analytical options (lab)
- Drafting a sampling plan
 - Select compounds and sampling locations
 - 10-15 locations next to highways, main roads and railroads
- Sampling and analysis
- Evaluation of results

4. Maps & tools



Maps & applications for diffuse soil contamination

Development of a tool,
using Spatial Model Flanders

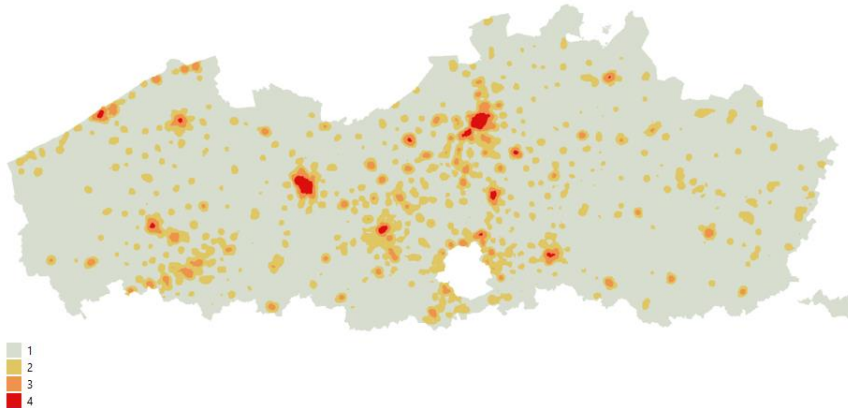
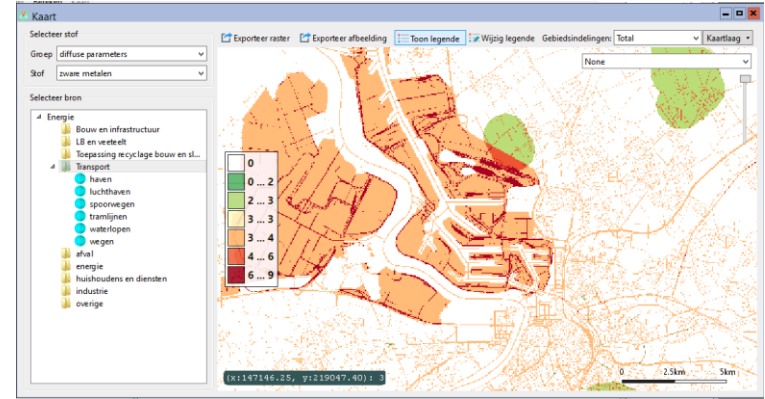


→ translating data into **maps**, + zones of influence

→ how to combine **different layers**:

≠ parameters

≠ sources



→ refine **impact analysis**

e.g. transport:

population hotspots

<10m away from roads

Maps & applications for diffuse soil contamination

Workshop 4:

“From point measurements to regional assessment:
using spatial analysis to map diffuse pollution”

A photograph of a plowed field with a line of trees in the background and a yellow graphic overlay on the left side. The field is filled with dark brown, clumpy soil, suggesting recent plowing. The trees in the background are green, indicating a spring or summer setting. The yellow overlay is a large, irregular shape that covers the left side of the image.

Conclusions – Way forward

Conclusions – Way forward



We need a policy on diffuse soil contamination

- (1) because of **risks** for human health & the environment
- (2) **to solve difficulties** in the management of contaminated sites

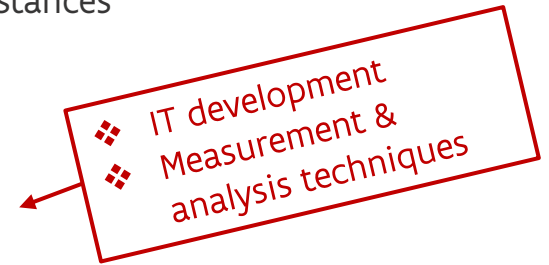
- (3) to **prevent** more diffuse soil contamination in the future
→ awareness raising & more carefully use of substances

For ‘legacy’ of diffuse soil contamination

- **avoiding risks** and **further spreading**
information & recommendations, maps & tools, ...

- **remediation** in case of unacceptable risks
in balance with protection of soil health

- **(co-)fundings systems** to distribute costs fairly





Thank you!



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