



# *Contaminated soils in the Netherlands: a change in perspective*

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## *Soil Protection Technical Committee (TCB)*

Permanent advisory committee

National government

Soil Protection Act

Technical/scientific aspects of environmental  
policy regarding soil and ground-water

## *Content*

- The Dutch delta
- Soil contamination: history and examples
- Soil policy and legislation
- Risk based approach: toxicology and assessment
- Standards, soil management, soil remediation
- The 'so what?' question and ecosystem services
- Conclusions

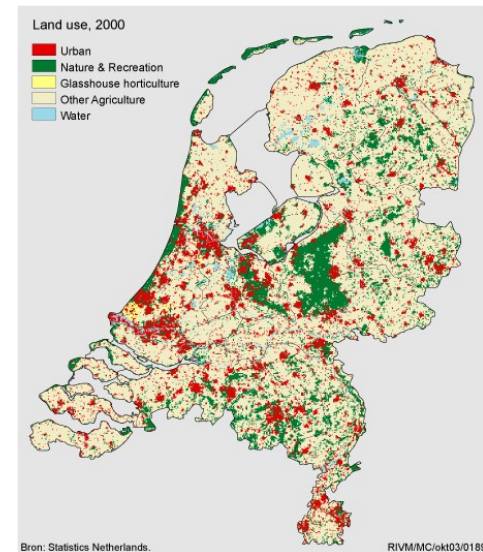


## EUROPE NIGHTTIME LIGHTS



## *Dutch delta (1)*

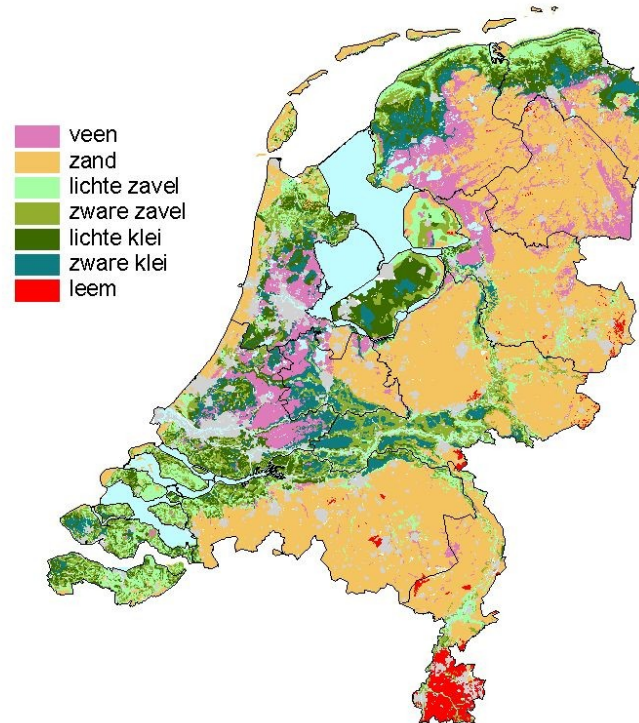
- » Rapid urban development (Netherlands 400 inh./km<sup>2</sup>)
- » Infrastructural projects
- » Preservation of natural areas
- » Industrialized (historic and present)
- » Intensive land-use and turnover
- » Public awareness for environmental issues
- » Many stakeholders



LAND USE	%
AGRICULTURE / NATURE	80
RESIDENTIAL	10
INDUSTRY	3
INFRASTRUCTURE	2
RIVERS / LAKES	5

## *Dutch delta (2)*

### Grondsoortenkaart Nederland



Soil types:

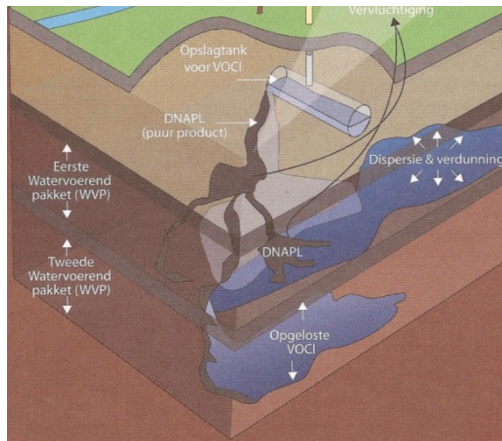
Clay (green)  
Sand (brown)  
Loam (red)  
Peat (purple)



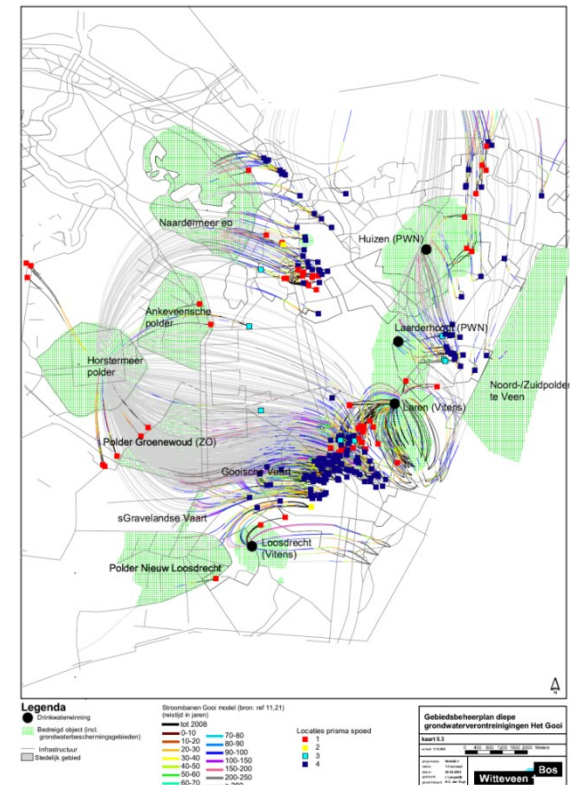
*Example in peat soil.  
Volgermeerpolder, former dump-site of chemical waste*



# *Example on sandy soil: groundwater contamination by chlorinated hydrocarbons due to dry cleaning*



Source: SKB cahier



Source: Witteveen+Bos

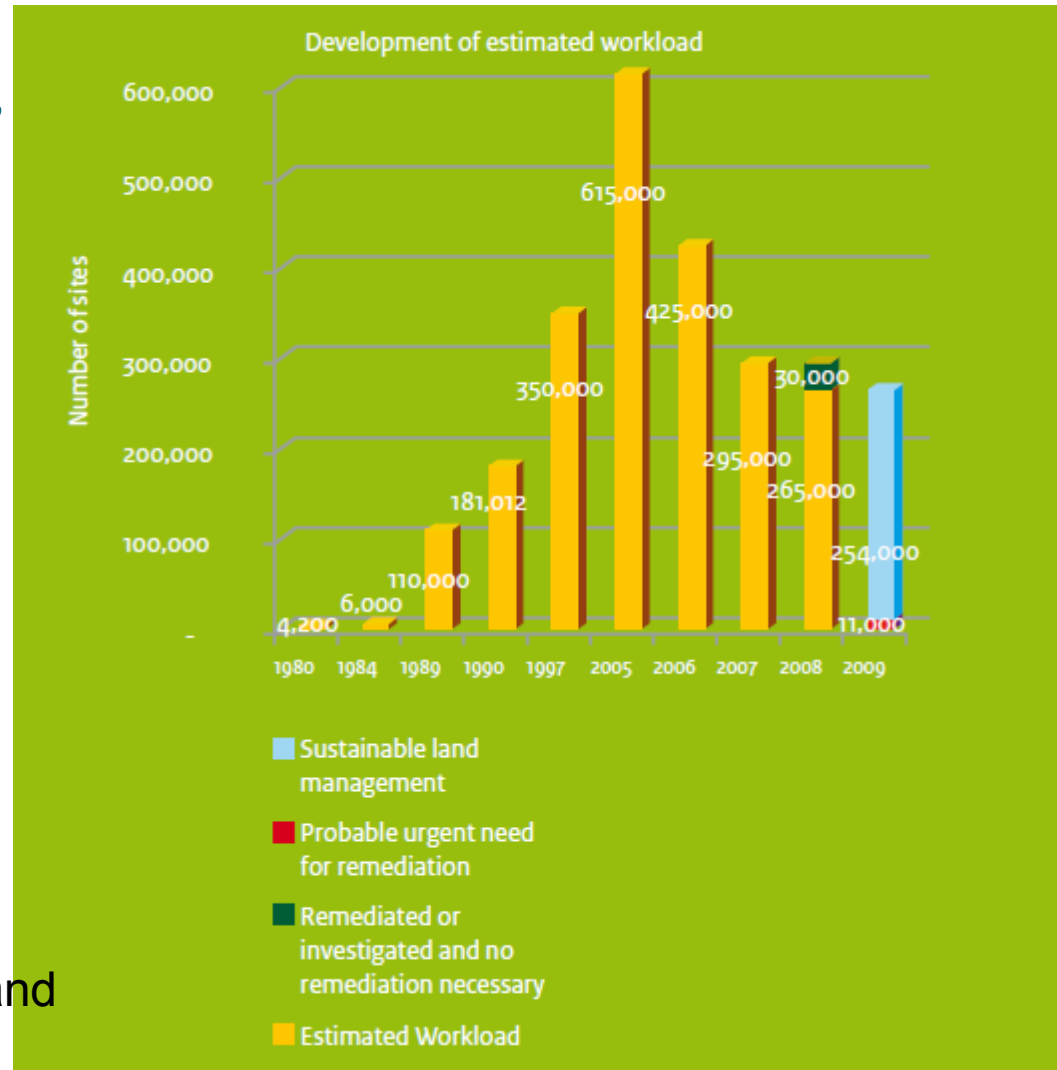


## *Development of estimated “workload”*

1980: case Lekkerkerk



1983: “Gifatlas” 1500 sites



Source: Into Dutch Soils, 2010,  
Ministry of Housing, Spatial Planning and  
the Environment

## *Dutch soil policy and regulations*

### Soil policy letter 2003 (“Beleidsbrief bodem”)

- Soil quality: biological, physical and chemical
- Soil use and soil function are leading
- “Rationally coping with risks”
- Responsibilities at local scale

# *Dutch soil policy and regulations*

## 1) **Prevention**

Decree and guidance on soil protection measures

## 2) **Remediation:** *suitable for use in 2030*

Circular soil remediation (2006, adapted in 2009) focusses on severely contaminated soil and describes the Soil clean-up decision criterium

Historic cases before 1987

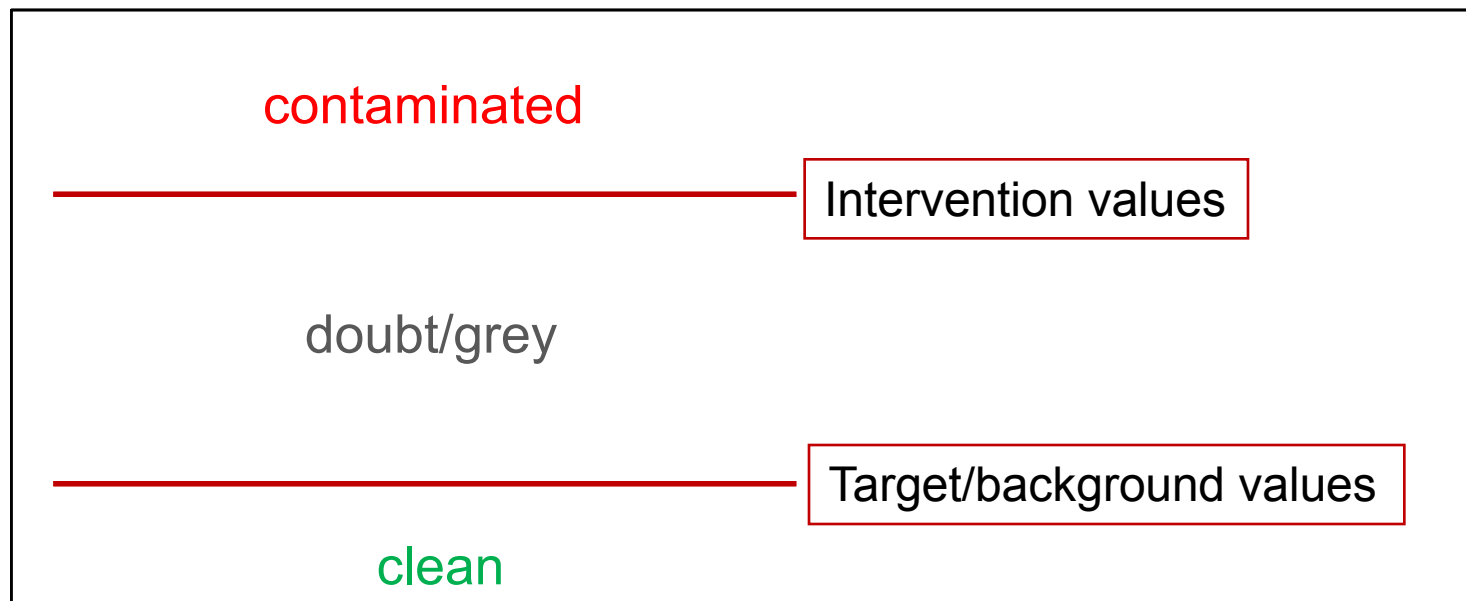
## 3) **'Sustainable management'**

Soil quality decree 2008: describes the generic and local decision criteria for soil and sludge allocation.

Fit for use and stand-still.



## *Standards: good, bad and ugly*

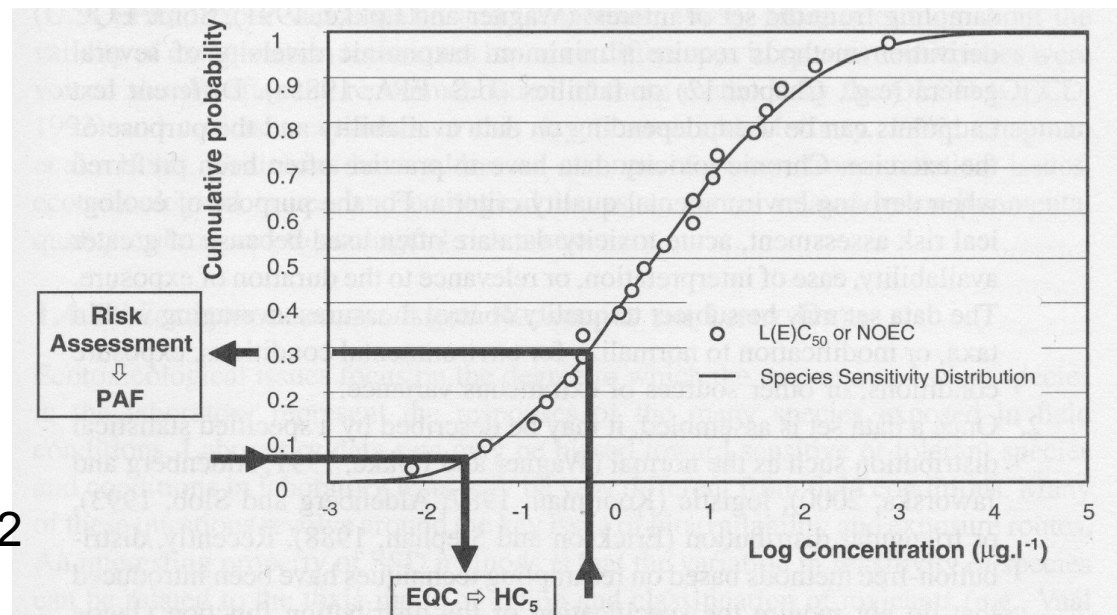


## Standards: ecotoxicology

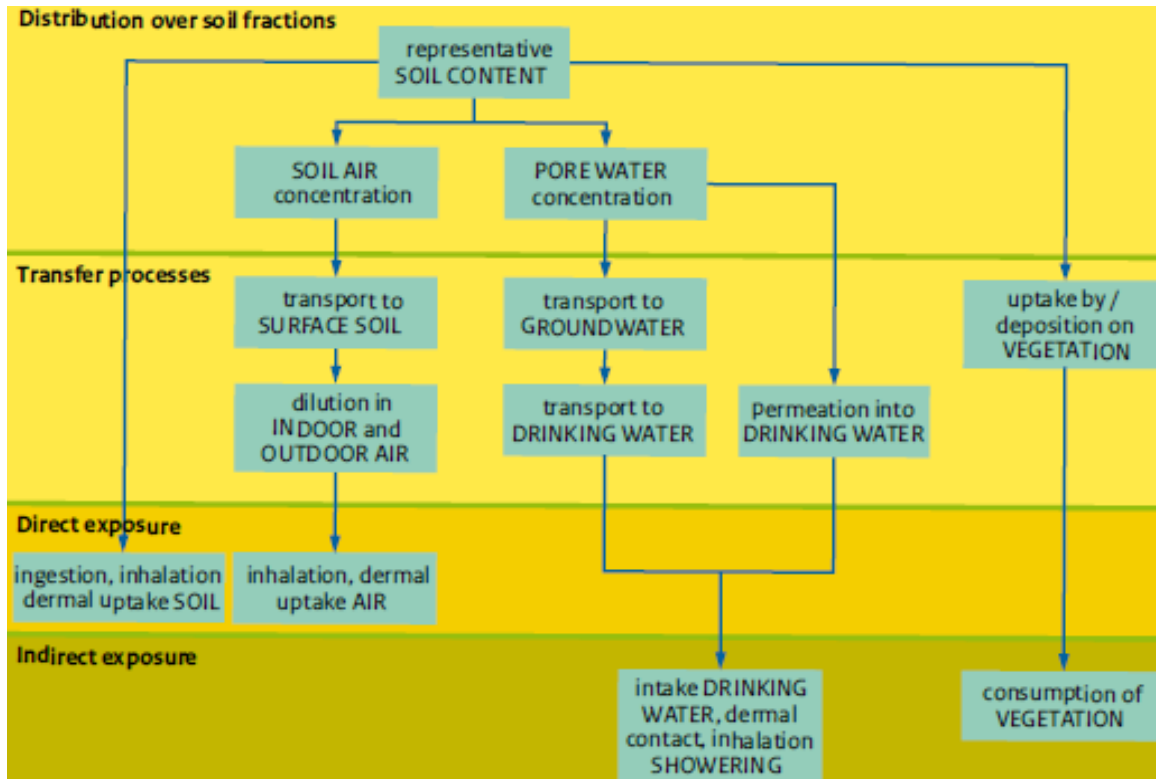
- End 1980's onwards
- Recognition of the importance of soil ecology for soil functioning, also in soil regulation (e.g. Dutch Soil Protection Act)
- Development of standardized soil test methods
- Introduction of Species Sensitivity Distributions



From Posthuma et al. 2002



# Human exposure (Csoil model)



Soil contamination

Soil use scenario

Exposure calculation.

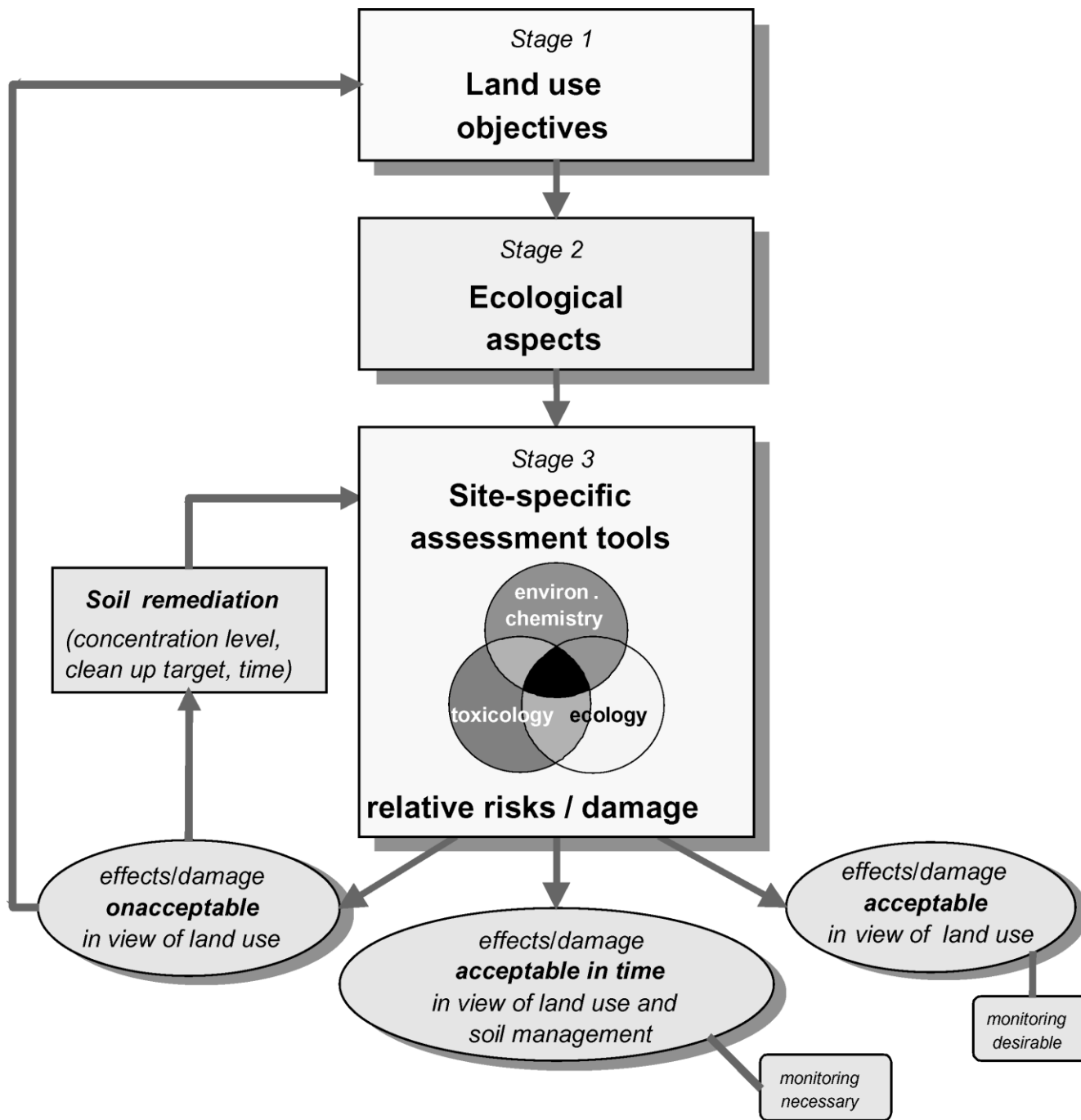
Compare with health criterium TDI

Picture from: Into Dutch Soils, 2010, Ministry of Housing, Spatial Planning and the Environment



## *Dutch Clean-up decision criterium (“Sanscrit”)*

- Step 1: severely contaminated? (Intervention value)
- Step 2: unacceptable risks?  
(simple risk assessment)
- Step 3: unacceptable risks?  
(refined risk assessment)



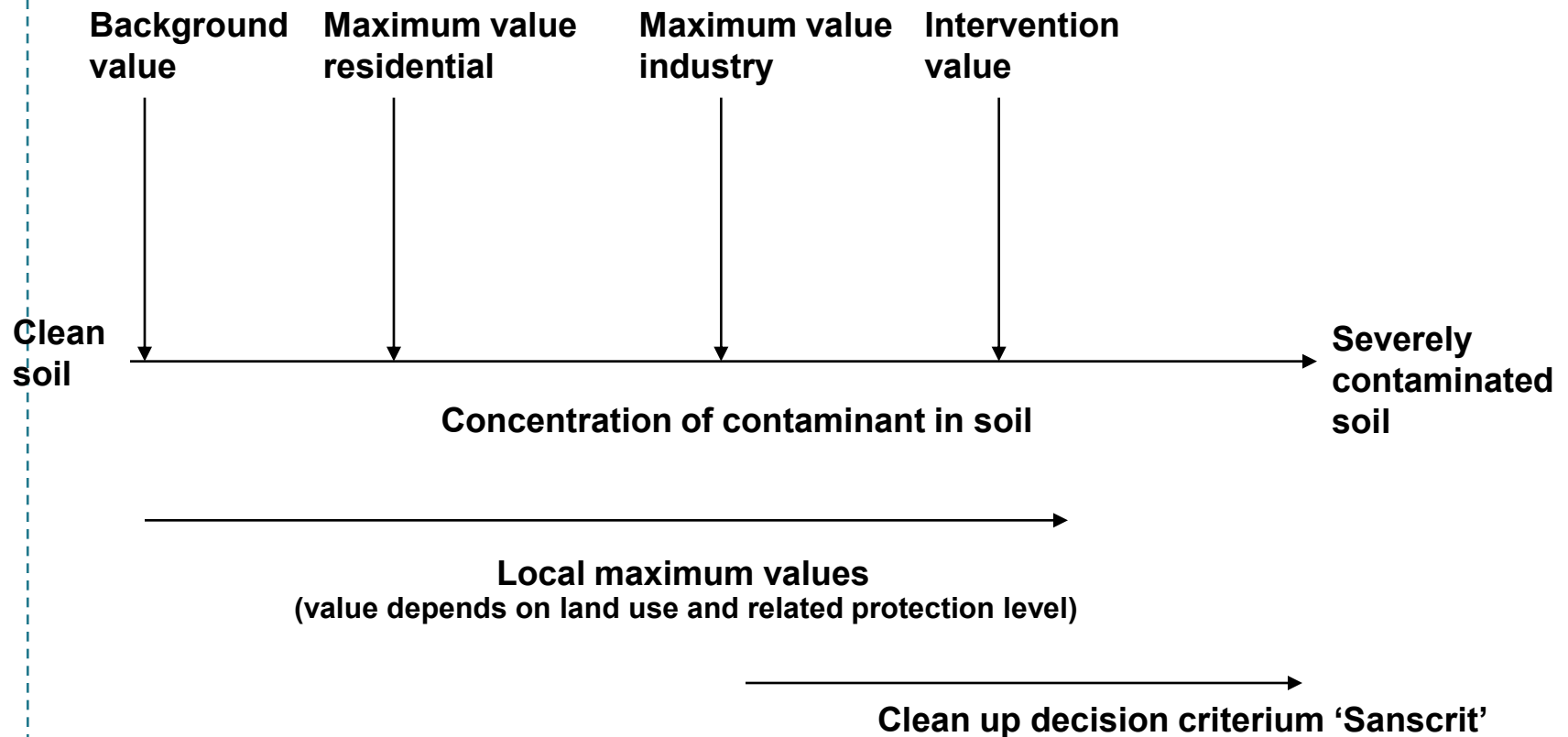
## *‘Sustainable management’: re-use of soil*

- Yearly demand for 80 to 100 million tons of soil
- 70% from primary sand winning
- 30% reuse of clean or slightly polluted soil



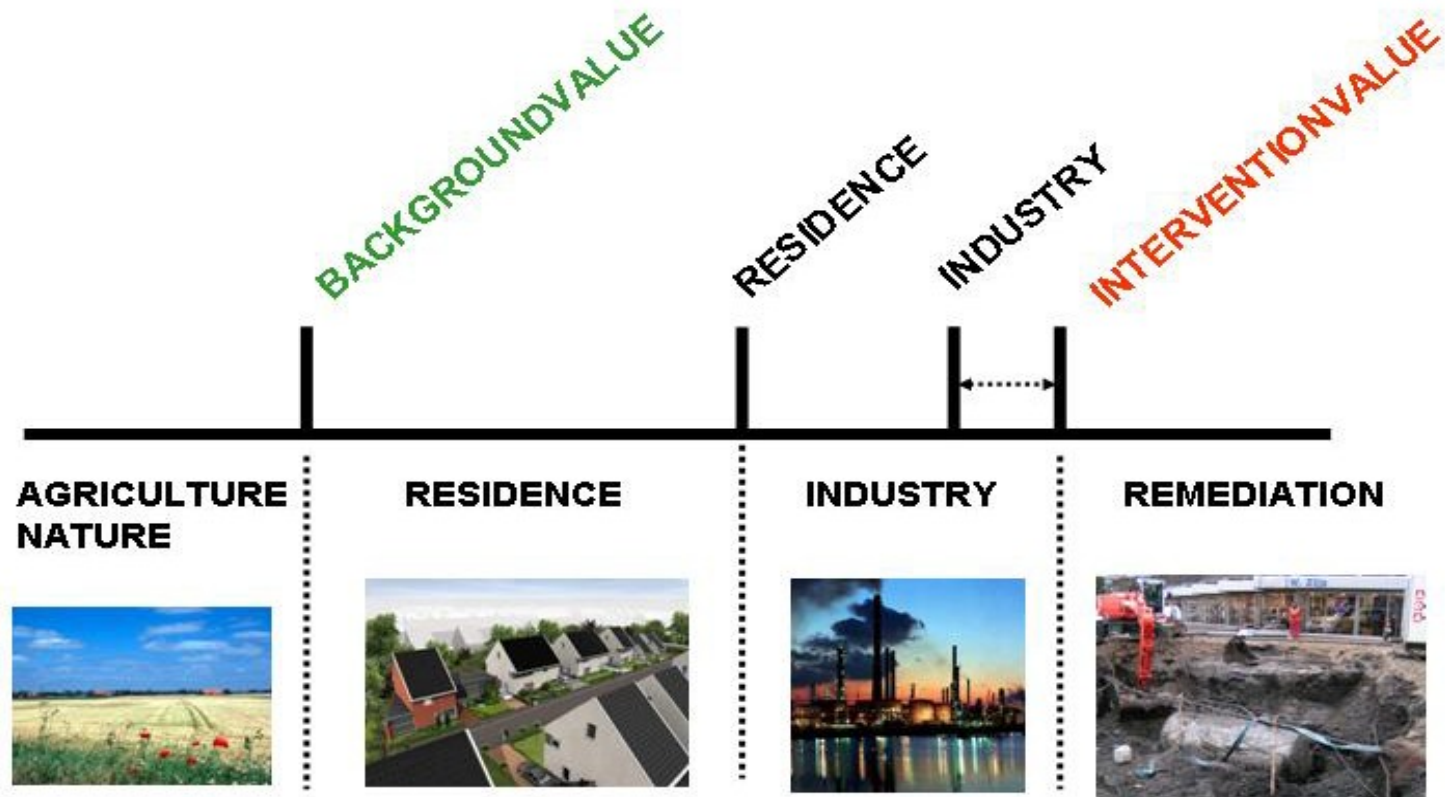
## *Dutch soil quality standards*

*according to soil quality decree 2008*



Based upon:: Wezenbeek, 2007. Know the quality of your soil or aquatic sediment: clarifying the risks. Senternovem publication reference 3BODM0704

## *Dutch soil quality standards (2)*

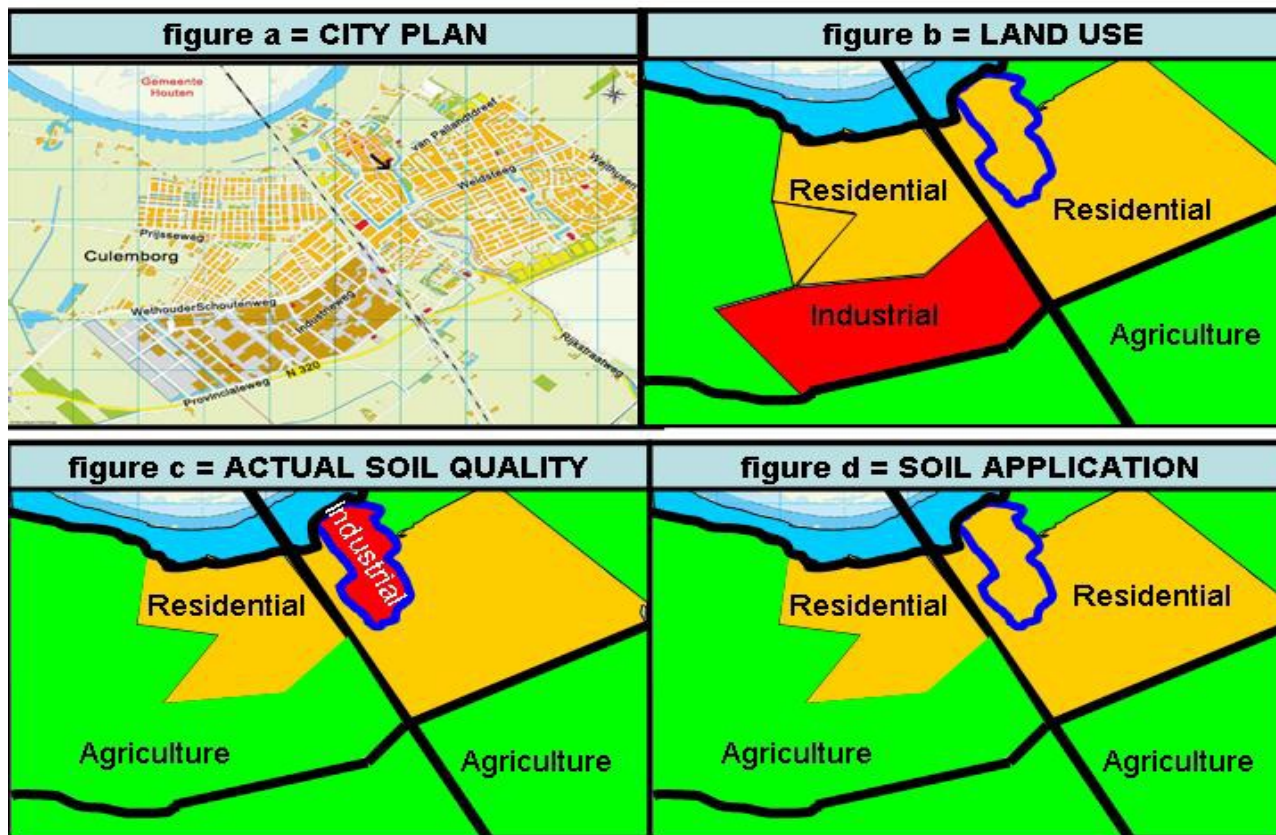


## *Some soil quality standards in mg/kg dw*

Contaminant	Background value	Residence	Industry	Intervention value
Arsenic	20	27	76	76
Cadmium	0.6	1.2	4.3	13
Cobalt	15	35	190	190
Copper	40	54	190	190
Mercury	0.15	0.83	4.8	36
Lead	50	210	530	530
Nickel	35	39	100	100
Zinc	140	200	720	720
PAH	1,5	6,8	40	40
PCB	0.02	0.02	0.5	1
Mineral Oil	190	190	500	5000



# *Nationwide policy for re-allocation of soil*

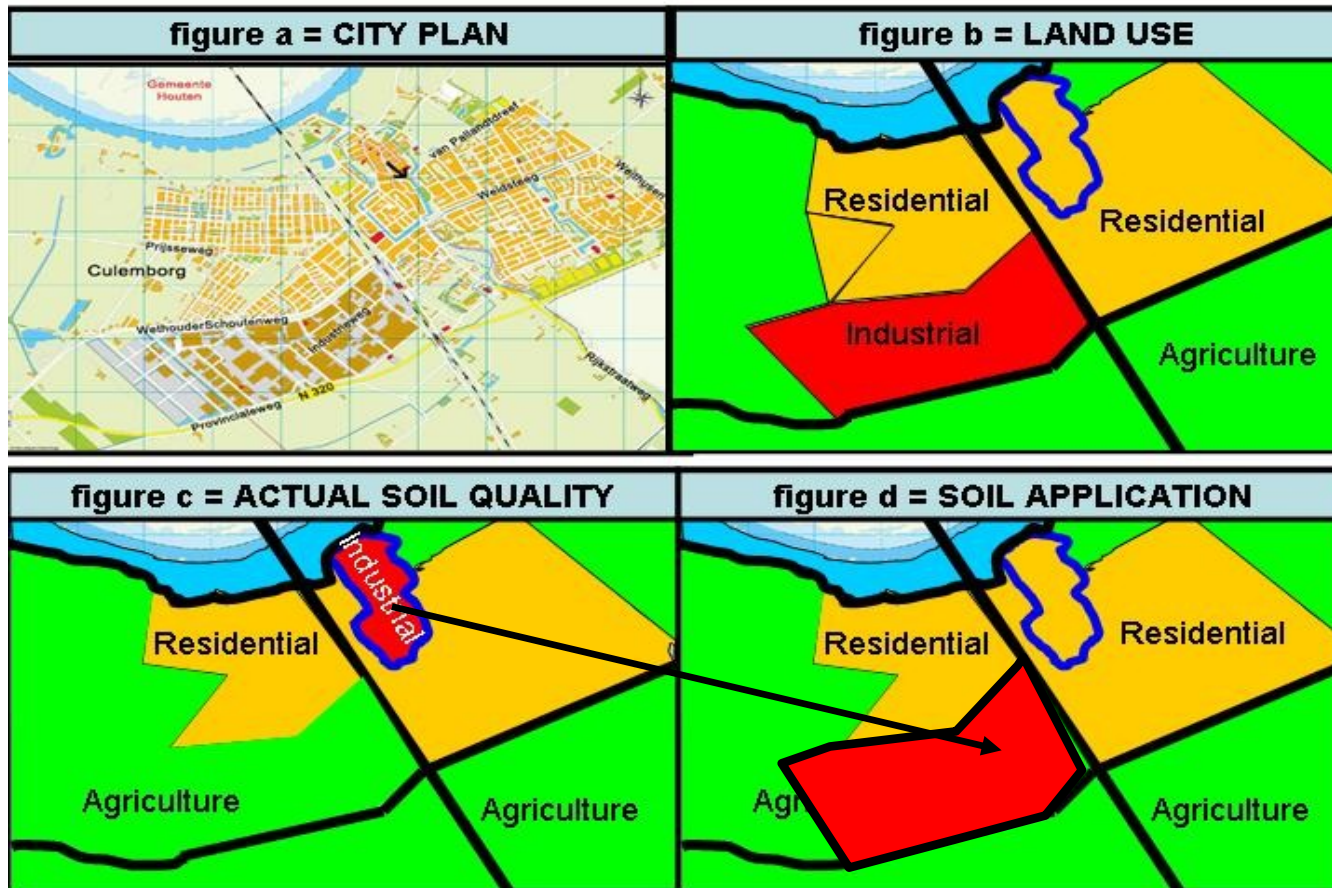


Criteria:

-Fit for use

-Stand still

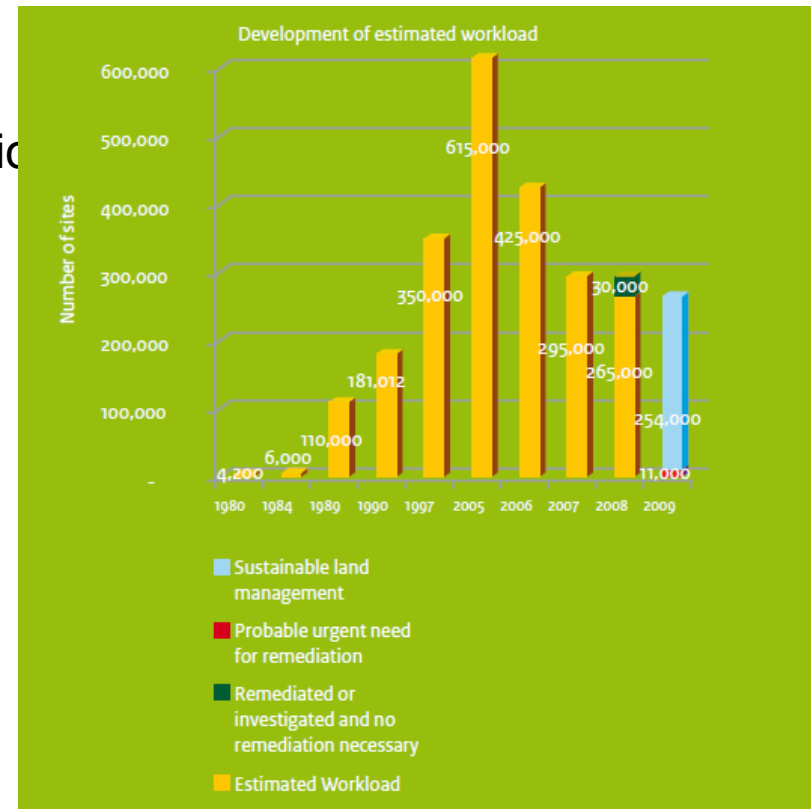
## Local soil policy





## *Where do we stand now?*

- Soil remediation operation is considered almost completed
- 2000 sites need urgent risk reduction
- 400 human health: before 2015
- Other: focus on sustainable land management
- Aria oriented approach
- Local government leading
- Stakeholder participation
- Soil management is part of spatial planning issues





## *Draft Soil Framework Directive*

### Services\*

- Biomass production, including in agriculture and forestry
- Storing, filtering and transforming nutrients, substances and water
- Biodiversity pool
- Physical and cultural environment
- Source of raw materials
- Carbon pool
- Archive of geological and archeological heritage





### Threats\*\*

- Loss of organic matter
- Compaction
- Sealing
- Erosion
- Flooding and land slides
- Salinisation
- Contamination
- Loss of biodiversity

\*In SFD these are called functions

\*\*Loss of biodiversity is not included as a separate threat in the SFD

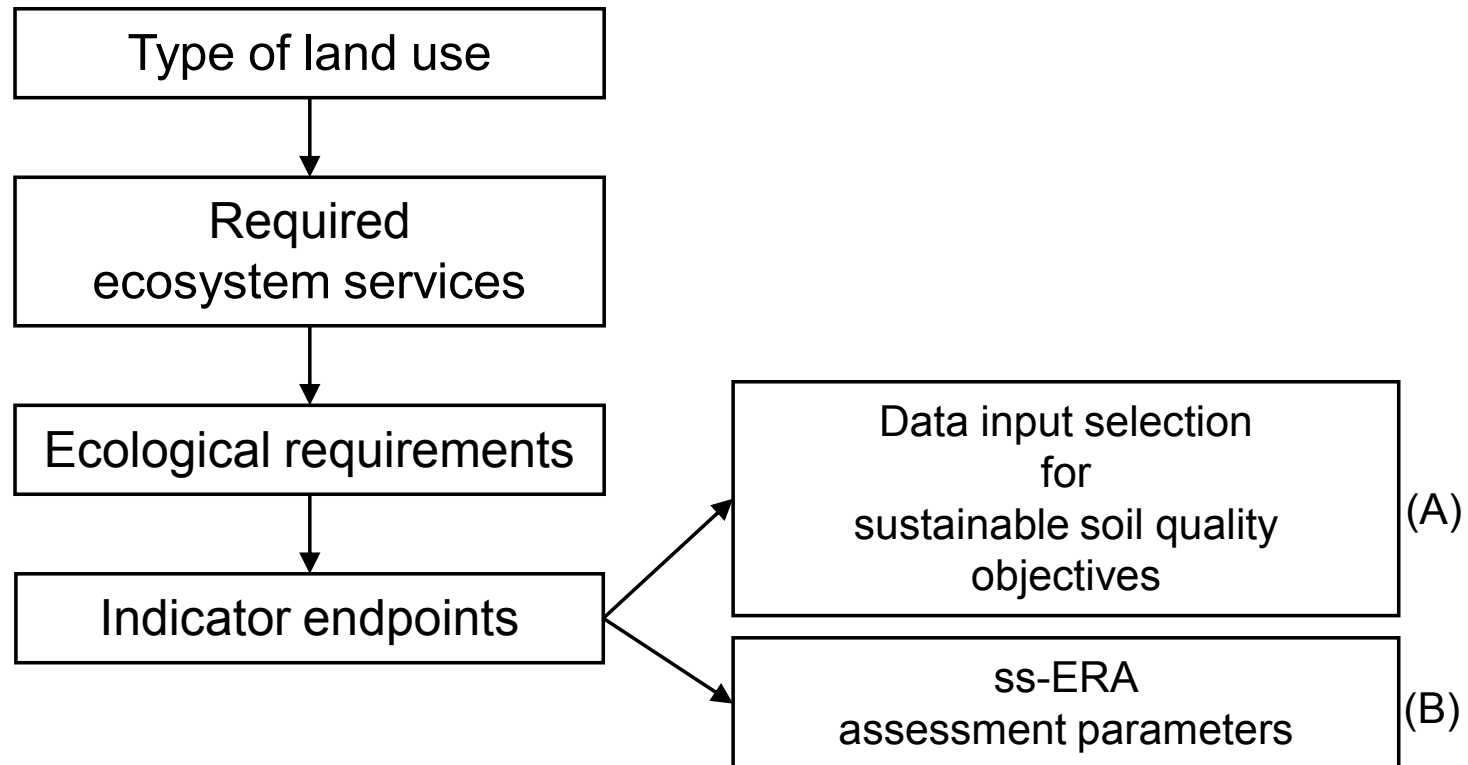


Provisioning services	Regulatory services	Cultural services
<ul style="list-style-type: none"> <li>• Food</li> <li>• Timber/fuel/energy</li> <li>• Genetic resources</li> <li>• Biochemicals /natural medicines</li> <li>• Ornamental resources</li> <li>• Fresh water</li> </ul> 	<ul style="list-style-type: none"> <li>• Pollination</li> <li>• Seed dispersal</li> <li>• Pest regulation</li> <li>• Disease regulation</li> <li>• Climate regulation</li> <li>• Air quality regulation</li> <li>• Water regulation</li> <li>• Erosion regulation</li> <li>• Natural hazard regulation</li> <li>• Invasion resistance</li> <li>• Water purification /waste treatment</li> </ul> 	<ul style="list-style-type: none"> <li>• Spiritual and religious values</li> <li>• Education and inspiration</li> <li>• Recreation and ecotourism</li> <li>• Cultural heritage</li> <li>• Aesthetic values</li> <li>• Sense of place</li> </ul> 
Supporting services		
<ul style="list-style-type: none"> <li>• Primary production               <ul style="list-style-type: none"> <li>• Photosynthesis</li> </ul> </li> <li>• Provision of habitat</li> <li>• Soil formation and retention               <ul style="list-style-type: none"> <li>• Nutrient cycling</li> <li>• Water cycling</li> </ul> </li> </ul>		

After :MEA, 2005

201204-02-  
2011

## *Soil quality assessment*



Faber & Van Wensem, Sc Tot Env 415 (2012)



## Conclusions

From ugly soil to rich soil

From 'dangerous and toxic' to  
rationally coping with risks

From protection to sustainable  
Land management

From sectoral to integral

from soil chemistry to  
Soil biology+physics+chemistry







*Thank you for your attention!*

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