www.cabernet.org.uk www.dais.unive.it/~glocom www.greenland-project.eu www.timbre-project.eu www.zerobrownfields.eu

CONFERENCE PROCEEDINGS

CABERNET 2014: Tailored & Sustainable Redevelopment towards Zero Brownfields

4th International Conference on Managing Urban Land

Final Conference of the EU FP7 Project "HOMBRE"

In cooperation with the EU FP 7 Projects "GLOCOM", "Greenland" and "TIMBRE"

14th – 16th October 2014 · Frankfurt am Main · Germany







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THE CONFERENCE IS CO-FUNDED BY PROJECTS WITHIN THE 7TH FRAMEWORK PROGRAMME OF THE EUROPEAN COMMISSION

Tuesday, 14th October 2014

09:30	REGISTRATION	
10:50	**OPENING** Hans van Duijne, Deltares, The Netherlands Paul Nathanail, University of Nottingham, UK	
	Chair: Paul Nathanail, University of Nottingham, UK	
11:15-11:55	KEYNOTE LECTURE **Integrated urban policies and land management** Didier Vancutsem, URBACT, EU	
	Policy approaches to brownfield regeneration challenges	**Gentle soil remediation options 1**
	Chair: Matthew Ashmore, University of Nottingham, UK	*Chair: Andrew Cundy, University of Brighton, UK*
12:00	**Value creation by connecting societal challenges with land management** Margot de Cleen, Ministry of Infrastructure and the Environment, The Netherlands	**Phytoremediation of trace element-contaminated soils in Europe – option appraisal based on long-term field experiments** Markus Puschenreiter, University of Natural Resources and Life Sciences Vienna, Austria
12:30	**Tradable planning permits for land use control – A Policy approach for less greenfield development and more brownfield regeneration?** Detlef Grimski, Federal Environment Agency, Germany	**Gentle Remediation Options for the management of largescale contaminated agricultural sites in Saxony, Germany** Silke Neu, Saxon State Office for Environment, Agriculture and Geology, Germany
13:00	**The EU Guidelines on Environmental and Energy State aid for 2014-2020 and the Remediation of Contaminated Sites** Joachim Sanden, Ministry of Urban Development and Environment of the Free and Hanseatic City of Hamburg, Germany	**Microbial community structure and activity in trace element-contaminated soils (phyto)managed by Gentle Remediation Options (GRO)** Maria Touceda-González, AIT Austrian Institute of Technology GmbH, Austria
13:30	LUNCH	LUNCH
	Solutions to bring state-of-the-art knowledge and information into application	**Gentle soil remediation options 2**
	Chair: Stephan Bartke, UFZ, Germany	*Chair: Markus Puschenreiter; University of Natural Resources and Life Sciences Vienna, Austria*
14:30	**Brownfield regeneration in a circular economy** Jaap Tuinstra, Soil Protection Technical Committee, The Netherlands	**Field demonstrations of Gentle (Phyto)Remediation Options in the EU FP7 GREENLAND network of trace element-contaminated sites** Michel Mench , INRA – University of Bordeaux, France
15:00	**The Brownfield Navigator** Linda Maring, Deltares, The Netherlands	**Deployment of aided phytostabilisation at field scale: set up and monitoring lessons** Valérie Bert, INERIS, France
15:30	**Timbre Information System for the provision of tailored and customized information on brownfield regeneration according to users' requirements** Lisa Pizzol, University Ca' Foscari Venice, Italy	**Processing of plant biomass harvested at trace element-contaminated sites managed by gentle (phyto)remediation options** Valérie Bert, INERIS, France
16:00	COFFEE BREAK	COFFEE BREAK
	Approaches to regeneration and evaluation of their sustainability	**Gentle soil remediation options 3**
	Chair: Uwe Ferber, Projektgruppe Stadt + Entwicklung, Germany	*Chair: Markus Puschenreiter; University of Natural Resources and Life Sciences Vienna, Austria*
16:30	**Conceptual site or project models for sustainability assessment and overall value** Pierre Menger, Tecnalia, Spain	**Developing a practical decision support tool (DST) for the application of gentle remediation options** Andrew Cundy, University of Brighton, UK
17:00	**Biomass production on brownfields** Karl Eckert, Projektgruppe Stadt + Entwicklung, Germany	**Testing novel combinations of amendments for stabilization of metals in heavily contaminated soils** Grzegorz Siebielec , Institute of Soil Science and Plant Cultivation (IUNG), Poland
17:30	End Day 1	
18:00	**Get together/ Poster Party**	

Wednesday, 15th October 2014

08:00	REGISTRATION	
	Chair: Thomas Track, DECHEMA e.V., Germany	
08:55 - 09:35	KEYNOTE LECTURE **Soil Remediation and Land Management – a Win-Win Situation** Harald Burmeier, ITVA/Germany	
	Decision support tools on technologies for land revitalization	**Brownfields ahead?! – Early Brownfield Indicators**
	Chair: Linda Maring, Deltares, The Netherlands	*Chair: Pauline van Gaans, Deltares, The Netherlands*
09:40	**Tool-assisted design and comparative evaluation of sustainable land use alternatives for brownfield redevelopment** Michael Finkel, University of Tuebingen, Germany	**Early Warning indicators brownfield regeneration: tipping points ahead?** Gerald Jan Ellen, Deltares, The Netherlands
10:10	**Soft re-use of Brownfields: decision support and opportunity matrix** Victor Beumer, Deltares, The Netherlands	**Use of social and economic indicators for the selection of sustainable site remediation options** Valérie Cappuyns, KU Leuven, Belgium
10:40	**GIS-based Identification of Infill Development Potentials on the Basis of Topographic and Cadastral Databases – Prospects and Limits** Robert Hecht, Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany	**Towards the anticipation of brownfield emergence?** Elsa Limasset, BRGM, France
11:10	COFFEE BREAK	COFFEE BREAK
	Emerging strategies and technologies for effective remediation 1	**Real world challenges and pilot cases for brownfield regeneration**
	Chair: Tim Grotenhuis, University of Wageningen, The Netherlands	*Chair: Maaike Blauw, Deltares, The Netherlands*
11:40	**HOMBRE technology trains: smoothening the transition of brownfields to new uses?** Martijn Smit, Wageningen University, the Netherlands	**Solec Kujawski (Poland) – HOMBRE philosophy around local brownfield regeneration project** Wojciech Irminski, Geo-Logik, Poland
12:10	**Technology train for reusing excavated material in a Brownfield regeneration context** Renato Baciocchi, University of Rome "Tor Vergata", Italy	**The brownfield city: Famagusta, Cyprus** Paul Nathanail, University of Nottingham
12:40	**Integrated strategies for Brownfield regeneration: treatment of subsoil and alkaline residues by the combined Ecogrout-carbonation process** Wouter van der Star, Deltares, The Netherlands	**Assessing the socio-economic benefits of turning brownfields into green/blue spaces: a case study for Eindhoven and Copenhagen** Peter Cornelis Roebeling, CESAM – Department of Environment and Planning, University of Aveiro, Portugal
13:10	LUNCH	LUNCH
	Chair: Hans van Duijne, Deltares, The Netherlands	
14:05- 14:45	KEYNOTE LECTURE **A Local Perspective on Unlocking Innovative Transatlantic Cooperation** Dale Medearis, Northern Virginia Regional Commission/USA	
	Emerging strategies and technologies for effective remediation" 2	**Prioritization and communication approaches**
	Chair: Renato Baciocchi, University of Rome „Tor Vergata", Italy	*Chair: Elsa Limasset, BRGM, France*
14:50	***In situ* remediation of Pb/Zn mining and processing impacted sites** Wolfgang Friesl-Hanl, AIT Austrian Institute of Technology GmbH, Austria	**Specifics of brownfields prioritization in large municipalities (case study area Brno)** Petr Klusáček, Institute of Geonics, Czech Republic
15:20	**A Novel Remediation Approach for POPs Contaminated Solids Using Carbonaceous Materials** Long Zhao, Chinese Research Academy of Environmental Sciences, China	**Communication-Based Approach to Improvement of Old Industrial and Commercial Areas** Anja Batke, Beate Huf, Regionalverband FrankfurtRheinMain, Germany
15:50	COFFEE BREAK	COFFEE BREAK
	Tools and technologies to foster land revitalization	**Sustainable urban land management**
	Chair: Renato Baciocchi, University of Rome „Tor Vergata", Italy	*Chair: Pierre Menger, Tecnalia, Spain*
16:20	**Biochars for mitigation organic contaminants in soil** Lisa Lundin, Umeå University, Sweden	**Urban planning and design with the subsoil system** Fransje Hooimeijer, TU Delft, The Netherlands
16:50	**Immobilization of Metals using Biochar and Green Waste Compost to Aid Biomass Production on a Contaminated Site** Sarah Jones, r3 environmental technology ltd, UK	**Brownfields and Gap Sites as Potential for Sustainable Urban Development – A Survey of German Cities and Towns** Andreas Blum, Leibniz Institute of Ecological Urban and Regional Development,Germany
17:20	**How to engage towards an effective and sustainable redevelopment of large and complex brownfield sites** Pascale Michel, BRGM, France	**Efficient Organisational Structures for the Management of Land Resources** Uwe Ferber Projektgruppe Stadt + Entwicklung, Germany
17:50	End Day 2	
19:30	**Conference Dinner**	

Thursday, 16th October 2014

08:00 REGISTRATION

Chair: Detlef Grimski, Federal Environment Agency, Germany

09:00 KEYNOTE LECTURE
Re-use of land: possibilities, decision making and stakeholders
Paul Bardos, r3/UK

Tools and methods for decision making and awareness raising

Chair: Lisa Pizzol, University Ca' Foscari Venice, Italy

09:40 **The HOMBRE BR2 tool for understanding urban systems**
Matthew Ashmore, University of Nottingham, UK

10:10 **Acting Sustainably: Redevelopment Scenarios for Borovo (Vukovar, Croatia)**
Irena Đokić, The Institute of Economics, Croatia

10:40 **Awareness raising for soil and necessarily for Remediation within the GREENLAND project**
Wolfgang Friesl-Hanl, AIT Austrian Institute of Technology GmbH, Austria

11:10 EXTENDED COFFEE BREAK

Best practice – lessons learnt

Chair: Paul Bardos, r3, UK

12:10 **BALANCE 4P: Integrating urban planning and the remediation sector for sustainable brownfield regeneration – experience from cases**
Jenny Norrman, Chalmers University of Technology, Sweden

12:40 **Brownfield redevelopment in Flanders: 5 years of transversal policy and integrated area development**
Koen Miseur, Enterprise Flanders, Belgium

13:10 **20 Years of Remediation of Inhabited Contaminated Sites in Hesse -Lessons Learned**
Christian Weingran, HIM GmbH, Germany

13:40 **Feasibility of phytoextraction with improved tobacco and sunflower for the remediation of soluble zinc top soil contamination – Results of a five and one year field scale experiment in Switzerland**
Rolf Herzig, Phytotech Foundation & AGB, Switzerland
Michel Mench, INRA, France

10:40 SPECIAL SESSION
"SoilBizz – A project idea for regional and local authorities to have contaminated industrial area regenerated"

11:10 EXTENDED COFFEE BREAK

11:40-13:10 SPECIAL SESSION
"Land information services für sustainable cities"
Project „URBIS" (www.ict-urbis.eu)

14:10 **Towards Urban Land management 2065 – key take home messages and next steps**
Hans van Duijne, Deltares, The Netherlands
Paul Nathanail, University of Nottingham, UK

15:10 End of conference

KEY NOTE LECTURES

Keynote Lecture: ***"Integrated urban policies and land management"***
14th October 2014, 11:15 – 11:55h
Speaker: Didier Vancutsem, URBACT/ EU

Since 2008, for the first time in history, more than half of human population is living in urban areas, and cities will absorb all the population growth expected in the future. The trend of urbanization will continue. By 2050, about 70 % of world's people are likely to be city dwellers, compared with less than 30 % in 1951. Between 2011 and 2050, the world urban population will pass from 7.0 billion to 9.3 billion (UN, 2012). In this global context, resource-efficiency of urban areas becomes crucial.

Our societies and their economic systems are based on natural resources. They are fundamental not only for the economy but also for the services they provide for our health, well-being and quality of life. In human history, the level of natural resources consumption per capita changed dramatically. In agrarian societies, the resources consumption per capita was essentially devoted to the food, the feed needed for animals and the biomass. As the demand of resource for the economy is growing, the standard of living is rising and the middle-class is emerging in developing countries, the demand of natural resources increases and threatens the security of supply. Access to resources becomes a major economic concern. The depletion and scarcity of natural resources generates competition and increasing prices, which is also the case of land. Cities use and need land. Land is an essential resource for cities, as it consists in the basis for built urban environment. Consequently, a resource-efficient use of the land is crucial for cities.

The European Framework

To assure their long-term viability, cities must disconnect social well-being and economic growth from the use of resources. Resource-efficiency is now a key priority for policymakers across Europe and there is a growing international awareness of the strategic importance of avoiding risks to supply of resources.

The Europe 2020 Strategy developed in the past years defines a roadmap to overcome the unsustainable consumption patterns, and surmount the economic crisis, concentrating the efforts on a smart, sustainable and inclusive economy (EC, 2010c). The Roadmap on Resource Efficiency (EC, 2011g) was published, identifying the need for new ways to reduce inputs, minimise waste, improve management of resource stocks, change consumption patterns, optimise production processes, management and business methods, and improve logistics. The roadmap recommends an integrated approach across many policy areas at European and Member States levels and focusing on the resources under most pressure. The instruments employed include legislation, market-based instruments, refocusing of funding instruments and promotion of sustainable production and consumption.

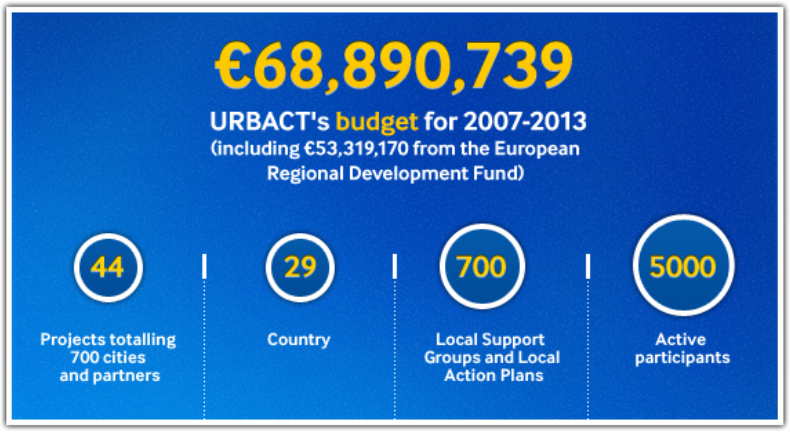
'A resource-efficient Europe' (Thematic Objective 6) is one of seven flagship initiatives as part of the Europe 2020 strategy. It aims to create a framework for policies to support the shift towards a resource-efficient and low-carbon economy (EC, 2011c).

URBACT as key program of the Europe 2020 Strategy

What is URBACT? URBACT is a European exchange and learning programme promoting sustainable urban development – as part of the Europe's cohesion policy: its goal is to help implement the Lisbon-Gothenburg Strategy, which prioritizes competitiveness, growth and employment.

URBACT enables CITIES to work together to develop solutions to major urban challenges, reaffirming the key role they play in facing increasingly complex societal changes. Therefore, URBACT help cities to develop pragmatic SOLUTIONS that are new and sustainable, and that integrate economic, social and environmental dimensions. The Program enables cities to SHARE good practices and lessons learned with all professionals involved in urban policy throughout Europe. The URBACT Community is representing 500 cities, 29 countries and 5,000 active participants.

The European Union (European Regional Development Fund) and the Member States jointly finance the URBACT program:



URBACT enables numerous European cities to work together in projects to share and capitalise on experience. Each project focuses on a specific urban issue, such as tapping into the positive potential of young people (MY GENERATION), social housing (SUITE), or taking built heritage into account in urban development (Hero). URBACT enables the development of solutions to urban challenges that other cities can then adapt to their own context.

4 missions are at the core of URBACT:

1. Coordinating exchanges to make things happen
2. Analysing and capitalising on Learning
3. Disseminating information and outputs
4. Funding project operations

2 Examples of URBACT projects dealing with Land Management, LUMASEC and Use-Act

The URBACT working group “Land Use Management for Sustainable European Cities - LUMASEC” researched and supported cities’ urban development at case study cities and city regions in order to learn more about practical ways to do sustainable land use management. Managing urban sprawl, unlocking the potential of brownfield sites and creating competitive, attractive environments where communities can flourish is the shared aim behind this European project. As a network of private and public sector decision makers, LUMASEC developed strategies for sustainable land use management on Land Use Management for Sustainable European Cities. At the centre of this URBACT working group of five European cities: Baia Mare (Romania), Bristol (United Kingdom), Bytom (Poland), Kavala (Greece) and the Saint-Etienne region/ Epures (France) supported by three research institutes: CERTU (France), the University of Ljubljana (Slovenia) and the lead partner Karlsruhe Institute of Technology (Germany.

The LUMASEC project presented in October 2010 a Handbook presenting the results of the 2-years work between September 2008 and May 2010 on strategic land use management, focussing on urban sprawl and urban brownfields, as one of the most important topics to address, to ensure competitiveness, attractiveness and sustainability of our European city-regions. It focused on both the strategic level (planning methods, observation tools) and the operational level (action plans, case-studies), and aimed at producing methods and practical recommendations.

The Use-Act project (Urban Sustainable Environmental Actions) is aiming to define ways to achieve opportunities for people and businesses to settle in existing locations without consumption of further land, thanks to new planning and partnership approaches and at the same time developing the construction and real estate economies, making the most of the historic building heritage and related character, reducing energy consumption in buildings and cutting back on further infrastructure building/management costs. The project was launched on 01 May 2012 and will conclude in April 2015; the partners are the City of Naples, as Lead Partner, together with Baia Mare, Barakaldo, Buckinghamshire, Dublin, Istanbul, Nitra, Ostfold Country, Riga, Trieste and Viladecans.

The philosophy of the Use-Act project is connected with the need to support urban communities, which express a desire to find solutions and implement practices to combat the harmful mechanism, which:

1. Pushes administrations to use territory to foster, such as demand for new spaces (and new quality of living and working spaces) by exiting inhabitants or newcomers, both in new settlements and in to be renewed districts; Development of the "real estate developers"/"builders" economy; and Increase revenue, in the short-term, through the takings from "planning fees".
2. Entails, through the urban sprawl, induced by the new use of land, the loss of environmental resources and, in the long-term, greater public and private costs, also in relation to the management of the public utilities network in very broadly urbanised areas, even those which are deteriorated.

Learning from the practice

Experiences from URBACT projects such as LUMASEC or Use-Act demonstrate the importance of integrated urban development processes, involving all actors and trying to go on "on the ground", by implementing concrete actions. The URBACT method asking municipalities to implement "Local Action Plans" is a very successful instrument, which confirms the necessary connection of research and practice.

Keynote Lecture: ***"Soil remediation and Land Management – A Win-Win Situation"***
15th October 2014, 08.55 – 09.35h
Speaker: Harald Burmeier, ITVA/Germany

Nearly 60 % of the population in the European Union lives in urban areas. Due to this cities play an important role in sustainable (environmental, economic and social) land use in nearly each member state of the EU. Economic development occurs in the area of cities being highly attractive to migrants. Rural areas are shrinking (population and economic situation) in addition to the migration of mainly young people to those cities. Industrial areas with more than 250 years of history (mining, smelter facilities,…) have created tremendous amounts pollution of soil and groundwater. Buildings and installations in these areas are no longer needed and have to be demolished. New industries and services have to be installed. As a result of these developments especially old member states of the EU (England, France, Italy, and Germany) have implemented national brownfield programs 10 to 15 years ago. The EU has adapted a lot of elements of these programs and implemented them in European programs and strategies. European and national research and development programs were additionally initiated such as REFINA, KORA, RUBIN (Germany) or CABERNET, INTERREG, URBACT, LIFE (European Commission) to develop strategies for brownfield redevelopment and remediation.

Soil and Groundwater contamination
Contamination of soil and groundwater is one of the environmental problems which have to be dealt with in brownfield redevelopment. It is often considered to be a key issue as it bears uncertainties and potential high risks in relation to the costs. Also the time needed for remediation contamination may block development in some cases, but in many other cases the revitalization of brownfields may help solve a contamination problem. In these cases the financial means and other resources provided for the solution of the contamination problem may be used to contribute to brownfield redevelopment /EUBRA/.

Basis for a „low risk" revitalization
Before starting any financial investments one must know the "quality" of the site and the planning conditions very well. It is very important to get an excellent risk assessment of the site concerning soil, groundwater and buildings. The costs of remediation have to be added to costs for removing buildings, setting up an inner opening and costs for financing. At least one has to check the profitability of the whole project.

Summary
Economic, environmental and social objectives are driver of brownfield redevelopment and create win-win-situations between:
- necessary remediation actions and reuse of land
- former brownfields and urban development
- reuse of land and reduction of Greenfield-consumption

Further information is given at the following homepages:

REVIT:	www.revit-nweurope.org
INTERACT:	www.interact-en.net
CABERNET:	www.cabernet.org.uk
EUBRA:	www.eugris.info
INTERREG:	www.interreg.euregio.de
REFINA:	www.refina-info.de
KORA:	www.natural-attenuation.de
RUBIN:	www.rubin-online.de

Keynote Lecture: ***"A Local Perspective On Unlocking Innovative Transatlantic Cooperation"***
15th October 2014, 14.05 – 14.55h
Speaker: Dale Medearis, Northern Virginia Regional Commission/USA

Global urban sustainable policy and technology transfer have tended to be insular and introspective, lacking a strategic perspective that is suitably tuned to regularly finding, understanding and applying lessons from pioneering to laggard countries. It is rare to find a city, county or state agency in the world engaged in the regular pursuit of international best practices in which outcomes are prospectively evaluated for suitable application. It is equally rare to see national urban, energy, environmental, or planning organizations engaged in formal or strategic searches, reviews and applications of lessons from abroad. Much of this is because most international urban sustainability work takes place within one of two contexts. The first context is one in which the developed nations export policies, ideas and technologies to developing countries. The other context is 'soft diplomacy' and the accidental contexts of random 'social exchanges' that lack formal problem-focused, goal-oriented searches and applications of technical or policy innovations from abroad (Dolowitz and Medearis 2009).

A review of the work of most international urban sustainability and brownfields exchanges points to stereotypical development assistance projects that result in few tangible or practical economic development, energy management, climate or environmental outcomes. This is consistent with the notion that developed countries stand to learn little from the rest of the world. In addition, many international development assistance projects focusing on urban development are often viewed as patronizing in the eyes of the developing countries.

When efforts are made to learn about sustainable development from other countries, they are often poorly structured and fail to inform policymakers and technical staff about how the innovations overseas evolve. They also lack assessment of the performance of the foreign innovations using apples-to-apples quantitative benchmarks and often there is little prospective assessment about how pieces (rather than entire copies) of the innovations can be applied into unique contexts of the importer. The lack of formal searches and testing of innovations from abroad for application into the importing country has led to the marginalization of international work in general and false perception that there is nothing to be learned from countries that offer valuable lessons in sustainable development. This is particularly the case at the local level.

This presentation highlights the evolution of work at the local level to develop and sustain a problem-focused and goal-oriented search and testing of innovative sustainable brownfields policies from abroad, using Germany and the US as a case study. Special emphasis will be given to the evolution of cross-national policy transfers characterized by random searches and informal structures, into a more rational and formal process characterized by problem-focused and goal-oriented searches for information, review, debate and testing of that information. In addition, to help frame the context of this story, this presentation reviews some of the national-level history and precedents with transferring urban brownfields and sustainability policies from abroad to the United States.

Keynote Lecture: ***"Re-use of land: Possibilities, decision making and stakeholders"***
16th October 2014, 09.00 – 09.35h
Speaker: Paul Bardos, r3/UK

The Roadmap to a Resource Efficient Europe suggests that by 2050 there should be no net land take sealed by built development. This will only be possible with effective "recycling" of formerly used land for buildings and infrastructure ("hard development") and unsealed uses ("soft development"). Of course across Europe a large amount of land recycling already takes place under the influence or normal market forces. However, in some cases the recycling of formerly used land is stalled for a variety of environmental, economic and/or social reasons, and these "Brownfield" sites are often in or near urban areas.

The dynamics of land use are cyclic, where site developments are planned, realised and then utilised and maintained until the site is decommissioned or simply abandoned, after which a new cycle for site re-development starts. The land use cycle basically consists of periods of beneficial use alternated by periods of transition. Brownfields reflect periods of stagnation and partial transition of land use, and typically require some form of intervention (usually public) to complete a process of transition. In practice the costs of transition for many Brownfield sites have remained a major barrier to action; and the robustness of transition achieved – in particular its longer term economic sustainability – have been insufficient to support durable re-use of some sites. HOMBRE's hypothesis is that these barriers and failures result from an incomplete understanding of the range of potential services a site could provide, and hence a sub-optimal overall value for the completed regeneration.

Sustainability and wider stakeholder participation are seen as important tools in achieving more services and hence higher overall value in regeneration and hence more cost-effective and durable solutions. This presentation will describe ways to improve value propositions and broaden stakeholder engagement, based on work carried out by the HOMBRE and Greenland FP7 projects.

PRESENTATIONS

14th October 2014, 12.00 – 13.30h
Session: "Policy approaches to brownfield regeneration challenges"
Chair: Matthew Ashmore, University of Nottingham, UK

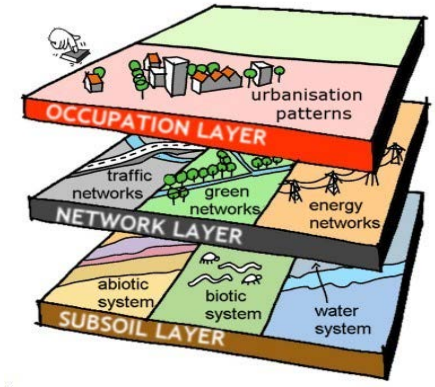
14th October 2014, 12.00 – 12.30h
"Value creation by connecting societal challenges with land management"
Speaker: Margot de Cleen, Ministry of Infrastructure and the Environment, The Netherlands

A transition in soil policy

Value creation is a starting point for revitalization of brownfields. Value creation can be optimized by connecting the revitalization objectives to societal challenges and conscious and sustainable use of the soil sediment water system (SSW). Land management is the key to define policy on sustainable use of SSW.

Worldwide the pressure on land and subsurface is high. Still brownfield generation stagnates and the number of brownfields increases. The sectoral approach is inefficient, potential value creation is underused. Policies are mainly focussed on protection and remediation, land management policy lacks. Societal costs of brownfields and the unconscious use of the SSW e.g. by soil subsidence, sealing etc. are substantial. In the Netherlands the damage of unconscious water balance interference is about 600 Mio Euro a year, damage to infrastructure caused by changes in the groundwater table are 1,650 Mio Euro a year. Potential benefits of the SSW are left unused by ignorance, e.g. the use of the buffer capacity to mitigate effects of climate change in urban environments (estimated benefit of 11bn Euro in total).

For brownfield revitalization a 4D long term outlook is needed up scaled to a regional plan for land use, use of the SSW and subsurface potentials showing regional ambitions connecting societal challenges (e.g. energy transition, efficient use of resources, water supply and adaptation to climate change) and creating value. An integrated approach with all stakeholders and disciplines is used.



The Dutch soil policy is in transition and fully decentralized. From subsurface care to deep and broad use of ecosystem services, from general regulations and prohibitions to tailor-made solutions on regional and local level; from taking the lead to involving the energetic society. This transition is directly connected to the spatial planning process and asks for early involvement of soil issues (SSW). To facilitate the local authorities a policy document (STRONG) is made with a framework for spatial planning of the subsurface, based on societal tasks and interests on national, regional and local level. Inventories are made by interviewing different societal stakeholders.

14th October 2014, 12.30 – 13.00h

"Tradable planning permits for land use control – A Policy approach for less Greenfield development and more brownfield regeneration?"

Speaker: Detlef Grimski, Federal Environment Agency, Germany

Land consumption in Germany is still on a high level. Day by day 70 ha of valuable mostly agricultural – greenfield land are converted into land for traffic and settlement (status 2012). Annually, land take in Germany sums up to ca. 25.000 ha – approx. the size of the City of Frankfurt (am Main). The consequences are various: urban sprawl, land and soil sealing, more traffic, higher costs for infrastructure, loss of biodiversity, etc.. A national target for reducing land take down to 30 ha per day until the year 2020 is set in Germany's strategy for sustainable development. To achieve this target, action is needed to direct new developments into the cities and to develop rather inner city vacant land like brownfields and open space between buildings instead of developing the free space on Greenfield sites at the outskirts of urban agglomerations. Thus, the German governmental parties have agreed in their coalition contract in 2009 to set up a model project on tradable planning permits in close cooperation with the communities. The idea behind this approach is that planning permits would be needed for the development of outer city Greenfield development. The total amount of permits would be limited to a specific national cap (in the case of Germany 30 ha per day) and freely distributed to the municipalities. Each municipality would get permits in relation to its population. If they do not cover their planning needs they would be allowed to buy more from those communities whose requests are covered. The main objectives of the model project are to test the tool under practical conditions, to identify possible impacts, to examine whether it is administratively appropriate for the municipalities and to prove if it will finally foster inner urban development and reduce land take on greenfields. This model project started in 2013 with a first group of municipalities. In the final phase, up to 100 municipalities across the country will be participating. In practical terms, the planned municipal land developments are simulated in fast motion over a period of 15 years. Professional consultancy assistance for the municipalities is provided for gathering the necessary data, setting the boundaries for inner and outer areas, performing cost benefit analyses and for calculating the fiscal and employment effects of various land development options. Current results of the model project and community feedback will be presented.

14th October 2014, 13.00 – 13.30h

"The EU Guidelines on Environment and Energy aid for 2014-2020 and the Remediation of Contaminated Sites"

Speaker: Joachim Sanden, Ministry of Urban Development and Environment of the Free and Hanseatic City of Hamburg, Germany

Restrictions by the European State aid law for the remediation of contaminated sites and the recycling of derelict land

1. Financial state aids for the support of new large scale projects (i.e. infrastructure projects) combined with the cleaning-up of contaminated sites should be in line with the EU-state aid law. Financial grants by the state in the remediation sector as state aid (Article 174 TFEU) are limited by the logic of the Treaties. Additionally, in particular the State aid guidelines for environmental protection, the General Block Exemption Regulation and the *de minimis* regulation concretize the rules. All these regulations are part of the current state aid modernisation ("SAM") agenda by the European Union announced in summer 2013. The presentation concentrates on the compatibility of national subsidies and other contributions to responsible parties.

2. The former Community guidelines on State aid for environmental protection 2001-2014 gave a clear framework to investigate the preconditions of the exception according to Article 107(3)(c) TFEU to the general exclusion of state aid in the field of re-development of contaminated sites. The European Commission was thereby enabled to undertake a careful and even restrictive analysis on the preconditions of state aid not disturbing competition. In particular, the guidelines mentioned above frame the consideration of the benefits and disadvantages of direct grants by the state to remediation works effectively. Several decisions of the Commission underlined that the financial aid shall not contradict the polluter pays principle. The analysis of the development of the guidelines showed some exceeding, i.e. for the relocation of enterprises with a high emission level.

3. Taking the decisions of the EU-Commission dealing with brownfield reuse programmes into account, I undertake an analysis in particular of the new "Guidelines on environmental and energy State aid for 2014-2020", which were adopted by the European Commission in principle on April 9th, 2014 and are applied since 01.07.2014.

The aid intensity (Annex 1) is now 100% for all types of enterprises. The eligible costs (Annex 2) for the remediation of contaminated sites incurred according 3.2.5.1. (No. 72a and Fn. 47) the costs for the remediation work, less the increase in the value of the land. This is the same situation like with the previous guidelines. In the field of remediation, the benefit of the renewed guidelines 2014-2020, that have generally strengthened the rules of incentive effects and proportionality, is therefore not relevant.

It would be a wise decision to endure the relocation aid for an effective granting of brownfield redevelopment and large scale projects. However, these new guidelines show shortcomings in the field of an intensive reuse of former contaminated sites for Large Scale Projects.

The most important aspect for the re-development of derelict land is, however, that in the Guidelines an aid for the relocation of enterprises (second type in the 2008 guidelines) was not planned any longer. Facing the critic, the European Commission re-integrated in section 3.11 the "aid for the relocation of undertakings". However, No. 238 requires the following

conditions: “The aim of investment aid for the relocation of undertakings is to create individual incentives to reduce negative externalities by relocating undertakings that create major pollution to areas where such pollution will have a less damaging effect which will reduce external costs. The aid may therefore be justified if the relocation is made for environmental reasons, but it should be avoided that the aid is granted for relocation for other purpose.” This, i.e. the closed-list-requirement of an extra environmental protection (or energy utilisation), makes clear that the relocation for reasons of re-developing land is not included.

Besides, my interpretation of the guidelines leads to the conclusion that we can include relocations caused by the distance requirements of the Seveso III-Directive 2012/18/EU. It makes no real sense in the framework of environmental protection, to limit investment aid for remediating derelict or contaminated sites to contamination only. This should be extended to allow for rectification of brownfield land to enable a change in use. Only by using this opportunity, big cities can re-develop abandoned or less-used areas.

> Examples: In the Cork port relocation case (Ireland), funding was used to terminate the presence of the Seveso sites in the area, which was the major obstacle to the development of the Cork Docklands. The relocation of the Seveso activities, funded by a relocation grant was the precondition of the regeneration of the Docklands with increasing the population from before almost 500 to a target of some 22,000 residents, with 27,000 jobs, in the years to 2027. Hamburg plans to develop its East (“Hamburger Osten”) including ca. 20.000 new flats; several Seveso sites and other industrial sites are located in this planning area.

4. The new “Guidelines on environmental and energy State aid for 2014-2020” are tailored in an interaction with the (drafted) General Block Exception Regulations (GBER), which defines grants up to 20.0 million EUR which shall be exempted from the notification requirement of Article 108(3) of the Treaty. This leads in general to a lower administrative burden for the authorities who support middle size redevelopment projects on brownfield. First requirement is the absolute validity of the polluter-pays-principle in No 63 of the preamble.

The aid above the *de minimis* threshold, € 200.000 as the amount of *de minimis* aid that a single undertaking may receive per Member State over any period of three years, “can only be caught by the prohibition laid down” in Article 107 TFEU (ex-Article 87 EC), “if caused by them impairment of trade, which are noticeable”.

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14th October 2014, 12.00 – 13.30h
Session: "Gentle soil remediation options 1"
Chair: Andrew Cundy, University of Brighton, UK

14th October, 12.00 – 12.30h

"Phytoremediation of trace element-contaminated soils in Europe – option appraisal based on long-term field experiments"

Speaker: Markus Puschenreiter, University of Natural Resources and Life Sciences Vienna, Austria

Contamination of soils with trace elements (TE) is worldwide still one of the major environmental problems. Conventional technologies for soil remediation are usually very expensive and may negatively affect or destroy soil structure and functions. Phytoremediation technologies, however, include a set of gentle remediation options (GRO) which are plant-based approaches to remediate trace element contaminated soils at low cost and without significant negative effects for the environment. GRO comprise environmentally friendly technologies that have little or no negative impact on the soil. The main technologies are phytoextraction, in situ immobilization and assisted phytostabilization. Although GRO comprise very innovative and efficient technologies, they are still not widely used as practical site solution due to several reasons of hindrance. Although major progress has been achieved on the lab scale, success stories obtained in the field are still limited, in particular regarding the long-term efficiency. Also, the issue of valorization of the potentially contaminated plant biomass has insufficiently been addressed so far. Furthermore, further development is needed regarding the adequate determination of end-points of GRO. Finally, the application of GRO as practical site solution may be hindered by legal frameworks and by insufficient knowledge of the decision makers. Long term and large scale field experiments may provide data required for the overall assessment of GRO efficiency, effectiveness and sustainability. Therefore, the EU-FP7-project "Gentle remediation of trace element-contaminated land – GREENLAND; www.greenland-project.eu) with 17 partners from 11 countries has been launched on January 1 2011 to address these issues and to make GRO ready for use as practical site solution.

14th October, 12.30 – 13.00h

"Gentle Remediation Options for the management of large-scale contaminated agricultural sites in Saxony, Germany"

Speaker: Silke Neu, Saxon State Office for Environment, Agriculture and Geology, Germany

In the region of Freiberg three large-scale field trials were conducted in the frame of the Greenland-project (FP7-KBBE-266124) in collaboration with farmers on trace element contaminated sites (TECS). The approaches comprised in situ stabilization with conventional fertilizers alone on grassland (cp. Fig. 1) and in combination with phytoexclusion on heavily contaminated arable land. Furthermore the cultivation of short rotation coppice (SRC) on a moderately TECS was evaluated with regard to the phytoextraction potential of different willow and poplar clones and their influences on TE-mobility in soil when compared to traditional agricultural production (cp. Fig. 2).

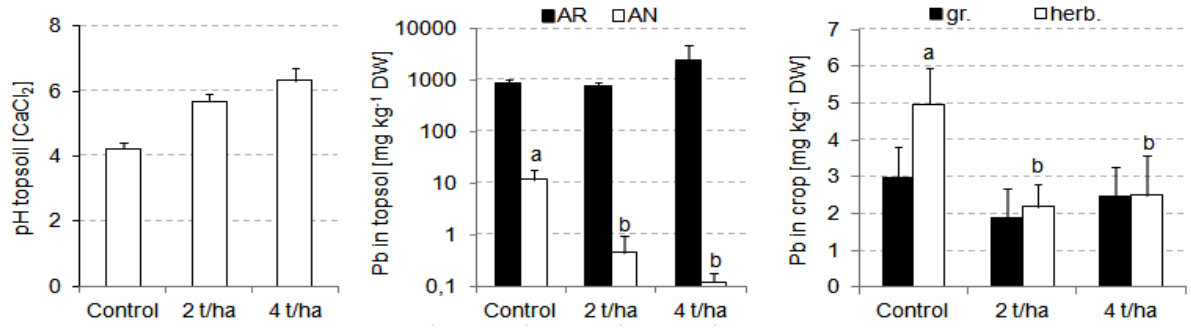

Fig. 1: In situ stabilization of Pb at grassland using marl lime; AR= aqua regia extractable Pb; AN =NH_4NO_3-soluble Pb; gr. = grasses; herb. = other herbaceous plants

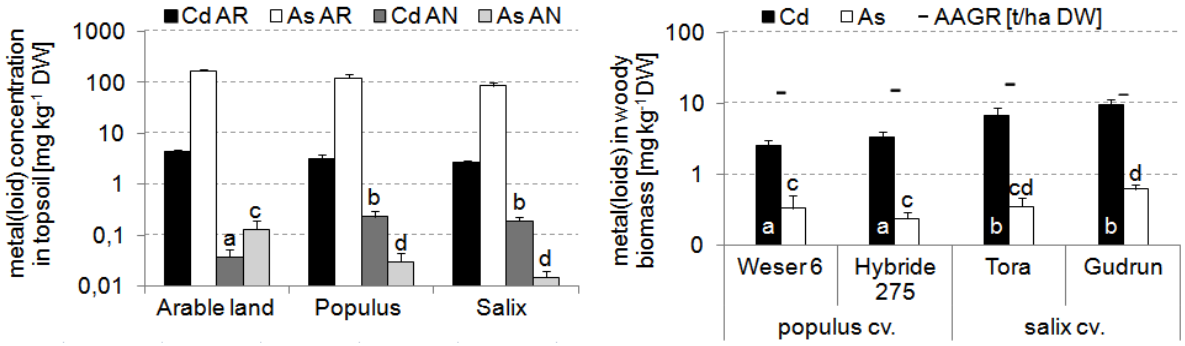

Fig. 2: Mobility of Cd and As under different land use options and TE uptake of different poplar and willow clones; AR= aqua regia; AN = NH_4NO_3; AAGR = average annual growth rate (biomass)

As a result marl lime amendments significantly enhanced pH and thereby reduced the mobility of heavy metals (HM) in soil and their concentration in plants e.g. on grassland (Fig. 1; exemplarily shown for Pb). As grasses tend to accumulate less HM when compared to other herbaceous plants, especially in case of Cd, agricultural measures to favor the predominance of grasses should be conducted on TECS in order to stay in line with legal thresholds for animal feed (COMMISSION DIRECTIVE 2002/32/EC).

A change in land-use from traditional agricultural production to SRC resulted in an increase of mobile Cd in soil, which can mainly be attributed to a decrease of pH (Fig. 2). This might be favorable for phytoextraction purposes. If phytostabilization and bioenergy production are intended liming should be conducted at least once during implementation of a SRC-plantation on TECS to avoid acidic soil conditions often associated with tree populations in the long term. In contrast to Cd the mobility of As in soil significantly decreased under SRC, especially in the rhizosphere of willows, when compared to arable land. Possible mechanisms for As-immobilization in the rhizosphere are sorption and precipitation processes, pH decrease, O_2 release from roots as well as the formation of Fe plaque (FITZ & WENZEL 2002). In conclusion differences in element uptake, biomass production and rhizosphere processes make a sound choice of species and cultivars crucial for phytoextraction or –stabilization purposes as well as for economically viable biomass production.

On arable land marl lime amendments significantly reduced mobile Cd and Pb in soil and Tl uptake by winter oilseed rape. Extended phosphorus fertilization slightly reduced As transfer into straw of winter oilseed rape. Among cereals distinct cultivar-dependent accumulation patterns are reported by several authors (STOLT, ASP & HULTIN 2006, KLOSE 2010). Therefore a mitigation of TE-transfer into the food chain can be achieved by the choice of low accumulating cultivars, which could be verified by results from a praxis field trial with different cultivars of winter wheat in Saxony (cp. Fig. 3).

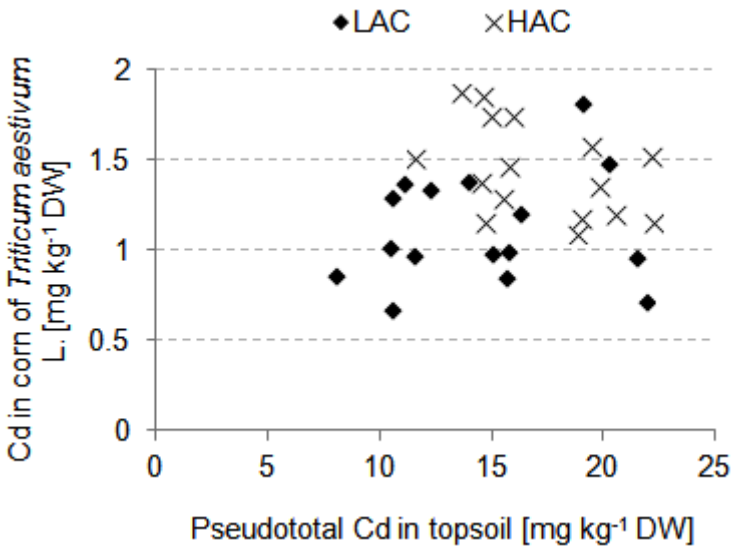

Fig. 3: Cultivar-dependent Cd-accumulation in corn of winter wheat; LAC = low accumulating cultivar; HAC = high accumulating cultivar

In summary a broad range of GRO exists to enable farmers who have to cope with the historical burden of soil contamination to remain conform with European and national legislation for e.g. food safety and simultaneously manage contaminated farmland in an economically viable and sustainable way.

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14th October 2014, 13.00 – 13.30h

"Microbial community structure and activity in trace element-contaminated soils (phyto)managed by Gentle Remediation Options (GRO)"

Speaker: Maria Touceda-González, AIT Austrian Institute of Technology GmbH, Austria

Background and objectives

Trace elements (TE) are among the most frequently occurring soil contaminants at polluted sites across Europe (EEA, 2007). Gentle soil remediation options (GRO) are clean-up techniques based on the combined use of plants, amendments and associated microorganisms, which can potentially restore soil functions and quality. Soil microorganisms play a vital role in biogeochemical TE cycling and ecosystem functionality (decomposition of soil organic matter, nutrient cycling and stabilization of soil structure), and microbial properties are considered ideal indicators of soil quality (Schloter et al., 2003). Monitoring the composition and activity of the soil microbial community, when evaluating the effectiveness of soil remediation practices, is vital (Mench et al., 2006). The objective of this study was to evaluate the effects of long-term GRO on the soil microbial biomass and activity, microbial community structure and activity of enzymes involved in C, N, P and S cycling.

Methodology

Soil samples were collected from untreated and treated plots of six European field studies of the EU GREENLAND project which have been managed for over 5 years with either aided phytostabilisation (Biogeco (FR)), *in situ* stabilisation and phytoexclusion (Arnoldstein (AT), Piekary (PL)), or (aided) phytoextraction (Biogeco (FR), Lommel (BE), Högbytorp site (SE), and Freiberg-Halsbrucke (DE)). Soil respiration, microbial biomass (ATP content) and the activities of hydrolase enzymes involved in the biogeochemical cycles of C, N, P, and S were measured. Community structure was studied using denaturing gradient gel electrophoresis (DGGE) focusing on the total Eubacterial community, *Alpha*- and *Beta-proteobacteria*, *Actinobacteria* and *Streptomycetaceae*. Similarities in DGGE fingerprints based on 16S rDNA amplified fragments were analysed using cluster analysis (UPGMA). Using quantitative PCR (qPCR), the numbers of copies of genes involved in key processes of the soil N cycle (ammonia oxidation and denitrification) were determined. The influence of general soil physicochemical properties (pH, CEC, total C and N, available P), total and phytoavailable concentrations of TE on the bacterial community were further assessed using canonical correspondence analysis (CANOCO v5).

Main results and conclusion

Depending on the site, the GRO applied induced an increase in microbial biomass and activity. At the Biogeco site basal respiration was also significantly higher in treated soils (Figure 1). Soil enzyme activities were generally higher in treated soils compared to untreated soils, and this was most pronounced at the Biogeco site where an increase in all enzyme activities was observed (Figure 1). In contrast, at the Högbytorp site a lower ATP content and enzyme activity was found in treated soils. Phytomanagement also led to clear differences in bacterial community structure, observed through the DGGE profiles (at both the total community and group level) and the numbers of copies of genes involved in the N cycle (nirK, nirS, nosZ, amoA). Complex DGGE band patterns were obtained for all sites and bacterial groups, and analyses of DGGE fingerprinting showed a clear separation in the microbial community struc-

ture between untreated and treated soils at all sites, albeit more pronounced at some sites than others. The most pronounced differences were observed at the Biogeco site where aided phytostabilisation (amendment with zerovalent iron grit and compost (OMZ) and cultivation of woody crops and grasses) and aided phytoextraction (amendment with compost and dolomitic limestone (OMDL) and crop rotation with tobacco and sunflower) were implemented (Figure 1). Large differences between soil treatments were also seen at the smelter-affected Piekary site where *in situ* stabilisation and phytoexclusion were applied. Soils were amended with combinations of a by-product limestone and municipal biosolids at two rates and vegetated with a mixture of grasses. Results obtained with the qPCR approach reinforced the results obtained using DGGE, showing in general an increase in the copy numbers of denitrification and nitrification genes in treated soils.

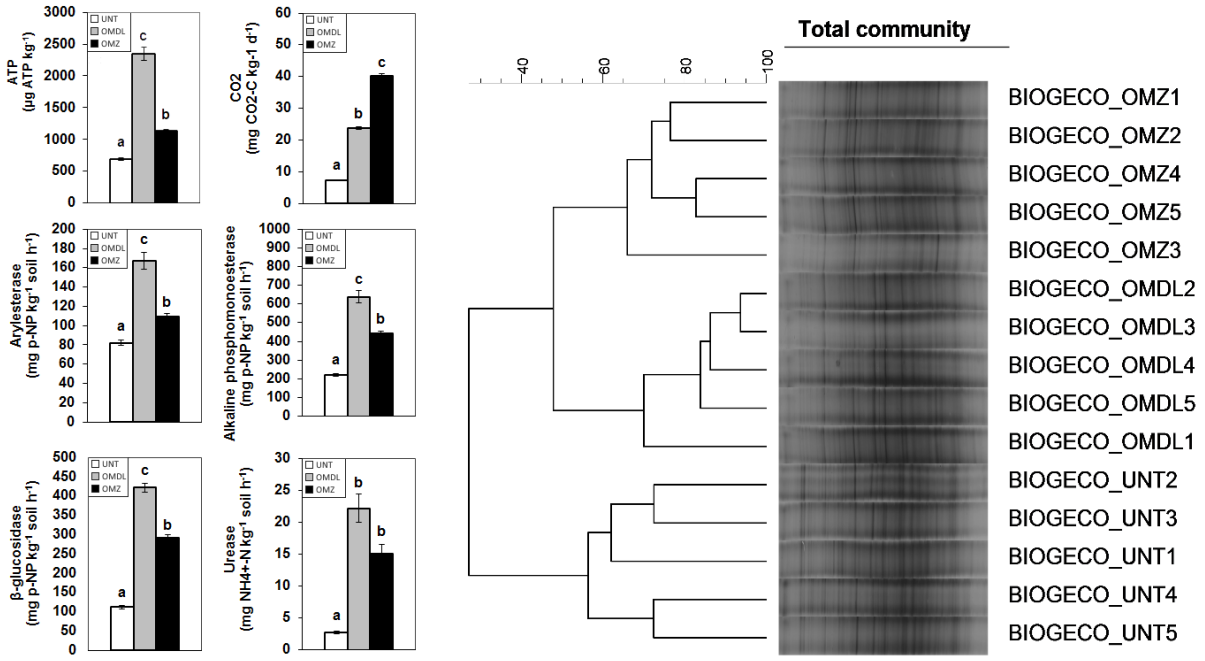

Figure 1. Soil respiration, ATP content, enzyme activities and similarity dendrogram based on Eubacterial DGGE profiles at the Biogeco site (untreated soils (UNT), phytomanaged soils (OMDL and OMZ)).

Overall, the results clearly demonstrate that GRO implementation leads to shifts in the bacterial community and diversity.

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14th October 2014, 14.30 – 16.00h
Session: "Solutions to bring state-of-the-art knowledge and information into application"
Chair: Stephan Bartke, UFZ, Germany

14th October 2014, 14.30 – 15.00h
"Brownfield regeneration in a circular economy"
Speaker: Jaap Tuinstra, Soil Protection Technical Committee, The Netherlands

The concepts of circular economy and ecosystem services can provide and inspiring and solid starting point for sustainable brownfield regeneration. Although soil or groundwater contamination has resulted in a negative imago, most brownfield sites have 'hidden' values that can be discovered by thinking in line with these concepts. As soon as these hidden values are vitalized, it might be possible to restore the societal and economic value.

Circular economy is an economic and industrial system with the aim to maximize the reuse of products and raw materials and minimize their value-destruction; it aims at adding value in every stage of the system. Hidden values related to the circular economy refer to both a technical and a biological cycle. In technical terms, one can think of the re-use of old building materials, infrastructure that can be re-used or restored or mining and re-use of waste on former dump sites. The biological cycle includes for instance the water cycle (infiltration, evaporation) and the carbon cycle. Climate adaptation measures like the improvement of water storage in soil and greening of the urban environment relate to these cycles.

The ecosystem services concept relates to decision making considering the benefits of ecosystems for humity. It increases awareness of the importance of the natural capital of, for instance, the (impacted) soil. Hidden values of a site might include the infiltration capacity, the potential for growing vegetation, stability, preservation of archeological findings etcetera.

Visualisation and (indicative) valuation of these ecosystem services are important first steps in the decision making process around the redevelopment of a brownfield.

The presentation will focus on these hidden values, related to the cycles and ecosystem services, and will conclude with a number of aspects of natural capital to be considered in decision making for regeneration of brownfield sites, based upon recent advises of the Soil Protection Technical Committee to the Dutch national government (see references).

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Advice Groundwater layer and soil toplayer to circular economy, TCB A086 (2013) [in Dutch]

14th October 2014, 15.00 – 15.30h
"The Brownfield Navigator"
Speaker: Linda Maring, Deltares, The Netherlands

Brownfield navigator objectives

The Brownfield Navigator (BFN) is developed within the HOMBRE project as a decision framework to facilitate successful Brownfield (BF) regeneration. Next to regeneration, attention is paid to the emergence and prevention of BFs.

The BFN is developed for a municipal target group as many BF cases start with the intervention of municipalities or regional authorities. Their actions, or inaction, have a decisive impact on the manner and pace at which brownfield land is brought back into beneficial use, or the degree to which it might remain under-used or derelict.

The BFN supports the study of brownfield emergence and subsequently prevention, and brownfield regeneration processes by providing guidance and tools through the various management phases of the land cycle and by map functionality, examples and documentation. The management phases that are distinguished in the HOMBRE decision framework are:

BFN management phases

1) Anticipating change (pre-BF phase);

The concept of anticipating brownfield emergence using "early warning indicators (EWI)" is developed in HOMBRE. It aims at anticipating at an early stage if a location is at stake of becoming a BF, so the obstacles for change are still surmountable. For the purposes of the BFN, a method for anticipating these changes has been proposed. Based on a set of EWI, this method allows to map areas which may be at risk of having brownfield emergence on various spatial scales (neighbourhoods, towns and possibly regional).

Figure 1 - BFN tools along the land cycle

2) Planning the transition (regeneration phase; this phase can also be used for the planning of preventive actions of a pre-BF site);
In the planning phase, stakeholders plan the transition towards the next use of a site. The current ease at which BF sites are being redeveloped and hence who will pay for the redevelopment depends largely on the perceived cost/benefit ratio of a redevelopment project. When value can be created and/or opportunities are foreseen that exceed the costs of regenerating the site while risks for regeneration are predictable, a site will probably be redeveloped by the private sector (A-type BFs). When value cannot easily be created for acceptable costs, a site will probably not redevelop and consequently won't transient to the next use phase unless a continuous flow of resources is guaranteed, e.g. by funding subsidies from authorities (C-type BFs). When the added value of a site is doubtful and/or not easily predictable while costs are relatively high, a site can only be redeveloped by private and public partnerships (B-type BFs). HOMBRE investigated different concepts that might enable regeneration of B and C sites. In the BFN different tools are offered to determine the best options for a site to unlock the site.
Once consensus has been reached (by an initiative group) that intervention is needed at a site, a first assessment is proposed to understand what is and has been going on at the site and its surroundings (up to the regional scale). Subsequently, the type of site (A/B/C) is determined with collected data of the site. Also stakeholders are identified and how they should participate to support the transition towards the new use phase. Stakeholders define their ambitions and vision, thus needs of the site, and investigate (together) the opportunities of the site and region; with this information scenarios are developed how these opportunities and needs can be reached. In this step, the different HOMBRE concepts and tools on finding synergies and opportunities are found. The HOMBRE input focuses e.g. on the opportunities for soft re-use. Finally stakeholders choose the most optimal scenario and set up the redevelopment plan (towards realisation).

3) Check achievement (the management and maintenance phase following a BF regeneration project);
The last phase of the Land Management Cycle is "Checking achievement" where success of the realisation is monitored. One of the main obstacles in redeveloping a site, is that redevelopment projects are often not (seen as) successful. This can have different reasons, for example when (maintenance) costs are higher than expected and/or goals set in the planning phase were (presumably) not met or realistic. Often criteria for success, service, and sustainability are not defined, monitored and evaluated, resulting in a scattering of decisions made by individual stakeholders. By monitoring the indicators set in the planning phase at a central point, the success of a project can be better determined. In HOMBRE tools are developed and taken up in the BFN, to set up and evaluate criteria. It also makes the BF redeveloper aware of the possibility that the chosen criteria can show signs that the site is changing again and losing its function, thus moving towards the 'anticipating change' phase. This closes the land cycle again.

Wrapping up
The modules and items in the BFN are not necessarily subsequent in their use. They can be used iteratively, simultaneously, or even left out by the user. The objective of this decision support framework is not to make decisions itself, but to support the stakeholders that have to make the decisions.

The BFN provides an overview of helpful modules, including visualization, information and tools. The BFN will therefore not replace the BF manager, but gives insight in management phases, decisions and to stimulate the use of the (HOMBRE) highlights that research on BF regeneration has provided and that can add to the business as usual.

The Brownfield Navigator is available as an online tool, developed using only open source tools and software. The BFN has been tested in its basic form, and can be made more fit-for use for specific users and/or countries in future projects.

14th October 2014, 15.30 – 16.00h

"Timbre Information System for the provision of tailored and customized information on brownfield regeneration according to users' requirements"

Speaker: Lisa Pizzol, University Ca' Foscari Venice, Italy

In the European context, brownfield regeneration has too often proven to be unsuccessful due to several problems, delays and failure factors. One of these problems concerns the non-visibility of available methodologies and tools, which hampers stakeholders in accessing and applying the most useful and customised information. This situation brings to an unsuccessful regeneration of brownfield sites, which is recognized as a problem.

In order to overcome this problem, the Timbre Information System for Brownfield Regeneration (IS) has been developed with the aim of supporting stakeholders in sharing, accessing and selecting the most suitable information for the different phases of the brownfield management process, taking into account their specific requirements and the evaluations provided by previous users.

The tool is composed of a web database, where web links to relevant information on brownfield regeneration are stored, and by a ranking methodology, which makes use of Artificial Neural Networks (i.e. a mathematical model inspired by biological neural networks and composed of interconnected groups of artificial neurons), to classify those web links according to users' characteristics, information needs and specific requirements. The tool is expected to become a "living system" which relies on end-users inputs, updates and evaluations and requires an active involvement of experts and stakeholders.

To this end, the IS has been tested in five events: the first testing activity has been conducted internally by Timbre partners, while the second, the third, the fourth and the fifth testing activities have been carried out by German, Czech, Romanian and Polish stakeholders during four *ad hoc* workshops.

Stakeholder commitment in testing the tool and in evaluating the accessed information allowed to improve both the tool functionalities and the results delivered by the ranking methodology which provides more and more tailored outputs as more users' sessions are collected in the system.

Moreover, the workshops results showed that the tool is useful in overcoming the barriers which actually hamper the optimal and effective use of available information, approaches, technologies and tools for brownfield regeneration across different European Countries, improving information sharing and application.

1. Introduction.

Brownfield regeneration is essential for sustainable land management in European Member States, and in the last decades many EU research projects and initiatives developed many approaches, tools and technologies to support this process. Yet this variety of products had and still has a limited impact on brownfield regeneration success, because they are too often not used in their entire potential. This is due to their scarce visibility, so that often stakeholders are not aware of the possibility to apply such useful, innovative and already available approaches and tools. Moreover, because of the specificity of local and regional administrative structures and because of the variety of stakeholders' attitudes, there may be significant difficulties in adapting such products to legal and site-specific requirements.

This situation highlights the need to improve the access to available information and to support the selection of the most suitable solutions based on stakeholders' needs.

The European project Timbre (Tailored Improvement of Brownfield Regeneration in Europe), funded by the 7th Framework Programme, aims to overcome these barriers by providing stakeholders with customised problem- and target-oriented packages of approaches, technologies and tools.

Within Timbre, Work Package 1 (WP1), coordinated by the University Ca' Foscari of Venice (UNIVE), developed an Information System for Brownfield Regeneration (IS), to provide stakeholders with customized information related to the main phases of the risk-based and sustainable brownfield regeneration process.

2. The Timbre Information System for Brownfield Regeneration.

The first step for the development of the IS consisted in the definition of a framework for the collection of information on brownfield regeneration, where the main phases of the risk-based regeneration process are depicted and correspond to "information categories" used to store, collect and access available information (in the form of web-links). This framework is the result of a stakeholder participative process. Selecting the information categories included in the framework, users can access the different sections of the Timbre web database: one of the main components of the IS where a wide collection of web-links to information on brownfield regeneration is available.

With the aim of guiding users among the variety of information, the IS makes use of a multi-criteria methodology for the ranking of the collected information, which makes use of Artificial Neural Networks (ANN, i.e. a mathematical model inspired by biological neural networks and composed of interconnected groups of artificial neurons).

The IS is expected to become a "living system", which will rely on direct users inputs, updates and evaluations. According to users' inputs, results will be tailored to site-specific and personal needs, local priorities and legal requirements.

In order to initiate and enhance this process, the IS has been tested by German, Czech, Romanian and Polish stakeholders during four workshops.

3. Conclusions.

The IS, thanks to the developed ANN methodology, is able to provide users with customised and tailored lists of web-links as outputs of search sessions. The web-links are ranked according to users' requirements, to statistics from previous users with the same characteristics, to users' search goals, and other specific indications.

This way the IS represents an innovative tool for increasing and improving the access to available information on brownfield regeneration, overcoming the barriers which hamper the applicability of available approaches, technologies and tools across different Countries.

14th October 2014, 14.30 – 16.00h
Session: "Gentle soil remediation options 2"
Chair: Markus Puschenreiter, BOKU, Austria

14th October 2014, 14.30 – 15.00h

"Field demonstrations of Gentle (Phyto)Remediation Options in the EU FP7 GREEN-LAND network of trace element-contaminated sites"

Speaker: Michel Mench, INRA – University of Bordeaux, France

Performances of the most promising gentle remediation options (GRO) for trace element-contaminated soils (TECS), i.e. (aided) phytostabilisation, phytoextraction, and in situ stabilization/phytoexclusion, are assessed in a European network of 14 large field trials, within the EU FP7 GREENLAND project (http://www.greenland-project.eu/). The GRO efficiency is evaluated regarding various (a)biotic stresses, climatic conditions, pollutant linkages, (phyto)remediation strategies and sustainable land management. Investigated field sites cover a range of contamination scenarios (e.g. agricultural soils contaminated by atmospheric deposition, sludged soils, mine tailings, landfills, dredged sediments, and post-industrial soils).

Harmonized datasets are developed on metal(loid) exposure, plant parameters and yields (notably for plant parts converted into feedstock), mineral and biochemical composition of plant parts, ecosystem services, financial costs and benefits. Soils are sampled to monitor changes in metal(loid) exposure (e.g. labile contaminant pools), transfer to environmental compartments and bioaccessibility, ecotoxicological risks, and soil (multi)functionality and biodiversity. Transfer and bioconcentration factors, shoot metal(loid) removal, contaminant fluxes, and tolerance indices are computed. Dose (exposure) – plant response relationships are modelled.

Data are summarized for various plant covers including poplar and willow short rotation coppices, annual crops of secondary metal accumulators (sunflower and tobacco), and metal-excluders (e.g. perennial grasses, barley and maize cultivars). The long-term efficiency and sustainability of GRO, progresses in remediation objectives (in compliance with national and best procedures), timescale management, maintenance, uncertainty and limitations (including spatial variation of contaminants, water requirements, global changes, etc.), potential flexibility and implementation at other sites are discussed as well as newly developed GRO and practices to improve the GRO efficiency (e.g. bioaugmentation).

Acknowledgements: The authors are grateful for financial support from the European Commission under the Seventh Framework Programme for Research (FP7-KBBE-266124, GREENLAND).

14th October 2014, 15.00 – 15.30h

"Deployment of aided phytostabilisation at field scale: set up and monitoring lessons"

Speaker: Valérie Bert, INERIS, France

In the project GREENLAND (FP7, KBBE-2010-4, 266124) project, different phytomanagement options at large field scale were tested to gain information on practical deployment and long term efficiency. Among the network of 13 large trace element (TE) contaminated sites, one located in the Nord-Pas-de-Calais region (France), was implemented in September 2011 with aided phytostabilisation, i.e. the combination of plants and soil amendment to reduce the risks associated to the presence of soil TE. The site (1 ha) is part of a large sediment disposal site which was affected by intensive industrial activities. The objective was to combine aided phytostabilisation with bioenergy production based on *Salix* cultivation to reduce the environmental risk posed by these sediments and allow the economic valorization of the contaminated sediments via the sale of the produced biomass. Another objective was to test aided phytostabilisation as a strategy to avoid the propagation of the Japanese knotweed, an invasive species that occurred at the sediment landfill site.

In a first step, *Deschampsia cespitosa*, a grass, and Thomas basic slag (TBS), a basic mineral amendment, already tested at field site on an experimental TE contaminated landfill site, were used to stabilise the TE of the top sediment. In a second step, a SRC composed of two *Salix* cultivars ('Inger' and Tordis') was deployed to produce biomass.

First results show the success of the plant cover that rapidly reached 100% and the success of the *Salix* plantation although phytoxicity signs appeared after few months. Several hypotheses were studied of which the grass competition for water and essential nutrients. As the sediment landfill site is highly contaminated with metals, mainly Zn and Cd, TBS is expected to decrease the metal shoot transfer towards the grass and the two planted *Salix* clones and to decrease the metal labile pool. At this stage of the project monitoring the effects of TBS on soil metal mobility or the *Salix* leaf metal concentrations have not yet been measured. The grass showed very little Zn and Cd concentrations in aerial parts that confirm the choice of this plant as a candidate for phytostabilisation. Conversely, the two Salix cultivars showed very high Cd and Zn leaf concentrations that might not be compatible with a phytostabilisation strategy. The Cd and Zn concentrations in leaves and wood at harvest might direct the conversion process of the produced biomass (thermal treatment, metal recovery). A decrease in Japanese Knotweed was visible after one year of monitoring and corresponded to a reduction in coverage of 27% of the surface area showing that the Japanese Knotweed is less competitive and its growth decrease represents a beneficial effect of phytostabilization in terms of ecological services.

The whole chain of the aided phytostabilisation, i.e. from field preparation to the conversion process of the produced biomass, is addressed by this project. Results will be presented step by step taking into account practical experiences and scientific knowledge as well as regulation and economical aspects.

14th October 2014, 15.30 – 16.00h

"Processing of plant biomass harvested at trace element-contaminated sites managed by gentle (phyto)remediation options"

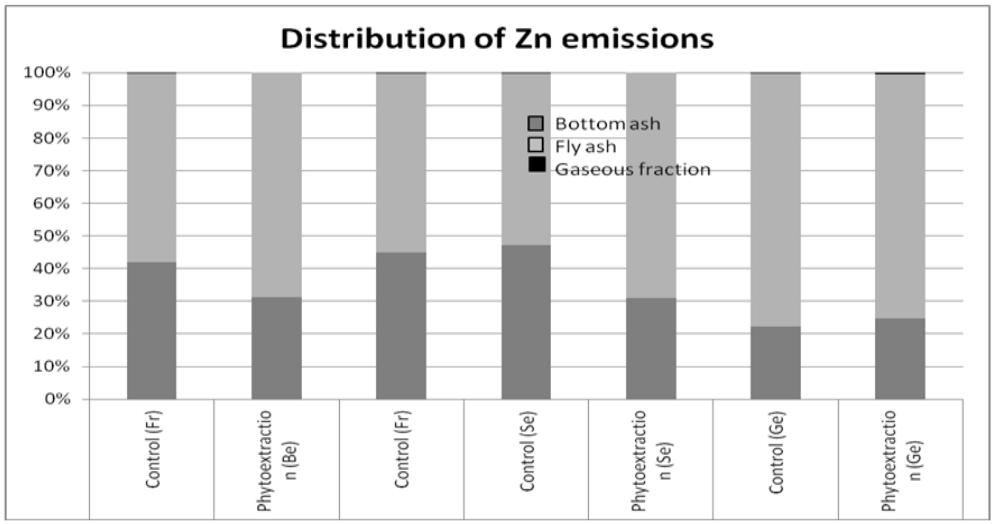
Speaker: Valérie Bert, INERIS, France

Depending on the GRO (phytoextraction, in situ immobilization and aided phytostabilization) set up on a polluted site and the type of plant used, harvested plant parts may contain concentrations of trace elements (TE) that may be higher than those found in similar vegetation grown on uncontaminated soils (background). To render such technologies economically attractive and feasible, harvested biomass should be valuable and enter valuation pathways. On contaminated lands, plants may serve to provide feedstocks for bioenergy, non-food products and biofuels and, thus, may contribute to achieve the EU aim by 2020, i.e. to get 20% of its energy from renewable sources. In GREENLAND (http://www.greenland-project.eu/), one task aimed at testing various conventional and innovative technologies of biomass valorisation, such as combustion, anaerobic digestion, pyrolysis and solvolysis, and determining the fate of the TE in the resulting products of each conversion process. Assays were carried out on a wide range of plant species cultivated at the field trials of the GREENLAND partners.

Figure 1 shows the distribution of Zn in the emissions, i.e. bottom ash, particulate fraction (fly ash) and gaseous fraction of the flue gas, as a result of combustion assays performed in a biomass boiler of 40kW on willows and poplars cultivated for phytoextraction purposes and the comparison with corresponding virgin wood (control). For all assays, Zn occurred mainly (> 50%) in the fly ash. The bottom ash represents the second compartment for the occurrence of Zn whereas the gaseous fraction of the flue gas represents a minor compartment for Zn emissions. The distribution is not depending on the initial burnt wood, i.e. virgin wood (control) or Zn enriched wood (phytoextraction). The use of TE enriched wood in biomass boilers seems possible if they are equipped with efficient filters to avoid air pollution. Anaerobic digestion, pyrolysis and solvolysis assays were performed in batch reactors. Results from all these conversion technologies will be presented and discussed as well as the possibility to use end products of the processes.

The valuation of plants produced by GRO seems possible if TE do not disturb the functioning and the performance of the process and if such plant use complies with current regulation.

Acknowledgements: This work was financially supported by European founds through GREENLAND (FP7, KBBE-2010-4, 26124).



14th October 2014, 16.30 – 17.30h
Session: "Approaches to regeneration and evaluation of their sustainability"
Chair: Uwe Ferber, Projektgruppe Stadt+Entwicklung, Germany

14th October 2014, 16.30 – 17.00h
"Conceptual site or project models for sustainability assessment and overall value"
Speaker: Pierre Menger, Tecnalia, Spain

A holistic approach to sustainability assessment allows the broadest range of possible project service opportunities (and their value) to be considered, and provides an understanding of their wider effects (positive or negative). However, some find such a broad approach to sustainability assessment overly complex and prefer to focus on a few readily usable tools and parameters such as carbon or environmental footprinting. Unfortunately these do not describe sustainability as whole, nor do they meet all stakeholder interests. This paper suggests the use of conceptual models for sustainability as a way forward that supports a more holistic understanding of services, sustainability and value.

The approach adapts well known land contamination risk assessment concepts to develop an approach for conceptual site models for sustainability. For a sustainability effect to be manifest there needs to be a "pressure" of some kind, a "receptor" that can be affected by that pressure; and, crucially, a mechanism through which the pressure influences the receptor. All three: pressure, mechanism and receptor need to be linked for a sustainability effect to exist – i.e. a sustainability linkage.

Developing a conceptual site model based on linkages allows for duplications to be identified and discarded, and a clearer way for combined effects on a particular receptor from several sources to be understood. A network diagram can exploit this to simplify the representation of sustainability and consequently facilitate its assessment and management. Such a model can assist design, option appraisal, verification and valuation for projects. It can also improve understanding of overall project value by explicitly linking the different services a project is intended to provide to sustainability, and potentially identifying opportunities for additional services from this broader sustainability outlook.

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www.aquaconsoil.org/AquaConSoil2013/Proceedings.html

14th October 2014, 17.00 – 17.30h

"Biomass production on brownfields"

Speaker: Karl Eckert, Projektgruppe Stadt + Entwicklung, Germany

Biomass provides an alternative energy source which can directly support the energy needs of a community with specific advantages, including its storability and the possibility of undertaking small-scale, decentralized operations. It is in this context that brownfield sites provide opportunities for implementing smaller scale operations for the production of biomass products. These actions have various social, environmental and economic benefits and can be pursued if the conditions are correct.

The HOMBRE project has developed a decision tree to support decision-makers in identifying brownfield land to recycle for the production of biomass products. The decision tree was created through the analysis of biomass production sites on brownfield land in Germany and England. The specific criteria of brownfield sties can be compared to the requirements of the decision tree to determine if the site in question can be, either fully or partially, reactivated for biomass production. Considerations detailed out by the decision tree include aspects related to ground quality, plot size, former site use, possible contamination, potential risks, legal restrictions among other considerations.

A particular attention is dedicated to landscape and biodiversity, in order to assure a good design and environmental quality to make the difference also for the local communities.

In this manner, the decision tree can help identify potential land to recycle for the location of the production of sustainable energy sources.

14th October 2014, 16.30 – 17.30h
Session: "Gentle soil remediation options 3"
Chair: Markus Puschenreiter, BOKU, Austria

14th October 2014, 16.30 – 17.00h
"Developing a practical decision support tool (DST) for the application"
Speaker: Andrew Cundy, University of Brighton, UK

A range of systems and tools have been proposed to support decision making within the contaminated land arena. A critical review, coupled with stakeholder feedback collected during the European Commission FP6 ERANET project SUMATECS and presented in Onwubuya et al. (2009), has highlighted a general lack of stakeholder knowledge of these systems and tools, and specifically of those which can be used to support the selection and application of less intensive and invasive remediation or risk management options, such as those involving plant (phyto-), fungal (myco-) or bacterial-based methods (termed here gentle remediation options or GRO). Following the SUMATECS project, the European Commission FP7 GREENLAND project was established to overcome a range of barriers to the practical application of GRO, focusing particularly on phytotechnologies. A key component of this project was the development, using data from long-term (> 5 years) phytotechnology site trials across Europe, of a practical and simple decision support tool (DST) focused on regulators, consultants, site managers and planners. This DST is presented here.

The GREENLAND DST is a Microsoft Excel-based tool which follows a tiered approach. The tool is designed to interface with existing national guidance at the options appraisal stage. The tiered approach used (Figure 1) consists of three phases: phase 1 (feasibility), phase 2 (semi-quantitative assessment) and phase 3 (technical assessment). Each phase terminates in a decision point (Y = proceed to next phase; N = return to option appraisal), with increasing complexity and time investment requirements from phase 1 to 3. Phase 1 includes definitions and high level operating windows, and examples of practical, large-scale GRO applications. Phase 2 contains modules on stakeholder engagement (drawing on stakeholder engagement principles recently published in Cundy et al., 2013), sustainability assessment and an outline cost-calculator. Phase 3 contains detailed operating windows, and technical information for practical remediation project design and implementation. The DST has been populated and tested using data from the GREENLAND site network, and a major redevelopment project in east London, UK. Ongoing work is aimed at finalising the DST, continuing the use of an iterative approach involving validation by a range of experts and potential end-users.

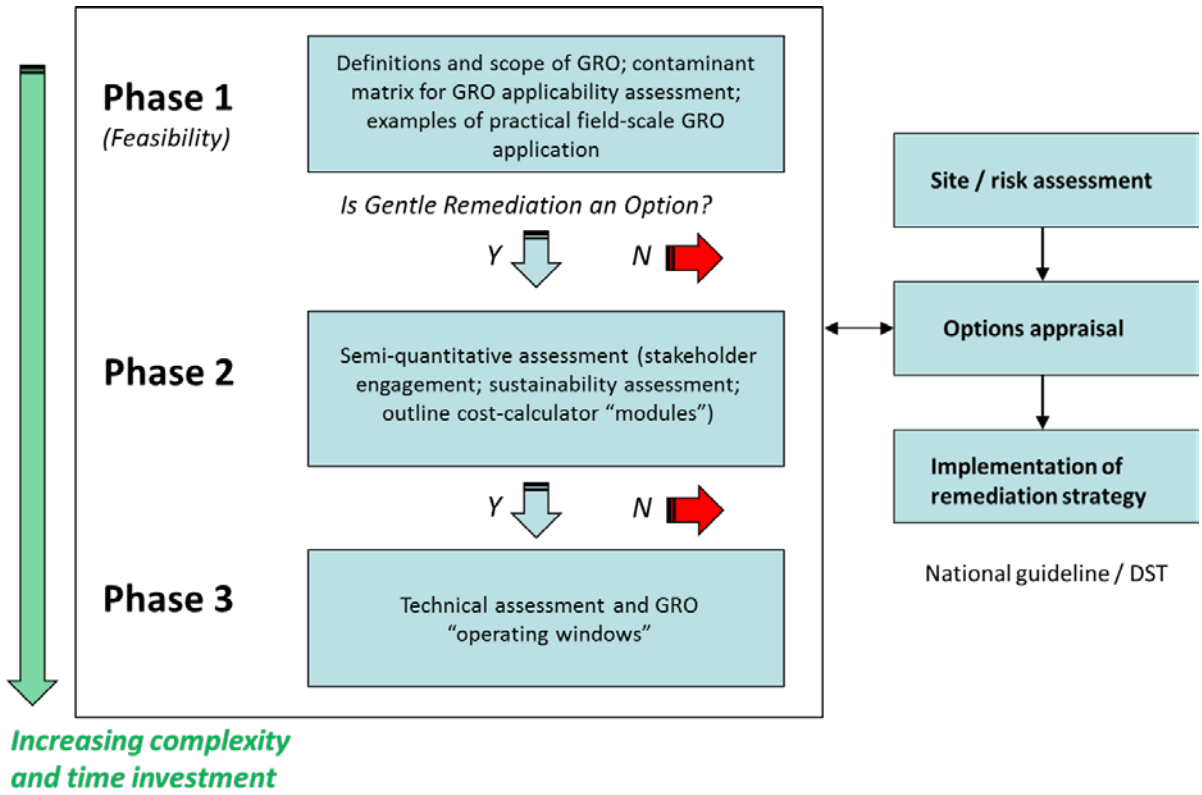

Figure 1: Overview of the phased approach used in the GREENLAND DST.

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Acknowledgements: The authors are grateful for financial support from the European Commission under the Seventh Framework Programme for Research (FP7-KBBE-266124, GREENLAND.

14th October 2014, 17.00 – 17.30h

"Testing novel combinations of amendments for stabilization of metals in heavy contaminated soils"

Speaker: Grzegorz Siebielec, Institute of Soil Science and Plant Culitvation (IUNG), Poland

Metals can be stabilized in soil by amendments increasing metal adsorption or altering their chemical form. Few experiments compare different amendments under similar environmental conditions, or consider whether all soil properties or functions (microbes, soil fauna, plant growth, retention, colloid stability, etc.) are similarly protected. Within the EU FP7 Greenland project (266124) we compared the impact of novel soil amendment combinations and traditional materials on metal solubility and response of plants, soil organisms and microbial activity.

One-year greenhouse pot experiments were established: soil A, less toxic agricultural soil contaminated through long-term Zn/Pb smelter emissions in Poland (pH 7.0); soil B, toxic soil contaminated through smelter dust spill in Poland (pH 6.8). Amendments were tested individually and in combination in planted and unplanted soils: compost, drinking water residue, iron grit, Ca-phosphate, LD slag, Thomas basic slag, gravel sludge, siderite, Fe nanosorbent, and cyclonic ash. Soil B was planted with grasses, and soil A with lettuce. Plants were periodically harvested, yields recorded and metal content determined. Soil metal extractability and bioaccessibility, pH, EC and enzymatic activity were measured. Soil pore waters were analysed for trace element/nutrient concentrations.

Parallel tests evaluated earthworm behaviour and metal accumulation. Earthworms Eisenia veneta were put into jars – five earthworms (previously weighed to record the initial weight) to each jar. The jars were stored at 20 ° C and soil moisture was maintained at field water capacity. Earthworms were removed from the soil after 4 weeks, weighted and analyzed for metals content. The soil was thoroughly mixed and samples were taken for the determination of metal solubility and pH.
The earthworms were removed from soil and kept on moist filter papers in glass vessels for 3 days for full depuration of worms. Then they were washed in deionized water, dried on paper towels, and killed by dry-freezing. Freezed earthworms were dried in a quartz crucible at 105°C for 20h. The dry weight of the earthworms was recorded and the samples were dissolved in concentrated nitric acid (Baker Analyzed Instra). Metal concentrations in earthworm extracts were measured with inductively coupled plasma mass spectrometry (ICP-MS, AGILENT 7500CE)

Acknowledgements: The authors are grateful for financial support from the European Commission under the Seventh Framework Programme for Research (FP7-KBBE-266124, GREENLAND)

15th October 2014, 09.40 – 11.10h
Session: "Decision support tools on technologies for land revitalization"
Chair: Linda Maring, Deltares, The Netherlands

15th October 2014, 09.40 – 10.10h

"Tool-assisted design and comparative evaluation of sustainable land use alternatives for brownfield redevelopment"

Speaker: Michael Finkel, University of Tuebingen, Germany

The reduction of land consumption is increasingly seen as a vital aspect of sustainable development. In many countries the redevelopment of brownfields has the potential to significantly contribute to this reduction. Since the redevelopment process is often complicated e.g. by uncertainties regarding the contamination of the site, anticipated costs of required clean-up and by intricate negotiation among stakeholders with differing interests, many of the brownfields to date remain undeveloped.

We present a web-based Decision Support System (DSS) that facilitates the design and comparative evaluation of land re-use alternatives for brownfields. In order to support decision makers in assessing and communicating pros and cons of possible re-use alternatives among stakeholders, the system features novel approaches to integrate three of the main aspects of brownfields redevelopment within a spatial planning and assessment framework, (i) costs for clean-up of soil and groundwater required to mitigate existing risks from contamination, (ii) the market value of land including perceived market risks of redevelopment, and (iii) the suitability of planned re-use with respect to sustainable development.

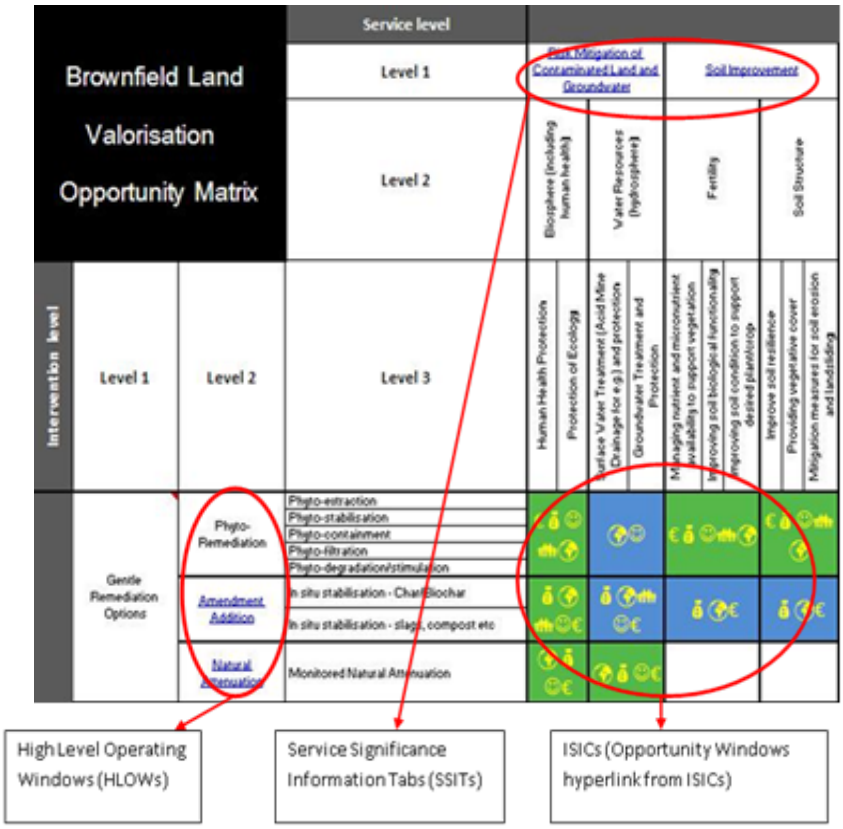
The potential of the DSS will be demonstrated by a number of case studies. In particular, it will be shown how re-use options can be systematically assessed with respect to different features and aspects of mixed land use. The studies suggest that sustainable planning alternatives on brownfields are not necessarily costly, and that the identification of beneficial options can be strongly facilitated by the integrated evaluation scheme of the DSS.

15th October 2014, 10.10 – 10.40h

"Soft re-use of Brownfields: decision support and opportunity matrix"

Speaker: Victor Beumer, Deltares, The Netherlands

To redevelop a Brownfield with soft re-use we have assembled a Decision Support Process (DSP). This procedure consists of blocks with a recommended order and completeness. The first stage comprises pre-exploratory design blocks that can be carried out by the project group itself. During this stage a group of stakeholders is identified. The second stage comprises exploratory blocks that refine the design. This step needs to include stakeholders and external consultees with legitimate interests in the project and not just the project team for best results. The output of these two stages is an outline scheme which can then go forward for detailed design work. The use and background of the simplified procedure to support Brownfield soft re-use will be explained.



The main tool for the DSP is the Opportunity Matrix. It demonstrates the potential soft re-use interventions (which are explored through High Level Operating Windows or HLOW's) with the services (which are explained in Service Significance Information Tabs or SSIT's) that may produce value on a brownfield site Intervention/Service Interaction Cells (ISICs) are denoted by a colour code. Behind each ISIC is an Opportunity window that provides the user with information on the effect of the intervention on the desired service via SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis. We will further explain the use and background of this tool.

15th October 2014, 10.40 – 11.10h

"GIS-based Identification of Infill Development Potentials on the Basis of Topographic and Cadastral Databases – Prospects and Limits"

Speaker: Robert Hecht, Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany

In the framework of a National Strategy on Sustainable Development, the German government ambitiously addresses the significant reduction of land consumption from today's 90 hectares per day to the value of 30 by 2020. Thus, infill development strategies of settlements become more and more important, which means that developments should be realized preferably inside existing built-up areas. Despite the highly appreciated nation-wide importance of this topic, there is no sufficient data available on the amount of infill development potentials (IDP) in Germany. In order to close this information gap, the Leibniz Institute of Ecological Urban and Regional Development in Dresden conducted a research project funded by the Federal Ministry of Transport, Buildings and Urban Affairs (BMVBS) and assisted by the Federal Institute of Building, Urban Affairs and Spatial Development (BBSR).

The project comprises the design and implementation of a nationwide analysis of IDP based on a standardized survey of 12% of all municipalities in Germany. Further, digital spatial base data and GIS-modelling techniques for a nation-wide acquisition and monitoring of IDP have been investigated. During the project procedures for IDP estimation have been developed and tested. Especially the identification of gap sites and under-utilized lots could be shown to be efficiently performed using the authoritative Digital basis landscape model (ATKIS® Basic DLM) and cadastral-based building polygons. The proposed methodology mainly consists of three steps: 1) Identifying relevant unbuilt areas within the settlement body; 2) Constraint-based exclusion of areas not suitability for infill development and 3) classification of the remaining detected IDP-candidates into gap sites and underutilized lots based on their adjacency to roads. The procedures have been implemented as GIS tools and are suitable to support future automation-based long-term monitoring of IDP.

The results have been validated and will be critically discussed in the paper including an outlook of gaining better detection results when using more detailed land-use information and real estate borders derived from cadastral information systems (e.g. ALKIS®, see Figure 1).

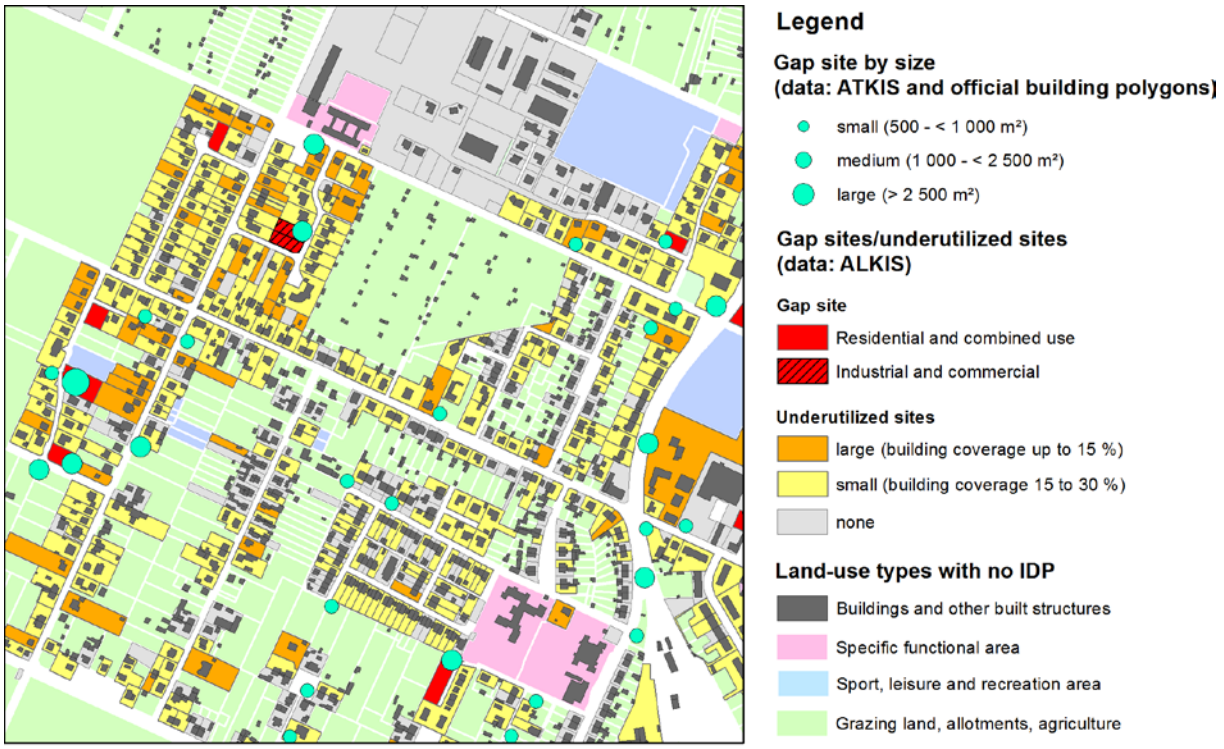


Figure 1: Identification of gap sites and underutilized sites using ALKIS® data compared to an approach using ATKIS® and building polygons (taken from BBSR 2013)

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Keywords:

Sustainable land use; infill development; gap sites; monitoring, GIS, geospatial modelling, Digital Landscape Model, building polygons, decision support tool

15th October 2014, 09.40 – 11.10h
Session: "Brownfields ahead?! – Early Brownfield Indicators"
Chair: Pauline van Gaans, Deltares, The Netherlands

15th October 2014, 09.40 – 10.10h
"Early Warning indicators brownfield regeneration: tipping points ahead?"
Speaker: Jan Gerald Ellen, Deltares, The Netherlands

Brownfields (BFs) are sites that have been affected by the former use of the site and surrounding land, are derelict or underused, may have real or perceived contamination problems, are mainly in developed urban areas and require intervention to bring them back to beneficial use (CABERNET, 2005).

The objective of this paper is to present and reflect upon a methodological approach which aims to enhances smoother land use transitions and prevent long term brownfields form emerging by designing and monitoring 'early indicators' and identifying 'tipping points' as a crucial trigger for pro-active management.

We will do so by describing state of the art theory on adaptive (land use) management and the use of early warning indicators and tipping points in this context. Using these insights from theory the results that are presented in this paper are a description and analyses of an early warning indicator approach – developed within the context of the HOMBRE project. Important conclusions are that, although it is possible to construct early indicators on societal, economic and ecological aspects of landuse management, the main challenges of using such an approach are: designing indicators together with the stakeholders, dealing with, attention for continues processes, the complexity and multilevel nature of some of the indicators and the interaction between the physical system and societal system.

The significance of a holistic and adaptive approach is that: because the future is uncertain and to prevent brownfields from occurring it is important to step up when all light are on orange.

15th October 2014, 10.10 – 10.40h

"Use of social and economic indicators for the selection of sustainable site remediation options"

Speaker: Valérie Cappuyns, KU Leuven, Belgium

In recent years, the integration of the principles of sustainability in the selection of site remediation alternatives has become an important issue. Most attention was initially paid to so-called 'green indicators' for the measurement of the wider environmental impact of soil remediation alternatives, while social and economic indicators received less attention. In the present study, 8 social and economic indicators, drawn up by the Sustainable Remediation Forum (SuRF) (SuRF-UK, 2010), were evaluated against the soil remediation policies and practices in the US, the UK, the Netherlands and Flanders (Belgium). Additionally, available decision support tools (DST) were critically screened and evaluated with respect to the inclusion of social and economic aspects represented by the SuRF indicators.

Most of these DST emphasize the environmental and health impact of the site remediation processes (i.e. primary and secondary impacts), whereas the evaluation of less tangible social and economic aspects are not or only briefly addressed. With respect to the 'economic indicators', many tools limit themselves to direct economic costs, while a few tools also consider indirect economic costs (e.g. financing debt) and benefits (e.g. increase in nearby property value). Moreover, non-monetary benefits (e.g. restoration of land for public use) are often neglected, whereas some investigations show that they are essential for a more balanced decision making. Particular attention went to the analysis of the methods that can be used to include the benefits of soil remediation projects in the decision process, both in a qualitative and quantitative way.

In the 4 investigated countries, environmental impact assessment and safety protocols are included in a standard soil remediation procedure because legal notices force the project managers to take measures to protect human and environmental health during site remediation.
Guidelines to quantify the environmental impact of different possible site remediation technologies (secondary impact) have also been established, going from simple carbon footprint calculations (e.g. in Belgium) to life-cycle based impact assessment methods (e.g. The Netherlands). In Flanders and the Netherlands the evaluation of the environmental burden of soil remediation options is still optional, while in the US the Greener Clean-up (GC) Interim Policy applies to all Superfund clean-ups, taking green remediation technologies as the "point of departure". In the UK, the environmental Agency provides several tools for wider environmental impact assessment of different soil remediation options. The UK legislative framework explicitly underpins sustainable development, including reducing environmental impact, through the remedial planning process.

While the cost of the site remediation project is also a determining parameter in the planning phase of the remediation, the assessment of indirect costs is often mainly restricted to the cost of potential damage or the interruption of business activities. Moreover, in none of the investigated countries, non-monetary benefits are (fully) taken into account when site remediation options are evaluated, whereas these non-monetary benefits could substantially influences choices made with respect to site remediation and redevelopment. Another weakness in many soil remediation projects is community participation in the different stages of deci-

sion making. Especially for big projects, such as for example in brownfield regeneration projects, this is an essential issue that determines the global sustainability of the project. The involvement of surrounding residents in the evaluation of soil remediation practices is thoroughly developed in the US, but other countries could consider a more proactive approach. Finally, more attention should go of the potential effects of climate change on remediation alternatives that imply a permanent control or stabilization of soil contamination.

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15th October 2014, 10.40 – 11.10h
"Towards the anticipation of brownfield emergence?"
Speaker: Elsa Limasset, BRGM, France

Objectives
One of the first objectives of the HOMBRE project is to better understand brownfield emergence and, ideally, to help develop a method to prevent their formation. Is it possible to anticipate brownfield emergence in urban areas? Which approach should municipalities and urban planners follow to anticipate possible brownfield emergence?

Current results
Following a literature review, a set of economic, social and environmental "Early Warning Indicators (EWI)" have been compiled. The monitoring of these indicators over time should help these municipalities and urban planners anticipate brownfield formation or identify related problems. A methodology for anticipating brownfield formations has been developed using the EWI concept. The testing of the overall approach has been carried out on two towns in Europe. All existing brownfields within a French town were mapped and the causes for their emergence were reviewed and listed. Based on available data, relevant indicators such as "land use evolution", "transport facilities", "perception of contamination", "land value" and "building obsolescence" were identified. A statistical correlation between these indicators and the presence of brownfields has been carried out. Initial results show that some indicators are indeed strongly linked to the presence of brownfields in urban units. A consultation of local stakeholders in Germany, on their perception of brownfield emergence was also undertaken. The results show that the new tool provides a useful instrument for the preparation of strategic urban planning documents.

Significance of the proposed contribution
The approach is a rather innovative concept in the European urban planning context. The methodology and decision making tool being developed (BoEWIT, Brownfield EWI Tool) should help towards integrating the anticipation and the planning phases of land use management.

15th October 2014, 11.40 – 13.10h
Session: "Emerging strategies and technologies for effective remediation 1"
Chair: Tim Grotenhuis, Wageningen University, The Netherlands

15th October 2014, 11.40 – 12.10h

"HOMBRE technology trains: smoothening the transition of brownfields to new uses?"

Speaker: Martijn Smit, Wageningen University, The Netherlands

Preventing sites from becoming brownfields (BFs) and regenerating existing BFs is key to tackling urban sprawl and ensuring a more sustainable built environment as was laid out at the start of the HOMBRE project. However, up to date, real or perceived barriers exist that make stakeholders prefer the development of greenfields over refurbishing / redeveloping brownfields.

A way to shift the preference of site development towards brownfields, is service provisioning and valorisation of available resources at the BF. Doing this in a smart way gives a potential competitive advantage for the post-BF compared to other sites. Within workpackage 4 of HOMBRE, three technology trains were elaborated that connect the main goods and services that are expected to be of value for the majority of urban functions: energy, water, and building materials (Grotenhuis et al, 2012; Smit et al. 2014). In addition to these specific (provisioning) services for "hard" urban use, environmental services such as supporting services (e.g. bearing capacity of sub-soil and minimal risk to site users from contaminants) were included.

In the paper we will present the technological concepts of the technology trains and their operation within economic, legislative and organizational constraints. We specifically pay attention to the scale-up of innovative technology concepts from laboratory scale into practice and provide suggestions to overcome barriers. We apply the technology train concept to the regeneration of two brownfield sites that were studied within the HOMBRE project (Terni (I) and Markham-Vale (UK)) to answer the question: are technology trains smoothening the transition of brownfields?

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Smit *et al.* (2014) HOMBRE deliverable 4.3: description of operating windows for successful implementation of the technology trains for uptake in WP2 and WP3 (draft)

15th October 2014, 12.10 – 12.40h

"Technology train for reusing excavated material in a Brownfield regeneration context"

Speaker: Renato Baciocchi, University of Rome "Tor Vergata", Italy

Introduction

Work Package 4 of the HOMBRE project was focused on the development of technology trains aimed at treating resources available at a Brownfield site in order to obtain products or services that could be useful during the regeneration phase of the same site. In this work, we propose the coupling of two techniques, i.e.: stabilization/solidification (S/S) and granulation as a treatment strategy for excavated material aimed at producing aggregates for construction purposes. The proposed approach appears to be particularly relevant in a Brownfield regeneration context, since it may potentially allow to avoid landfilling, save natural resources and make Brownfield redevelopment more viable and sustainable. Recently, a few studies have focused on the coupling of the above-mentioned techniques in order to obtain aggregates from the treatment of several waste materials (see e.g.: Cioffi et al., 2011; Scanferla et al., 2009), proving that such a treatment may be effective in obtaining pellets exhibiting sufficient mechanical strength and a decreased release of toxic elements, such as As, Pb, Cd and Hg (Scanferla et al., 2009). However, a systematic study of the influence of the operating conditions and of the type of binder on the properties of the final product is still missing. In order to identify the preliminary conditions of applicability, i.e. operating windows, of this process, lab-scale tests were first performed on a natural soil, by varying the operating conditions and the type and amount of binders and additives. In a subsequent phase, a second set of experiments was carried out on an industrial soil sampled from a Brownfield site, selecting the operating conditions and binder type that provided the best results in terms of mechanical strength in the preliminary tests.

Materials and methods

The S/S - granulation experiments were performed on the natural non contaminated soil by employing 20, 25, 30 and 35% of a high resistance Portland cement (CEM I 52.5R) and of a Portland composite cement (CEM II/A-LL 42.5 R) and 1 and 2 % of sulfonate-based (A1) or acrylic-based (A2) superplasticizer additives. A few of the mixture formulations were subsequently selected to treat an industrial soil sampled at the Terni-Papigno Brownfield site, located in the municipality of Terni (Italy), exhibiting concentrations of Cu, Pb, Hg and Sn exceeding the relative Italian threshold values for residential use (Italian Legislative Decree 152/06). The obtained aggregates were cured and characterized in terms of their physical (particle size distribution, ASTM D422), mechanical (Aggregate Crushing Value - ACV, BS 812-110) and environmental (leaching behaviour, EN 12457-2) properties. The description of the employed set-up as well as of the adopted experimental procedure are reported in Capobianco et al. (2014).

Results and discussion

This section provides a short overview of the main results obtained from the S/S-granulation treatment of both natural and industrial soil. The detailed discussion of the results is reported in Capobianco et al. (2014). The experiments carried out on the natural soil showed that the type of cement employed was the factor that most influenced the particle size and mechanical strength of the obtained aggregates, while the type and amount of superplasticizer

proved to be less relevant. Moreover, the outcome of the preliminary tests allowed to identify an optimum operating range for the tested technology train also in terms of binder content and suggested that the use of a cement content higher than 30% wt. may result in a significant decrease of the mechanical performance of the final product, regardless of the type of cement employed. Specifically, the use of 25 and 30% of the high resistance cement (R 52.5) resulted in the production of granules characterized by a mechanical strength comparable to that of natural gravel (ACV≈20%). With regard to the industrial soil, the obtained granules showed an average d_{50} between 5 and 8 mm, one order of magnitude greater than that before the treatment (about 0.7 mm). It was found that soil characteristics may influence the effectiveness of the applied treatment, as well as the effects of the binder on the properties of the product. Indeed, an optimum ACV (≈ 20%) was achieved by increasing the cement content to 30% and by employing 2% of the acrylic-based superplasticizer, probably due to the high fraction of organic carbon (1.2% wt.) of the industrial soil compared to that of the natural soil. The S/S - granulation treatment yielded an increase of the eluate pH from 8.3 to alkaline values (pH > 12) due to the addition of CEM R 52.5 (pH = 13). The increased mobilization of Ba as a result of the treatment was mainly ascribed to the characteristics of the cement used as a binder, which showed to release significant concentrations of this metal. The treatment appeared to exert a mobilizing effect also for Cr and Cu, which, besides to the leaching behaviour of the cement, was correlated to the highly alkaline conditions produced as a result of cement-based treatments, which may lead to the formation of more soluble phases containing these metals. In order to investigate the effects of the proposed technology train on industrial soil with different initial properties, and hence to better characterize the operating windows of the process, additional tests were performed on other soil samples taken from the Terni site, the results of which are presented and discussed in Capobianco et al. (in preparation).

Conclusions

The combined S/S - granulation treatment applied to the Brownfield contaminated soil proved effective in obtaining a product presenting a mechanical strength suitable for construction applications once that the appropriate type and amount of binder were selected. However, it proved less efficient in improving the environmental behaviour of the treated soil, leading to an increased release of certain metals, especially Cu. Nevertheless, the obtained leaching concentrations complied with the regulatory limits established by the Italian legislation for groundwater quality (Legislative Decree 152/06), suggesting that the proposed combined process may be a viable treatment for recycling the excavated soil produced during the expected regeneration phase of the Terni Brownfield site.

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15th October 2014, 12.40 – 13.10h

"Integrated strategies for Brownfield regeneration: treatment of subsoil and alkaline residues by the combined Ecogrout-carbonation process"

Speaker: Wouter van der Star, Deltares, The Netherlands

Abstract

According to the approach developed within the HOMBRE project, a specifically tailored combination of technologies, named technology train, should be identified and applied within a Brownfield (BF) regeneration context in order to address contamination issues, while generating at the same time products that may be of use for the regeneration stage itself or for the future uses of the site. In this framework, the coupling of accelerated formation of carbonate (carbonation) with a new method developed within the context of HOMBRE for improving the technical properties of the subsoil called Ecogrout may be an interesting option for treating different matrices present in the BF while achieving several benefits. The Ecogrout process involves the reaction between calcium chloride and dissolved sodium carbonate according to Eq.1.

$$CaCl_2 + 2NaHCO_3 \rightarrow CaCO_3 + 2NaCl + CO_2 \qquad \text{Eq. 1}$$

The reaction produces calcium carbonate and carbon dioxide in an equimolar ratio. The precipitation of calcite may cause an in-situ increase in stiffness and strength of the soil and a decrease in permeability while the produced CO_2 may potentially allow the in-situ stripping of volatile organic contaminants (VOCs) from the groundwater. In addition, the upward CO_2 flow produced by the Ecogrout process may stimulate the carbonation of an overlying layer of alkaline material, eventually present in the site as a result of past inappropriate disposal, resulting in the improvement of its environmental properties as well as in CO_2 storage. As an example, the carbonation reaction of calcium silicate is reported in Eq. 2.

$$CaSiO_3 + CO_2 \rightarrow CaCO_3 + SiO_2 \qquad \text{Eq. 2}$$

In order to evaluate the potential of the coupled process, a 3-stage sequential experimental investigation was carried out. In stage 1, preliminary batch Ecogrout tests and column carbonation tests were performed at laboratory scale. The Ecogrout tests were carried out to estimate the CO_2 flow evolved during the reaction as a function of the injection regime and stirring conditions (see Figure 1a), while the carbonation tests (see Figure 1b) were aimed at evaluating the degree of carbonation of the selected alkaline material (stainless steel slag - SS) as a function of the reaction time and particle size. In stage 2 combined tests were performed by assembling the set-ups used in the previous phase, as shown in Figure 2a, and applying the operating conditions which gave the best results in the preliminary tests. Finally in stage 3, a combined test was performed using the larger reactor shown in Figure 2b, designed in order to simulate field conditions so to estimate the effect of different injection strategies on calcite precipitation in the gravel layer as a result of the Ecogrout process, as well as the differences in the degree of carbonation occurring in the slag layer.

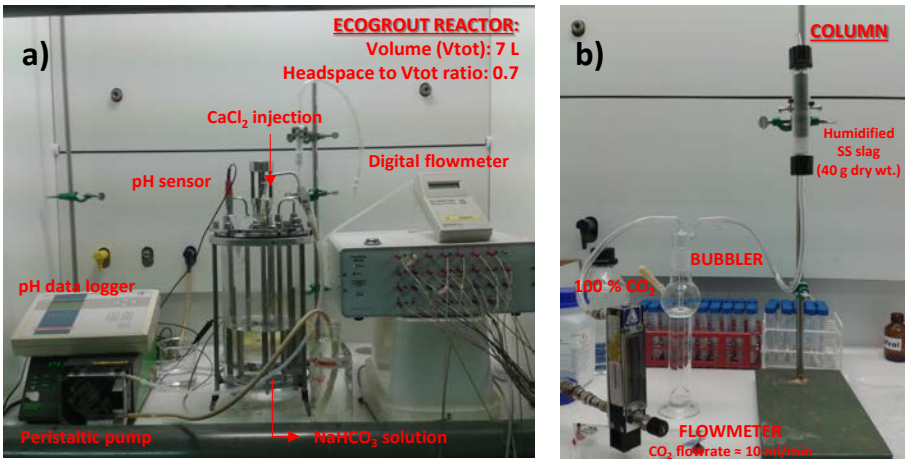

Figure 1 : Set-ups for proof of principle tests for a) Ecogrout and b) carbonation

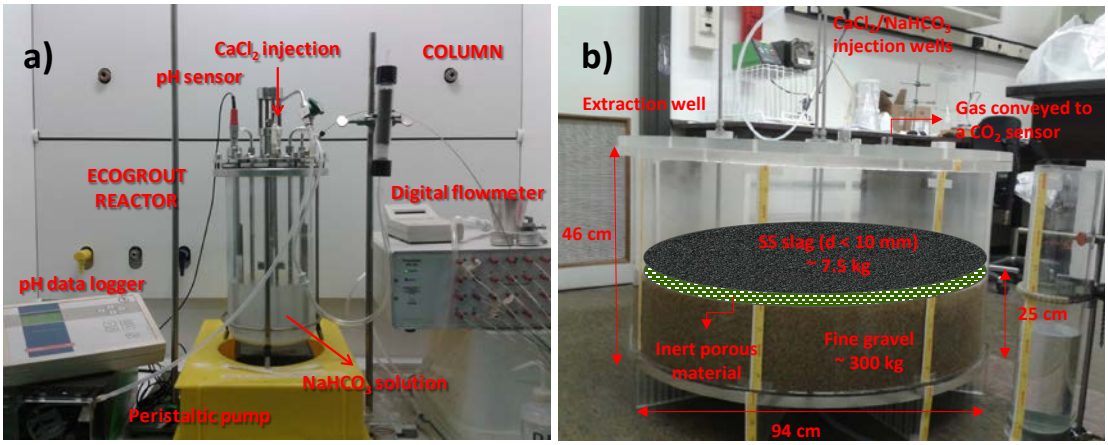

Figure 2: Set-ups used to perform the combined Ecogrout – carbonation tests at a) small scale; b) large scale

The results of the column carbonation tests showed that the CO_2 uptake achieved by the slag depended strongly on its particle size, the highest value (≈ 11.3 % wt.) being achieved for the finest SS size fraction (d < 0.84 mm) at 24 h. The bulk SS slag (d < 10 mm) showed a maximum CO_2 uptake of about 7% after 24 h, suggesting that significant CO_2 uptakes may be achieved also in presence of coarse SS particles. Further discussion of the obtained results in terms of CO_2 uptakes and leaching behaviour of the carbonated slag is reported in Capobianco et al. (2014). The results of the combined tests performed on the finest SS size fraction at small scale showed that relevant CO_2 uptakes (≈ 7%) could be potentially achieved in a relatively short timeframe (90 min) and that the release of both major and regulated elements may be strongly affected in a combined scenario, providing more pronounced effects, e.g. a decreased release of Ba, Cr and Mo, than those found as a result of the column carbonation tests performed on the same size fraction and at similar reaction times but with 100% CO_2 obtained from a gas bottle. The large combined system showed to exhibit a strongly heterogeneous behaviour, with CO_2 being first produced closer to the injection point of calcium chloride than to that of sodium bicarbonate, probably due to the larger diffusion coefficient of HCO_3^- compared to Ca^{2+}. As far as the carbonation of SS slag is concerned, differently from the combined tests performed at small scale, negligible CO_2 uptakes were obtained for all the collected SS samples, regardless of the distance of the sampling points from the injection wells, as well as of the analyzed size fraction. This result could be attribut-

ed to the weak mixing of reagents, as well as to the formation of preferential pathways for CO_2 outflow through the slag layer.
More efforts are hence required to elucidate the influence of the regime and mixing conditions on the Ecogrout reaction and consequently on the degree of carbonation of the alkaline material. In addition, future work should focus on specific case studies in which soil strengthening is required for the redevelopment of the site and where alkaline residues, such as steel slag, are present.

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15th October 2014, 11.40 – 13.10h
Session: "Real world challenges and pilot cases for brownfield regeneration"
Chair: Maaike Blauw, Deltares, The Netherlands

15th October 2014, 11.40 – 12.10h
"Solec Kujawski (Poland) – HOMBRE philosophy around local brownfield regeneration project"
Speaker: Wojciech Irminski, Geo-Logik, Poland

A small town Solec Kujawski near Vistula River in the kuyavian-pomeranian region (northern Poland) is well known and popular especially among children due to the Jurassic Park located in a park in the city center. This is an open air touristic attraction, which consists of dinosaurs reconstructions in the natural size, fascinating paleontological museum and 5D cinema. For the local authorities it is one of the reasons for satisfaction. But right next to the park, almost in the heart of the city, there is also a big problem – a classical brownfield – degraded and heavily contaminated with creosote postindustrial area – the former railway wood preservation facility. The city bought the land in 2008 to prevent an uncontrolled division of the area into building plots and to stop private development without necessary environmental restoration of soil and water.

After a period of research and after consideration of various remediation concepts it was decided to erase this risk from the city map.

The treatment is performed in-situ complex combination of physical, chemical and biological methods. It is an ambitious, totally innovative project in Poland – co-financed by the EU from Operational Program of Infrastructure and Environment.
At the same time Solec Kujawski and EU Project HOMBRE start cooperation, that goes beyond the issues of regeneration and redevelopment of the former preservation facility.

HOMBRE introduces thinking about the short- and the long-term development scenarios and development options for public consultations.
Zerobrownfield philosophy is also an evaluation of the risks, opportunities and barriers to the development of land located next to the postindustrial area.
Nowadays, while the 16 ha in Solec remediation is being conducted, the citizens understand the objective, investors are implementing plans for adjacent areas and in other areas the contamination sources are being detected.
Loved by children dinosaurs in Solec Kujawski gain new, friendly environment.

15th October 2014, 12.10 – 12.40h

"The brownfield city: Famagusta, Cyprus"

Speaker: Paul Nathanail, University of Nottingham, UK

Its civilian population abandoned Famagusta on 15 August 1974. The then modern seaside town has lain vacant behind a secure perimeter fence and subject to periodic military patrols ever since. Its abandoned, underused and essentially available for reuse condition has meant its former inhabitants have long believed in their eventual return unlike other parts of the island were new settlers have inhabited properties.

Large swathes of urban brownfields have been successfully reintegrated into the urban system in the past. Notably are the once militarised zone around West Berlin and large tracts of former industrial land. However there has never been a successful reoccupation of a deserted city. A peaceful solution to the geopolitical problems in European Union's south eastern border cannot be envisaged without a return to beneficial use of Famagusta – or Αμμοχωστος as its former residents call it.

Famagusta is a coastal city with loose unconsolidated sediments and shallow aquifers. Its soils are fertile and known for their citrus fruit. Its built environment compromised a mixture of concrete framed low and midi-rise structures interspersed among a stock of older houses built out of local limestone blocks.

Although now uninhabited, its residents were largely of Greek Cypriot origin. Turkish Cypriots living in and around the walled old city of Varosha and now living in the modern buildings of Magusa.

The ghost town was once the island's number one tourist destination – particularly popular with British, German and Scandinavian visitors. It was also a busy commercial centre not least due to the adjacent port from which much of Cyprus' produce was exported.

The governance structures of the town and district have been maintained – in exile. There is an elected Mayor and District Council. Famagusta's former residents vote for their own members of the national parliament.

Various scenarios can be – and have been – envisaged for the return of residents to the city. There is a need to consider both safety and the right to return. A city left unmanaged for over 40 years will contain natural and manmade, chronic and acute, hazards that are not normally encountered in an urban environment. The short term impulse to 'go back home' will need to be satiated and then replaced by a medium term audit of the urban infrastructure and a plan for the long term regeneration of the city. Everything will need to be reinstated: electricity and water supply; sewage systems; transport signals; signage and even property ownership. Individual buildings will need to be surveyed for obvious structural stability and perhaps sless obvious hazards such as degraded asbestos containing materials, mould and root damage. A post Katrina-like triage of occupy, repair and demolish will be needed and despised by the owners of the third category.

And then the big task of rebuilding a vibrant community and environmentally sustainable economy can begin. Some big questions can begin to be asked now. What vision do its owners have for the city? Will it try and supplant the tourist traps of Ayia Napa and Protaras or will Ammochostos seek to remain exclusive, hidden among its sand? How will it co-exist with its neighbour Magusa?

Famagusta offers a perfect opportunity to apply the decoupled management & land use cycles identified by HOMBRE; to use the Brownfield Remit/Response tool to explore the urban system that is and will become Famagusta and then to explore the relative sustainability of different reuse options.

15th October 2014, 12.40 – 13.10h

"Assessing the socio-economic benefits of turning brownfields into green/blue spaces: a case study for Eindhoven and Copenhagen"

Speaker: Peter Cornelis Roebeling, CESAM – Department of Environment and Planning, University of Aveiro, Portugal

Sustainable management and regeneration of urban brownfields is on planning and political agendas worldwide while, at the same time, it is increasingly recognized that urban green/blue spaces provide important ecosystem services, prevent flooding problems and boost real estate values. Hence, there is an opportunity to deploy the potential of brownfields in urban landscapes through requalification into green/blue spaces. This paper aims to assess to what extent green/blue space interventions in brownfields can potentiate the social and economic well-being of residents in (peri-) urban landscapes, with case studies for Eindhoven (Netherlands) and Copenhagen (Denmark). To this end we use the scenario simulation decision support tool SULD (Sustainable Urban Landscape Development) – a GIS-based optimization model based on a classic urban-economic model with environmental amenities.

Results show that the establishment of high quality parks in urban brownfields attracts medium to high-income households and, hence, leads to increases in real estate values of up to +25% in the area surrounding the intervention area. Note that these increases are dependent on the location of the intervention area relative to existing environmental amenities and urban centres. In case these urban parks are designed as potential retention basins, low risk though frequent flood events can be reduced or even avoided. These kind of combined urban parks and retention basins prove, however, to be ineffective for high risk and infrequent events due to their insufficient retention capacity.

The SULD decision support tool is not an aim in itself but the starting point of a process. It facilitates participatory planning and scenario development, creating confidence and familiarity with the model and its outputs, encouraging stakeholders to reflect about their reality and future possibilities, and effectively engaging them in the design of urban development plans.

15th October 2014, 14.50 – 15.50h
Session: "Emerging strategies and technologies for effective remediation 2"
Chair: Renato Baciocchi, University of Rome "Tor Vergata", Italy

15th October 2014, 14.50 – 15.20h
"In situ remediation of Pb/Zn mining and processing impacted sites"
Speaker: Wolfgang Friesl-Hanl, AIT GmbH, Austria

In the GREENLAND-project "best-practice" examples for remediation and re-use of heavy metal contaminated sites are brought together in an exchange of experiences. These contaminated sites pose, in addition to the recent acute risks, also a long-term risk which should be reduced by appropriate in situ measures.

Three stages of impact

Three stages of impact of Pb/Zn-ore-treatment on environment are discussed here:

(1) On sites where the ores are mined impacts are the result of crushing, grinding, concentrating activities, as well as by the massive amounts of remaining deposits or wastes (mine tailings). (2) On sites where smelting and processing takes place, depending on the process (Welz, Doerschel) different waste materials are deposited. (3) On sites close to the emitting source metal contamination can be found in areas for housing, gardening, and agricultural use.

In-situ treatments have the potential for improving the situation on site and will be shown by means of field experiments in Spain (phytostabilization with *Cytisus* and *Festuca*, *Salix* for phytoextraction), Poland (*in-situ* immobilization with biosolids) and Austria (*in-situ* immobilization and phytoexclusion with gravel sludge and iron and selected cultivars). The shown techniques and methods can contribute to a reduction of these risks and to improvements at these sites for the environment and human health.

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15th October 2014, 15.20 – 15.50h

"A Novel Remediation Approach for POPs Contaminated Solids Using Carbonaceous Materials"

Speaker: Long Zhao, Chinese Research Academy of Environmental Sciences, China

Introduction

Dioxins including polychlorinated dibenzo-p-dioxins (PCDDs), dibenzofurans (PCDFs) and coplanar biphenyls (Co-PCBs) are one kind of ubiquitous and persistent organic pollutants (POPs)[1]. In order to combat the threat posed by these chemicals to human health and the environment, the Stockholm Convention on Persistent Organic Pollutants was adopted in 2001 and the production and usage of these compounds were heavily regulated[2]. However, these contaminants have been globally distributed in practically all environmental sectors[3]. Therefore, research and development of technologies for removal of these contaminants has gained considerable importance.

A thermal desorption technology in which dioxins-contaminated solids are being remediated by desorption and degradation is increasing used because of their high reliability and efficiency of dioxins removal[4]. However, high energy consumption during continuous heating and required cost for treatment of the effluent gas have prevented widespread implementation. In this study, a novel remediation approach based on thermal desorption is proposed using cost-effective recycled charcoal as both an adsorbent and thermal source. There is no need for post-treatment of the used charcoal in the adsorption column, which saves cost. Thus, it is potentially a promising alternate to conventional POPs remediation technologies. Main objective of the work was to examine the removal behavior and efficiency of dioxins, and to investigate the degradation pathways and mechanisms of dioxins using this technology.

Materials and methods

Dioxins-contaminated sediments used in this study were taken from Fugan-unga in Toyama, Japan, one of the areas of most heavily contaminated by dioxins in Japan, even in the world[5]. Commercially manufactured charcoal produced from charred conifers (Ishiko Co. Ltd., Japan) was used as an adsorbent for adsorption of dioxins in the effluent gas, which was recycled as a thermal source for continuous heating during the treatment process.

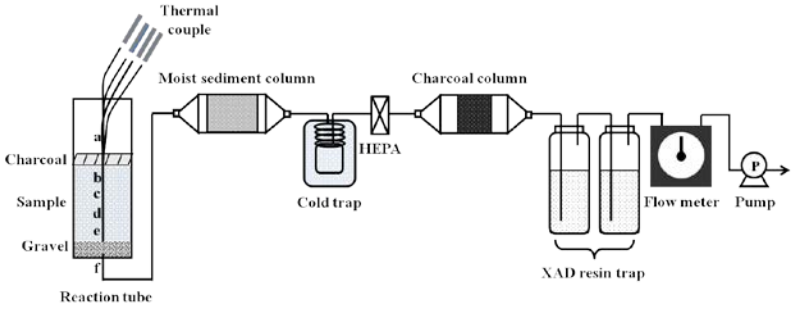

Fig. 1. Schematic diagram of the experimental apparatus

A schematic diagram of the experimental apparatus is shown in Fig. 1. Experiments were conducted in a stainless steel cylindrical reaction tube (height: 20 cm; inner diameter: 4.7 cm). Before each experiment, 50 g of gravel was placed at the bottom of the reaction tube as a substrate. Next, sediment samples mixed with charcoal at 10 wt% of the total weight (70 g) were added to the reaction tube. The procedure of thermal treatment process was as follows: 1) combustion was initiated by ignition using 20 g of burning charcoal that had been preheated at 500°C for 10 min; 2) during combustion, gas suction was applied by air (10% O_2/N_2) from the top of the reaction tube to the bottom; 3) the temperature at the top of the sample increased and the combustion gradually proceeded downward in the tube. The sediment and

gas temperatures were measured using thermocouples mounted at 2, 4, 6 and 8 cm from the top of the sample and at the inlet/outlet gas lines, respectively. Effluent gas passed through a series of traps prior to its release into the atmosphere. After the treatment, samples collected from treated sediment, moist sediment and XAD traps were analyzed for dioxins by HR-GC/MS (JMS-700, JEOL, Tokyo, Japan)[6].

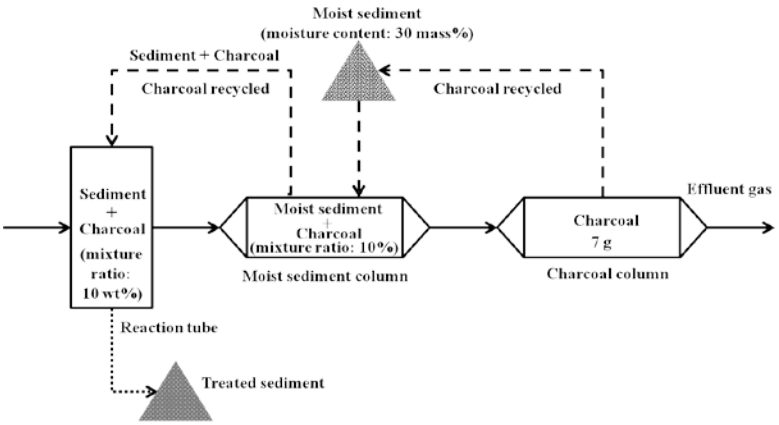

Fig. 2. Schematic diagram of the charcoal recycled process

The merit of this proposed process is that there is no need to treat generated secondary contaminated waste. As shown in Fig. 2, after charcoal was used for adsorption of dioxins, it can be mixed with moist sediment (contaminated sediment before dehydration) and filled in column. Eventually, charcoal can be recycled to the reaction tube as a thermal source for combustion.

To investigate the feasibility of this proposed method for removal of dioxins from contaminated solids, experiments were carried out using recycled charcoal shown in Table 1.

Table 1 Experimental conditions during the thermal treatment process.

Apparatus	Conditions	Run 1	Run 2	Run 3
Reaction tube	The amount of sediment	63 g	66 g[a]	66 g[b]
	The amount of charcoal	7 g		
	Charcoal/sediment ratio	10 wt%	10 wt%	10 wt%
	Air superficial velocity	3.0 cm s^{-1}	3.0 cm s^{-1}	3.0 cm s^{-1}
Moist sediment column	The amount of moist sediment	84 g	84 g	84 g
	The amount of sediment	7 g	7 g[c]	7 g[d]
	Moisture content	25%	25%	25%
Charcoal column	The amount of charcoal	7 g	7 g	7 g

[a]: Moist sediment (including charcoal) used in Run 1 was used as a sample in Run 2 after drying for 2 h.

[b]: Moist sediment (including charcoal) used in Run 2 was used as a sample in Run 3 after drying for 2 h.

[c]: Charcoal filled in the adsorption column of Run 1 was recycled in the moist sediment column of Run 2.

[d]: Charcoal filled in the adsorption column of Run 2 was recycled in the moist sediment column of Run 3.

Results and discussion

1. PCDD/Fs

The concentrations of PCDD/Fs in the initial, treated and moist sediment of all runs are shown in Fig. 3 (Panel A, B and C). The removal efficiency calculated with concentrations of PCDD/Fs in all runs between the initial and treated sediment were higher than 99.8%. Toxic equivalency quantities (TEQ) values of PCDD/Fs were obtained by using the contents of seventeen 2,3,7,8-chlorinated congeners and their toxicity equivalency factors (TEF), those contents in runs 1, 2 and 3 were 0.42 pg-TEQ g^{-1}, 1.5 pg-TEQ g^{-1} and 0.091 pg-TEQ g^{-1}, respectively. These values were far below 150 pg-TEQ g^{-1}, the sediment pollution standard limit in Japan[7], indicating that heating with charcoal achieved high PCDD/Fs removal efficiencies from the sediment. Additionally, as shown in Fig. 3 (Panel C), only the concentrations of O_8CDD in the moist sediment column significantly increased compared to

those in the initial sediment, whereas other PCDD or PCDF homologues did not. The result is likely due to the reason that O_8CDD might be formed from pentachlorophenol (PCP), a potential precursor of O_8CDD, during a cooling process in a post-combustion zone[8,9], After the moist sediment column, there were no PCDD/Fs detected in the effluent gas, indicating that moist sediment column is effective for adsorption of PCDD/Fs in the effluent gas.

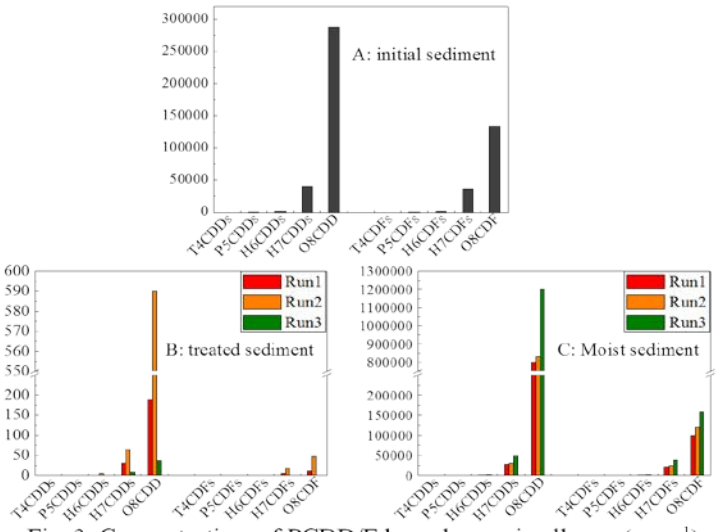

Fig. 3. Concentrations of PCDD/F homologues in all runs (pg g^{-1})

The homologue profiles of PCDD/Fs in the initial, treated and moist sediment are also presented in Fig. 3, respectively. In the initial sediment, as the number of chlorine atoms in the PCDD/Fs increased, their concentrations increased. O_8CDD/Fs were the most abundant homologue, accounting for more than 87% and 78% of total PCDDs and PCDFs, respectively. After thermal treatment, there were no differences observed in the homologue profiles of PCDD/Fs among all three runs in the treated sediment. These suggest that decomposition was the primary mechanism during the treatment process.

2. Coplanar PCBs

The concentrations of coplanar PCBs in the initial sediment and different fractions of all runs are presented in Fig. 4. Similar high removal efficiencies were obtained as PCDD/Fs, showing above 99.9% of all runs. Adsorbed coplanar PCBs were higher in the moist sediment column than those in the initial sediment, indicating that coplanar PCBs were released from combustion sediment into the effluent gas, and then adsorbed on the moist sediment. There were also some coplanar PCBs detected in the effluent gas, which were different from the results of PCDD/Fs since no PCDD/Fs were detected in the effluent gas. These results suggest that the charcoal used in this study had better adsorption ability for PCDD/Fs than coplanar PCBs.

The isomer profiles of coplanar PCBs in all fractions are also shown in Fig. 4. PCB 118 was the predominant isomer, consistent with all runs, followed by PCB 77 and 105. The TEQ of coplanar PCBs in the effluent gas was calculated by multiplying TEF, showing the highest value was only 0.14 pg-TEQ m^{-3} in all runs. This value was far below the gas emission limit of Japan[7] (100 pg-TEQ m^{-3}).

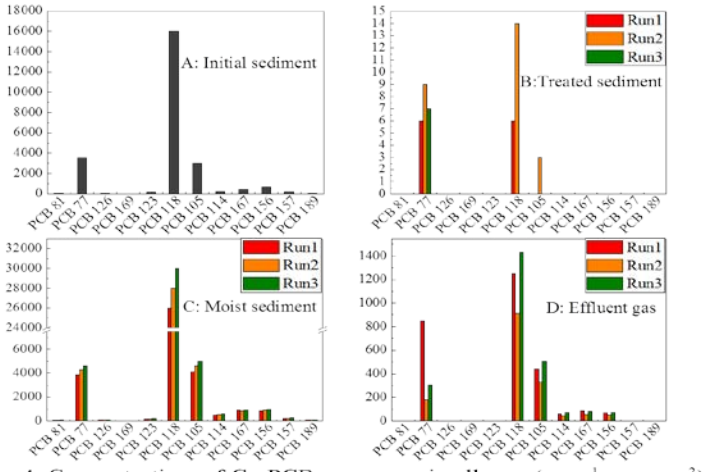

Fig. 4. Concentrations of Co-PCB congeners in all runs (pg g^{-1} or pg m^{-3})

In summary, a novel cost-effective remediation technology was proposed for POPs removal from contaminated solids by utilization of charcoal as an adsorbent

for dioxins adsorption in the effluent gas, and recycled charcoal as a thermal source for continuous heating. There was no need for post-treatment of the used charcoal with high amounts of the absorbed PCDD/Fs, which saved cost. Results showed that higher than 99.8% of dioxins were removed from the treated sediment. The primary mechanism was decomposition since the homologue profiles after combustion were consistent with those in the initial sediment. Total TEQs in both the treated sediment and effluent gas of all runs satisfied the environmental pollution limit of Japan and USEPA, no harmful contaminants were released into the environment during the treatment process. Besides, the high removal efficiencies were also gained for other POPs, such as PCBs, OCPs and HCB. Thus, it is feasible to use this method for removal of POPs from solids using recycled charcoal. Future research will aim to setup this method in large scale experiments.

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15th October 2014, 14.50 – 15.50h
Session: "Prioritization and communication approaches"
Chair: Elsa Limasset, BRGM, France

15th October 2014, 14.50 – 15.20h
"Specifics of brownfields prioritization in large municipalities (case study area Brno)"
Speaker: Petr Klusáček, Institute of Geonics, Czech Republic

The contribution, which is focused on specific of brownfields prioritization in large municipalities, is based on prioritization, which was conducted for case study area of Brno City (the second largest city in the Czech Republic with approximately 380 thousands inhabitants). The contribution describes how the data was selected and prepared for the TIMBRE web-based prioritization tool and how the first results of the prioritization process were discussed in detail with local stakeholders (experts, who are responsible for brownfields databases in Brno). The final version of prioritization was tailored and modified according feedbacks received from responsible stakeholders. The contribution concludes with some general recommendations how to prepare the prioritization for large municipal brownfields databases.

15th October 2014, 15.20 – 15.50h

"Communication-Based Approach to Improvement of Old Industrial and Commercial Areas"

Speaker: Anja Batke, Beate Huf, Regionalverband FrankfurtRheinMain, Germany

13 case studies provide practical experience on how to involve local real estate and business owners in joint activities aiming at improving the site conditions for economic development.

Common problems in industrial areas dating from the 1960s and 70s

Many industrial sites are no longer considered to be attractive locations for modern enterprises. In many cases the roads, communication networks, technical equipment as well as the external appearance of buildings are outdated. New types of use, such as housing or retail, have been introduced into the areas, leading to higher land prices and creating conflicts among new neighbours and long-term occupants. Since planning authorities can only implement direct change in publicly acquired space, many obstacles to revitalizing and marketing brownfields remain due to private ownership and behaviour. No improvement process can be managed without the active contributions of local real estate and business owners, whom we view as parts of a system. It is in this system that communication is the key to change.

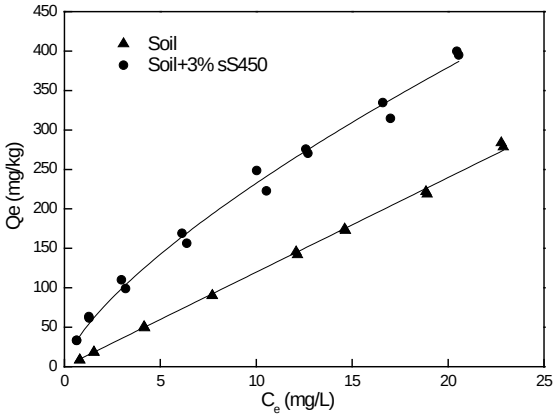
Standard procedure to look for tailored solutions

We have designed a project schedule to enable local authorities to embark in a dialogue process with local stakeholders. In agreement with our project partners we have appointed specialized consultants to analyse the characteristics of the project areas. Real estate and business owners are invited to planning workshops to discuss the future development of their neighbourhood. Afterwards the communication process is to be carried on in local responsibility. Regular meetings allow for the mutual exchange of experiences. So far cooperation has been established with 13 local planning authorities and business promotion agencies, in areas ranging from 7 to 70 ha. Though symptoms of decline may be similar in all project areas, there is a need to find specific solutions which take into consideration the individual background and the perspectives of different types of local stakeholders, as for instance smalll craft business owners, real estate professionals and residents.

15th October 2014, 16.20 – 17.50h
Session: "Tools and technologies to foster land revitalization"
Chair: Renato Baciocchi, University of Rome "Tor Vergata", Italy

15th October 2014, 16.20 – 16.50h
"Biochars for mitigation organic contaminants in soil"
Speaker: Lisa Lundin, Umeå University, Sweden

Agricultural soils are burdened with chemicals in different ways either by amendments or the use of herbicides and the soils become important sources of non-point source pollutants. The groundwater can be polluted with the migration of contaminations in soil and water. Biochar which produced by pyrolysis of biomass under limited oxygen conditions can be used as soil remediation agent to reduce the risk of contamination of the environment. We show that persistent organic pollutants (POPs) present in amendments are transferred to the soil and that adding biochar to the soil is a feasible way to prevent leakage of herbicides from agricultural soils. Soils amended with compost or sewage sludge absorb POPs but it varied between the compound groups. The sorption of atrazine on the pure soil and biochar-amended soil showed that the 3% biochar addition increased the sorption capacity of the soil for aztrazine which was about 3 time larger that pure soil from the parameter (K_F) obtained from Freundlich model. Biochar as an agricultural soil amendment could be a potential strategy to reduce the agrochemical pollution of agricultural environment.



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15th October 2014, 16.50 – 17.20h

"Immobilization of Metals using Biochar and Green Waste Compost to Aid Biomass Production on a Contaminated Site"

Speaker: Sarah Jones, r3 environmental technology ltd, UK

This presentation details work which aimed to determine the effects of different biochars and green waste compost on immobilization of metals in soil from a heavily Cu contaminated site (a former wood treatment plant, France). The results provide an indication of the potential for production of biomass usable for energy on marginal land, by establishing if there is an improvement in yield when green amendments are applied. A further objective was to gain insight into the optimal mode of use of these amendments as gentle remediation options. Three biochars were investigated: a specialised biochar called C-Cure-Metal developed for remediation of metal contaminated substrates (C-Cure Solutions Limited, Farnham, UK) and two biochars (unamended and Fe-amended), manufactured by AIT using poplar grown on the Biogeco remediation site[1]. As the biomass used for biochar production was grown on the site to be remediated, the project also investigated the possibility of recycling biomass produced on contaminated sites for further site improvement.

Biochar and compost were applied as both single and combined amendments, as previous findings suggest amendments combining biochar and compost together are more effective in reducing phytotoxicity (Bes & Mench, 2008). Soils amended with the biochars and compost at various application rates were analysed using leach tests pre- and post-incubation and post-growth. Soils were planted with sunflower and the resulting plant material was assessed for yield and Cu concentration, as indicators of phytotoxicity reduction and Cu immobilization, respectively.

Pre- and post-incubation leach tests suggested all treatments significantly reduced available copper compared to the control, with the higher biochar application rate reducing Cu most greatly. Initial results suggest the greatest improvement in plant yields were obtained with the higher application rate of biochar in combination with compost. The most effective biochar for this purpose was found to be C-Cure metal.

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Acknowledgment This paper is based on work carried out by the EU FP7 HOMBRE project (www.zerobrownfields.eu), using information provided by C-Cure Solutions Ltd, supported by the EU FP7 Greenland Project (www.greenland-project.eu).

[1] A former wood treatment site in the Gironde county, France, previously used for the application of Cu, As, Cr and creosote. The site is contaminated with a range of trace elements, most notably Cu.

15th October 2014, 17.20 – 17.50h

"How to engage towards an effective and sustainable redevelopment of large and complex brownfield sites"

Speaker: Pascale Michel, BRGM, France

Objectives

The REFRIN^{DD} project is developing an integrated approach for the sustainable remediation and urban redevelopment of complex contaminated brownfields sites. The approach will propose the use of a multi-criteria analysis (MCA) tool to help stakeholders discuss and choose the most-fit for purpose scenarios, taking into account their sustainability objectives and economic constraints.

Current results

A wide range of French stakeholders were consulted on the main challenges they face when working in brownfield regeneration projects (e.g. numerous stakeholders, managing risks, regulatory constraints, assessing sustainability, etc.). The relationships between the stakeholders and the data they exchange when delivering a revitalisation project were listed and then modelled. Data collection, historical memory and data transmission were seen as main areas where improvements are needed. Following the reviews and using the partners own experiences, the methodology was drafted. A draft prototype tool is also proposing various MCA to assess the sustainability of remediation techniques and redevelopment projects.

Significance of the proposed contribution

Stakeholders have confirmed their need for an integrated approach in managing large and complex brownfield regeneration projects. Their recommendations, along with the partners research work helped identify the criteria for the delivery of successful projects. The REFFRIN^{DD} approach and these criteria are currently being tested in three on-going French brownfield revitalisation projects. The approach and a pilot MCA tool are to be delivered in 2015.

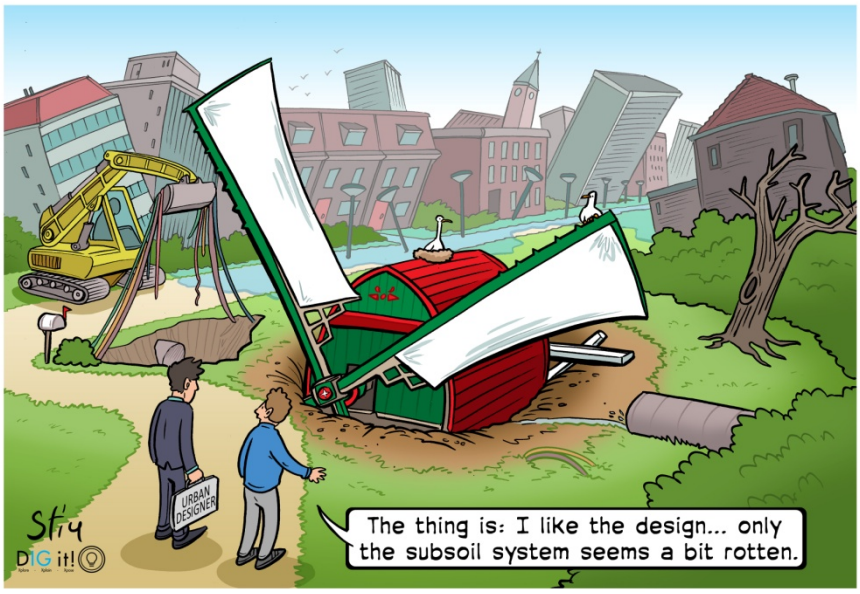
REFRIN^{DD}: Sustainable Brownfield regeneration Approach- [2012-2015]) partly funded by ADEME

15th October 2014, 16.20 – 17.50h
Session: "Sustainable urban land management"
Chair: Uwe Ferber, Projektgruppe Stadt+ Entwicklung, Germany

15th October 2014, 16.20 – 16.50h
"Urban planning and design with the subsoil system"
Speaker: Fransje Hooimeijer, TU Delft, The Netherlands

Urban designers are not used to taking the subsurface into a holistic perspective on spatial development. Nevertheless, the subsurface accommodates numerous functions crucial to urban life, such as infrastructure, carry capacity, heat, water, etc.. Moreover, it also carries the natural system crucial for urban quality and health. In the light of the current climate change, energy transition and the financial crisis these issues are more important for different reasons. The subsurface stores water, plays a role in cooling the city, provides geothermal warmth as renewable energy, and smart use of the subsurface can save considerable money. Besides, urban renewal (brownfield development) is the preferred option over taking new land (greenfield development). Brownfields do not have an unexplored soil system; it is already used in many ways. Therefore 'Urban design with the subsurface' should be considered a new frontier in urban planning and design.
The neglect of the subsurface in spatial planning is due to the fact that responsibilities, tools and knowledge of subsurface engineering and urban planning and design are not integrated, they work together but sectorial. The urban designer is usually dealing with the opportunities for socio-economic benefits whereas the subsoil engineer deals with the technical challenges. Both on a practical level of fabricating city, as well as at policy level 'subsurface' and 'surface' are separate realms. The aim of this report is to reveal this segregation in three countries that are active in integrating subsurface in urban development: Sweden, Netherlands and Flanders (Belgium). The main research questions are: What characterises these planning systems? How is the subsurface framed in these countries? A comparison is performed as the first step in learning and proposing better ways of integrating subsurface in urban planning and design, and vice versa.

There are many ways of doing as well as theorizing spatial planning; and planning practice is continuously changing. This contribution tries to provide descriptions of a status quo (2014) that identify key moments where it could be useful to integrate subsoil knowledge, technology and procedures in planning. The first section defines the field and identifies the sources that provide the framework for the description of spatial planning for each country. The following sections describe the main features such as guiding principles, main institutions, legal framework and planning documents in the Netherlands, Sweden and Flanders. For every feature both aboveground spatial planning as well as the management in the underground of subsoil aspects are highlighted. The conclusions provide an overview of the main differences and overlaps. They demonstrate that soil legislation and management have increased importance to adapt to climate change and energy transition. Finally and foremost integration of subsoil in urban planning allows to (re-) develop cities with lower costs. This forms the basis for potential strategies for integrating subsoil decision-making with spatial planning.


URBAN DESIGNER
The thing is: I like the design... only the subsoil system seems a bit rotten.
Stig
DIG it!

15th October 2014, 16.50 – 17.20h

"Brownfields and Gap Sites as Potential for Sustainable Urban Development – A Survey of German Cities and Towns"

Speaker: Andreas Blum, Leibniz Institute of Ecological Urban and Regional Development, Germany

It is a central aim of the German governmental strategy for sustainable development to reduce the amount of land used for building and transport from today approximately 90 hectares per day to 30 hectares per day in the future. To achieve this goal, the infill development of cities, towns and villages should be strengthened. This means that developments should preferably be realized within the existing settlement bodies, primarily on brownfield and gap sites. A lot of cities and towns are already aiming at such targets. However, there is no sufficient and reliable overall knowledge about the amount of infill development land use potentials. Therefore the Federal Ministry of Transport, Building and Urban Development (BMVBS) and the Federal Institute of Building, Urban Affairs and Spatial Development (BBSR) commissioned the Leibniz Institute of Ecological Urban and Regional Development in Dresden to conduct a survey on these development potentials for Germany.

Roughly 12% of the overall number of 11.255 cities, towns and villages were contacted with a standardized survey questionnaire, 451 responded, sufficiently distributed to gain representative data. The survey was concluded in October 2012, the data being processed and analysed until the mid of 2013. With the suggested contribution we would like to present quantitative and qualitative results dealing with questions like: How high are the infill development potentials from brownfields and gap sites in the cities and towns in Germany? How do cities and towns deal with these potentials in terms of land use management as well as with respect to political strategies? Which instruments are used to monitor land use potentials? Are there differences showing up between growing and shrinking cities, for different types of cities and towns or in regional comparison? Which conclusions can be drawn with respect to future developments, needs and strategic tasks?

15th October 2014, 17.20 – 17.50h

"Efficient Organizational Structures for the Management of Land Resources"

Speaker: Uwe Ferber, Projektgruppe Stadt + Entwicklung, Germany

The German Environmental Agency initiated a research and development project within the framework of the Environmental Research Plan on the topic of organisational and stakeholder structures related to municipal land management and land recycling in view of strategic land resource management. The goal of the project was to identify efficient organisational structures for land resource management, locate deficiencies within these as well as create adaptable recommendations for public and private organizations.

A study of the administrative routines and the public/private processes took place through the analysis of representative examples of organizational structures in municipalities, (regional) associations and public private partnerships from all over Germany. The analysis resulted in the identification of the relevant decision makers and project participants and their responsibilities, interests and communication structures in relation to the respective administrative process, discipline, responsibilities, decision-making process and hierarchical arrangement in countries and municipalities.

The presentation will show the practical "cornerstone" recommendations for the implementation of efficient organisation structures for administrative duties created by the project. Every municipality or association involved on the topic of land resource management can test and modify the organisational structure best suited for the responsibilities of land resource management according to their context (municipal, inter-municipal or commercial). The extensive documentation of the organisational models by the project can serve as support in this process. The "cornerstones" can be used by the municipalities as a check list for orientation when choosing the most appropriate organisational structure for an efficient land resource management.

16th October 2014, 09.40 – 11.10h
Session: "Tools and methods for decision making and awareness raising"
Chair: Lisa Pizzol, University of Venice Ca´Foscari, Italy

16th October 2014, 09.40 – 10.10h
"The HOMBRE BR2 tool for understanding urban systems"
Speaker: Matthew Ashmore, University of Nottingham, UK

Objectives: to develop a user friendly systems approach to identifying the most suitable re-development options for brownfield sites.

The Brownfield REMIT/RESPONSE Tool
In deciding between potential future uses of a brownfield site, it is important to consider not just the site in isolation but also its place in the wider urban context; considering the social, economic and environmental consequences of the 'system perturbation'. That is: the site may be considered as part of a broader urban system, both affecting and affected by that system and changes to the site will result in changes to the system which will ultimately help to determine how successful the redevelopment will be.

Matrix-based systems analysis techniques have been used to assess the behaviour of complex systems such as engineering geology, (Hudson and Harrison 1992), the likely performance of deep geological repositories (Pers *et al* 1999) and mapping the vulnerability of air quality (Mavroulidou *et al* 2004).

The Brownfield REMIT/RESPONSE (BR2) tool is a systems–based methodology, building on the work of Leney (2008), which employs a generic matrix technique combined with site-specific information to assess the impact of a particular brownfield redevelopment on the surrounding urban area. The tool allows assessment of the importance of the relationships between individual generic urban system components to be assessed in a systematic, site-specific fashion by a cross-section of stakeholders. Each relationship is scored according to a binary system (one element does/does not affect another) and an Expert Semi-Quantitative (ESQ) system, i.e. a value judgment is made on the overall importance of the interaction. The results populate a matrix of direct relationships between the system components and plot a "Cause-Effect" chart based on the matrix.

These outputs are then analysed to determine the level of interactivity of the system as a whole, and of the individual components within the system together with the dominance or subordinacy of each component. Repeating the exercise for each redevelopment option allows a semi-quantitative comparison of those options, revealing relative strengths and weaknesses in each option so that appropriate options may be identified, or weaknesses in scheme may be addressed.

BR2 was applied retrospectively to the Markham Vale site in Derbyshire UK to assess the chosen redevelopment option, together with a realistic, hypothetical alternative, in order to assess the potential system responses to the redevelopment options. The BR2 output indicates that the chosen scheme should produce very interactive, balanced system, with no overtly dominant or subordinate components, while comparative deficiencies in the alternative scheme are highlighted.

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16th October 2014, 10.10 – 10.40h

"Acting Sustainably: Redevelopment Scenarios for Borovo (Vukovar, Croatia)"

Speaker: Dr. Irena Dokić, The Institute of Economics, Croatia

Authors will explore possibilities for redevelopment of Borovo site, located in Vukovar, in northern-eastern part of Croatia. Literature review, desk research and other adequate research-scientific methods and analyses will be used to answer the question on optimal future use of the site.

Vukovar is one of Croatian towns with very long and rich history. It is a witness of the European industrial culture and exemplary town planning practice (Mumford, 1938; Gibberd, 1967; Marshall, 2009). Establishment of a factory unit, at the beginning of 30ties, in 20th century, has had a long-lasting impact on overall development of the town. Vicinity of the Danube river and good transport connections were key conditions to set up a complex for production of leather and rubber footwear, rubber-technical goods, automobile and bicycle tires. Bata, founder of the company set up a modern organization of production, sale and supply. In parallel with an industrial boom, the neighbourhood around the factory („Borovo naselje"), with all necessary infrastructure – housing, social, working, education, re-creative and other functionalities, evolved creating a small, almost fully independent settlement.

During almost 60 years factory recorded a continuous growth, until 1991 when the majority of the factory was devastated during the war, causing its closure. After fall of industry, along with various negative environmental and socio-economic effects, Borovo today is mainly a brownfield site (only small production unit still operates). It needs a coherent urban revitalisation action, with clearly defined spatial (and other) functionalities of the site (Lincoln Institute of Land Policy, 2004; Dixon et al., 2007).

Current socio-economic situation in wider area (town and county) is unfavourable, whereby the Borovo site has a significant redevelopment potential on a local and regional scale. Paper will conclude with identification of possible scenarios for development of the site, regarding local and wider opportunities and constraints.

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16th October 2014, 10.40 – 11.10h

"Awareness raising for soil and necessarily for Remediation within the GREENLAND project"

Speaker: Wolfgang Friesl-Hanl, AIT Austrian Institute of Technology GmbH, Austria

One aim of the GREENLAND-project (http://www.greenland-project.eu) was the dissemination of the output of each involved field experiment. Several approaches where chosen, differently by each field site manager. The approach of awareness raising for soil and remediation on a Pb/Zn-contaminated site in the village Arnoldstein (Carinthia, Austria) was to include and invite scholars from the neighboring villages. For that purpose the Austrian Soil Science Society that runs a workshop series, aiming at awareness raising of the value and functions of soil ("Boden macht Schule" – "Soil meets Schools") has been commissioned.

Field day

As highlight of the dissemination process a field day in May 2014 was conducted. At that day approximately 100 scholars from 4 different classes walked to the remediation field plots to see the efforts which have to be undertaken for improving a contaminated site. At that time the farmer prepared the plots for the new vegetation period and the field experiment was established. Additionally, due to the vicinity of the industrial site an industry representative gave important information about industry history, actual situation and the positive example of the re-use of the industrial area for industrial companies – instead of greenfield strategy.

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"Boden macht Schule" – workshop, developed in cooperation between the Austrian Ministry for Agriculture and Forestry, Environment and Water management and the Austrian Soil Science Society
http://www.umweltbundesamt.at/leistungen/seminare_schulungen/boden_schule/ (2014-03-31).Or: http://www.bodeninfo.net/index.php?article_id=310 (2014-03-31)

16th October 2014, 12.10 – 14.10h
Session: "Best practice – lessons learnt"
Chair: Paul Bardos, r3, UK

16th October 2014, 12.10 – 12.40h
"BALANCE 4P: Integrating urban planning and the remediation sector for sustainable brownfield regeneration – experience from cases"
Speaker: Jenny Norrman, Chalmers University of Technology, Sweden

Land take as a result of urbanization is one of the major soil threats in Europe. One of the key measures to prevent further urban sprawl and additional land take, is redevelopment of urban brownfields: underused urban areas with, in many cases, soil and groundwater pollution. The latter issue can be a bottleneck for redevelopment of brownfields instead of green fields. A difficulty for brownfield redevelopments is that in urban projects the responsibilities, tools and knowledge of subsurface engineering and urban planning and design are not integrated; they depend heavily on each other but work in sectors. The urban designer usually deals with opportunities for socio-economic benefits while the subsoil engineer deals with the technical challenges of the site. Better cooperation between urban developers and soil specialists can accelerate brownfield redevelopment and potentially identify better and more sustainable redevelopment strategies.

The project BALANCE 4P, funded by the SNOWMAN network, provides methods for, and examples of, application of a holistic approach that supports redevelopment of brownfields by integrating technical, economic and social aspects, and provides means for clearly communicating challenges and opportunities of site-specific subsurface qualities. Linking the holistic approach to rules and regulations will enable its implementation in practice. We will present examples of integrating urban planning and the subsurface in three case studies: the harbour of Rotterdam, the Fixfabriken site in Göteborg, Sweden, and the Alvat site in Buggenhout in Flanders, Belgium.

The city harbours of Rotterdam are redeveloped in a large project, on both sides of the river Meuse. The whole area is in transition and will become available for urban functions, while the harbour functions are moving or changing. The MerweVierhavens (M4H) is used as a case study, which is an area in a vision phase and where BALANCE 4P is investigating the possibilities of the subsurface within this vision: What are innovative possibilities for the subsurface in relation with the aboveground redevelopment? How can we use the subsurface in the development strategy?

The Alvat site is an abandoned and underused industrial area of 4.6 hectares, located in the municipality of Buggenhout along the river 'Scheldt' and adjacent to the living area 'Oude Briel' in the North. The site is highly polluted with BTEX, VOCs, mineral oil, heavy metals, PCB and PAHs and a heavily contaminated industrial landfill has been identified at the site. At present, the redevelopment of the Alvat-site is blocked due to: 1) soil contamination, 2) uncertainty about the future land-use and, 3) the ownership situation. Based on stakeholder consultation and sustainability assessment, more specific designs for alternative visions for this site (industry, residential, recreational area, combinations) are developed and compared.

The Fixfabriken area is an area with mainly industrial use located in an attractive and centrally located part of western Göteborg. The urban planning office of Göteborg municipality is

now in the process of changing and developing the detailed plan of the area. The aim is to redevelop the Fixfabriken are into an area with much more mixed use, i.e. residential housing, commercial buildings and public spaces. BALANCE 4P is involved with both public and private land-owners in order to lift forward the subsurface issues and their connection to the redevelopment potential of the area. Based on the visions of the site and the subsurface conditions, alternative land-use and remediation strategies are outlined and evaluated from a sustainability point of view.

Stakeholders are involved in the identification and evaluation of future redevelopment strategies for each case, although the applied methods for stakeholder participation differ. The three sites represent different settings with regard to sub-surface conditions, ownership relations, development visions and governance. The planning systems in the Netherlands, Sweden and Flanders also differ with regard to guiding principles, main institutions, legal framework and planning documents. Thus, so does potentially the moments where it is useful to integrate subsoil knowledge, technology and procedures in planning. The collective experiences from the cases will support the final recommendations for an applicable holistic approach to sustainable brownfield regeneration.

16th October 2014, 12.40 – 13.10h

"Brownfield redevelopment in Flanders: 5 years of transversal policy and integrated area development"

Speaker: Koen Miseur, Enterprise Flanders, Belgium

Introduction

As a densely built and populated region, the Flemish area has a lot of urban and industrialized grounds strongly affected by former manufacturing activities. In various cases the neglected sites become enclosed by later urban expansion, without further investigation or remediation. As an important European economic hub, Flanders cannot afford to leave such potential economical valuable sites un(der)used. Especially, because there is a severe shortage on the market for space demanding industries and the competition for the remaining building area in general is huge.

Hence an integrated project approach between cleanup, sustainable spatial planning and reuse was required. Consequently the Flemish Government developed its own transversal approach towards the redevelopment of brownfields: the Brownfield Act of March 22, 2007.

The way it is…

Conform the act, the government organizes each year at least one open call with specified criteria concerning the type of submitted projects. The conditions may change per call. Within the boundaries of the criteria, the developer can submit any kind of project (bottom up). Therefore these open calls have a very mobilizing effect and give the developer a lot of freedom in the project design research.

The Act gives developers the opportunity to sign a contract (a brownfieldcovenant) with the Flemish Government and other involved private or public parties with mutual commitments on the realization of a brownfield project. This contract is the result of a process, gaining the (public) support and the co-operation of all the stakeholders involved. After the contract is closed, a steering committee will follow up the redevelopment over the coming years.

To facilitate the whole process, the parties are accompanied by a brownfieldcovenant negotiator; an expert appointed by the Flemish government. In this Flemish Brownfield approach, the governmental agency Enterprise Flanders plays a key role as one-stop shop for all the questions and needed support to make this integrated project approach possible. In the last 5 years about 126 projects were evaluated and in more than 50 cases the followed procedure resulted in a brownfieldcovenant, revitalizing the Flemish redevelopment market.

As the Act is the basis for a transversal policy, the realization of brownfieldprojects is only possible by specific supporting policy from spatial planning, soil remediation, taxes, mobility etc.. For instance Enterprise Flanders subsidizes the construction of the public infrastructure on the industrial developments site up to 85%.

It works…

This year an evaluation study is executed. For the projects with a covenant, all the stakeholders involved were asked to fill in a survey. With a response of 35 project developers and 102 persons of public parties, more than 60% of the projects with a covenant were covered. Several additional depth interviews helped to interpret and deepen the results. As the evaluation study is still ongoing, the first preliminary conclusions and lessons are taking shape.

The predominant strength of the Brownfield Covenant instrument is the integrated strategic and operational process that is behind it. The relevant Flemish departments are looking at the applications as a team, and in concertation with each other, including Enterprises Flanders, the spatial planning department, and the soil remediation agency of the environmental department (OVAM). Additionally, local governments (provinces and municipalities) are also in the involved in the deliberation.
On that account, the covenant is one of the best examples of a successful horizontal and vertical policy integration efforts in Flanders. This policy innovation is a trigger for an equally innovative way of thinking that is taking over nowadays, which is the view that the soil remediation of a brownfield is just one (integrated) element in the development of an urban project: the intended land use will determine the type of remediation, and vice versa.
Although the shrinking market of greenfields in Flanders and the existing/current legislation in the fields of soil remediation and spatial development are the strongest triggers, the Brownfield Covenant instrument plays a significant role in speeding up brownfield developments. Next to the already mentioned policy integration, another positive incentive is found in a number of financial benefits for brownfield sites with a covenant, including an exemption of land registration taxes and of the deposit for soil remediation.
The survey showed that developers see the covenant as a valuable support mechanism, which facilitates the brownfield development. This is reflected in the high percentage of project developers (more than 75%) that would submit their project in a brownfieldcall again.

It can always be better ...
Looking at the future, it will be important for the Flemish brownfield programme to go along with the evolutions in the economic market. A distinction could be made between complex dossiers, for which the current process is well suited, and the smaller and less complex developments, which could do with a more routine treatment. Now that the sector of brownfield developers is maturing, the ratio of less complex projects versus complex projects increases. There is also the need for further integration of policies and supporting tools for sustainable development of sites.

In the presentation, the general approach of 5 years stimulating the brownfield redevelopment in Flanders will be interpreted, enriched with lessons learnt in the field and of the recent policy evaluation on the instrument “brownfieldcovenant” and the brownfield methodology in Flanders. There will be some more details about the effectiveness analysis of the program, as some final conclusions and policy recommendations in order to ensure a continuing effective and efficient support policy for brownfield development in Flanders.

16th October 2014, 13.10 – 13.40h

"20 Years of Remediation of Inhabited Contaminated Sites in Hesse – Lessons Learned"

Speaker: Christian Weingran, HIM GmbH, Germany

Over a period of more than 20 years HIM-ASG successfully remediated by order of the Hessian Ministry of Environment the inhabited contaminated sites of Stadtallendorf, Hessisch Lichtenau und Lampertheim considering ecological, economical and social aspects. Approx. 650 ha were returned to use (and had not to be taken from green land), homes of more than 5.000 people und more than 8.500 jobs were saved and potentials for development are now provided. The projects are characterized by complex issues, the multitude of different stakeholders and the long duration and the high expenses.

The most important experiences gained in these projects can be summarized as follows and will be illustrated on the basis of concrete examples in the paper:

- All relevant stakeholders should participate in the planning and the realization of projects. Project-specific structures should be developed.
- Project aims and structures should be systematically developed in a transparent, multistage process without predisposition and documented as guiding principles in a project manual.
- Early, comprehensive and continuous information of all stakeholders is an important precondition of a qualified participation and the acceptance.
- Communication that is determined by dialog and consensus is the key success factor in complex projects.
- Good data basis is essential for professional planning und decision making. Data and information should be available for all stakeholders.
- The spatial structuring of the large-sized sites into remediation areas as well as the step-by-step realization allow the stepwise optimization of structures and processes and makes learning by doing possible.
- The careful planning of technical measures should be completed by a systematic modification management.
- Continuity of acting persons and decisions especially on procet aims and financing is of great importance for an effective project work and for building trust.

16th October 2014, 13.40 – 14.10h

"Feasibility of phytoextraction with improved tobacco and sunflower for the remediation of soluble zinc top soil contamination – Results of a five and one year field scale experiment in Switzerland"

Speaker: Rolf Herzig, Phytotech Foundation & AGB, Switzerland;
Michel Mench, INRA, France

The phytoextraction with mutant lines of biotechnically improved tobacco and sunflower (non-GMs) can be a sustainable alternative to existing destructive decontamination methods (excavation, soil washing etc.), especially for the remediation of soluble zinc and cadmium of topsoil. Results of a 5-year time series experiment at field scale at Bettwiesen in northeastern Switzerland will be shown.

Overall results confirm that the initial soluble (bioaccessible) zinc soil contamination can be lowered by 40-70%, whereas subplots without phyto-extraction treatment remains at initial concentrations within this five year phytoextraction treatment. In 2011 the phytoextraction experiment was enlarged by a factor of 3, and the results show a promising 15-50% reduction of the initial soluble zinc concentration within one harvest, only.

A Mass Balance Analysis MBA confirm the reduction of zinc in soil, and it can be well explained by the plant zinc uptake. Moreover it can be shown, that the phytoremediation plants also partially feed from the pool of the total zinc soil contamination. Already phytoremediated subplots, that no longer exceed the Swiss trigger value, are now assessed for their stability of the remediation treatment over time.

In contrary to the phytorextraction of the "total amount" of soil contamination that normally need a very long cleaning up time, it can be shown, that the "risk based approach" of the phytoextraction of the "bioaccessible, labile amount" of the metal soil contamination can be feasible within a few years period.

The Swiss phytoremediation site is part of the GREENLAND net-work with 14 large field trials (http://www.greenland-project.eu/), where the feasibility of phytoremediation strategies are comparatively assessed for a future sustainable land management in Europe.

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Key-words*:* phytoremediation, bioavailable contaminant stripping, labile 0.1 M NaNO3 extractable Zn concentration, non-GM plant, feasibility of phytoextraction

16th October 2014, 10.40 – 11.10h
Special Session: "SoilBizz – A project idea for regional and local authorities to have contaminated industrial area regenerated"

Speaker: Rene Beijnen, Province of Noord-Brabant, Netherlands

In the upcoming years regions and cities are challenged to have their agenda's implemented in a changing Europe striving for economic growth and jobs. In these policies regional and local public authorities also have to focus on keeping their environment healthy, safe and attractive. In order to get industrial area's available for companies, to save land for agriculture and to avoid degraded industrial area's public authorities have to remediate areas that has been contaminated in the past. These industrial areas, historically contaminated are not easy to redevelop because companies (especially SME's) find difficulties in having the environmental risks properly financed. As a result investments and new jobs are delayed.

Aim and objectives

The overall aim of SoilBizz is to assist public authorities (Regions and cities) in remediating contaminated industrial areas by having companies cooperating in managing the site together. Sub objectives of SoilBizz are to prevent further degradation of these industrial areas, to promote the use of heat from the surface, to set up area based funds for financial risks and aftercare, to apply flexibility in the thresholds of the contaminants to be monitored. The integrated approach to tackle pollution of soil and groundwater in cities delivered by the CityChlor project will be applied in SoilBizz.

Results

SoilBizz will deliver:

- a model strategy for soil quality management of industrial area's;
- 12 regional and local action plans for having companies implementing a joint soil quality management system (technical conceptual model, business model and long term stewardship);
- 3 project applications to have the investments co-financed by the relevant transnational INTERREG-programs;
- a program for monitoring the implementation of the action plans through the relevant transnational INTERREG-programs;
- at least 12 industrial sites that have implemented a joint soilquality system and that have invested in new jobs.

EU Thematic objective and program

In order to have SoilBizz co-funded by the EU the application will be submitted in the first call of INTERREG EUROPE. SoilBizz supports the EU-thematic objective for protecting the environment and promoting resource efficiency. It will be submitted as an interregional cooperation project in 2 phases. For investments applications will be submitted in INTERREG North West, Central and North Sea/Baltic.

Partners

The Province of Noord-Brabant would like to cooperate in this project with regional- and local authorities and with development agencies that are governed by public law. For phase 2 the partnership should equally cover 3 transnational INTERREG areas.

Finances

The costs per project partner is about € 200.000,- In case of 75% EU-funding it will cost about € 50.000,- For project partners in the transnational INTERREG program (50% EU-funding) the cost is related to the investments.

Planning

SoilBizz will be submitted in the first call. This is planned for February 2015. After approval the project will start in January 2016 and will end December 2019.

POSTERS

The development of soil environment management system in China and some advices learned from European soil management

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1. Introduction

The world has witnessed in the last thirty years the astonishing growth of China’s economy. Although unevenly distributed, economic development has produced a sensible rise in living standards of the Chinese population. This came, however, at a great environmental cost. Since the late 1990s Beijing has made considerable efforts to curb air and water pollution. More recently, Chinese authorities have been devoting increasing attention also to soil pollution. On June 25, 2013, in occasion of the 23rd National Land Day, the Ministry of Environmental Protection (MEP) issued a report titled “Policies for Soil Environmental Protection of China.” According to the report, soil contamination in China is very severe. Part of soil is seriously polluted; numerous heavily polluted districts and high risk districts are present, located around single polluting plants, industrial districts, mining areas, and the surrounding regions (Wang et. al 2013). Against this background, China’s soil environmental management system is not effective enough to ensure prevention, assessment, control, and remediation of soil pollution. European countries have since the 1970s developed policies, laws, regulations, and standards to face phenomena of soil contamination. This presentation aims at introducing main features of the Chinese system, individuating European positive experiences applicable to China’s soil management structure.

2. Soil environment protection in China

2.1 Situational assessment

In order to gain a precise understanding of soil pollution, on which to base decision making, between 2006 and 2010 China carried out the “First National Soil Pollution Survey.” The survey, whose results were released in April 2014 by MEP and the Ministry of Land and Resources (MLR), was conducted on a surface of 6,300,000 sq Km (66% of the total national surface), including all cultivated lands in the country. The survey targeted as well 690 industrial sites with heavily polluting industries, 81 abandoned industrial sites, 146 industrial parks, 188 treatment and disposal sites for solid waste, 13 oil producing districts, 70 mining areas, 55 sewage irrigation areas, and 267 major highways. Results indicate that soil quality of 19.4% of cultivated land does not reach national standards. Major contaminants are cadmium, nickel, copper, arsenic, mercury, lead, DDT, and polycyclic aromatic hydrocarbons (PAHs). In industrial sites, soil quality doesn’t reach the national standard in 36.3% of cases. Critical industries include those producing and processing ferrous and non-ferrous metals, leather, paper, oil and coal, chemicals and pharmaceuticals, chemical fibers and rubber plas-

tic, minerals, metal products, and electric generation plants. Heavy metals contamination is particularly severe in mining areas, where 33.4% of soils do not meet requirements set by national standards (MEP, MLR 2014: 1, 3, 4-5).

2.2 Legislative framework

At present, no dedicated national legislation regulates contaminated soil management in China. Provisions relevant to soil protection are dispersed among a variety of sources. These include the Constitution, the Criminal Law, the Environmental Protection Law, and some sectorial laws and regulations targeting land administration, solid waste, water pollution, chemical substances, agricultural land, and the real estate sector (see Table 1). These laws and regulations are not systematic or consistent, lacking operational details, accountability provisions, and specific control and prevention requirements. Although piecemeal, this body of legislative sources establishes nonetheless fundamental principles, such as the ‘polluters pays’ principle, first introduced in the 1989 Environmental Protection Law.

Table 1. National Laws and Regulations on Soil Protection

Year	Law/Regulation	Year	Law/Regulation
1982	Constitution of PR China and relevant amendments	2006	Regulations for Assessment of Cultivated Land Requisition and Compensation
1989	Environmental Protection Law	2008	Law on Prevention and Control of Water Pollution
1997	Criminal Law and relevant amendments	2010	Soil and Water Conservation Law
2000	Tentative Regulations on Land Reclamation Projects in Comprehensive Agricultural Projects	2011	Regulations for Safe Management of Hazardous Chemicals
2004	Land Administration Law	2011	Regulations for Land Reclamation
2004	Law on Prevention and Control of Environmental Pollution by Solid Waste	2011	Management Regulations for Development and Operation of Urban Real Estate Sector
2004	Circular on Prevention and Control of Environmental Pollution During Enterprise Relocation	Under Discussion	Soil Environmental Protection Law
2005	Regulations for Prevention and Control of Hazardous Chemicals Pollution	Under Discussion	Provisional Rules for the Environmental Management of Contaminated Sites

Wang et al. 2013; Caldwell, Wang 2011; CWR 2014

Chinese authorities are aware of the necessity to develop a specific law targeting land contamination: the National People’s Congress is discussing a law on prevention and control of soil contamination. Moreover, the Provisional Rules for the Environmental Management of Contaminate Sites have been drafted by MEP. Hopefully, such instruments, when implemented, will promote the protection of soil environment in China. A further demonstration of political commitment was the release by the State Council in 2013 of the Arrangement on the Soil Environmental Protection and Integrated Treatment in the Near Term, indicating the following major tasks: (a) strictly controlling new soil contamination; (b) identifying priority districts; (c) enhancing risk control of contaminated sites; (d) carrying out treatment and remediation of soil contamination; (e) improving capacities in terms of supervision and management.

2.3 Standards and technical guidelines

Key national standards and guidelines are listed in Table 2. Development was particularly notable during 2014, when MEP issued 5 documents related to contaminated sites, targeting soil contamination investigation, risk assessment and remediation.

Table 2. National Standards and Guidelines for Soil Environmental Protection

#	Standard/Guideline	Code	Status
1	Environmental quality standard for soils	GB 15618-1995	Under Revision
2	Environmental quality risk assessment criteria for soil at manufacturing facilities	HJ/T 25-1999	In place
3	Standard of Soil Quality Assessment for Exhibition Sites	HJ 350-2007	In place
4	Environmental quality evaluation standards for farmland of edible agricultural products	HJ 332-2006	In place
5	Environmental quality evaluation standards for farmland of greenhouse vegetables production	HJ 333-2006	In place
6	Interim regulation for acceptable levels of residual radionuclides in soil of site considered for release	HJ 53-2000	In place
7	The technical Specification for Soil Environmental Monitoring	HJ/T 166 -2004	In place
8	Soil quality – Vocabulary	GB/T 18834-2002	In place
9	Technical Guidelines for Environmental Site Investigation	HJ 25.1-2014	In place
10	Technical Guidelines for Environmental site monitoring	HJ 25.2-2014	In place
11	Technical Guidelines for Risk Assessment of Contaminated Sites	HJ 25.3-2014	In place
12	Technical Guidelines for Site Soil Remediation	HJ 25.4-2014	In place
13	Terms of Contaminated Sites	HJ 682-2014	In place

Sources: Wang et al. 2013

Until recently, the void in terms of national standards was partially filled in by local authorities in developed regions of China, where the need to manage contaminated sites is more pressing. Considerable work in this direction has been done by Beijing, Shanghai, and Chongqing municipalities, as well as by Zhejiang province and Shenyang prefecture. In some cases, standards introduced locally have been later adopted nationwide (Wang et al 2013).

3. Some experiences learned from Europe

3.1 European management system for soil environmental protection

Since the end of the 1970s, when the management of contaminated sites entered the agenda of European public authorities, public and political perception has changed and the understanding of the nature of the issue has greatly evolved. Strategies for managing issues contamination have been constantly refined and improved. Three generations of contaminated sites policy have been adopted, from early command-and-control regulations at a national level towards more flexible, site-specific and incentive-driven management approaches at the local level. Currently, the focus of European soil management is on contaminated industrial sites and mining sites.

Major EU policy indications relevant to soil contamination are included in the documents Towards a Thematic Strategy for Soil Protection (COM(2002)179), and Thematic Strategy for

Soil Protection (COM(2006)231). Moreover, a draft proposal for a Soil Framework Directive is currently under discussion. These documents aim at setting up a framework for soil protection, illustrating goal, measures, and medium term work plans. Provisions over soil protection can be found in many other EU environmental laws and regulations, such as the Waste Framework Directive (2006/12/EC), the Water Framework Directive (2000/60/EC), the Air Quality Framework Directive (96/62/EC), the Directive on Biocidal Products (98/8/EC). EU member states also released national regulations or standards for soil protection. The latter are based on a common feature, i.e., providing guidance on soil quality targets based on risk management.

3.2 Soil monitoring systems

In recent years, EU devoted great efforts to ameliorate its soil contamination monitoring structure. To improve the collection and sharing of data on soil contamination, the European Commission and the European Environment Agency (EEA) established the European Soil Data Centre (ESDAC), a thematic centre for soil related data and information, located at the European Commission’s Joint Research Centre (JRC) (Panagos et al. 2012). Moreover, JRC organises monitoring campaigns to evaluate the progress in contaminated sites management (Van Liedekerke et al. 2014). By 2014, 23 out of 28 Member States had established inventories for contaminated sites, managed either at national or subnational level.[2] In order to ensure data comparability, harmonizing sampling procedures and soil analytical methods, EU initiated the project Environmental Assessment of Soil for Monitoring (http://eusoils.jrc.ec.europa.eu/projects/envasso/). The key areas targeted by the project include the selection of monitoring indicators and monitoring point distribution, and the update of sampling and analysis methods. China has no systematic design and action for long-term monitoring of soil quality As such, it could learn the design method and implementation mechanism from EU.

3.3 National Priority List (NPL) Sites

Some member States identified National Priority List (NPL) sites to target the soil pollution problem more efficiently. For example, Italy has identified 54 NPL sites, with a total area of 975,068 ha. At local level, in Italy there are 4,400 contaminated sites and more than 13,000 potentially contaminated sites (Wang et al. 2013: 36-7). In the case of orphan sites (or if the polluter cannot bear the cost of remediation), public funds can be earmarked to partially cover costs of remediation. China should also identify the NPL sites, remediate them first to ensure people’s health, and to protect the ecological environment.

3.4 Financial mechanisms

Adequate financial support is essential to sites remediation. EU has applied many financing techniques such as tax increment financing, revolving loan fund, benefit sharing & claw-back, development charges, integrated contracts to stimulate remediation actions. Although room is left to ameliorate such instruments, their experimentation constitute a basis on which to further develop financing mechanisms in the EU (on the issue, see Munchmeyer et al., 2009; Darmendrail 2013; Van Liedekerke et al. 2014). In contrast, China has no clear and effective rules on financial policies to encourage the remediation of contaminated sites. Relevant provisions should be included in the Soil Environmental Law and in the Provisional

[2] On the availability of inventories for contaminated sites in EU, see http:/ / www.eea.europa.eu/ data-and-maps/ figures/ availability-of-inventories-for-sites.

Rules for the Environmental Management of Contaminated Sites, currently under discussion. Local regulation could improve as well financial instruments, based on local economic and institutional characteristics.

3.5 Information release and public involvement

EU has set up instruments and platforms aimed at informing and engaging both the general public and practitioners on soil contamination and related policy development. These include the environment-dedicated web portal of the European Commission website (http://ec.europa.eu/environment/soil/index_en.htm), the European Soil Portal operated by the EU Joint Research Centre (http://eusoils.jrc.ec.europa.eu/), the Network for Industrially Contaminated Land in Europe (NICOLE, http://www.nicole.org/pagina/11/Links.html), the Common Forum on Contaminated Land in the European Union (http://www.commonforum.eu/), the Contaminated Land Rehabilitation Network for Environmental Technologies (CLARINET see information at http://www.commonforum.eu/publications_clarinet.asp). Moreover, most member States make available inventories relevant to soil contamination, operated either at national or local level (see e.g. http://regionalni-rozvoj.kraj-lbc.cz/page3531/english-version; http://www.regione.piemonte.it/ambiente/bonifiche/servizi/consultazione.htm.).

On the basis of information release, stakeholders are given a chance to take part into decision-making processes. The information release is very limited on soil pollution in China in comparison with the EU. This is due to both technical and institutional reasons. There is no official information release platform providing information on soil pollution, and the only important information release website is the one operated by the “Chinese environment remediation network“ （*zhongguo huanjing xiufu wang*, http://www.hjxf.net/), which is mainly used for risk assessment method and remediation techniques exchange.

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GLOCOM: Global Partners in Contaminated Land Management

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Complex hazardous contamination of soil and water are obstructing sustainable re-development of previously industrialized urban land in Europe as well as in China. Despite several significant efforts in this field, a systematic and integrated approach for the sustainable management of contaminated sites is still lacking. Developing effective regulatory and management approaches to deal with environmental hazards can be facilitated by sharing international experiences and practices. In order to enhance know-how transfer and communication between Europe and China, the exchange project “Global Partners in Contaminated Land Management” (GLOCOM) is currently being funded by the EU Seventh Framework Programme - People, in the framework of Marie Curie Actions - International Research Staff Exchange Scheme (IRSES).

Four European and Chinese partners are involved in the GLOCOM project: University Ca’ Foscari of Venice, Italy (UNIVE), with the role of coordinator; Umeå University (UMEA), Sweden; the Chinese Research Academy of Environmental Sciences (CRAES), P.R. China; Beijing Normal University (BNU), P.R. China.

Main aims of GLOCOM project are: (a) to support the definition and the implementation of a regulatory and operational framework for the management of chemical substances and contaminated land in China; (b) to stimulate a regulatory and scientific harmonization process at international level (both among EU Member States, and between EU and China); (c) to strengthen the quality of research by developing international collaborations; (d) to advance the decision making on complex issues in contaminated land management; (e) to facilitate strategic collaborations in future research projects.

These objectives are pursued through the organization of several exchange activities in the fields of contaminated soil characterization, environmental risk assessment and decision making processes. Specifically, GLOCOM project supports the exchange of both junior and senior personnel among partner institutions, for periods up to six months. Personnel exchange provides thus the chance to carry out a wide set of collaboration activities including training sessions, writing of joint publication and joint workshops, allowing EU and Chinese researchers to identify common ground for future research.

COMPREHENSIVE DEFINITION OF BROWNFIELD SITES IN THE SCALE OF IRAN

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Abstract: Brownfield lands are, nowadays, recognized as a problematic element in large number of countries, as it is assumed to cause gradual land decline by means of environmental, physical, social and economic negative effects. At present, there is no standard definition for brownfields. The term Brownfield is applied in different themes and very country has its own perception of the term brownfield based on its certain geographical, social and economic needs as well as its organizational priorities which eventually results in different sets of definitions.
Since in Iran there is no consensus to address what brownfield lands are basically referred to, the worldwide understanding of the term brownfield has been taken into account in this article in order to place a strong framework for definition of this term in the context of Iran.
In Iran, the term brownfield has not been unanimously defined yet. But rather, unlike most pilot countries in urban issues, the lack of an accurate definition of the term brownfield could be observed in urban vocabulary in Iran. Accordingly, this matter along with a significant number of poor-quality and disturbed urban sites in Iran accelerate the urgency of a deliberative move in order to explicitly characterize the concept of brownfield in this country.

How Sustainable is ‘Sustainable Remediation’ in the Context of Brownfield Redevelopment?

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The remediation industry has grown exponentially in recent decades. International organizations of practitioners and remediation experts have developed several frameworks for integrating sustainability into remediation projects, yet there is no accepted definition or universal framework. Literature on sustainable remediation is emerging with limited attention on how sustainability is operationalized in current remediation frameworks or whether sustainable remediation plays a meaningful role in brownfield redevelopment.

Methods

This research examines the role of sustainability in recent remediation frameworks. Methods are based on a review of six remediation frameworks against a set of normative criteria for sustainability integration adapted from sustainability assessment principles (Bond et al, 2013; Gibson, 2006). The six frameworks are: ASTM, 2013; Federal Contaminated Sites Action Plan, 2013(Canada); United States EPA, 2008; SuRF UK, 2011; SuRF USA, 2011; Wisconsin Green and Sustainable Remediation, 2012.

Results

All six frameworks speak to the importance of site end- use and brownfield redevelopment at the forefront of sustainable remediation projects. This aspect is important for effective use of resources in remediation project by identifying acceptable levels of contaminate. Additionally, there is growing acknowledgment that land is a scarce resource (Hou & Al-Tabbaa, 2014; WGSR, 2012). Furthermore, redevelopment and better use of land can revitalize communities, stimulate economies, and restore ecological function, which can be seen as a socio-cultural benefit (Beames et al, 2014; Hou & Al-Tabbaa, 2014; Petríková 2004; US EPA, 2008; WGSR, 2012).

Socio-economic objectives should be assessed throughout site end-use and remedial options for balanced decision-making (Beames et al, 2014; Hou and Al-Tabbaa, 2014; Petríková 2004). However, the frameworks lack explicit tools to address optimal brownfield redevelopment and stakeholder engagement. Methodologies like spatial decision support tools can help in land use planning (Schädler et al, 2013). Fidler (2010) emphasizes that meaningful input from stakeholders must be crafted in order to achieve sustainability. Innovative tools like multi-criteria decision analysis (MCDA) can help achieve meaningful stakeholder engagement, which will help secure more sustainable outcomes (Petelina et al, 2014; White and Noble, 2012).

Conclusion

Considering brownfield redevelopment and site end-use is imperative to achieving sustainability operationalized through sustainable remediation. Assessing site end use through socio-economic assessment tools like MCDA can contribute meaningfully to stakeholder engagement. By increasing the ability to identify optimal community benefits through spatial tools may mend social, economic, or ecological damage from impacted or brownfield sites. Sustainable remediation industry can mature to be an excellent resource for brownfield and community revitalization.

Keywords: Sustainable Remediation; Sustainability Assessment; Sustainable Brownfield Redevelopment; Stakeholder Engagement.

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Calorific Mining – A new approach to the economic, sustainable and climate friendly remediation

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Background

Large-scale contaminated areas of the oil industry close to densely populated urban areas often block the structural development of the entire region. The implementation of remediation concepts often fails in non-existent financial resources and the lack of remediation technologies and waste disposal and recycling options of the residues. In order to solve this problem under the consideration of economic, sustainable and climate friendly remediation in the overall context of today’s energy policy and social responsibility, a new long-term concept for the remediation of such sites in combination with sustainable waste recycling strategies was developed by Baufeld.

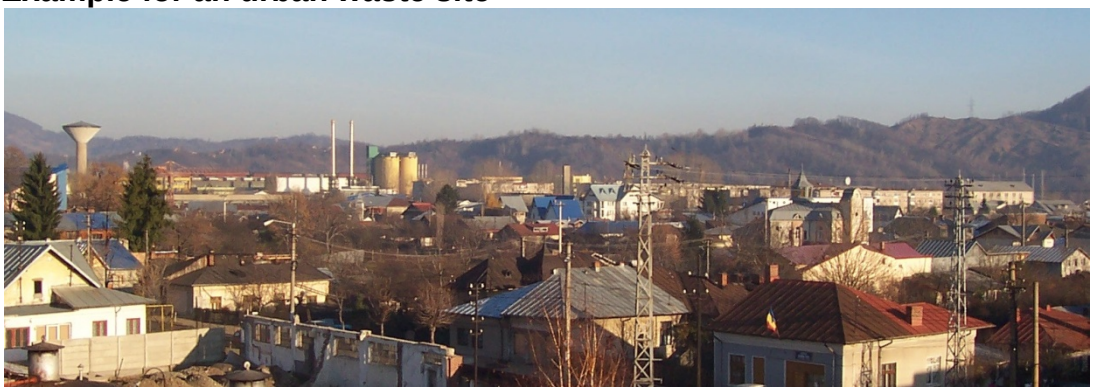
Aim of the concept

In continuation of Baufeld’s research activities in 1999 and due to decades of practical experience with energy recovery of residues from the oil industry the concept of "Calorific Mining" was developed together with Envirotherm. This concept aims at the use of the calorific value of the residues for power and heat generation using a special incinerator based on a circulating fluidized bed or gasification technology.
The overall goal is to transform large quantities of residues over years into electrical energy and heat, making the remediation can be done economically. This concept includes the planning of the system, the remediation of the sites, i.e. the excavation, treatment of the waste to a usable fuel in the combustor in combination with long-term waste management concepts in the regions. The remediated areas are then available for the further development of urban space and the region.

Advantages

This concept is sustainable in terms of a final, long-term disposal of waste by means of energy production and finally CO_2 savings. In addition, it allows a gradual deployment of the remediated areas for development of the region under provision of long-term waste management concepts.

Example for an urban waste site



Identification and prioritization of sources for optimal coastal and river basin management using multivariate statistical tools

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On a river basin and coastal scale, the level and composition of contaminants are generally originated from multiple sources. The contribution from point sources and diffuse sources will vary both on temporal and spatial scales. In order to identify sources of significant which should be prioritized for mitigation a strategy, which includes “chemical fingerprinting” of environmental samples and sharp statistical tools capable of decompose systematic source patterns, can be applied.

Objectives: Demonstrate a strategy for identification of critical sources for prioritization of mitigation activities on coastal and river basin scales

Results: Sediments samples from the Baltic Sea coastal areas (Sweden) and Taihu Lake (China) were screened for chemical fingerprints of polychlorinated dioxins and dibensofurans (PCDD/Fs) and polycyclic aromatic hydrocarbons (PAHs), respectively. By applying a combination of principal component analysis (PCA) and positive matrix factorization (PMF) source patterns were identified, suggesting the most likely significant anthropogenic activities influencing the system. In the case of PCDD/Fs in coastal sediments (Sweden), 4 – 6 sources were identified, related to diffuse sources as well as a number of specific industrial activities situated along the coast [1-2]. The PAH fingerprinting from the Taihu Lake in China revealed 3 major sources, with varying influence along the river basin system[3].

Conclusions: Source apportionment based on chemical fingerprinting is a powerful tool in management of contaminants on coastal and river basin scales.

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Improving modeling approaches for children exposure assessment in contaminated areas: a case-study in a smelter site in China

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The understanding of human health risks for populations living close to industrially contaminated sites can be improved through the application of up-to-date, refined modelling approaches for evaluating human exposure to environmental contaminants. A new software tool for the integrated assessment of human exposure is currently being validated within the EU project “4FUN”. This tool provides a library of exposure models which can be flexibly combined, and allows to couple on the same platform multimedia and physiologically-based pharmacokinetic models for simulating human intake and internal exposure to a wide set of chemical substances. The 4FUN tool is applied to estimate children exposure to lead in a historical Pb-Zn smelter site in southwest of China. Lead contamination may represent a significant hazard for the health of children living in mining and smelter areas in China, as proved by cases of lead poisoning reported in the country in recent years. However, until now the limited availability of human biomonitoring data and scarce detailed exposure assessment hamper the characterization of the most significant exposure pathways for children. Therefore, the application aims at identifying and characterizing the most significant exposure pathways, in order to support more effectively the definition of appropriate risk management measures. The results of the testing application of 4FUN model are compared with the ones provided by the Integrated Exposure Uptake Biokinetic (IEUBK) model developed by USEPA. The application allows to identify the most relevant exposure routes and to explore their relative contribution to the overall children exposure, as well as to identify the differences between the applied modelling tools.

Precautionary approach to soil protection by optimizing the urban impact regulation

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Ecosystem service is a term that describes that nature constantly ecological services (a term used in economics) provides, for which all who use this have to pay anything. It will constantly create values that all of us, which we live on earth, as livelihoods need and use. These are translated from different presently interdisciplinary and international research teams working in monetary values .

The impact regulation is an existing and long-proven method from the conservation and urban planning, which attempts to implement the basic idea that the polluter has to make an intervention into nature for an adequate compensation.

Brings you the two approaches together, then you can understand the ecological value , the nature has on the face of a planned intervention, and it is understood that this would be reduced upon engagement or even cease completely. Likewise, it is understood that compensate this value or must be replaced.

The soil, which is destroyed when sealed, but not restore. It takes about 100 years to 1 cm soil has formed again.

- Therefore, soil protection must precede recovery.

- Therefore, the intervention regulation by representatives of nature conservation considered indulgences.

Here, the potential and the basic idea of engaging compensation control is misunderstood.

The point is to make the loss in value conscious and to take the cause of the loss in value for the responsibility. The objective is (in all provinces equal to) the order of the interference minimization and compensation: first intervention avoidance, then minimization procedure, then compensation amounts or compensation payments.

For the process of awareness you need to find a language that everyone understands: translated into the language of the market means that the ground (soil, biotopes area) has a monetized value - which can also be high and must, if the ecological value of the area is high. And that can be very high and must, if the area is not in restore their ecological value (previously usually to be adopted) 25 years.

Similarly, there are areas that have a lower ecological value and therefore their use (and / or destruction) also monetized lower.

On the other hand, the same rules must apply: Any appreciation of a floor, any removal of contamination from the soil, leads to an appreciation of the area in the ecological sense. And this appreciation must also monetized, so they can be evaluated predictable.

In combination these considerations, this transfer of ecological value in the language of the market, so money is achieved the following:

1. The value of a face is detected and logically follows that a destruction of the surface leads to a generally understandable loss of value.

2. The second potential cause of the loss in value will be held responsible and can read the extent of his liability directly - he understands what it would cost.
3. It will be interesting alternatives that lead to a lesser value, and therefore cost less would - the engagement avoidance is not understood as preventing the planned (construction) measure, but a variable gets meaning: The location.
4. The cause is even aware that he has the chance to create ecological values that give him financial benefits.

- There is not only cost, there are also financial benefits.
- The potential client has the choice on which area he wants to build.
- Ecology is becoming a serious player in location decisions,
- What is possible only by the fact that the value of nature is translated into the language of the market.
- The goal is not to stay with "Drain payments, but to use the translation of ecological value in money for the control of construction and location decisions.

Of course there are limits to the monetization of nature: nature protection is not to completely subdue the market and the economy, on the contrary, the market and in particular the construction industry will be expanded to the value of nature.

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Concept for sustainable revitalization of a ‘model’ brownfield

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An increasing number of brownfields (BFs) is becoming a serious problem in many European countries and worldwide [1]. This study describes the concept for sustainable revitalization of a ‘model’ BF using the approach, methodology and tools developed within the frame of the VII EU FP project - HOMBRE (Holistic Management of Brownfield Regeneration) [2,3]. The concept is focused on highest possible economic profits to be obtained after BFs revitalisation, taking into account sustainable development principles as well as the respect for local communities. A ‘model’ BF was defined and characterized, including both environmental, social and economic problems and available potentials (resources/services) profitable not only for the BF itself but also for the surrounding areas [4]. The effective alternatives for future land use were selected. Technology trains were developed to obtain (by closing mass and energy cycles) indicated potentials, thus contribute to sustainable revitalization. For suggested technology trains operation windows were defined. The set of indicators for successful ‘model’ BF revitalization was also proposed. The developed revitalization concept includes technical, economic, environmental and social aspects. It is an example of the innovative and sustainable approach that allows for solving many problems, which may often occur during BFs revitalization.

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Calculator for the Follow-up Cost of Urban Development in Infrastructure

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The direct cost incurred by the maintenance and restructuring of urban utility systems (water, sewer, gas, electricity and streets) are often opaque and not properly taken into consideration when planning decisions are made. These costs are becoming even more relevant with the advent of demographic pressures within shrinking cities. Population decline increases the per head cost of these systems since there are less tax payers to distribute the cost among as well as threatens their proper functioning through under-utilisation. It is in this context that sustainable settlement patterns can be promoted by providing municipalities and responsible stakeholders with information on the long-term financial impact of development.

To tackle this issue, the Saxonian Ministry for Agriculture, Environment and Geology commissioned a research and development project to develop a follow-up cost calculator for urban development within the State. The goal of the project is to develop a practical tool to be used by the municipalities to calculate the long-term cost of infrastructure by adapting an already developed follow-up cost calculator for German municipalities (available in German at: www.was-kostet-mein-baugebiet.de) to the specific context of Saxony. Expert interviews, consultations with four partner city administrations and desk research activities are all contributing to the development of the calculator tool. The finalised tool is envisioned to be made available for municipalities to support decision-makers in the State to make financially sound land management decisions which contribute to realising sustainable settlement structures on a long-term basis.

CityChlor: integrated approach for urban development

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Traditional ways of dealing with polluted soil and groundwater are not effective in all cases. Cities are expanding, brownfields and former gasworks are within city boundaries and threaten our soil and groundwater quality and therefore human health. In urban environments with many stakeholders involved and complex contaminations of chlorinated solvents, an integrated approach is needed to tackle these problems.

Sustainable urban development and soil quality: they are connected!
A poor soil quality can form a risk for the desired urban environment and a limiting factor for developments, while urban developments are important triggers and a chance to restore soil quality (and overall local sustainability levels for that matter). Also a good and sustainable urban design can draw new customers towards an area and increase value and profit. So, soil quality, sustainability and urban development are interconnected. How can a win-win situation be reached? An integrated approach which allows more synergy through early connecting stakeholders and involving different overlapping disciplines in urban planning has proved to be effective. But it is also complex matter to deal with. It needs strong guidance to collaborate and achieve and perform an integrated approach.

Overcoming the bottlenecks
The major bottleneck for collaboration is formed by the different ‘languages’ used by different disciplines (like environmentalist, spatial planners, project developers, etc.) involved in urban spatial planning and development. These professionals appear to be living in different worlds and working on different goals and ambitions. Early involvement of and connection between these disciplines is the key.
There are also other crucial stakeholders like politicians, inhabitants, owners, users with their own agenda. In this playing field it is important to look for common goals. This can be sustainability, but also other mutual goals and interests can be discovered. Next step is to bridge the gap between actors and their goals with methods and tools. CityChlor has worked since 2009 on tools and methods that contribute to the integrated approach.

Conclusions
There is a lack of knowledge and synergy between the fields of soil, water, green, energy and urban development, which needs to be elevated to meet the demands of tomorrow. Urban living conditions -sustainable and resilient cities- need to be tailored for the demands of the future. There are several common success factors that you can try and apply when setting up an integrated approach for urban redevelopment projects with many stakeholders and complex contaminations. These success factors are described in the CityChlor project. Next step is to propagate these success factors to other urban projects within Europe.

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Development of solar energy project (photovoltaic power plants) on brownfields in the Czech Republic and in Germany

Contributors: Petr Klusáček, Stanislav Martinát and Stephan Bartke

The contribution compares the experiences from development of solar energy project (photovoltaic power plants) on brownfields (so called brightification of brownfields) between two neighbouring European Union member countries: the Czech Republic and Germany. The conducted research, which is based especially on analyses of selected statistical data and on information from both Czech and German experts, showed that the development of this kind of energy projects was relatively weak in the Czech Republic in comparison to Germany, because there was no systematic support from side of Czech public administration, for example by means of the tailored feed-in tariffs or by special regulative instruments as in Germany. The contribution pays also attention to the selected cases of so called “best practices” – concrete examples of successful projects developing photovoltaic power plants on brownfields in both studied countries. The research results can be inspiring and important for other countries where the potential of brownfields redevelopment for solar energy project has been unused yet or it has been used only marginally.

Use of *Mucuna pruriens* for soil and weed management in a horticultural tree crop based urban land use type.

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A field study was conducted to assess the potentials of cover crops as alternative to use of agro chemicals for soil management and weed control in horticulture based tree crop production in urban land use.

Mucuna pruriens seeds were sown in a mature Citrus orchard at spacing of 0.5m x 0.5m, 1m x 1m, 1.5m x 1.5m, 2m x 2m and slashing used as control. *M. pruriens* planted at spacing 0.5m x 0.5m and 1m x 1m performed better than 1.5m x 1.5m, 2m x 2m and slashed plots. It improved soil quality and suppressed weeds in the Citrus orchard. *M. pruriens* at 0.5m X 0.5m improved soil pH, organic carbon, total nitrogen and available phosphorus by 16.67%, 28.57%, 127.77% and 23.41% respectively. The soil water holding capacity using 0.5m X 0.5m and 1m x 1m spacing had better result in comparison with other spacing as they recorded moisture content of 14.6% and 19.3% respectively. *M. pruriens* at 0.5m X 0.5m and 1m X 1m reduced weed biomass and this was significantly different from the control ($p = 0.05$).

Cover crop such as *M. pruriens* is a good alternative to use of agro chemicals for soil and weed management in horticultural based tree crop production in urban land use. They are economical and can reduce soil and water contamination. However, *M. pruriens* is a climber and should be trimmed periodically as it can take over the canopy cover of the tree and reduce the photosynthetic ability of the Citrus trees.

The tailoring of decision support tools and technologies: findings on stakeholder requirements from the TIMBRE project

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The TIMBRE project strives to overcome existing barriers to brownfield regeneration by developing and providing customized problem- and target-oriented technologies and tools for enhanced brownfield regeneration in Europe. In order to assess the degree of “tailoring” of the project tools to the actual needs and requirements of potential end-users, we carried out a survey among participants taking part in TIMBRE workshops that involved the presentation or hands-on application of project tools (namely the Information System for Brownfield Regeneration, the Prioritization Tool and the Integrated Site Assessment Tool for re-use options planning) as well as of the project technologies Tree core sampling, Membrane Interface Probe (MIP), Laser Induced Fluorescence (LIF), Hydraulic Profiling Tool (HPT), Groundwater Sampling, High Resolution Characterization of contaminated sites and Conceptual modeling. The poster presents the main findings of this survey, which was conducted in 2013 and 2014 in Romania, Poland, the Czech Republic and Germany. It focused on the perceived usefulness of the technologies and tools, the applicability of tools in the concrete circumstances of the respondents and the likelihood that they will use these tools in the future. It allows drawing some general lessons on user requirements.

Towards Future Nano-Remediation Markets: Understanding Drivers for Market Scenarios

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NanoRem (Taking Nanotechnological Remediation Processes from Lab Scale to End User Applications for the Restoration of a Clean Environment) is a European Commission FP7 funded research project facilitating practical, safe, economic and exploitable nanotechnology for in situ remediation.

The potential, risks and benefits of the use of nanotechnology for the remediation of contaminated land (soil and groundwater) have been of increasing interest (Bardos *et al.* 2014). Various aspects from economy, technology development, politics and society drive the evolution of the market for nano-remediation technologies. NanoRem is using economic analyses tools to provide a better understanding of this market place, to more closely examine different market development scenarios and hence the likely market drivers.

Scenarios are consistent visions of how a specific system might develop in to the future. They help to understand and systematise (i) what drivers and the uncertainties related to them are, (ii) what the extent of their impact is, and (iii) how they do interdepend.. In addition, deducted scenario narratives support identification of different market development trajectories, enable concluding responsive or proactive strategies for business (Gausemeier *et al.* 1998) or provide clarification where development can be influenced by policy makers (Priess & Hauck 2014).

This poster will report on initial results of an engagement process with key practitioners and stakeholders (“key informants”) from across the EU to understand the market drivers on which the scenario development is based.

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Two brownfields sites, two municipalities, two different regeneration ways

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This paper is concerned with two examples of good practice of brownfields redevelopment. Both brownfield sites in question are located in the Moravian-Silesian Region and the redevelopment of both started in 1998. In both cases the redevelopment has been successful, although it was achieved using different methods. Both ways towards the redevelopment were long, difficult and dangerous at times, yet in the end, everything worked out well and the goal was attained. Nowadays, in both municipalities there are industrial parks, providing employment also for local people.

Introduction

Looking for ways to redevelop brownfield sites can be a long and laborious task. The term “brownfields” used to denote mainly sites affected by industrial production, but nowadays, it is a much broader term encompassing many more sites. To enable a more precise addressing of the issue brownfield sites can be divided into several categories, as [1], [2] mention. One of the suitable categorizations is based on former use. It is the categorization of sites based on former use which gives us quite a clear idea about the kind of difficulties we might encounter in these areas. [3], [4] However, it does not usually tell us what the best thing to do would be if we wanted to turn the unsightly, repulsive, depressing brownfield site into a property useful and beneficial for its surroundings. There are various approaches to redevelopment and it largely depends on the size of the municipality which of the possible methods will be adopted. Brownfields redevelopment is easier in bigger cities, as there are usually quite a lot of experts, and quite bigger municipal authority, larger municipal budget and stronger interest among investors. The situation is different, and in some respects more difficult in smaller municipalities, yet there are still several examples of successful redevelopment.

Two municipalities, two examples – the starting point

This paper is concerned with two examples of good practice – the redevelopment of an old colliery and the redevelopment of a former agricultural property.

Both municipalities – Horní Suchá (old colliery “František”) and Třanovice (agricultural property) are situated in the Moravian-Silesian Region, east of Ostrava. Horní Suchá has about 4,500 inhabitants, and most of them used to work as miners in the coal mine “František”. Třanovice has about 860 inhabitants, and most of them used to be employed in agriculture.

By the end of 1998 and the beginning of 1999 both municipalities were faced with a difficult situation as the principal employers, the colliery “František”, and the company TRANAGRO respectively, were closed for various reasons, which led to increase in unemployment rate and the social pathological phenomena connected with it. At the same time, the entire Moravian-Silesian Region had to deal with growing crisis arising from the change of government and restructuring of heavy industry, and the resulting high unemployment rate and young people leaving the region to look for jobs in Prague.

However, what these two municipalities have in common is the fact that both are managed by open-minded mayors, who know how to promote the citizens’ welfare, and municipal councils who trust the elected mayors and are willing to run small risks.

Třanovice

In 1998 the only shareholder – the Land Fund (a public body) called a general meeting of shareholders in the company TRANAGRO (an agricultural company in Třanovice). Taking into consideration the fact that the former management had been so poor that the company then owned no cattle, only the buildings and was heavily in debt, the Land Fund appointed a liquidator and a new president of the board of directors and two new members of the board of directors – the mayor and another municipal council member.

The principal aims of the area redevelopment were clear: 1. To transfer the ownership of the site to the municipality (the description of the mortgage on the property took up twenty pages of the title deeds). 2. To sell the buildings on the premises separately and for other than agricultural purposes and to target at the local entrepreneurs. 3. To use the space in the centre for the needs of small businesses. [5]

The primary goal of the project was to do something about the site. The key issue was how to transfer the ownership of the property to the municipality, how to clear the debts and how to sell it so that the entrepreneurs could afford to purchase it (and still would have enough left to build up their business).

The municipality started negotiating with the creditors and managed to buy Komerční banka’s claim, thus becoming the main creditor of the company TRANAGRO, then in liquidation. However, there were still debts to pay off and the liquidator had to repay the creditors somehow. Again the municipality provided help. After clearing the debts little by little – buying the claims – the municipality sold the buildings on the premises to entrepreneurs for the assessed value, giving them half of the amount by way of subsidies on condition that they ran their business in Třanovice for at least five years, then the subsidy would be irreclaimable.

And so little by little the decaying agricultural property was turned into an industrial park. The municipality set up the non-profit organization Třanovické služby (Třanovice Services), which runs the park. The municipality had applied for and received funds from various programmes, such as SAPARD and PHARE. The municipality has been renovating the Kapplův dvůr (Kappel’s Yard), situated in the central part of the premises, which now serves as a business incubator.

The most adventurous part of the process came to an end in 2003, as the redevelopment had been basically finished by then. The company Tranagro went bankrupt and was removed from the business register. The municipality with a population of 860 got an industrial park, which provided for the employment of 450 people. The park has been doing well and has actually reached some capacity limits, such as an undersized wastewater treatment plant, etc. Entrepreneurs have built more plants on the premises and the industrial park did not even encounter any bigger problems in the recession of 2008 – 2010.

Horní Suchá

With regard to the possibility of transferring the ownership of the property to the municipality the situation was completely different in Horní Suchá. In 1999 the colliery was also owned by a private company, in this case it was the company OKD, which intended to sell the premises, however the price they quoted was absolutely inacceptable to the municipality. [6]

So, whereas in Třanovice they had already set up the industrial park, in Horní Suchá at that time they could do nothing but wait and see if the owner came to their senses. Hope began to spring in 2002, when the ownership of the property was transferred from the company OKD to DIAMO, state enterprise. Diamo undertook the demolition of some buildings on the premises (this had been agreed on with the municipality and done with the aim of transferring to the municipality a property free of various purpose-built buildings which offered little possibility of a new use). The municipality again tried to purchase the premises, but a state enterprise could not sell state property for less than the assessed value (even though it acquired it at a price of 1 CZK). (It is interesting to note that an auction was conducted in three rounds for the purpose of gradually bringing down the price.) A significant alteration in the negotiations occurred due to the amendment to the Act No. 77/1997 Coll., on state enterprise, which came into effect on 31st December 2003. The amendment provided for a free-of-charge transfer of ownership of brownfield sites from the state to the municipalities – Diamo could thus dispose of a property they did not need. The ownership was transferred in February 2005. What did the municipality get? Premises with an area of 15 hectares and demolished buildings – only the foundations and public utilities were left (although these were defunct and mostly built in reinforced concrete pipes). Owing to this the construction of new infrastructure was much more expensive. [7]

It was clear that it would not be possible to rent out the entire premises as one unit, and that was not what the municipality really intended to do, instead, they planned to attract the attention of entrepreneurs. (Unlike Třanovice the municipality of Horní Suchá remains the owner of the premises and the site is rented out to individual companies). The municipality also applied for several subsidies under various operational programmes, e.g. the Operational Programme Industry and Enterprise – the programme of support Real Estates.

Three goals were established – Infrastructure, Renovation and Construction of a new plant.

The renovation of the park infrastructure cost more than 80 million CZK. The expense was covered by the Ministry of Finance of the Czech Republic following a successful project submitted by the Inter-Ministerial Commission for Redevelopment of the Moravian-Silesian Region.

Another goal was to renovate the remaining buildings, which could be put to some use – the main building and the healthcare centre; the application was approved. The renovation of the main building was done in 2006 – 2007 and cost about 20 million CZK. It was funded from the Operational Programme Industry and Enterprise. Nowadays, the buildings are used by companies – however, the buildings cannot be used to their full potential owing to the existing regulations on the use of buildings and the location of small-scale production.

Unlike Třanovice, who decided to target local entrepreneurs, the municipality of Horní Suchá intended to attract the attention of foreign companies. Unfortunately, northern Moravia has a rather poor reputation and it was therefore necessary to make the first step and show entrepreneurs that the municipality was able to provide help, that the industrial park was ready and that it was safe to do business in the cross-border region of the Czech Republic. That was why a new plant was built on the premises – it covers an area of about 2.000 m^2 and is located near the entrance to the park. The construction was done in 2007 – 2008. It cost about 40 million CZK. Out of the total amount, 20.6 million CZK came from the EU Structural Funds, 6.8 million CZK were taken out from the state budget (Operational Programme Industry and Enterprise) and 12.6 million CZK were given by the municipality. [8]

The industrial park was opened in 2009. Nowadays, all plots of land are rented out to entrepreneurs. The park is still owned and run by the municipality. With regard to finances, some revenue comes from that. More than 500 people are employed in the park and the number is continually increasing.

Conclusion

We have discussed two different examples, two different municipalities, which, nevertheless, pursued the same aim of promoting business development, reducing the unemployment rate and disposing of sites, which did not produce any aesthetic or beneficial effect. Ever since the process of redevelopment was begun the mayors in both municipalities have been the same – Mr Tomiczek in Třanovice and Mr Lipner in Horní Suchá. They both had a vision and put in considerable effort to carry out the projects, which would have otherwise never been launched. So what conclusions can we draw? Well, the success of each redevelopment project depends on the people who run it, the effort they put in and their ability to find compromises and pursue their aim.

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Trust and Knowledge Creation in the Regeneration of the Szprotawa Brownfield: A Project Ecology Perspective

Authors: Filip Alexandrescu, Alena Bleicher, Janusz Krupanek, Standa Martinat, Beata Michaliszyn

Interest for the social and cultural aspects of brownfield regeneration has recently focused on the drivers and barriers intervening in such processes (e.g. as part of the Cabernet and Timbre research, among others). By using a project ecologies perspective we aim to understand drivers and barriers as project internal factors rather than as external to revitalization projects. Understanding regeneration as projects means paying attention to the institutional contexts, the project and pre-project networks, the role of trust and the generation and accumulation of knowledge for regeneration. Out of these four factors, we aim to bring a specific form of trust to the focus of attention and ask: what role does swift trust play in generating knowledge for revitalization projects? The answer will be based on the analysis of the regeneration efforts that have taken place at the Szprotawa site in Poland, by relying on qualitative interviews carried out in 2012 and 2014.

The relationships of Cadmium in Paddy Soil-Rice-Urine System around the World’s Longest-operating Tungsten Mine in China

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1. Introduction

Cadmium (Cd) is toxic and related to many negative influences, especialy bone fractures, kidney dysfunction and hypertension [1-4]. Soil-rice-food chain is considered as the predominated pathway of human Cd exposure[5]. Once the farmland soil is contaminated by Cd, it would be accumulated into crops, and transferred to human body[6-7]. Rice is the particular one with high Cd uptake and accumulation[8], and about 65 percent of China’s population relies on rice as a dietary staple[9], so the cadmium contamination issue is considered extremely serious, and this red tape may pose a big challenge. The worst adverse health impact–Itai-itai disease caused by environmental Cd[10] has not been reported in China, but many studies found that the levels of Urine cadmium were abmormal[11]. In this artical, a typical typical Cd contaminated and rice producing region was selected to explore the relationships among Cd concentrations in soli, rice and urine, which can provide a basic information for national health risk evaluation and land management ccording to national spatial distibution of soil Cd contamination and rice production.

2. Method and study area

In 2012, 92 pair samples of rice and soil, and 1130 urine samples from 8 villages (shown as Figure 1)were collected from study area, where revers rich tungsten ore and owns three major tungsten mines with 70-year producing history[12]. Cd concentrations were measured by an inductively coupled plasma mass spectrometry (ICP-MS) following GB/T 5009.15. The relationships were analyzed through the regression method.

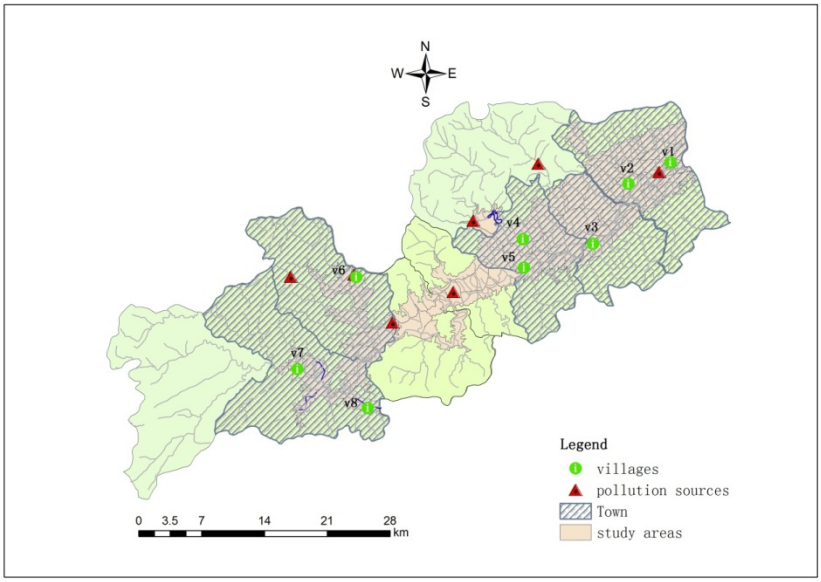

Figure 3 The location of study areas and distribution of sampling sites

3. Main results

The mean Cd level is 0.401mg/kg (range 0.039-1.750mg/kg), 0.201mg/kg (range 0.007-1.480 mg/kg) , 15.86μg/g Cre in soil, rice and urine , respectively. According on the current standard for soil (0.3mg/kg) and rice (0.2mg/kg), 39.13% and 29.35% of total samples were over the Cd contamination level. In term of soil quality, which was much higher than the latest soil survey that indicated that up to 19.4 percent of all cultivated land has been contaminated[13]. Figure 2 showed the Cd levels in collected samples in various villages, and the maximum was observed at v6 in the vicinity of a tungsten mining smelter and located at downstream of the main stream in this region.

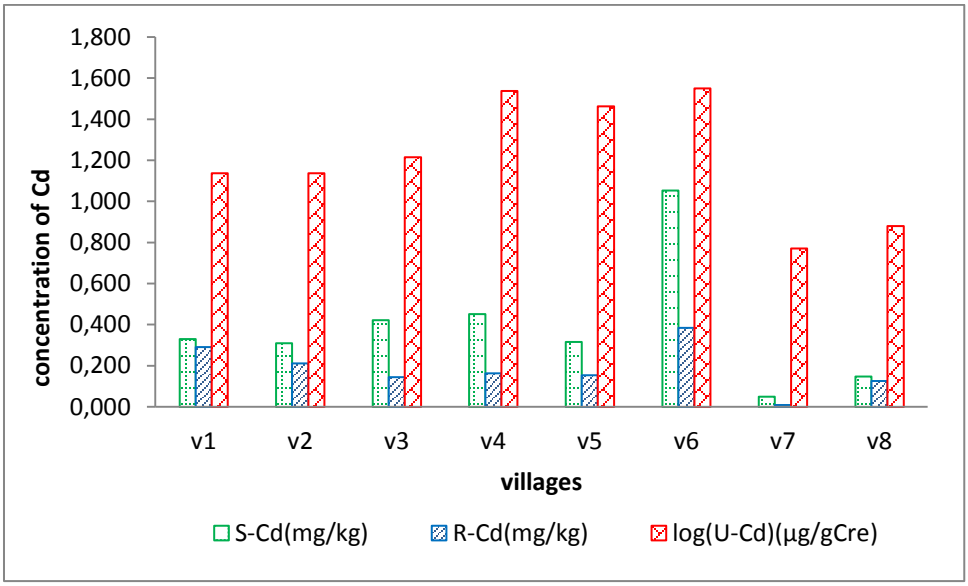

Figure 2 The Cd levels in collected samples in various villages

There was a positively correlation between paddy soil Cd and urine Cd (r_s=0.881, p=0.004), but the relationship between rice grain Cd and urine Cd was not significant (r_s=0.619, p=0.102) at $\alpha = 0.01$ level (shown as Table 1), which suggested that human been lived there would exposure to environmental Cd through other pathways, such as wheat, potatoes, and even skin contacted to soil[14]. Therefore, the prediction and management of health risk caused by Cd pollution can be conducted according to the nationally spatial distribution of soil Cd contamination and paddy area. In China, a national soil quality survey has been done, which can provide fundamental information for national health risk evaluation and land management conbined with the correlation between the S-Cd and U-Cd.

Table 1 correlation matrix of Cd level among soil, rice and urine

	S-Cd	R-Cd (p value)	U-Cd (p value)
S-Cd	1.000	0.690(0.58)	0.881(0.004)**
R-Cd		1.000	0.619(0.102)
U-Cd			1.000

** Significant at$\alpha = 0.01$ level. S-Cd, Cd concentration in soil, R-Cd, Cd concentration in rice, U-Cd, Cd concentration in urine.

4. Conclusion

Soil-rice-food chain is only a route of human beings exposure to environmental Cd and the other pathways, and it is necessary to identify other main Cd exposure pathway to prevent health risks. Soil could well characterize the variation of urinary so the correlation between the S-Cd and U-Cd can used to guide national health risk evaluation and land management.

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Urinary cadmium concentration and related factors in a Southern county

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Abstract:

Objectives: This study was carried out for the purpose of evaluating the differences in different levels between urinary cadmium concentration of the residents of some county in southern polluted area and control area, and finding some socio-demographic and environmental factors to explain such difference.

Method: The general and occupational characteristics were gathered from 1274 participants using a structured questionnaire and collected their disposable urine samples, samples of soil, air, drinking water, rice were collected and determined in contaminated and control area. Using these detection survey data, multilevel statistical model was used to fit the data.

Results: Urinary cadmium concentration of residents had significant differences at different levels, the QL-3, FJ-4pollution area urine cadmium concentration was significantly higher than other research area, far more than its critical value. Urinary cadmium concentration of residents had significant positive correlation with Soil cadmium content, cadmium content in rice and resident gender, and a significant negative correlation between urinary cadmium concentration and the out working time and the distance from polluting enterprises.

Conclusion: The individual and regional differences of the residents’ urine cadmium concentration and the impact of socio-demographic and environmental factors were effectively revealed by applications of multilevel modeling.

Selecting Chemical And Ecotoxicological Test Batteries For Risk Assessment Of Trace Element-Contaminated Soils (Phyto)Managed By Gentle Remediation Options (GRO)

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During the past decades a number of field trials with gentle remediation options (GRO) have been established on trace elements (TE) contaminated sites throughout Europe. Each research group selects different methods to assess the remediation success making it difficult to compare efficacy between various sites and treatments. This study aimed at selecting a minimum risk assessment battery combining chemical and ecotoxicological assays for assessing and comparing the effectiveness of GRO implemented in seven European case studies.

Two test batteries were pre-selected; a chemical one for quantifying TE exposure in untreated soils and GRO-managed soils and a biological one for characterizing soil functionality and ecotoxicity. Soil samples from field studies representing one of the main GROs (phytoextraction in Belgium, Sweden, Germany and Switzerland, aided phytoextraction in France, and aided phytostabilisation or *in situ* stabilization/phytoexclusion in Poland, France and Austria) were collected and assessed using the selected test batteries.

Extractable TE concentrations generally decreased more significantly in soils managed by *in situ* stabilisation combined with phytoexclusion, phytostabilisation or phytoextraction than in soils only managed with phytoextraction. Pseudo-total TE concentrations did not change in the phytomanaged sites, except for one case, which was attributed to the dilution by the amendments. Among the single chemical extractions, the NH_4NO_3- and EDTA-extractions showed most frequently the differences in the extracted TE concentrations between the treated and untreated soils, while the most frequent correlations with the biological responses occurred for NH_4NO_3, followed by $NaNO_3$-extractable TE. Pseudo-total (*aqua regia* extractable) concentrations showed weak correlation with the biological responses.

Out of the bioindicators (plants, earthworms, and nematodes), dwarf beans, especially through root mass, followed by shoot length, and stress enzyme activities, were the most responsive indicators to the soil treatments. Even though the selective chemical extractions did not always show statistically significant changes in TE extractability, dwarf beans and stress enzymes developed a stronger response to the tested GRO options. Generally, the plant growth decreased with higher extractable TE concentrations in soil, while bean stress enzymes reacted in the opposite way, *i.e.* increased with increasing TE extractability.

It is suggested that a minimum risk assessment battery to compare or monitor the sites phytomanaged by GROs might consist of the NH_4NO_3-extraction and the dwarf bean Plantox test including the stress enzyme activities. Validation of this assessment battery as a potential indicator of successful remediation should be further implemented for a broader range of soils and long-term treatments.

Integrative Military Conversion for Sustainable Spatial and Economic Development in Baden Württemberg, Germany

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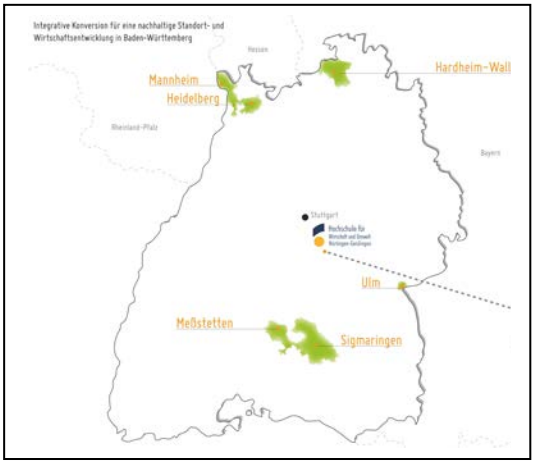
The project strives to create urban laboratories on former military sites (see map 1 below for locations in Baden Württemberg) in order to foster innovative solutions covering the full breadth and depth of sustainable spatial as well as economic development. In this context a team of researchers, private practitioners, local authorities and students works together in a trans disciplinary approach with a view to tackle the complex set of problems arising in local authorities with military conversion sites – where at times several hundred hectares of land fall into disuse, often affecting a wider region. This occurs in very different spatial and economic settings (very prosperous areas with huge development pressures versus areas faced with urban and demographic shrinkage), which means that tailored approaches for individual local authorities are required but also joint efforts in the form of inter communal cooperation as well as public private partnership.

Phase I of the project created the organizational structure and defined a list of focal topics for each urban laboratory – for example: possible interim uses; maximizing transparency and participation; growth management and streamlining of complex and lengthy planning procedures; dealing with conflicting objectives e.g. maximizing eco-housing potential versus providing low cost homes. Phase II of the project aims to combine further academic research and teaching (including student projects and PhD theses) with the realization of projects in the urban laboratories - real sustainable developments on conversion sites which reap the ‘peace dividend’ while being monitored academically.



COMUNE DI GENOVA

City of Genoa
The public historical heritage’s enhancement

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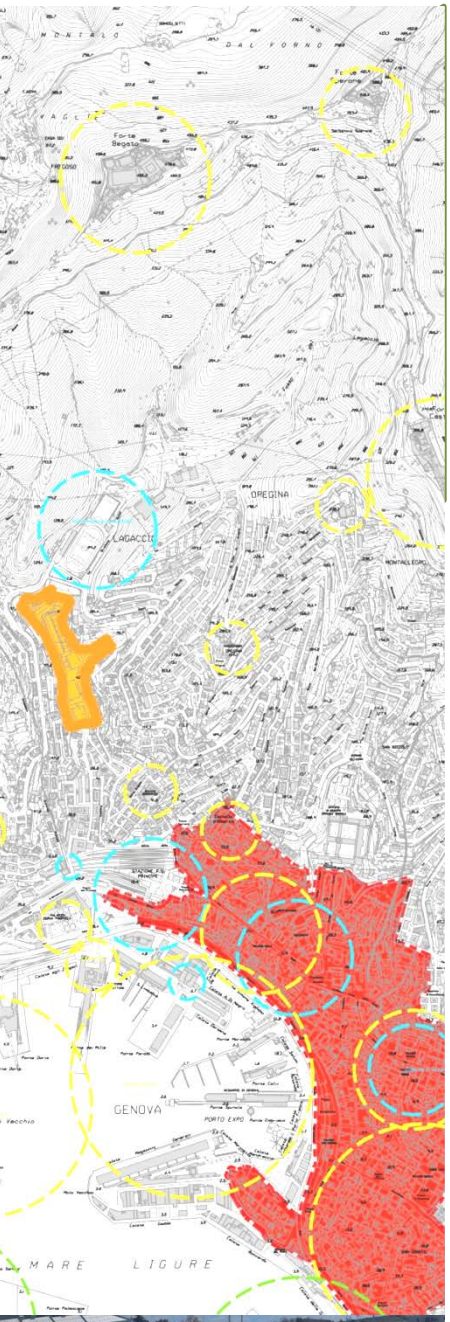

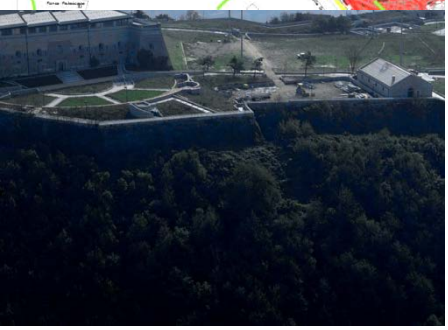

The aim of the project is the redevelopment of a huge historical militar complex in the city of Genoa, unused for a long time, to start processes of environmental regeneration and empower the cultural offering to the city and tourists.

The Forts of Genoa's and the ex militar district Gavoglio's enhancement programs

The local administration intends to restore and enhance the urban shape of traditional Genoa’s look.

It extended from sea to the historical centre up to the ridges concerned by one of most important in Europe defense systems. This form is now compromised by the presence of large brownfield sites in the urban context and by the abandonment of the defensive structure.

The project intends to consolidate a connection from the Old Port, to the former military district Gavoglio and further to the ridges of the Forts Park, which dominate the city. Along this connection there are important urban hotspot: the railway station, now under renovation, and the maritime station interested by the new waterfront project.

The Gavoglio's project also aims to regenerate the environment and re-establish the nearest urban fabric acting on open and green facilities, in order to solve also hydrogeological issues. Moreover economic opportunities and jobs will be provided by new private activities and it’s a positive effect on local real estate market is expected due to the landscape improvement.

The Forts park project develops for 19 km of walls, and aims to return to the city an important part of great historical and environmental suburban territory, inserting cultural/artistic, sporting, touristical functions and recreational activities, contributing to the sustainable city’s development, according to the ongoing trasformation of Genoa in a Smart City.