# Strategies for rehabilitating mercury-contaminated mining lands for renewable energy and other self-sustaining re-use strategies

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# Acknowledgements


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- The views expressed in this paper are those of the authors alone and do not necessarily reflect the opinions of FCO

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blog/turismo-de-naturaleza-en-bogota/

# Who we are

- r3 in the UK, established 1997
  - Research and consultancy on land and waste management, sustainability assessment, brownfields and renewables, brokering new technologies
  - Projects: companies, local authorities, government agencies in the UK, EU, also USA, Australia, Colombia and China
  - Leading participant in several major European funded projects
- r3 in Colombia, established 2014
  - Environmental consulting, identification and assessment of contaminated sites, hazardous waste management and implementation of remediation techniques.
  - Projects : PCB´s evaluation site (Bello, Antioquia), Consulting in designing management strategy of environmental liabilities in Colombia.
  - Environmental legal support.
  - Member of Sustainable Remediation Forum – Colombia.

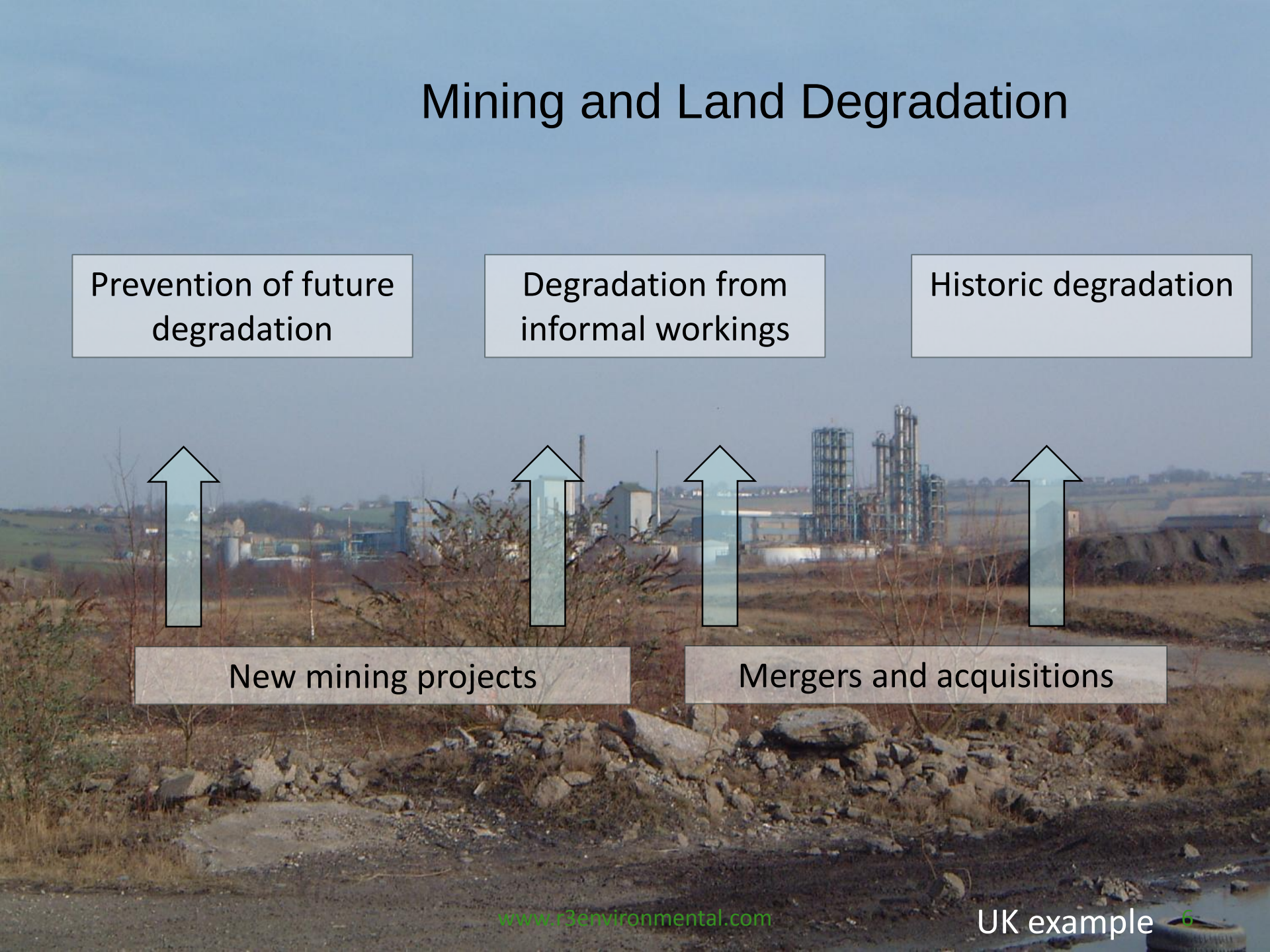
# Goal and Purpose

- To deliver change with strategies to bring degraded mining land in Colombia back into productive use
  - Re-use for “soft” uses, such as renewables (PV, biomass)
  - Focus on land affected by soil mercury pollution in disadvantaged areas in Colombia
  - This supports the FCO goals of increasing regional stability, facilitating sustainable economic growth, harnessing innovation in particular for low carbon development, supporting OECD accession, and identifying possibilities for new community enterprise.

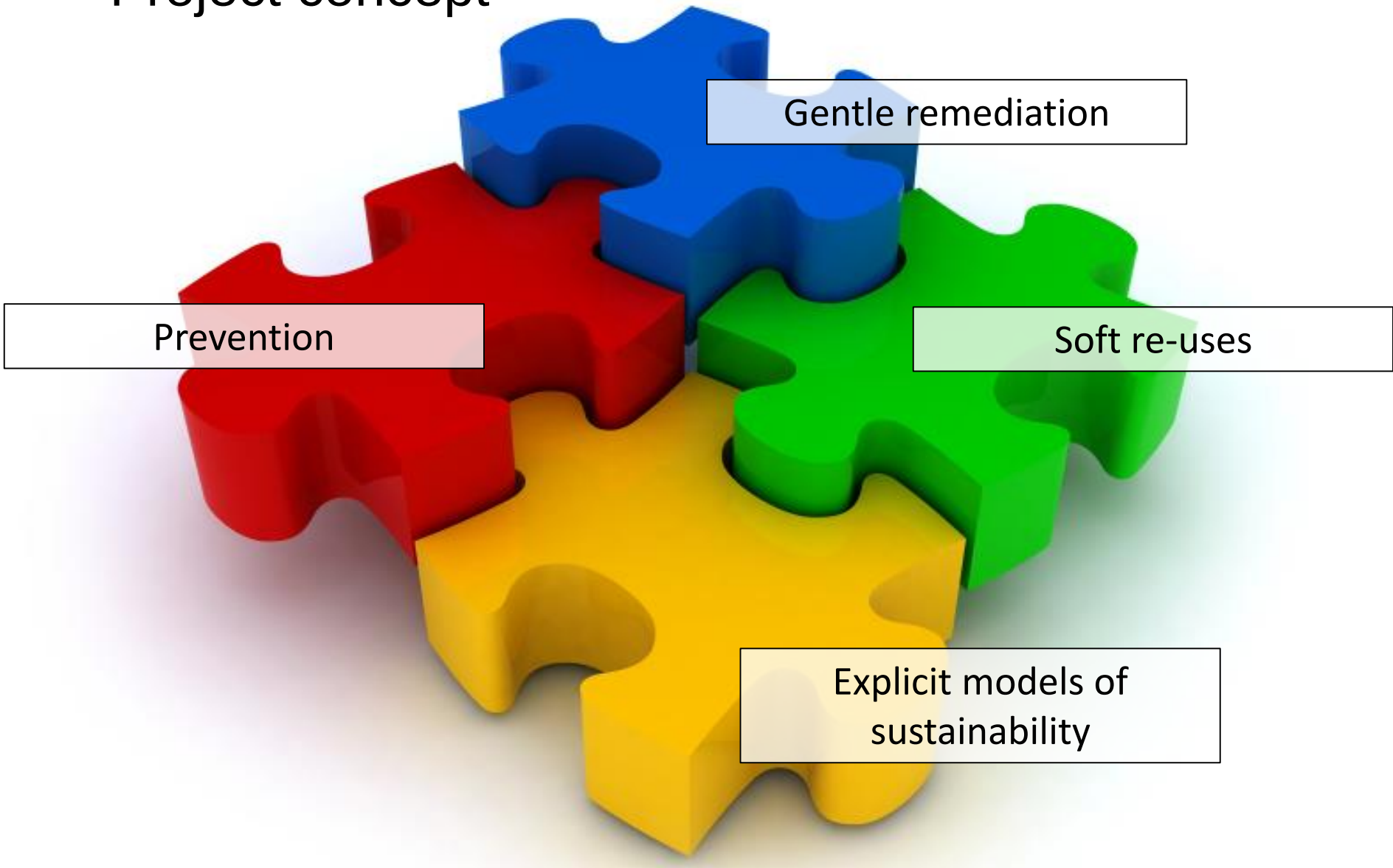
Segovia, Antioquia

Tado, Choco

# Mining and Land Degradation



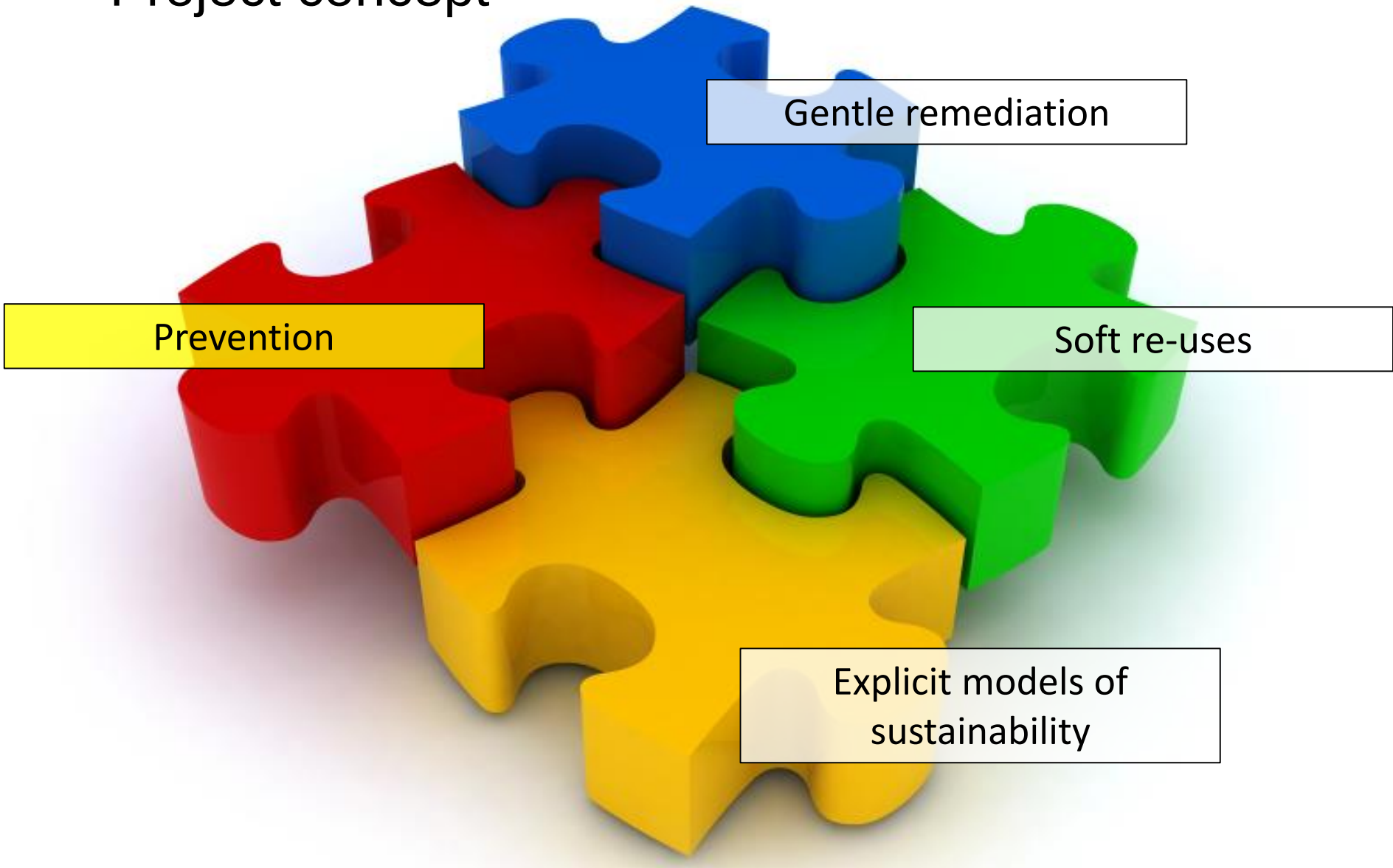
# Project concept



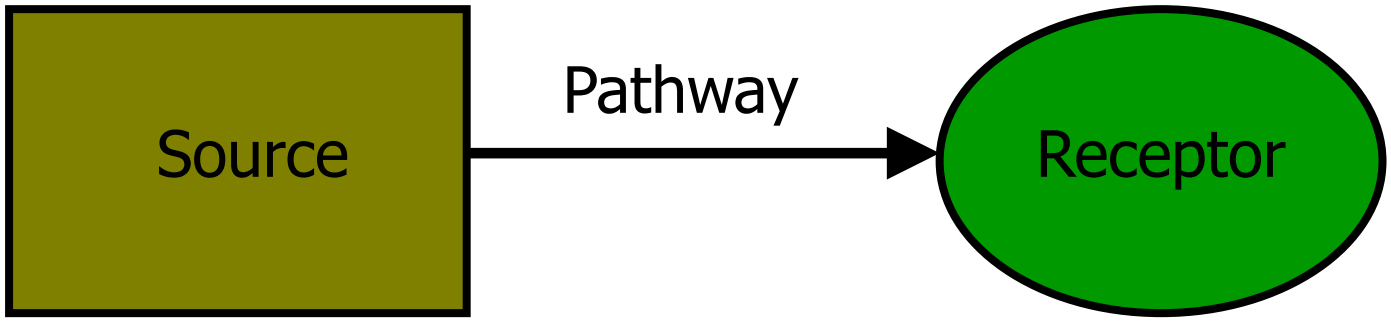
# Prevention, “gentle” remediation, services from “soft” restoration and their value

- Prevention – planning with impacts and after care in mind
  - Avoidance of new brownfield
- Gentle remediation: low input risk management processes, typically along contaminant pathways, such as in situ immobilisation and phyto techniques
  - Longer term but lower cost (mainly pathway mananagement)
- Services from soft re-use: renewables, water storage, habitat, amenity, leisure
  - Direct returns, wider economic values
- Providing a site conceptual model of sustainability
  - Providing a clear frame of reference for decisions and economic valuations

# Project concept



# Managing risks: contaminant or pollutant linkages




Source Reduction

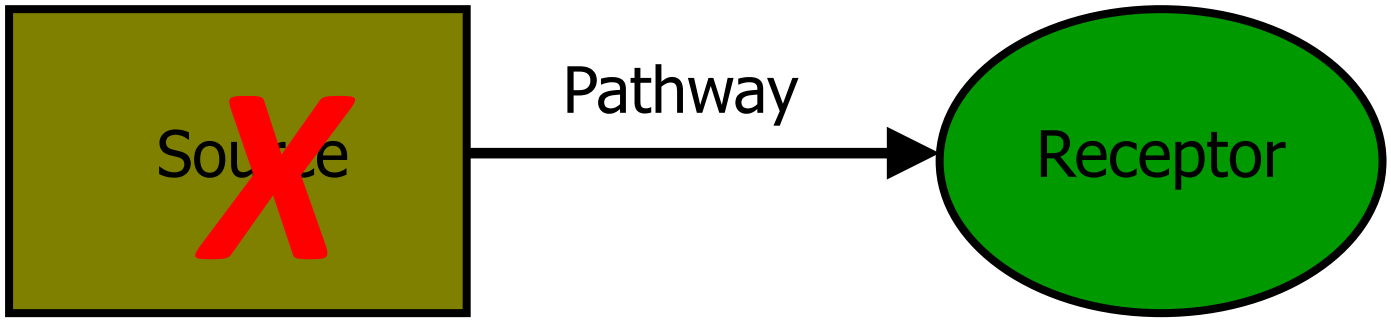
Pathway Management

Limiting Access

*Historical contaminated land management is all about managing risks to appropriate levels.*

www.readyreference.co.uk

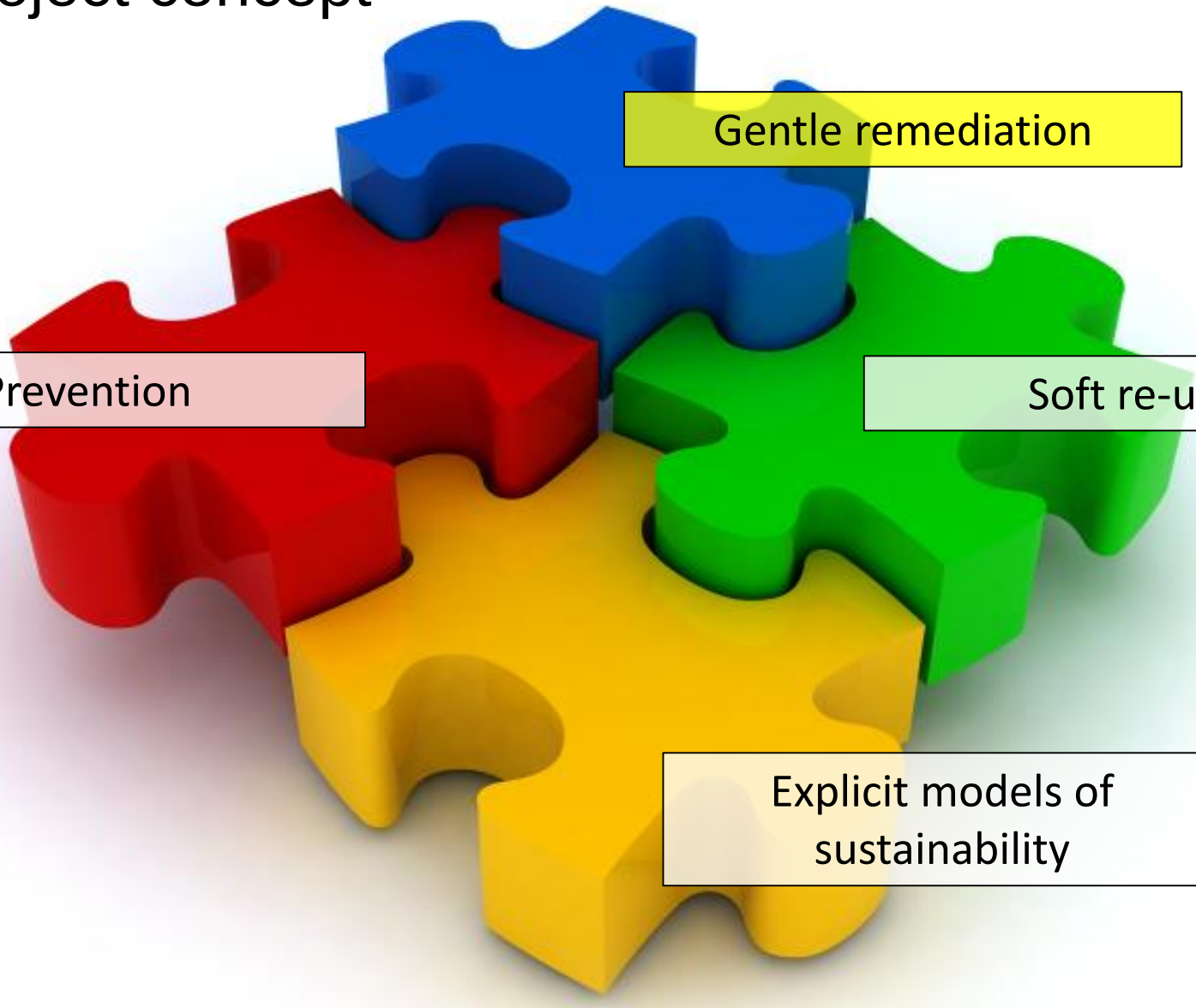
# Prevention




*Prevention is the avoidance of future risks. In the EU under the IED new pollution must be cleaned to background – very expensive!*

*Therefore a lot of effort is put into problem prevention by industry and regulators alike.*

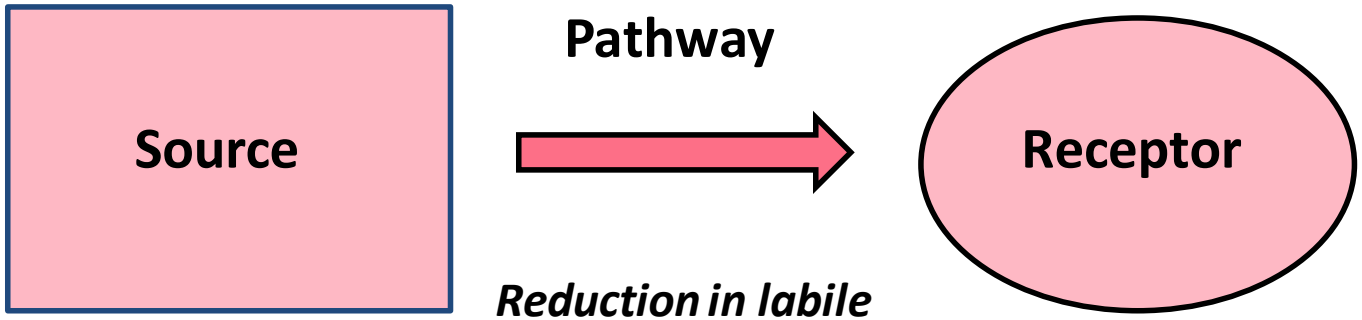
# Project concept



# Gentle remediation of legacy problems

**"Risk management strategies / techniques that result in no gross reduction (or a net gain) in soil function, as well as risk management"**

- **e.g. Biochar, Phytodegradation, Green cover (phytostabilisation / immobilisation), (Phytoextraction)**



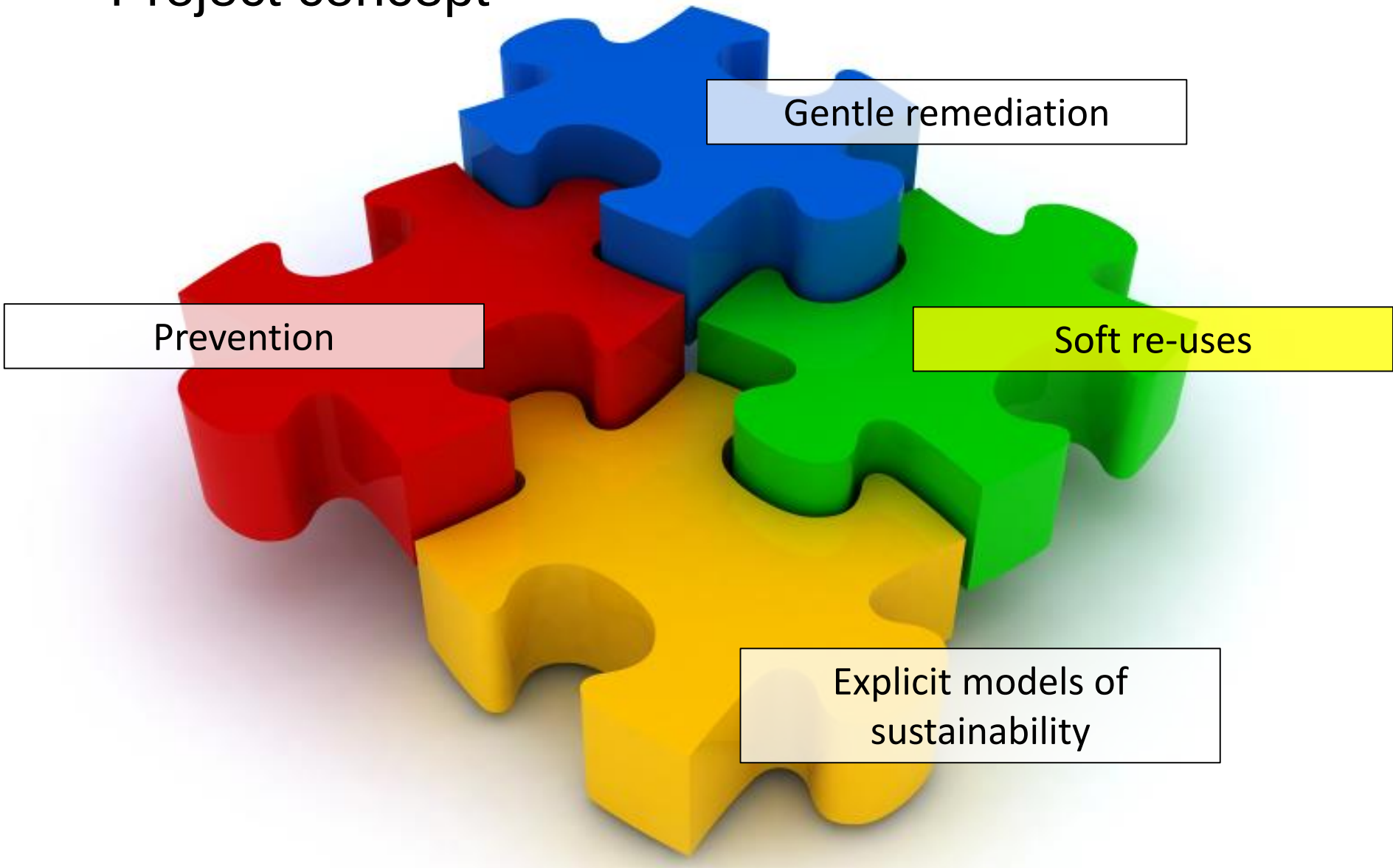

***Gradual removal or immobilisation of source term***

***Reduction in labile pool, rapid reduction in flux of contaminants to receptors at significant risk***

***Using vegetation to manage receptor access to the subsurface***

www.greenland-project.eu

# Project concept

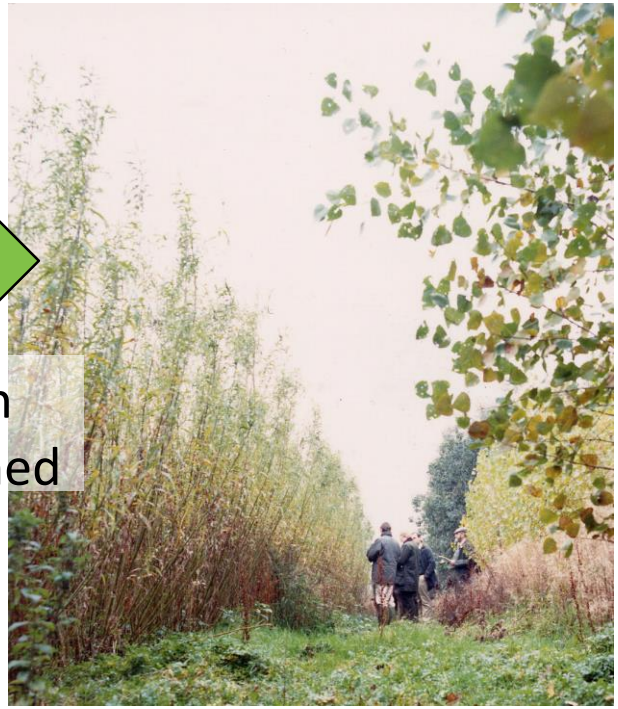


# What is “soft” re-use

- “Hard Re-Use”
- “Soft-Re-Use”

Building or infrastructure

Often combined



Unsealed soil

www.zerobrownfields.eu

# Services possible from soft re-use

| Category | Types |
|---|---|
| **Risk Mitigation of contaminated land and groundwater** | **Biosphere** (including protection of human health) |
| | **Hydrosphere** (protection of water resources/environmental receptors) |
| **Soil improvement** | **Soil fertility** |
| | **Soil structure** |
| **Water Resource improvement** | **Water resource efficiency and quality** |
| | **Flood and capacity management** |
| | **Rehabilitation of water** |

| Category | Types |
|---|---|
| **Provision of Green Infrastructure** | **Enhancing ecosystems services** |
| | **Enhancing local Environment** |
| | **Conservation** |
| **Mitigation of Human Induced Climate Change (Global Warming)** | **Renewable energy generation** |
| | **Renewable material generation** |
| | **Greenhouse gas mitigation** |
| **Socio-economic Benefits** | **Amenity** |
| | **Economic assets** |

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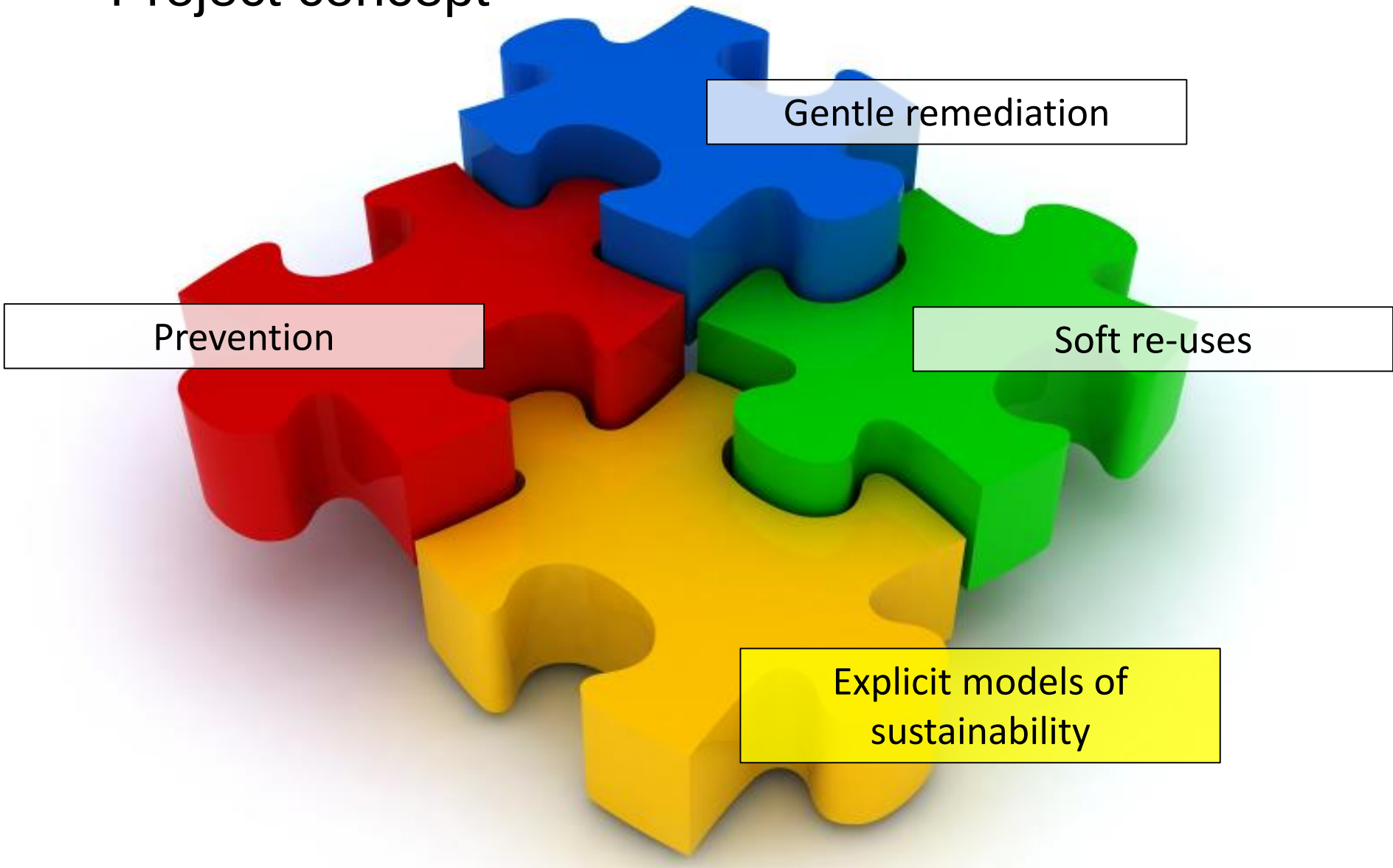
# Services for the community save public money and budgets

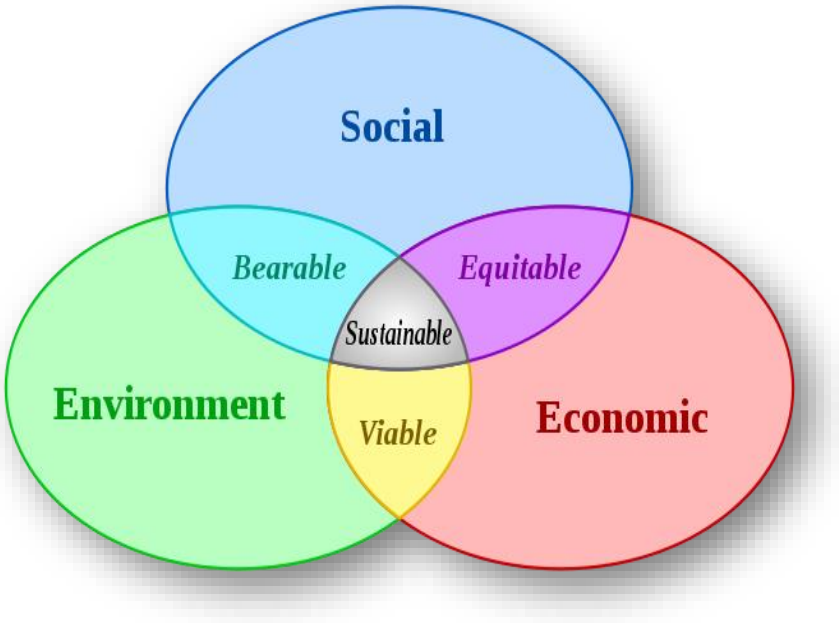

http://thelandtrust.org.uk

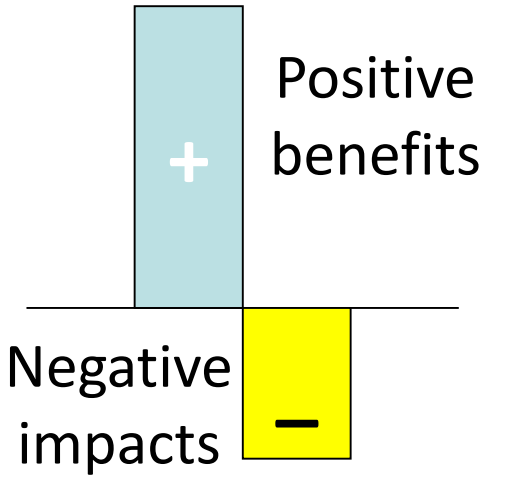
# Project concept



# Sustainable development

'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (*Brundtland, 1987*)




….a net benefit

# Surf-UK Indicator Categories

| Environment | Social | Economic |
|---|---|---|
| Emissions to Air | Human health & safety | Direct economic costs & benefits |
| Soil and ground conditions | Ethics & equality | Indirect economic costs & benefits |
| Groundwater & surface water | Neighbourhoods & locality | Employment & employment capital |
| Ecology | Communities & community involvement | Induced economic costs & benefits |
| Natural resources & waste | Uncertainty & evidence | Project lifespan & flexibility |

www.claire.co.uk/surfuk

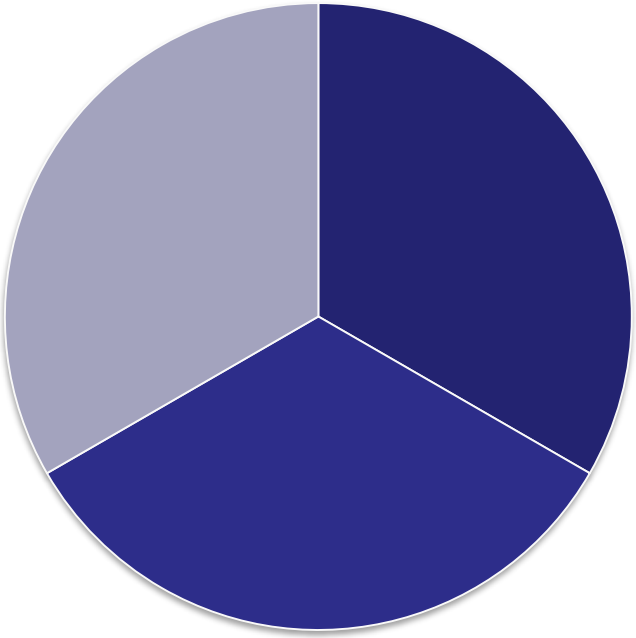
# A sustainability linkage

| | | |
|---|---|---|
| PRESSURE / CHANGE | MECHANISM | RECEPTOR |
| Access to amenity | Improved health | Local community |

Former landfill near Liverpool, UK

http://dx.doi.org/10.1016/j.scitotenv.2015.12.002

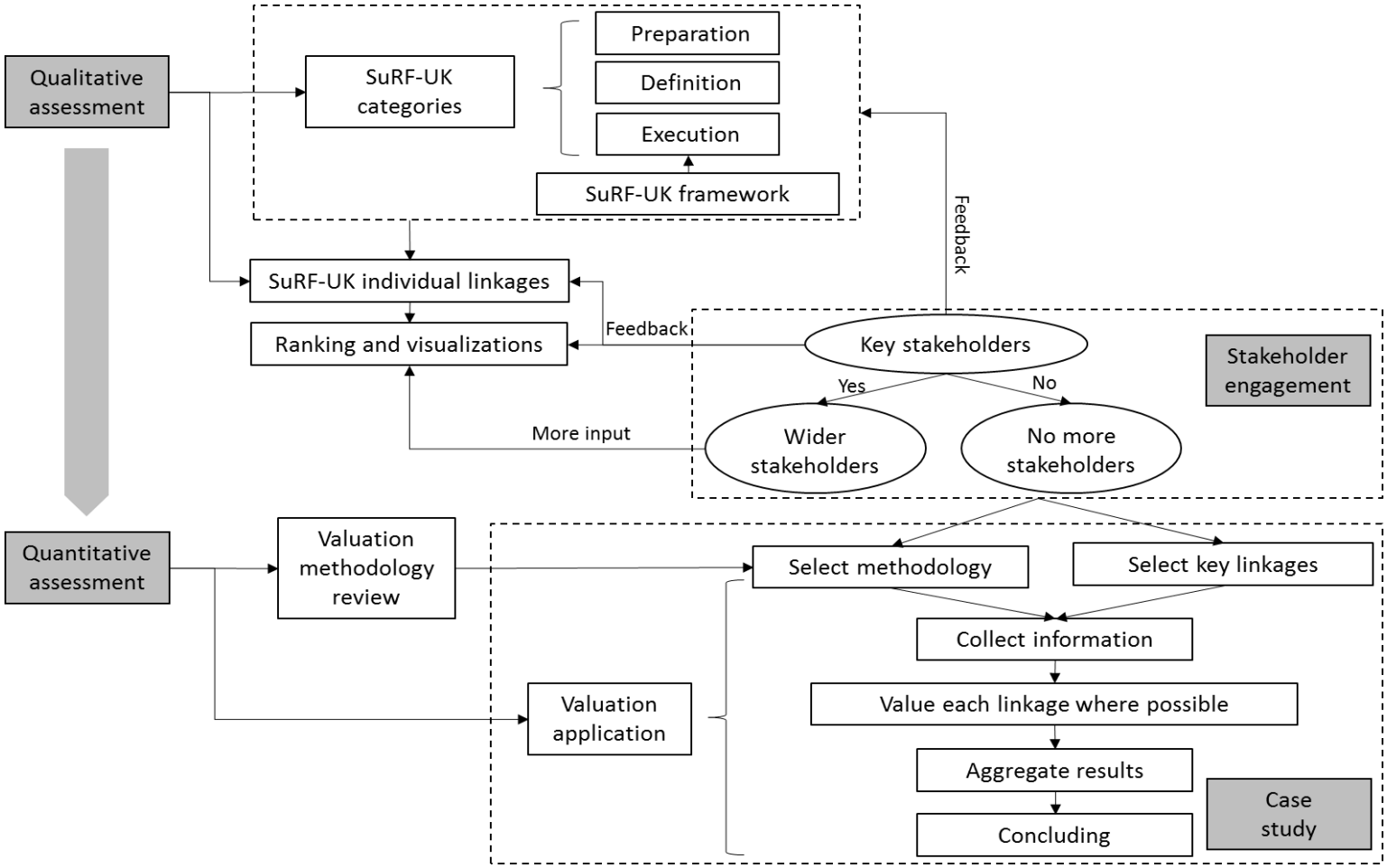
# Grouping sustainability linkages to assess value



- Direct financial benefits related to services
- Wider effects agreed as monetisable (tangible)
- Wider effects that are not readily monetisable (intangibles)

***Individual linkages can be assigned to these different classes in a transparent way***

# Robust economic valuations to support an investment case



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# Project activities

# Output 1: low input techniques to mitigate contamination risks (Public)

- Lab trials of immobilisation to biochar using commercial products, desk study of other alternatives such as “phyto”, goal pathway management
- → An onsite field testing plan for techniques that promise to be replicable to other similarly contaminated sites, for a possible future phase of work on site

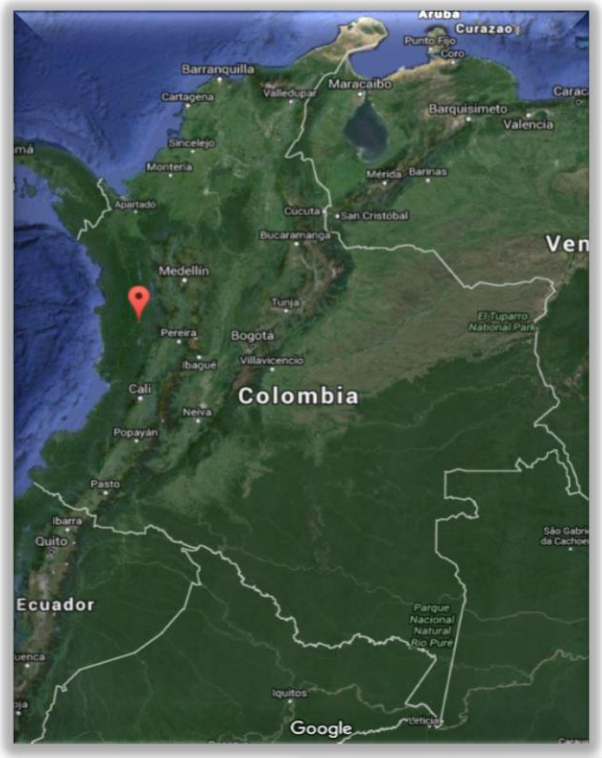
http://www.ccuresolutions.com/

environmental technology

## Segovia, Antioquia



## Tadó, Choco



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# Output 2: Decision support – how to select interventions and services (Public)

- Transferring state of the art knowledge and successful implementation from the UK, EU and North America, and adapting it to the local situation as circumstances dictate.

SuRF
SUSTAINABLE REMEDIATION FORUM UK


HOMBRE

GREENLAND

www.zerobrownfields.eu

www.greenland-project.eu

# e.g. facilitated discussions

## Formato de discusión

30 minutos: cada grupo formule en las respuestas en un rotafolio y elegir a un relator de su grupo

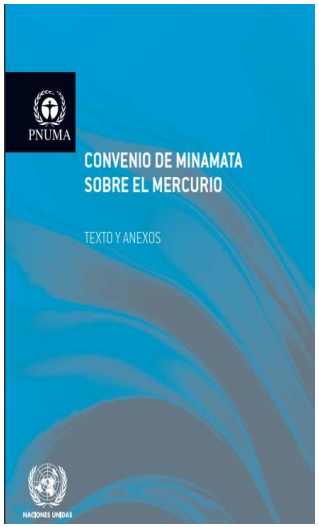
Luego, en un estilo de World Café,? Grupos rotar a los siguientes cuadros y tener una rápida revisión del proyecto desde el último grupo allí. Ellos pueden agregar comentarios -? En un color diferente (15 minutos para cada otro grupo).

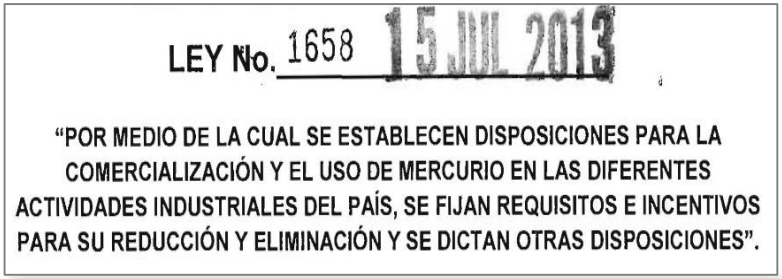
Ponentes permanecen en las mismas mesas y presentará un informe a cada uno al final de las conclusiones del proceso para su mesa (5-10 min) informes.

Un facilitador permanecerá en cada mesa

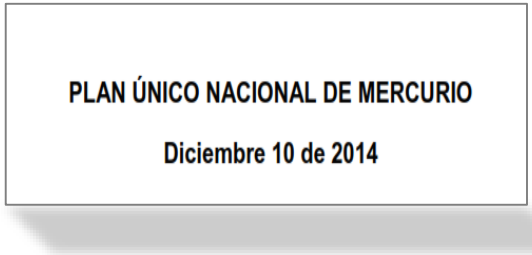
# Output 3: Policy Brief

- A policy brief for regional and national governments in Colombia. The brief will address Law 1658 of 2013, Colombia's commitment to the UN Minamata Convention (i.e. The Unique Plan of Mercury), the 2015 Paris Climate agreement, and Colombian accession to the OECD.





LEY No. 1658 15 JUL 2013

"POR MEDIO DE LA CUAL SE ESTABLECEN DISPOSICIONES PARA LA COMERCIALIZACIÓN Y EL USO DE MERCURIO EN LAS DIFERENTES ACTIVIDADES INDUSTRIALES DEL PAÍS, SE FIJAN REQUISITOS E INCENTIVOS PARA SU REDUCCIÓN Y ELIMINACIÓN Y SE DICTAN OTRAS DISPOSICIONES".


PLAN ÚNICO NACIONAL DE MERCURIO

Diciembre 10 de 2014

# Output 4: Next steps planning

- A review of next steps and high level review of brownfield land re-use potential for renewable energy, identifying opportunities for community and/or Colombian commercial enterprise and international organisations and (2) outlining partner business development plans and more broadly prospects for “UK-PLC.

# Outcome:
*Giving Colombia a leading edge in a global context*

- *Better stewardship*
- *Robust delivery of sustainable development*
- *Clearer valuations*
- *Reduced liabilities*
- *Less impact*
- *Community engagement*
- *Easier planning and establishment*
- ***And so ultimately better economic returns for business, government and society***

# Technical Team

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Kovalick
USA

Alfonso
Rodríguez
Colombia

# Technical Team

**Tony Hutchings UK**

**Euan Hall UK**

# Thank You!

COLOMBIA S.A.S

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*Contact us to get involved!*

- *Your first step is being here! Bogotá meeting Nov 30 2016*
- *E-Contact group*
- *Technical support*
- *Brokerage and advice*

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