SOILveR Soil and land research funding platform for Europe

Review of the last two decades experiences of Technosols construction for urban greening

Deeb M.[1], Vidal-Beaudet L.[2], Groffman P.M. [3,4], Blouin M.[5], Egendorf S.P.[6], Vergnes A.[7], Walsh D.[4], Morin T.[4], Vasenev V.[8], Séré G.[9]

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URBAN SOILS INSTITUTE

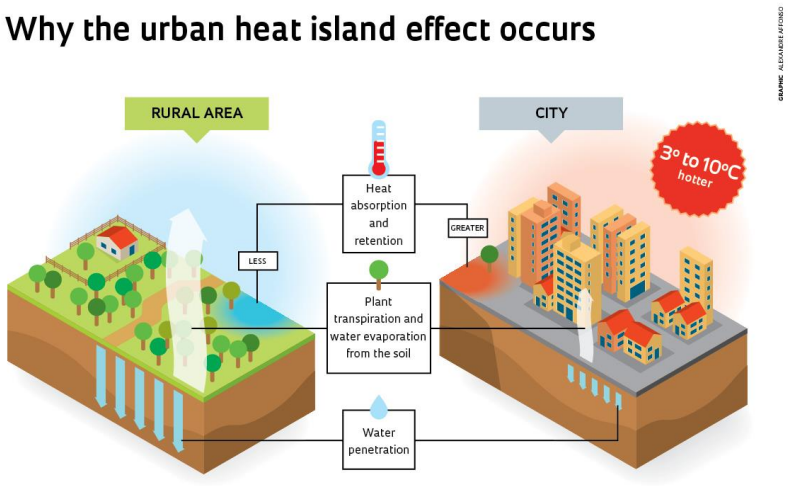
Rise in urban population + urban sprawl

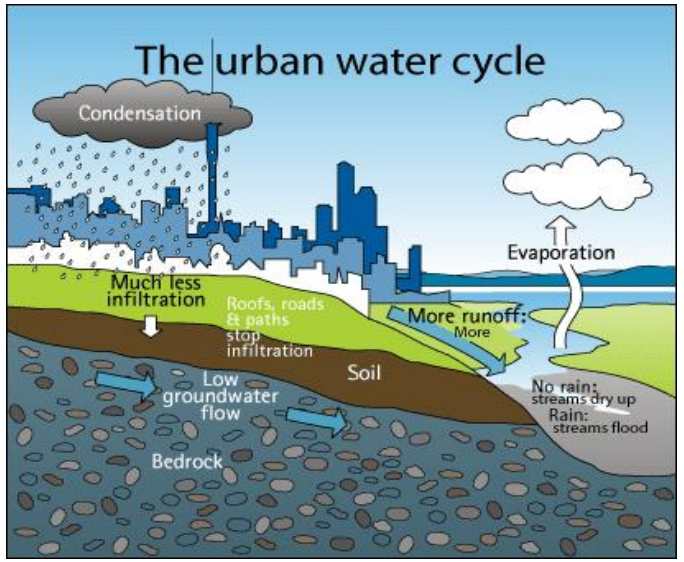
- 54% of the world population live in urban areas
- Urban areas cover 3% of the total land areas (0.45% of artificial impervious areas)
- Artific

Liu *et al.* 2014;
Gong *et al.*, 2020

Need for vegetation and functional soils to tackle environmental issues

- Green infrastructures are interconnected urban spaces that provide multi-ecological functions are part of the solution…
- …and they mainly rely on their soils component

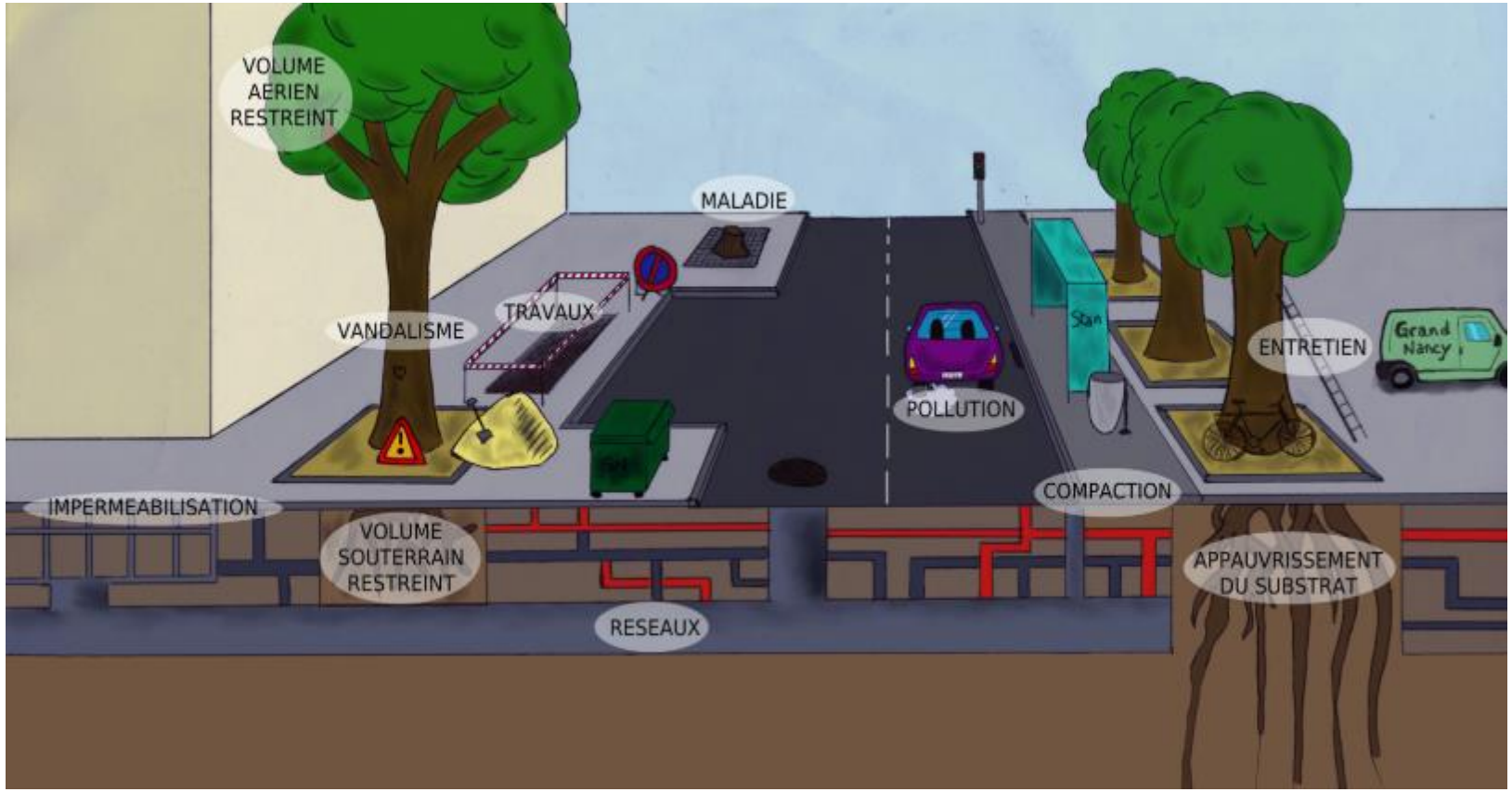




Margules, 1992; Adelmann, 1998; Johnson,

Urban environment is not optimal for vegetation development

- Anthropogenic activities led to degradation of urban soils
- Tough cohabitation between vegetation and urban infrastructures



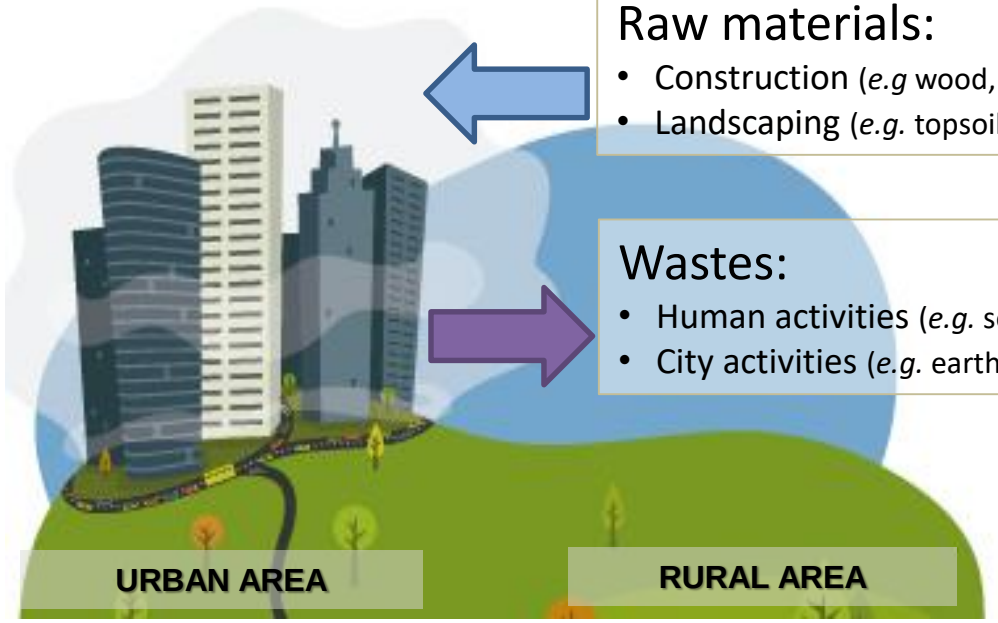
ENSAIA, 2013

Use of natural resources as substitutes to urban soils

- Excavation of *in situ* urban soils
- Scrapping and transportation of natural top soils (3 millions t yr^{-1} in France)
- Expensive and serious impact on the environment

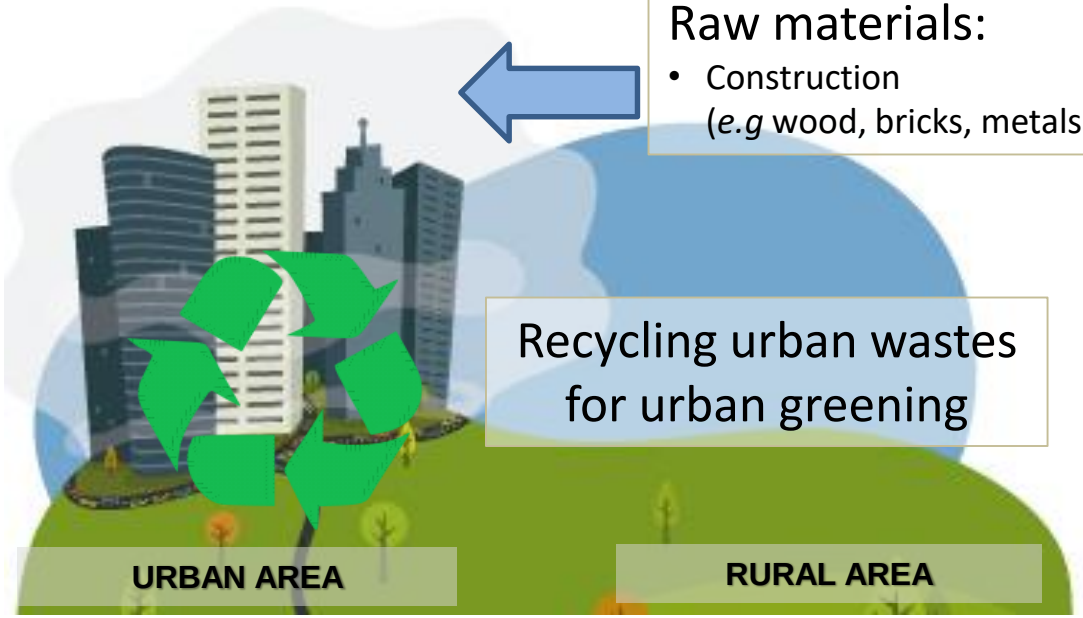
Damas & Collon, 2016

Circular economy for urban greening



Raw materials:
- Construction (*e.g* wood, bricks, metals)
- Landscaping (*e.g.* topsoil, peat)

Wastes:
- Human activities (*e.g.* sewage sludge, municipal wastes)
- City activities (*e.g.* earthwork, green wastes, demolition)

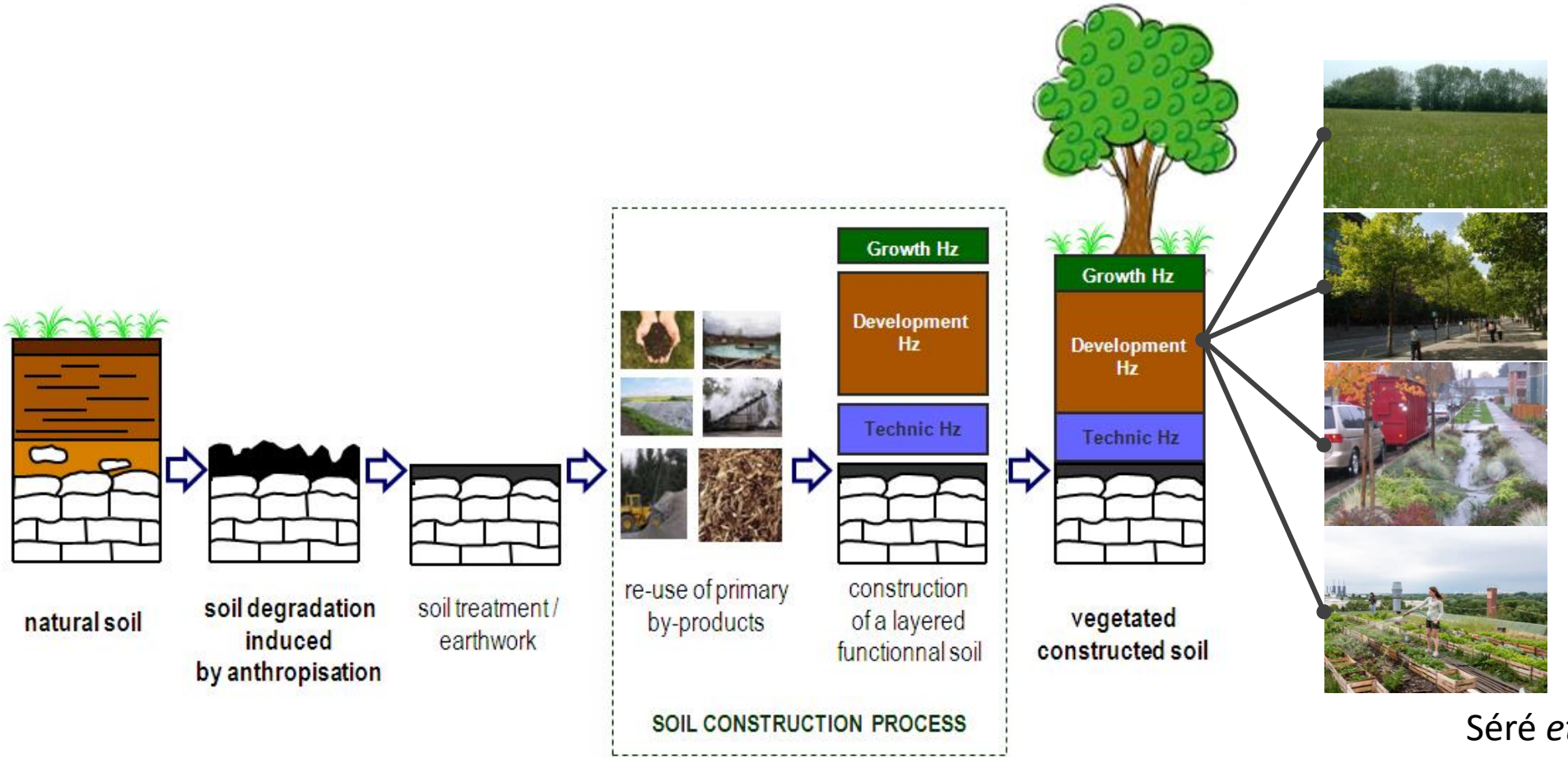


Raw materials:
- Construction
  (*e.g* wood, bricks, metals)

Recycling urban wastes for urban greening

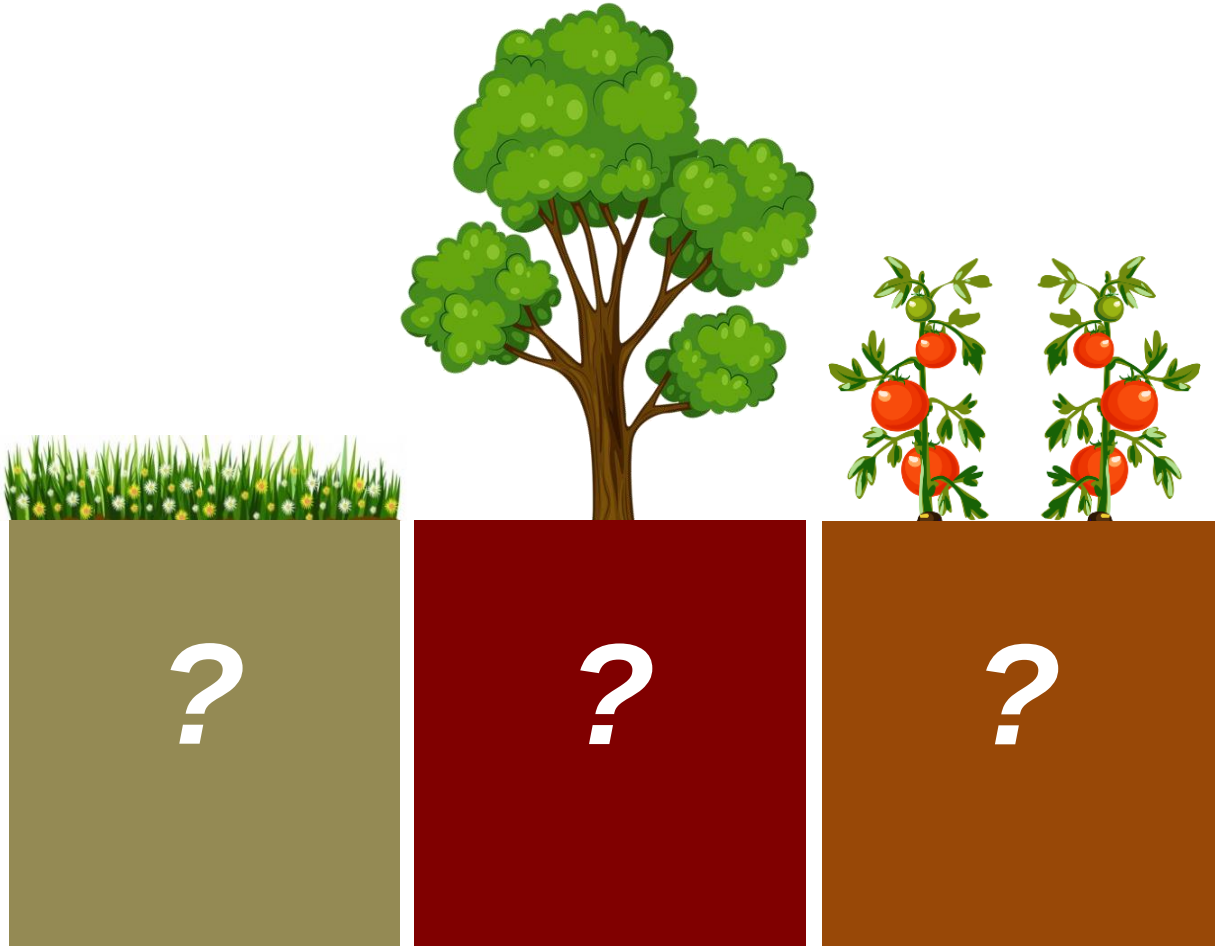
Construction of Technosol

- Adapt the formulation of by-products as a function of future land-use



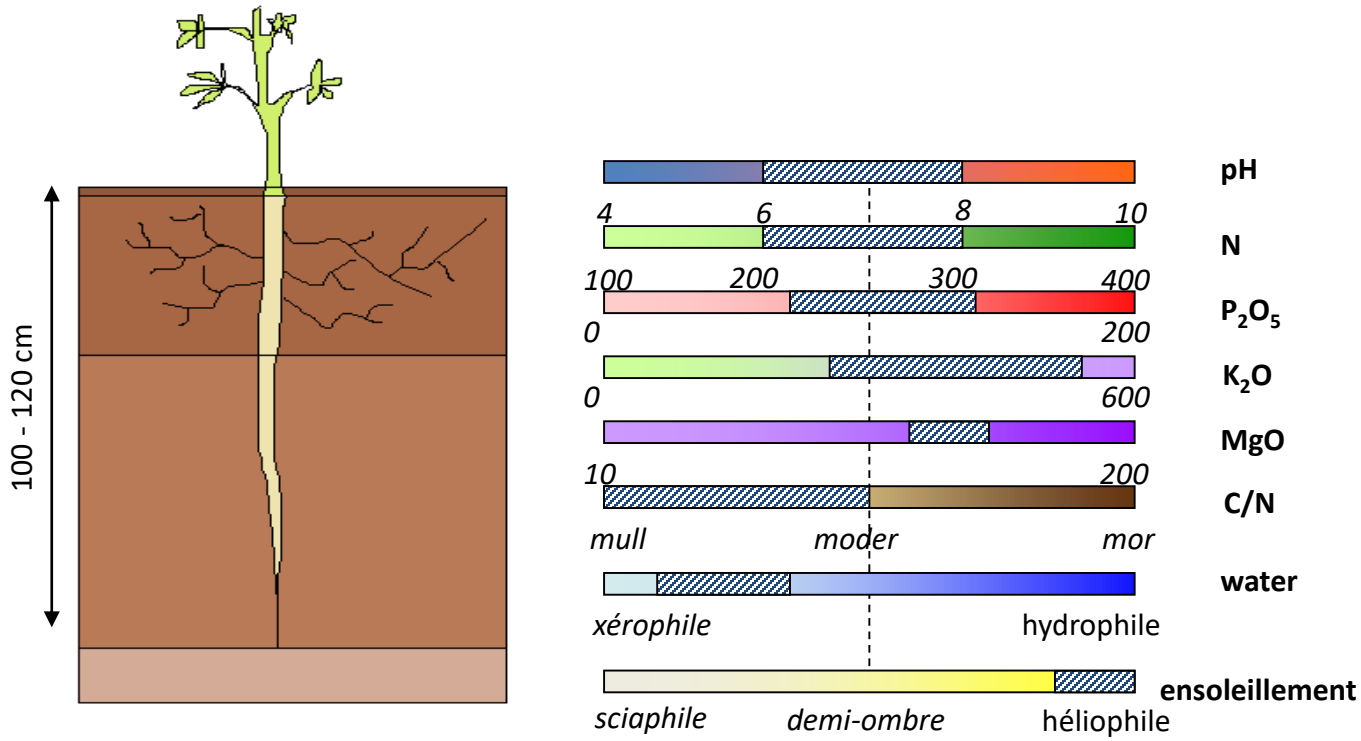
Séré *et al.*, 2008;
Deeb *et al.*, 2020

1. An ideal soil for each land-use



1. An ideal soil for each land-use

- Adapt the intrinsic properties of the soil to the requirements (vegetation, water infiltration, human health)
- Define optimal parameters to create ideal soils



ENSAIA, 2015

2. Identify adapted parent materials = wastes & by-products

- Identify & characterize local deposits of wastes & by-products
- Compost, sewage sludge, sawdust, papermill sludge, sediments, ballast, b

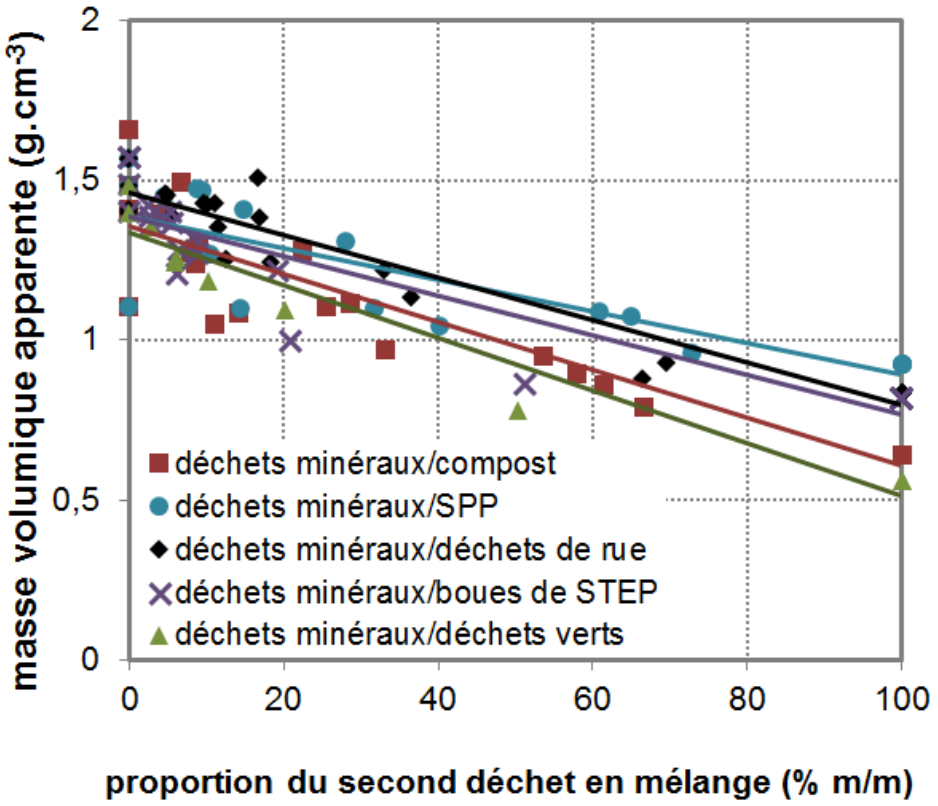





Rokia *et al.*, 2014; Vidal-Beaudet *et al.*, 2017; Deeb *et al.*, 2017; Fourvel *et al.*, 2018; Grard *et al.*, 2017; Deeb *et al.*,

3. Define optimal recipes

- Define the nature & ratio of each materials (modelling approach)
- Define the procedure to mix & implement the mixtures



Rokia *et al.*, 2014;
Deeb *et al.*, 2020

Visual Results in brief

CARBON SPONGE

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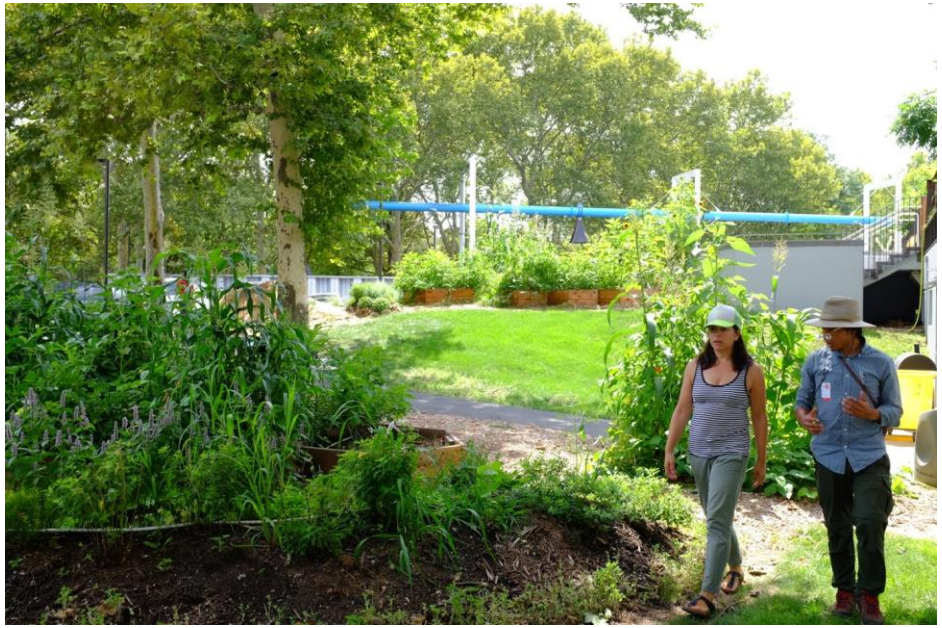
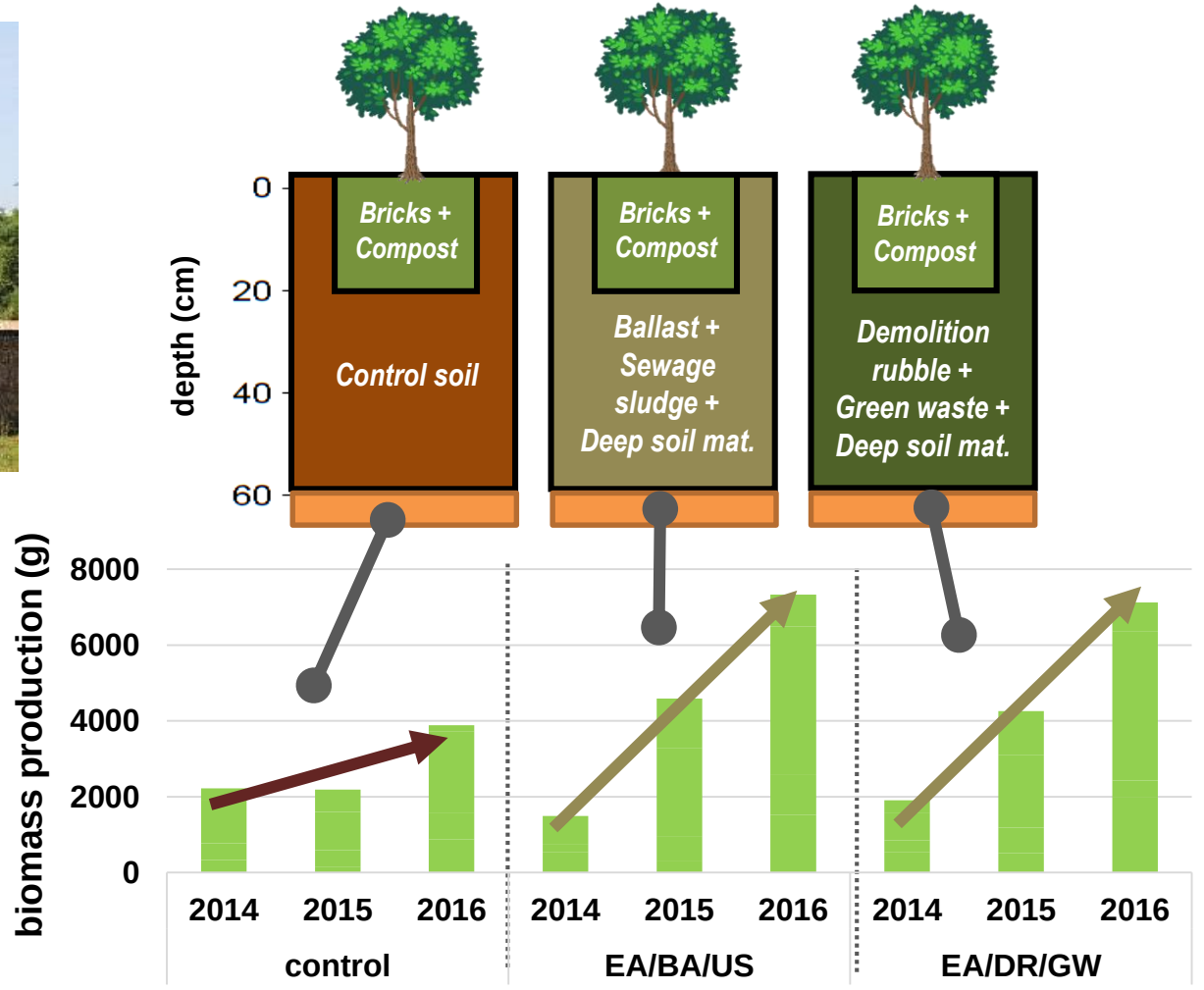
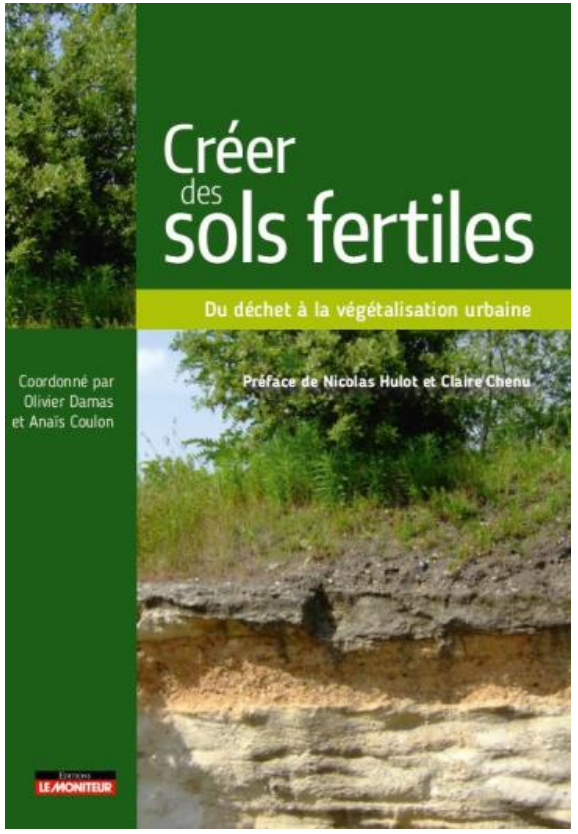
- Living lab to construct Technosols along local inhabitants
- Urban design + carbon sequestration



Visual Results in brief

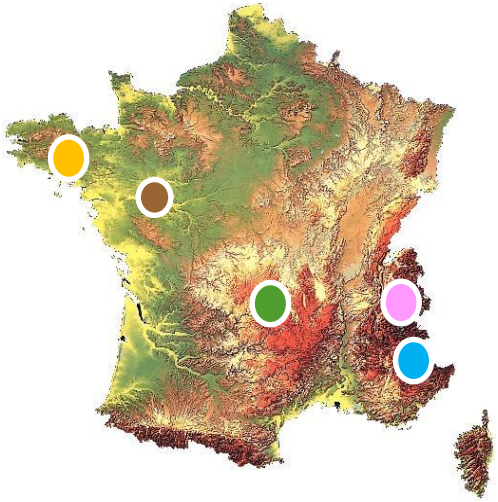
- Recycle urban wastes to construct Technosols for urban greening

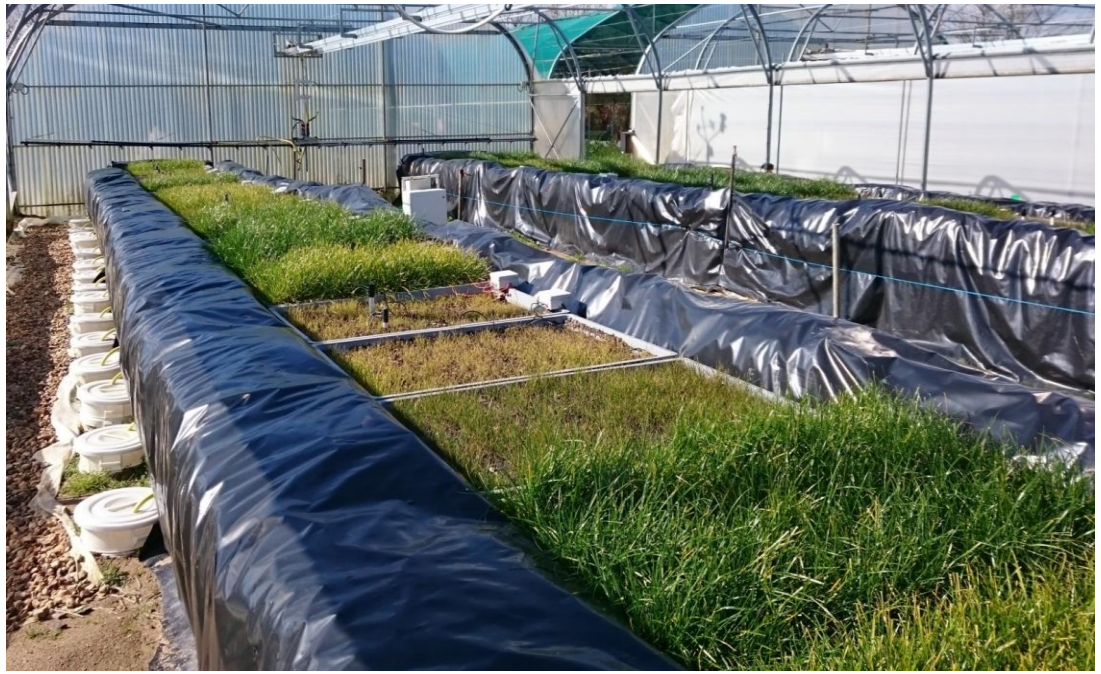




Visual Results in brief

- Integrate hydroelectric dam sediments into Constructed Technosols for urban greening



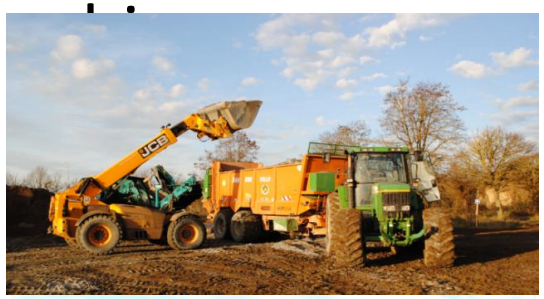


April 2016

Fourvel *et al.*, 2018

Visual Results in brief

- Construct Technosols with wastes & by-products to produce non food



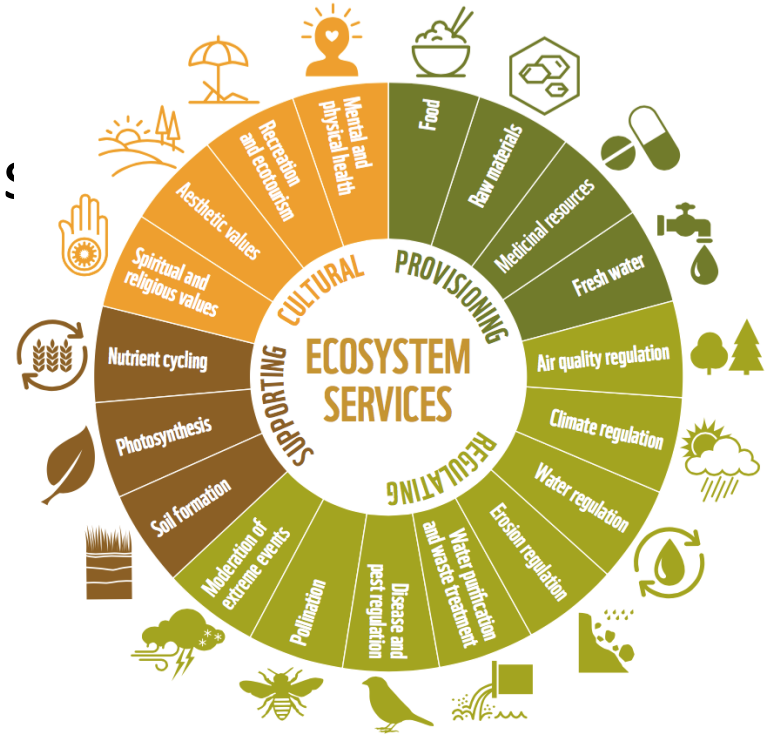
90% bioremediated soil
10% compost

85% bioremediated soil
15% dredged sediment

75% papermill sludge
25% dredged sediment

Conclusion: Constructed Technosols…

- are artificial soils made of artefacts (*i.e.* wastes & by-products)
- can be implemented as substitutes to natural resources for urban greening
- are capable to provide ecosystem services (provisioning; regulation; cultural)



Séré *et al.*, 2010

Thx for your attention! Join us at SUITMA 11 in Berlin in September

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SUITMA

SUITMA 11










Visual Results in brief

- Recycle urban wastes to construct Technosols for urban greening