Soil: A Natural Resource and its use in productive Landscaping and Gardening Projects

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Introduction to Enrich

- Irish Company, Established 2004
- Operating in Ireland, UK, United Arab Emirates
- Diverse Activities all Focused around soil and resource recovery
- Largest producer peat free soil products in Ireland
- Now the largest producer of compost in Abu Dhabi, UAE

What we do

- Operate composting facilities producing Organic Compost

- Manufacture different specialist soils:–
  - Green roofs - SuDS
  - Tree soil - SuDS
  - Top dressing
  - Customised soil blends.
- Nationwide stockists of Enrich of topsoil products
- Soil Testing, assessment, specification and

My Background

- Degree in Environmental and Analytical Chemistry
- 2010 -2014 Post Graduate Research in Dublin City University focus on Tracking the Fate of Carbon in Soils and Sediments
- 2014 – 2016 Post Doctorate Researcher on an Enterprise Ireland Innovation Partnership Programme – Focusing on Bioremediation approaches and degradation of organic pollutants in soils and composting systems
- 2016 – present Senior Scientist at Enrich Environmental – Resource Recovery and Soil Services

Enrich facility, Kilcock, Co.Meath

What is soil? (dirt, earth, clay, mud)

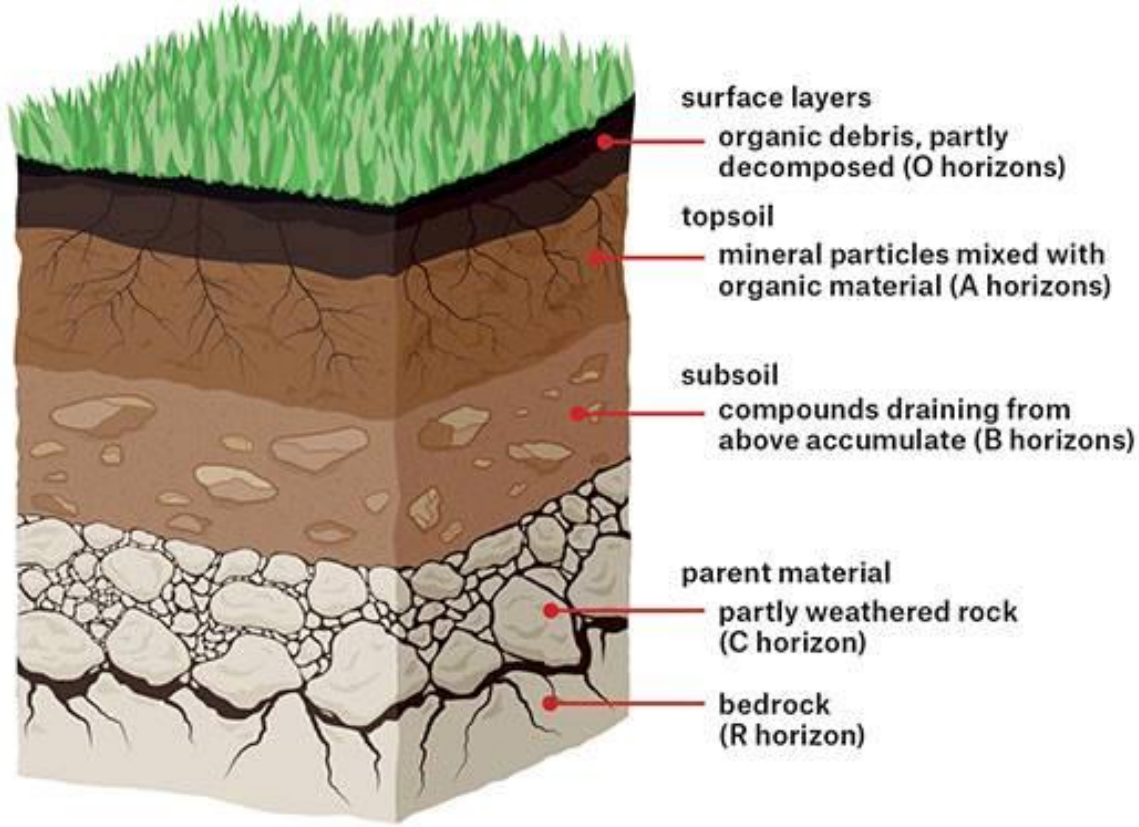
- Minerals (inorganic component, aggregates)
- Dead and Living organisms (organic component, “humus” = soil organic matter)
- Air
- Water

“we know more about the movement of celestial bodies than the soil underfoot”. **Leonardo Da Vinci**

What is soil?

- It is the top layer of the earths crust
- Natural soils originally formed from parent material
- Soil forms in layers to create a soil profile
- Soil is different things to different people

To a soil scientist it is the surface mineral and organic layer of the earth that has be subjected to chemical, physical and biological “weathering”.



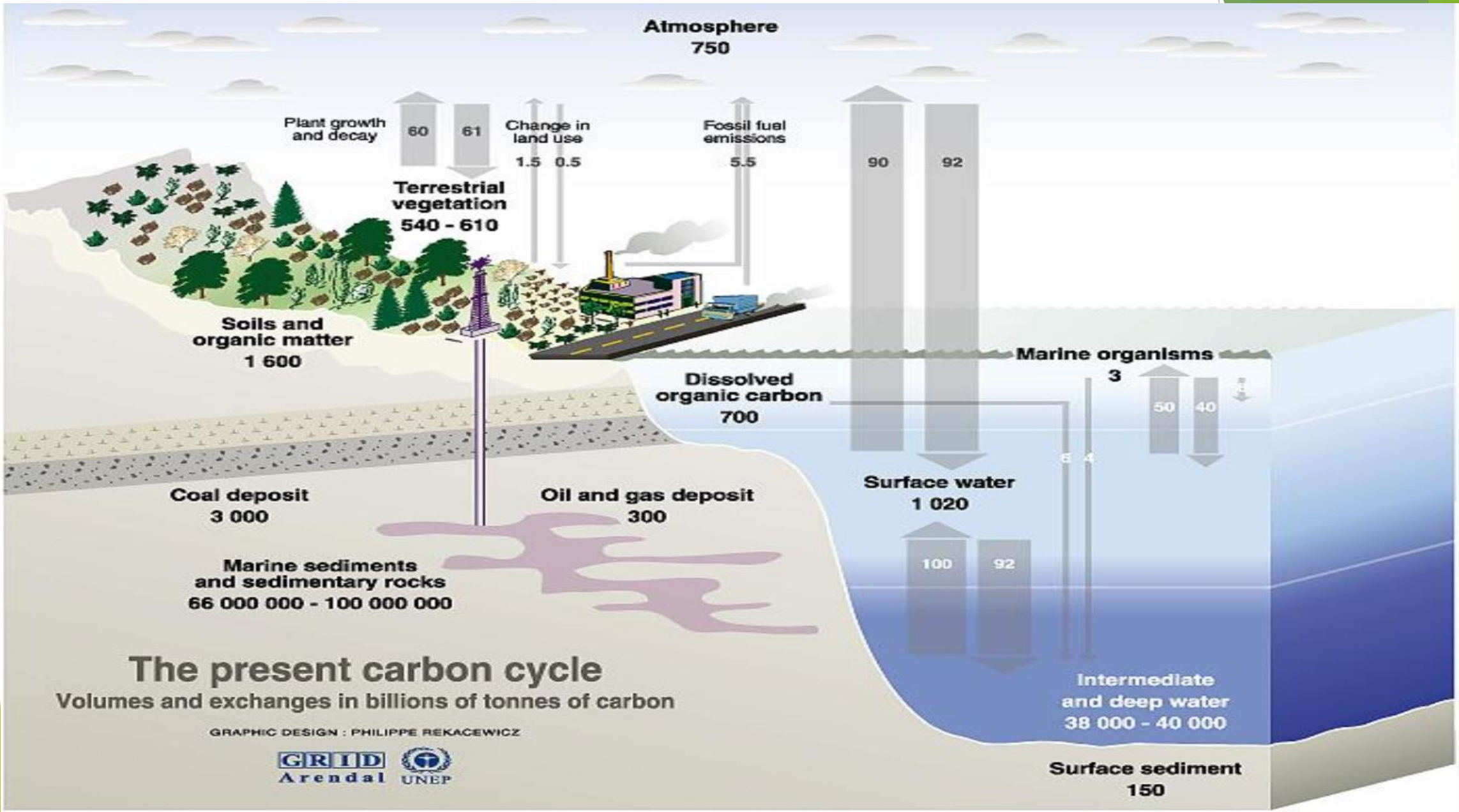
Soil Functions

Like Air and Water, Soil is part of our planets life support system. Soil cleans our air and our water, it provides us with food and the materials to produce clothing and shelter.

<u>The main ecosystem services provided by soils are:</u>

- A medium for plant growth
- Nutrient supply and cycling
- Water regulation and supply
- Habitat provision
- Atmospheric regulation (a carbon sink)
- Construction

Focus on soil as a carbon sink



Sources: Center for climatic research, Institute for environmental studies, university of Wisconsin at Madison; Okanagan university college in Canada, Department of geography; World Watch, November-December 1998; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

Focus on soil as a Carbon Sink

Soil holds two to three times as much carbon as vegetation and two to three times as much carbon as the atmosphere.

To put it in perspective it is estimated that EU soils hold 70 billion tonnes of organic carbon*

Green house Gas emissions from EU member state are estimated at 2 billion tonnes of carbon a year

"Soil is a crucial link between global environmental problems such as climate change, water management and biodiversity loss" *José Luis Rubio, President of the European Society for Soil Conservation*

*European Commission: European Commission, 2008, http://ec.europa.eu/environment/soil/pdf/climsoil_key_messages.pdf

Soils offer a solution and should be managed to mitigate climate change

- Soil Organic Matter is the Key
- Possible Solutions: Soil Carbon Management plans for Agriculture
- Manage soils to increase soil organic matter and carbon storage, reduce degradation of organic matter.
- Increasing organic matter in soils increases carbon storage, increases biomass and the potential for microbial sequestration, improves soils fertility and structure, reduces the need for chemical fertilizers.
- Farmers who increase the carbon content of their soils should be rewarded.
- Where does soil fit into to Irelands recent climate action plan?

Soil Management to Increase Soil Carbon Sequestration

Soil is a limited natural resource

We know that Soil Organic Matter levels are decreasing across Europe*

Soil and all the vital function it provides are vulnerable to:

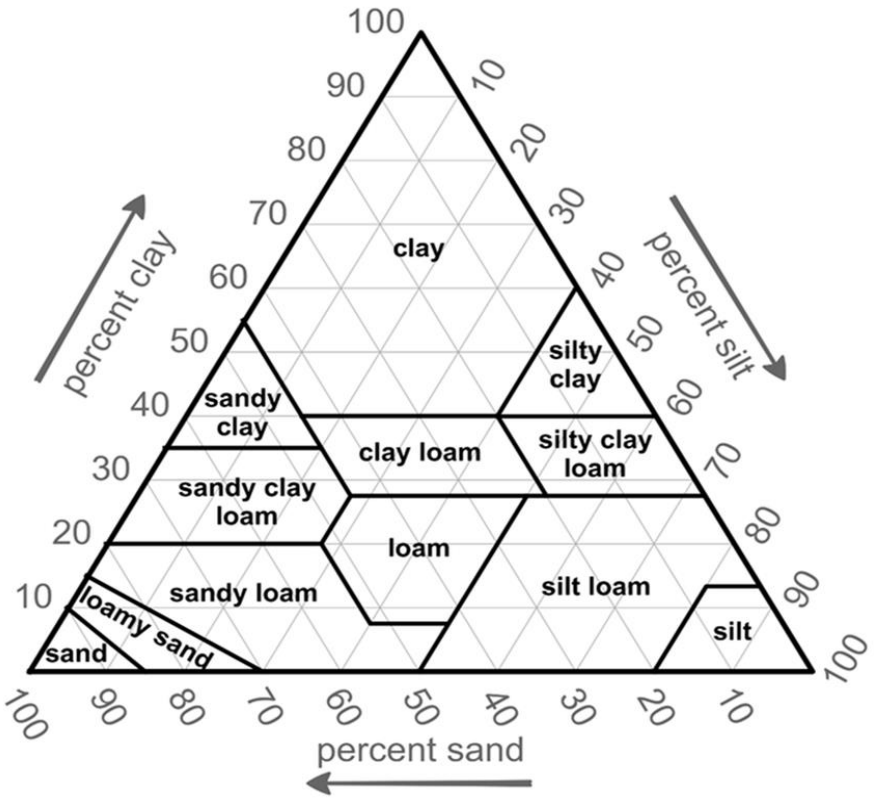
- Erosion
- Sea Level rise
- Desertification
- Compaction
- Contamination
- Urban Development
- Intensive Agriculture and exploitation >

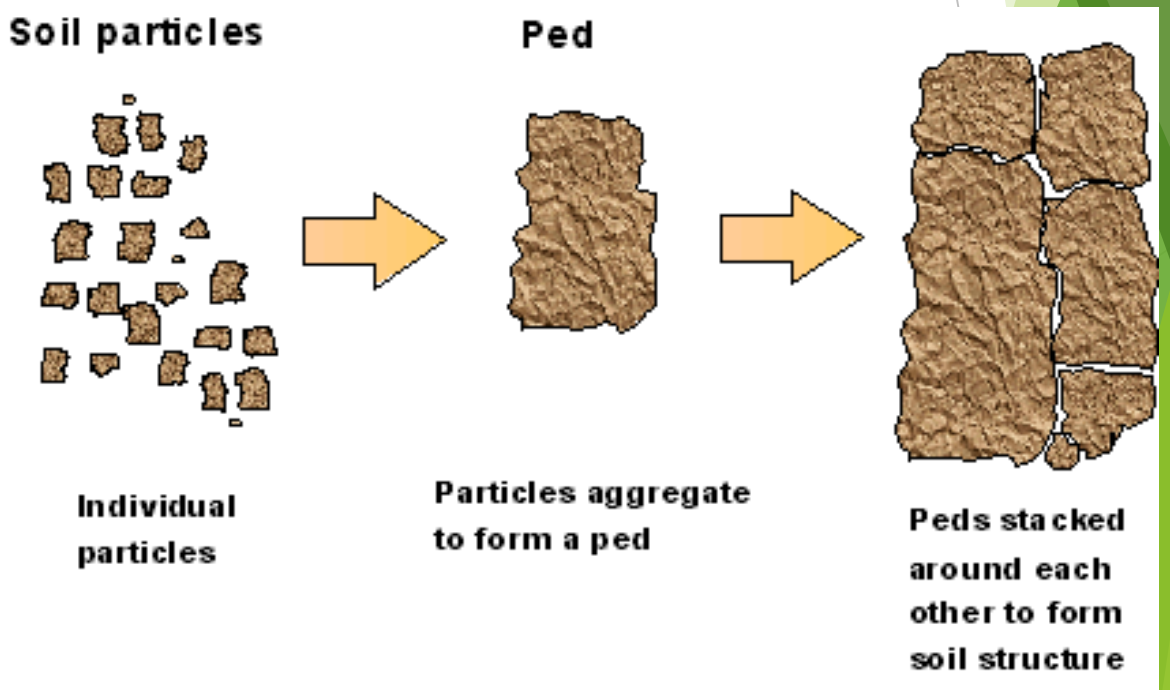
Bellamy, P.H., Loveland, P.J., Bradley, R.I., Lark, R.M. and Kirk, G.J.D. 2005. Carbon losses from all soils across england and wales 1978–2003. Nature, 437pp.245-248.

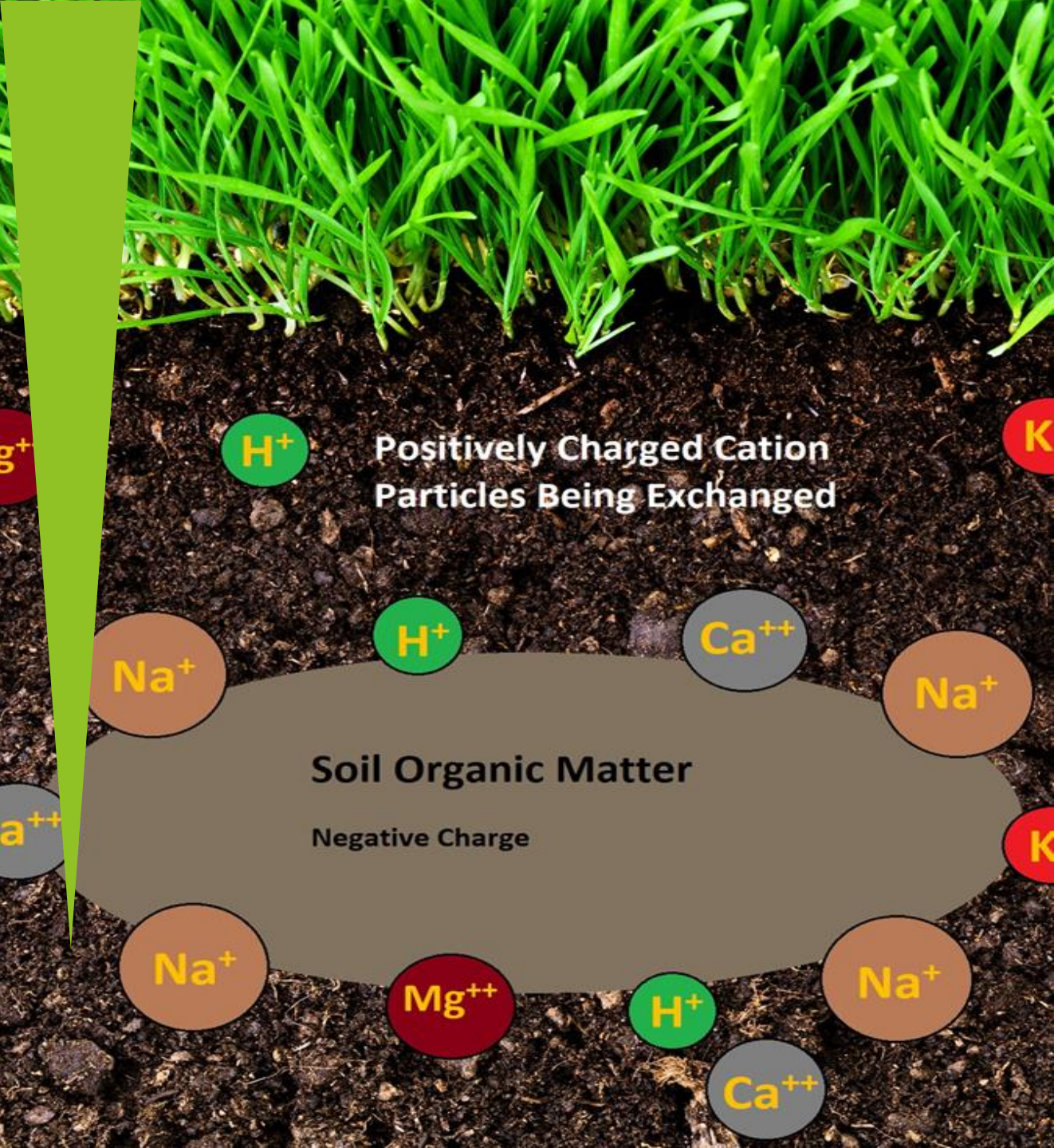
Soil Characteristics

Physical

- Soil has texture (sand, silt, clay) which impacts soil structure i.e. how they bind together.
- Clay and Organic matter give soil its colloidal properties, a binding together of sand, silt, clay, water, gases and ions. This makes soil unique and essential to life.







Soil Characteristics

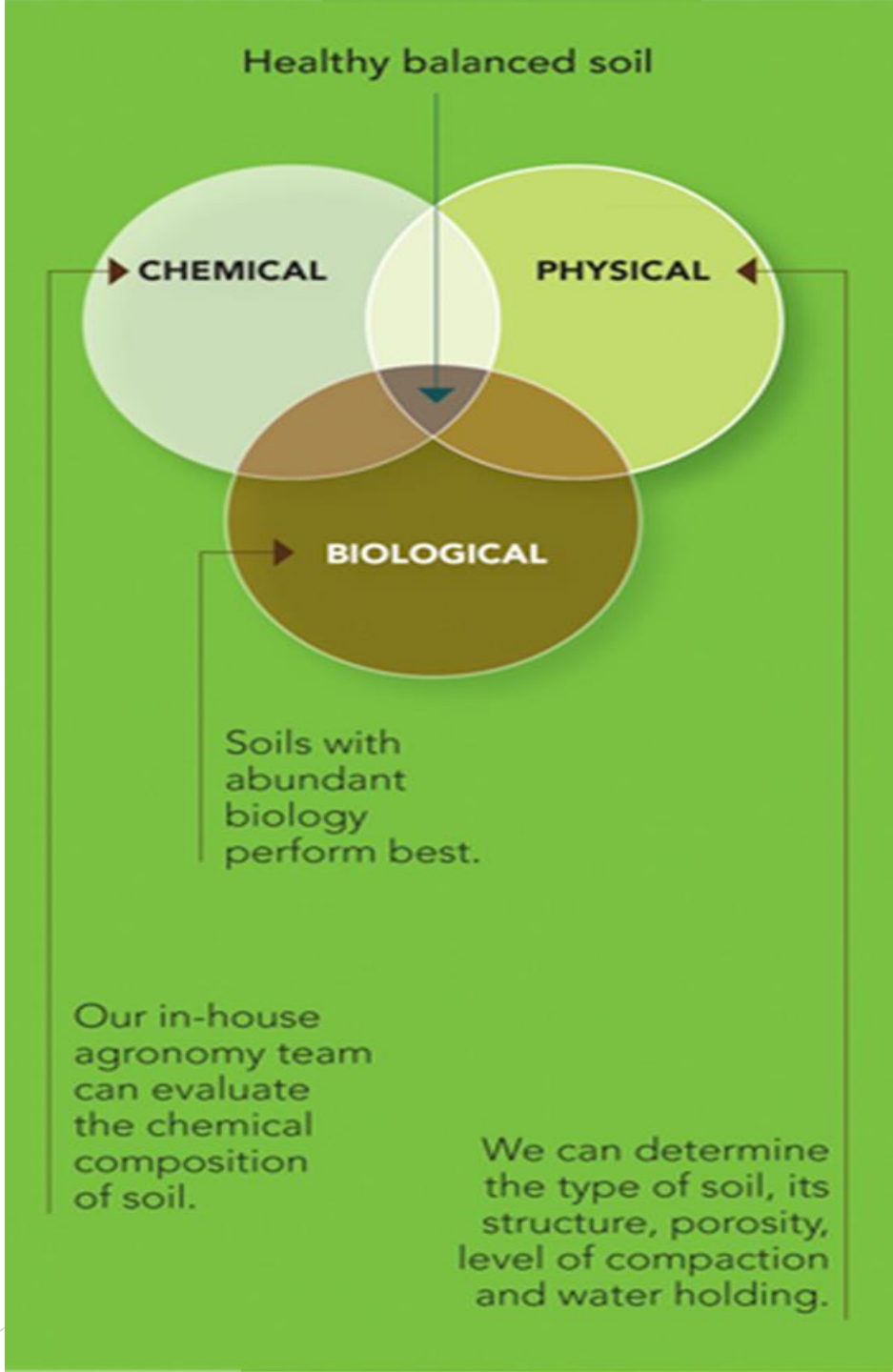
Chemical

- pH and EC
- Macro nutrients and Micro nutrient, nutrient rations
- Organic Matter
- Cation Exchange Capacity

Soil Characteristics

Soil biology/microbiology

- Fungi a bacteria which form symbiotic relationships with plants, make nutrients available, cycle nutrients and fix nutrients, prevent disease, degrade pollutants
- Getting the chemistry and physical aspect right lead to healthy microbiology



Soil/Compost Microbiology

Biological Parameter	Value	Optimum
Total Bacteria	856 mg/kg	>150 mg/kg
Bacterial feeders	8760 no/kg	--
Juveniles	2400 no/kg	--
Predators	0 no/kg	0 no/kg
Plant Parasitic	0 no/kg	0 no/kg

@ SoilBioLab Ltd. /Soil Foodweb Biological Compost Standards

Beneficial Bacteria in Enrich Organic Compost	Plant – Growth Promotion Value	Value
Flavobacterium	Nitrogen fixing and phosphorus mineralization abilities Often used in bio-fertilizer & bio-control formulations	30%
Bacillus		10%
Paenibacillus	Pest control (specially in disease by root-knot nematode and fusarium wilt), nitrogen fixing, phosphorus solubilisation & iron acquisition abilities	3%
Pseudomonas	Free living nitrogen fixing; some known for phosphorus solubilisation abilities.	2%

Soils in Landscaping

Main functions:

- Aeration
- Drainage
- Support
- Water storage
- Nutrient supply
- Microbiology

Soil design and specification for Landscaping should reflect natural soil profile and conditions as much as possible.

Topsoil maximum depth should be 400mm??

Sustainable approaches to Soils for Large Landscaping Projects

- Assess the soil already on site and improve it to meet the specification.
- A soil resource survey should be performed to assess the soil on site
- Significant savings to be achieved by re-using and improving on site soils
- Less waste and more sustainable (corporate, social responsibility)
- Specifications for soil should be practical, “Don’t over spec it”.

Common Specifications

Landscape specification Q28 clause 315:

IMPORTED TOPSOIL TO BS 3882 FOR ALL TURF, GRASS, AND SHRUB AREAS Standard: To BS 3882.

- Structure:

Clay (less than 0.002mm)	5-27%
Silt (0.002 - 0.06mm)	5-45%
Sand (0.06 - 2.00mm	50-90%

- Soil reaction: 5.5 to 7.5 pH.
- Reasonably free of stones; 35% by dry weight.
- Maximum size of stones in any dimension: 30 mm
- Organic matter: not less than 4%
- Electrical conductivity: below 1500 micromhos per cm in 1:2.5, Soil: Water extract
- Nitrogen (N): not less than 0.2%
- Available Phosphorus (P): not less than 26 ppm when extracted with 4.2% $NaHCO_3$ at pH 8.5
- Available Potassium (K): not less than 240 ppm when extracted with 8% ammonium nitrate.
- Available magnesium (Mg): Not less than 50ppm when extracted with 8% ammonium nitrate.
- Free of weed seeds, roots of perennial weeds, sticks, subsoil and foreign matter.
- Soil should have a defined granular texture. Retain for comparison with subsequent loads.

only Texture

Approx. 5 sample

– in house

– in-house

– ?

– in house

– in house

The importance and benefit of a soil resource survey

Soil is an important natural resource and should be treated as such. A soil resource survey should be carried out on site by a suitably qualified and experienced soil scientist, ideally this should be performed prior to excavation works. Designated areas for soil reuse on site must be identified on a soil resource map. Other site assessments available such as geotechnical, contamination and soil classification, ecological, invasive species and archaeological assessments must also be considered. The survey must include chemical and physical assessment of representative samples for parameters such as:

- pH
- EC
- textural analysis
- nutrient levels
- organic matter
- Drainage and compaction

Soils for Gardening projects

- Basic Soil Assessment

Soil texture by feel, does the soil form a ball, does the soil ribbon?

Basic percolation tests - drainage

The worm test – organic matter

Is the soil compacted - structure

- Ask for advice

Improving Soil

- Poor structure/ drainage – aggregates, stable organic matter
- Poor nutrient values – chemical or organic soil improvers
- Compaction – aeration subsoiling
- Correct handling and stockpiling
- Blending and screening on site
- Good landscape design
- Improve soil microbiology and function with composts and compost tea
- Feasibility of reuse/improvement vs manufactured soil products

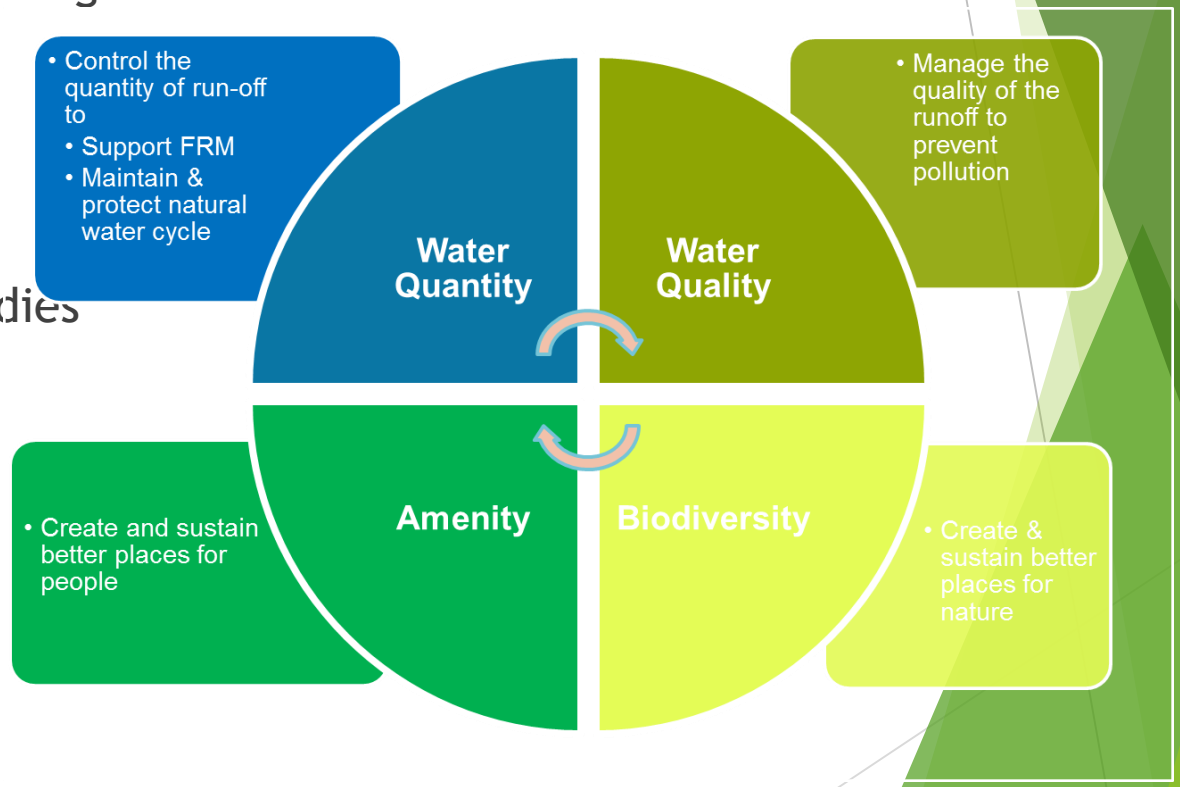
Specialist Soils for Urban Landscapes

- Trees soils for Urban Trees
- SuDs soils
- Green Roof soils
- Soil for biodiversity
- Customised soils


Swale
Green roofs
tion

Aims of Sustainable urban drainage

- Reduce runoff rate, volume and flood risk
- Replicate **the natural processes** of runoff generation
  - Interception losses
  - Infiltration
- Reduce pollution of receiving water bodies
- Improve urban amenities
  - More attractive places to live.
  - Healthier Trees
- Improve use of resources
- Reduce overall scale of site infrastructure



Extensive Green Roof

Bio-diverse / brown roof

Urban Trees – Where compaction is required

Structural soil and SUDs.
Linear pit:

- High Load Bearing
- Matrix Protects soil for root development
- Rainwater attenuation

▶Cell Systems

Amsterdam Tree soil

A note on standard tree pit profiles.

Enrich Soil Specialists

Testing Services

- Soil Chemical, physical and biological analysis and assessment.
- Specification Compliance
- Compost analysis
- Leaf analysis/herbage analysis
- Interpretative reports and recommendations

SuDS – Soil specification & technical support

- Green-roof substrates
- Bioretention Soils
- Urban Tree Soils
- Landscape / Gardens
- SuDS compliant substrates

Soil evaluation, monitoring & consultancy

- Soil Resource Survey
- Soil sampling (“in-situ” and stockpiled)
- Landscape Specifications
- On-site soil management strategies
- Failure (soil/plant) Investigations
- Soil remediation

Soil & Compost manufacture

- SuDs/ Urban Soils
- Sport pitches
- Enrich Topsoil
- Progrow
- Organic Compost
- Ericaceous soils

Contaminated Soil Testing & Disposal

- Soil sampling
- Accredited WAC analysis
- HazWaste Online
- Invasive species (Knotweed)

Conclusions

- Soil is a vital natural resource and should be treated as such
- Soil is a major sink for carbon and can offer climate change solutions
- A basic soil assessment or resource survey will reduce overall project costs
- Good soil design and an informed soil management plant supports successful planting schemes

Thank you

Please come and speak to us at **Stand E3**

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