

In defense of integrated public policies for soil resources

Carlos Alexandre

(Portuguese Society of Soil Science)

Geosciences Dept., University of Evora

Institute of Mediterranean Agrarian and Environmental Sciences (ICAAM)

Plano

1. Introduction
2. Soil is a very special resource
(that we have to raise its public awareness)
3. Multiple soil-society relationships
(that we have to know better)
4. Integrated public policies for the soil
(that we have to defend)
5. Final remarks

The soil is mentioned since the “creation”

“And God said, “Let the waters under the heavens be gathered together into one place, and let the dry land appear.” And so it was. **God called the dry land Earth**, and the waters that were gathered together he called Seas. And God saw that it was good. And God said, “Let the **earth sprout vegetation, plants yielding seed, and fruit trees bearing fruit in which is their seed, each according to its kind, on the earth.**” (...) third day.” (Genesis, Israel)

Outline of Genesis 1

Part	Section	Verse	Event/Condition
1	a	1	God created the heavens and the earth
	b	2	Earth is formless and empty, darkness over the surface of the deep (NIV)
	c	2	Spirit of God hovers over the waters
2	a	3 - 5	Day 1: Light
	b	6 - 8	Day 2: Firmament
	c	9 - 13	Day 3: Dry land; flora
	d	14 - 19	Day 4: Sun, moon and stars
	e	20 - 23	Day 5: Sea creatures and birds
	f	24 - 31	Day 6: Land creatures; Adam and Eve



<https://gpront.wordpress.com/2014/03/>
<http://www.purifiedbyfaith.com/CreationEvolution/Genesis1/Gen1%20-%20Creation%20101.htm/>

The soil is mentioned since the “creation”

"When Pan Gu died, the wind and clouds were born from his breath. His voice became lightnings, his eyes became sun and moon, his body gave way to five great mountains and it is from his blood that today flow the waters (rivers). From his hair come the stars, **from his muscles the fertile soil** and from his sweat the rains. Man was born of his lice and his fleas." (China)



<https://www.britannica.com/topic/Pan-Gu>

The soil is mentioned since the “creation”

In the classical elements of the Greeks, attributed to Empedocles of Agrigento, Sicily (490 a.C. - 430 a.C.):

- **Earth**
- Water
- Air
- Fire



<http://vivendocomciencia.blogspot.com/2013/01/mudancas-ambientais-globais-partir-dos.html>

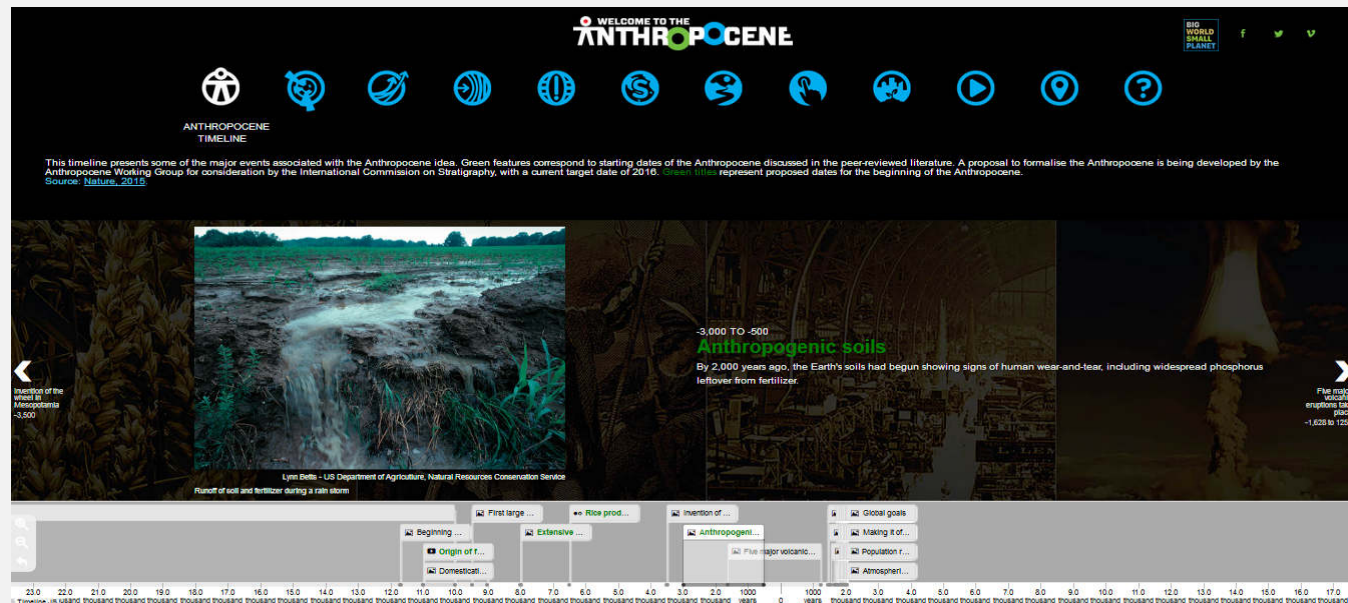
Appropriation of the soil's productive capacity

- Land (and soil) has always been a vital resource for the livelihoods and wellbeing of societies.
- **Land ownership in so many societies** – a set of social rules that allow the appropriation of the productive capacity of nature (and soil) – **is a recognition of the soil's vital role.**

The soil - humanity relationship left marks that could start the Anthropocene

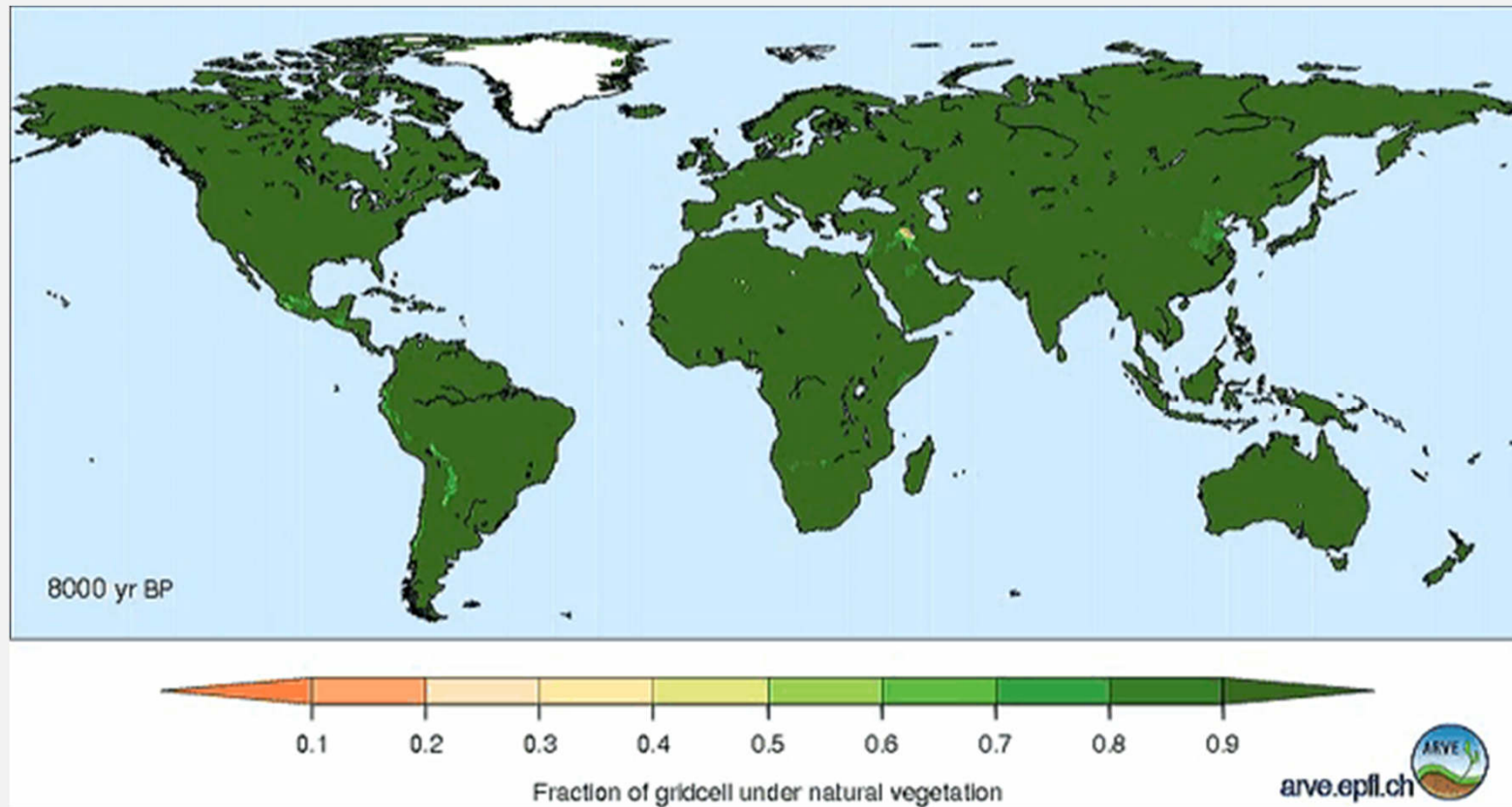
Examples:

- Origin of farming (~11.000 AC);
- Occurrence of soils rich in phosphorus due to prolonged fertilizer use (3.500 - 500 AC).



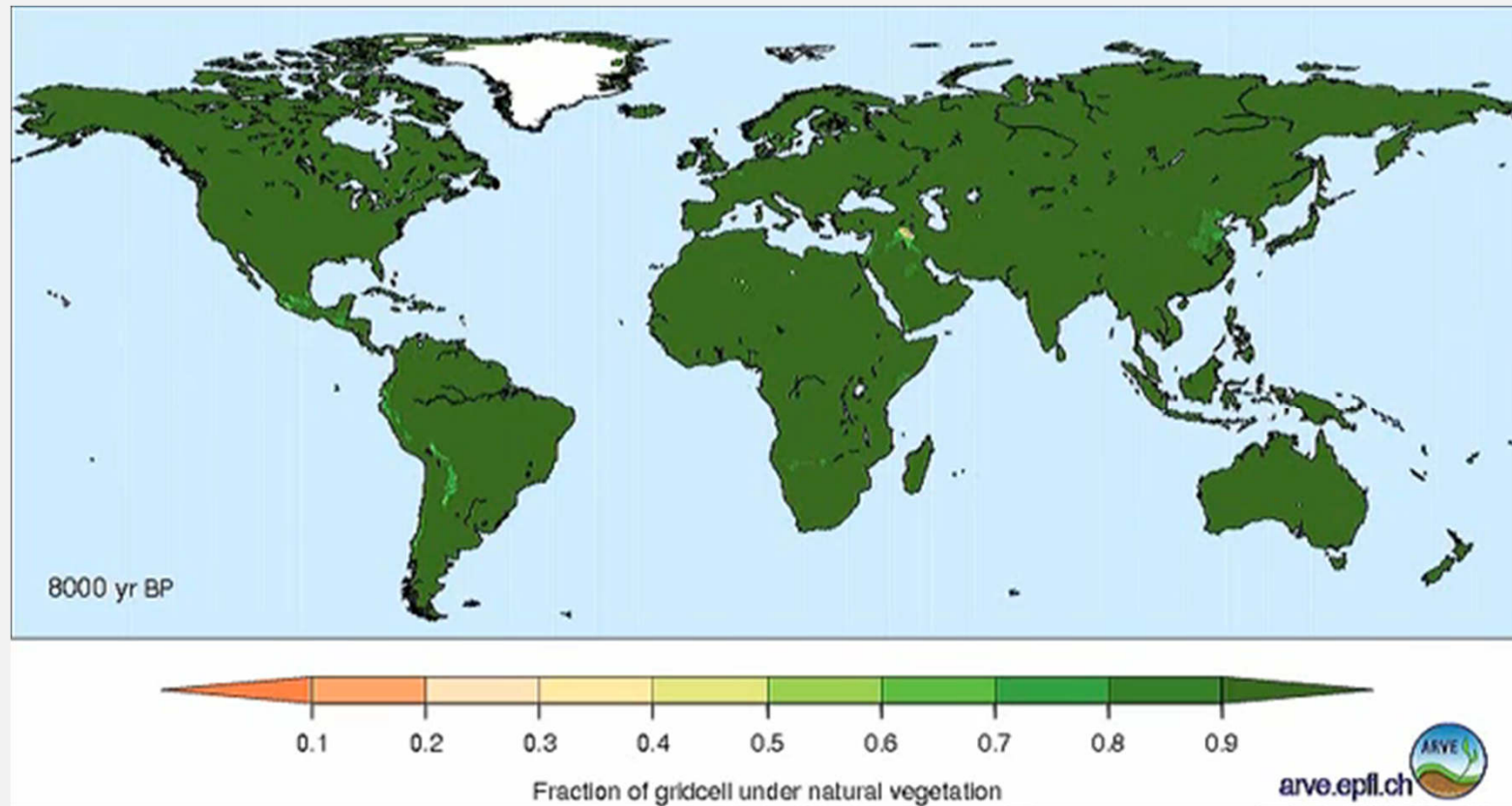
<http://www.anthropocene.info/anthropocene-timeline.php>

Global natural vegetation reduction is an indicator of the human impact on soils



<http://www.anthropocene.info/anthropocene-timeline.php>

Global natural vegetation reduction is an indicator of the human impact on soils



<http://www.anthropocene.info/anthropocene-timeline.php>

The soil resource loses relative value

The industrial revolution and the services economy have brought profound **changes to societies and to their relationship with the soil:**

- Strong **urban expansion;**
- **Less rural population;**
- **Relative loss of value** of the agriculture and forests in the economy;
- **Relative loss of the land's symbolic value** (well-being of the urban population apparently does not depend directly on the "products of the land").

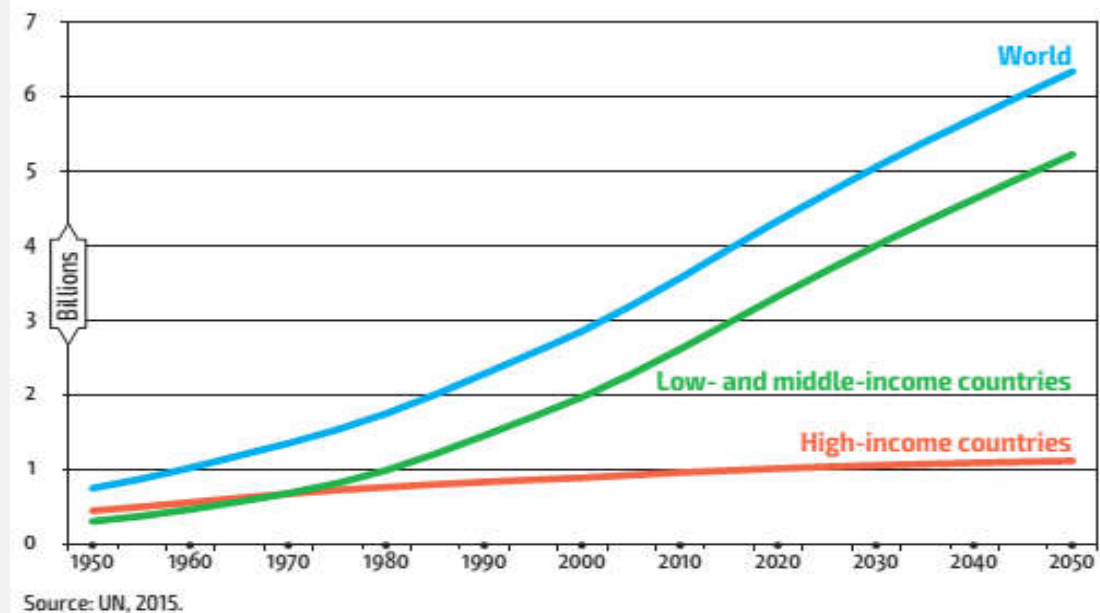


Current "paradox" of the soil-society relationship

Increases the population that **does not seem to depend on soil** to maintain their well-being and lifestyle ...

Urban population will continue to increase from 54% (2017) to 66% (2050).

Figure 1.4 Urbanization trends, by region

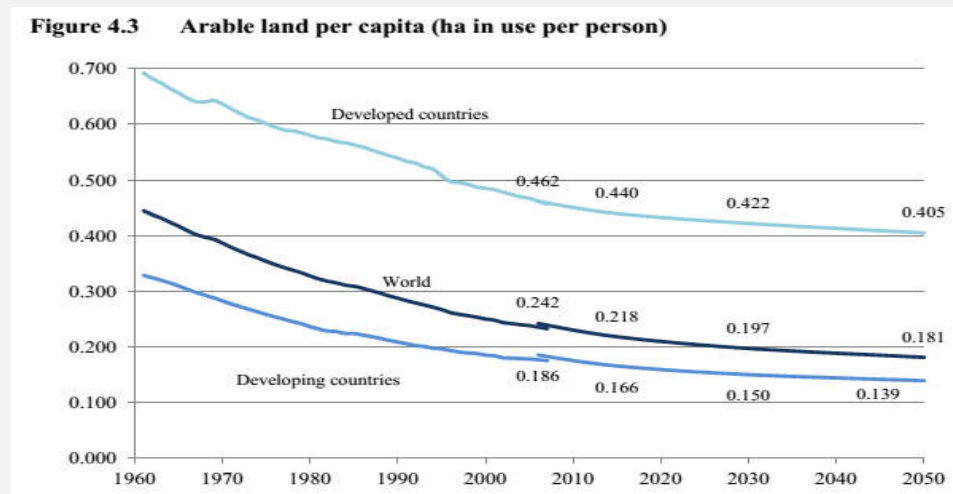


<http://www.fao.org/3/a-i6583e.pdf>

Current "paradox" of the soil-society relationship

... at the same time as **humanity is increasingly dependent on the soil resources** (with higher pressure on soil and other natural resources).

- > 9 billion inhabitants in 2050 and 11 billion in 2100.
- Arable land:
 ~0,25 ha/capita (2000)
 ~0,18 ha/capita (2050)



<http://www.fao.org/docrep/016/ap106e/ap106e.pdf>

Soils have no voice ...

- **Agriculture needs less and less people** and too little attention is given specifically to soil in the areas of **ecology and environmental protection.**
- “Soils have no voice and few people speak on their behalf”
(José Graziano da Silva, General Director of the FAO)

2. Soil is a very special resource

“emancipation from the bondage of the soil is
no freedom for a tree”

(Rabindranath Tagore, Indian poet and philosopher)

Soil is one of the main natural resources

The classification of natural resources adopted by OECD * and SEEA ** includes:

- Mineral and energy resources
- Soil resources
- Water resources
- Biological resources.

*OECD: Organisation for Economic Co-operation and Development

**SEEA: United Nations' System of Environmental-Economic Accounts

The soil is special in several ways

(a) **It incorporates in itself other natural resources** (sand, clay, peat, organisms);



<https://www.ashdesignassessment.co>



<https://www>



<http://www.vesan.se/3Bjork/images/internat/tibet/tibet33.jpg>

The soil is special in several ways

- (b) The most important soil uses **do not imply its consumption** (although they may cause degradation);
- (c) It is a resource **to support others**, which are consumed;



<http://aaes.auburn.edu>



<https://www.smhi.se/en/research/research-news/adaptation-to-a-changed-climate-benefits-the->



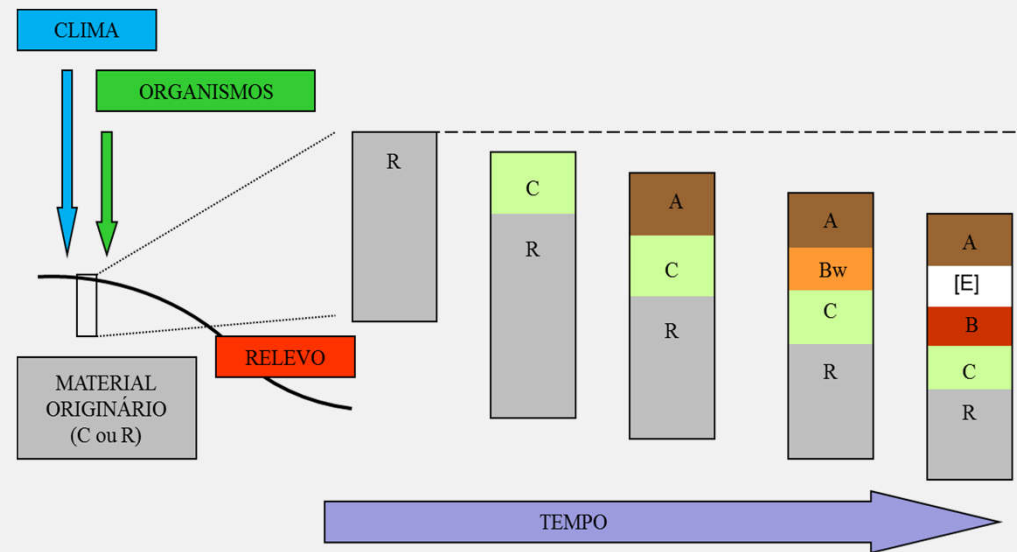
The soil is special in several ways

(d) It can be modified by man to a point of questioning whether it is still “just” a natural resource;



The soil is special in several ways

(e) it has very slow formation rates which makes it, in practice, a **non-renewable resource** for human societies.



It takes several thousand years to form a soil (~ 100 years / cm in temperate regions)

The soil is special in several ways

(f) When a non-renewable resource becomes scarce (and more expensive), it is necessary to implement technological transitions to replace them by similar ones. **What other resource could replace the soil?**

Considering the soil-society relationships, humanity might be not much different than the tree:

“emancipation from the bondage of the soil is no freedom for a tree”

(Rabindranath Tagore, Indian poet and philosopher)

3. Multiple soil-society relationships

“Anything that just costs money is cheap”

(John Steinbeck)

Soil functions and services

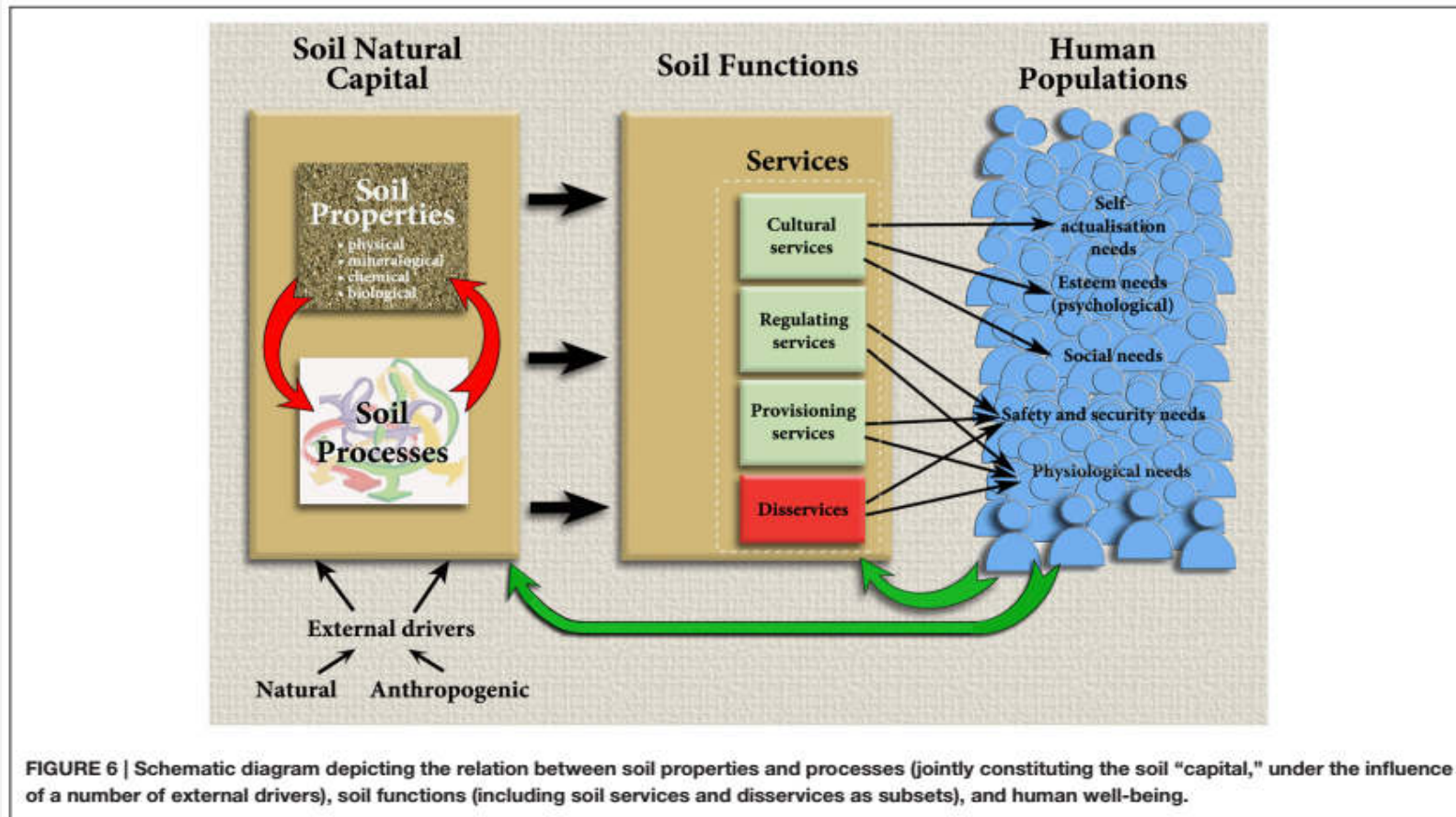


FIGURE 6 | Schematic diagram depicting the relation between soil properties and processes (jointly constituting the soil "capital," under the influence of a number of external drivers), soil functions (including soil services and disservices as subsets), and human well-being.

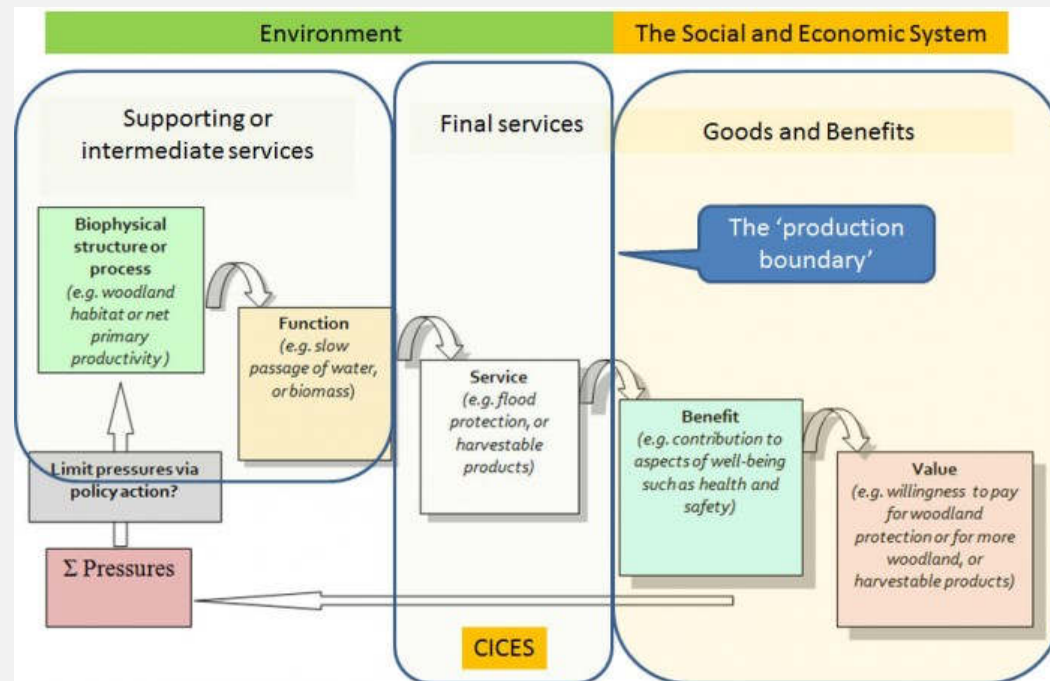
Baveye et al., 2016, p. 13

CICES*

Ecosystem services are **contributions of ecosystems to human well-being** (what ecosystems do by people).

It considers **goods** and **benefits** that people can withdraw from those services.

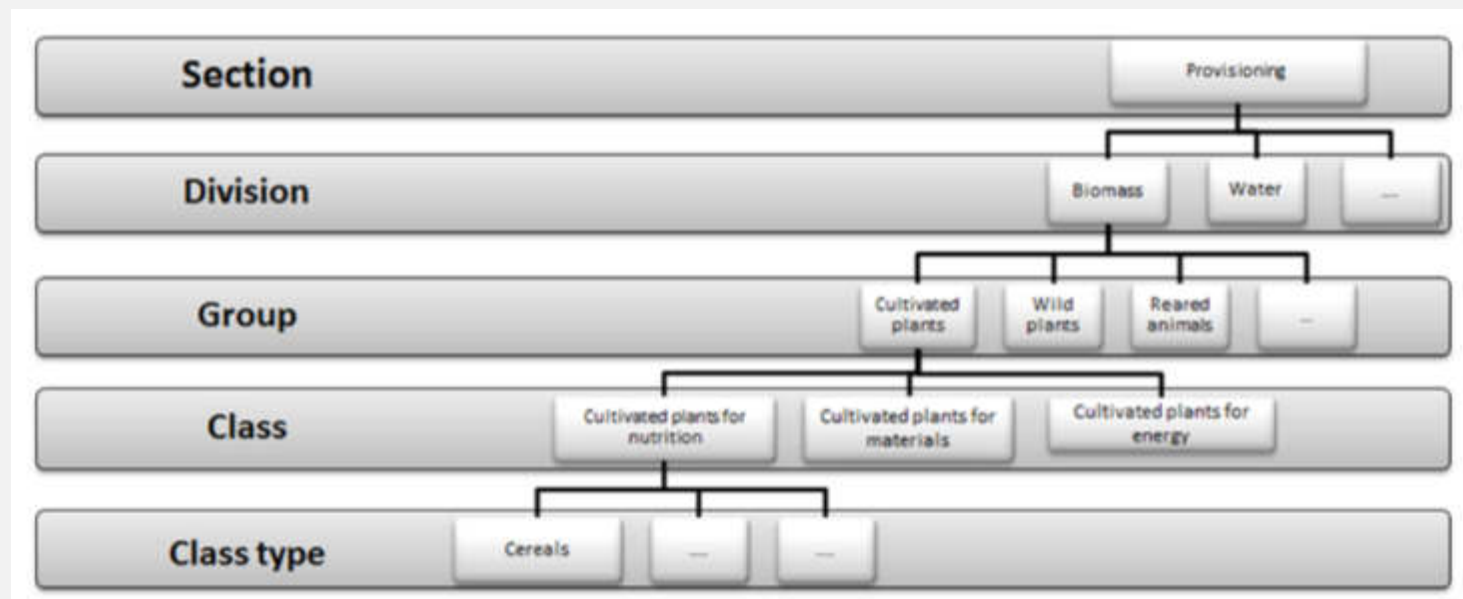
*CICES – Common International Classification of Ecosystem Services, European Environment Agency.



Cascade model (Potschin, M & Haines-Young) <https://cices.eu/supporting-functions/>

CICES

Divides ecosystem services into **five hierarchical levels**:



Haines-Young & Potschin. 2018, p. 9

CICES

It admits three sections, that is, three main types of services: **Provisioning, Regulation & Maintenance, and Cultural.**

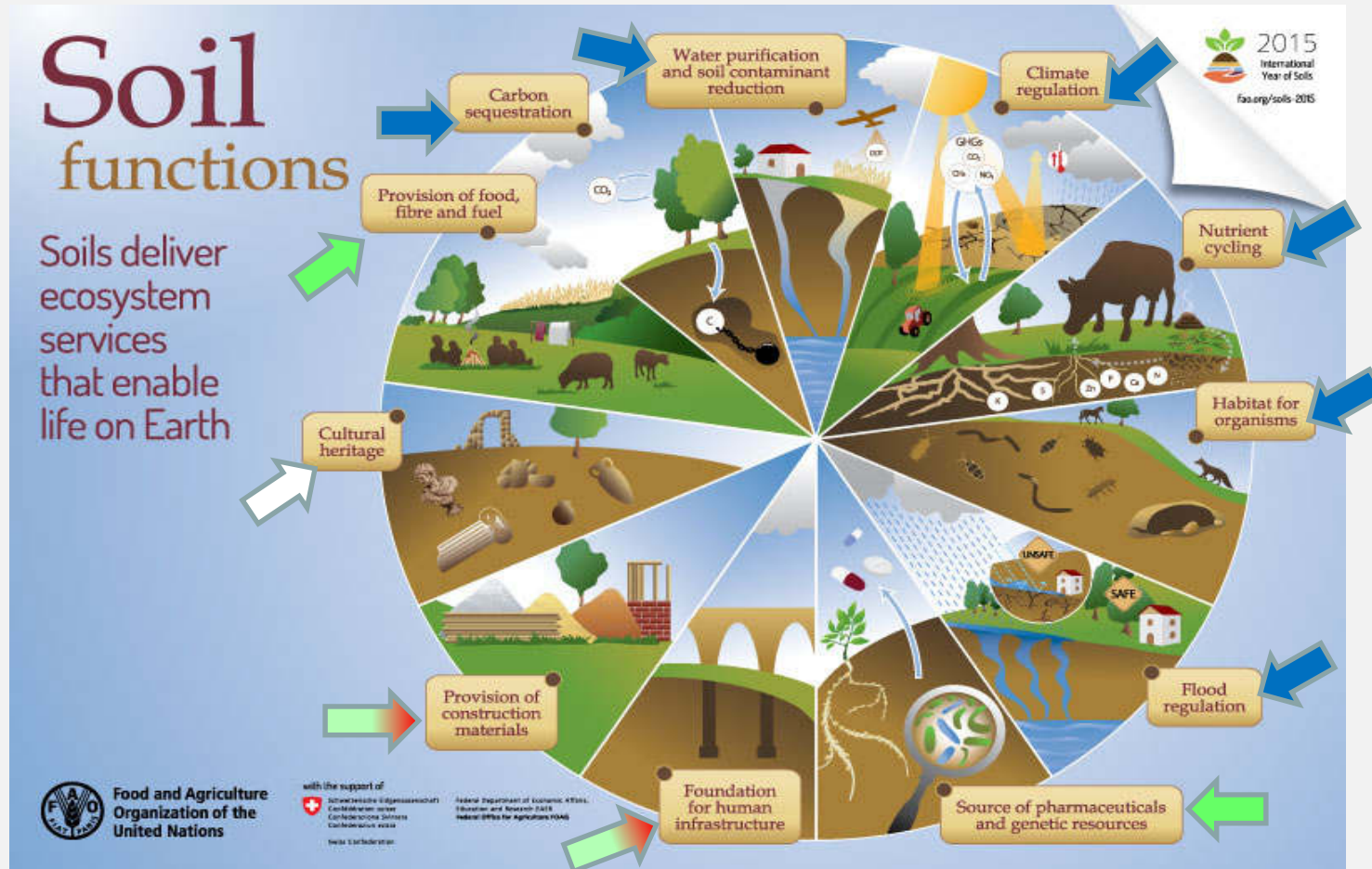
Filter	Section	Division	Group	Class	Code	IPBES Name	MA	TEEB	Soil
CICES	Provisioning (Biotic)	Genetic material from all biota (including seed, spore or gamete production)	Genetic material from animals	Wild animals (whole organisms) used to breed new strains or varieties	1.2.2.2	Medicinal, biochemical and genetic resources	Genetic materials	Genetic materials	1
CICES	Provisioning (Biotic)	Genetic material from all biota (including seed, spore or gamete production)	Genetic material from organisms	Individual genes extracted from organisms for the design and construction of new biological entities	1.2.2.3	Medicinal, biochemical and genetic resources	Genetic materials	Genetic materials	1
CICES	Provisioning (Biotic)	Other types of provisioning service from biotic sources	Other	Other	1.3.XX	Not assigned	No equivalent	No equivalent	
CICES	Regulation & Maintenance (Biotic)	Transformation of biochemical or physical inputs to ecosystems	Mediation of wastes or toxic substances of anthropogenic origin by living processes	Bio-remediation by micro-organisms, algae, plants, and animals	2.1.1.1	Formation, protection and decontamination of soils and sediments, Regulation of organisms detrimental to humans	Water purification and water treatment, air quality regulation	Waste treatment (water purification), air quality regulation	1

<https://cices.eu/resources/>

CICES

- In the CICES (v5.1) the soil is in 3 final services (**3 classes of the Regulation & Maintenance section**):
 - *Control of erosion rates (2.2.1.1);*
 - *Weathering processes and their effect on soil quality (2.2.4.1);*
 - *Decomposition and fixing processes and their effect on soil quality (2.2.4.2).*
- However, the soil is **involved in ~ 70% of the 90 services listed** (classes) – “**hidden**” (also here) but providing a huge diversity of goods and benefits.

Soil functions



<http://www.fao.org/resources/infographics/infographics-details/en/c/284478/>

Monetarization of the soil-society relationship

- From the monetarization of the relations between the soil and society some risks emerge, e.g.:
 - a) appropriation of value by some, for the natural services provided to all;
 - b) loss of value for many whenever degrading the soil is cheap enough (not preventing the short-term profit achieved by some).
- “Anything that just costs money is cheap”
(John Steinbeck)

4. Integrated public policies for the soil

“In the end we will conserve only what we love;
we will love only what we understand; and we
will understand only what we have been taught”
(Baba Dioum, Senegalese forest engineer)

Soil policies: revisiting Jenny's model!

- In Jenny's (1941) conceptual model, or *clorpt* model, each soil property (*s*) is expressed as a function of the factors of soil formation:

$$s = f(cl, o, r, p, t, \dots)$$

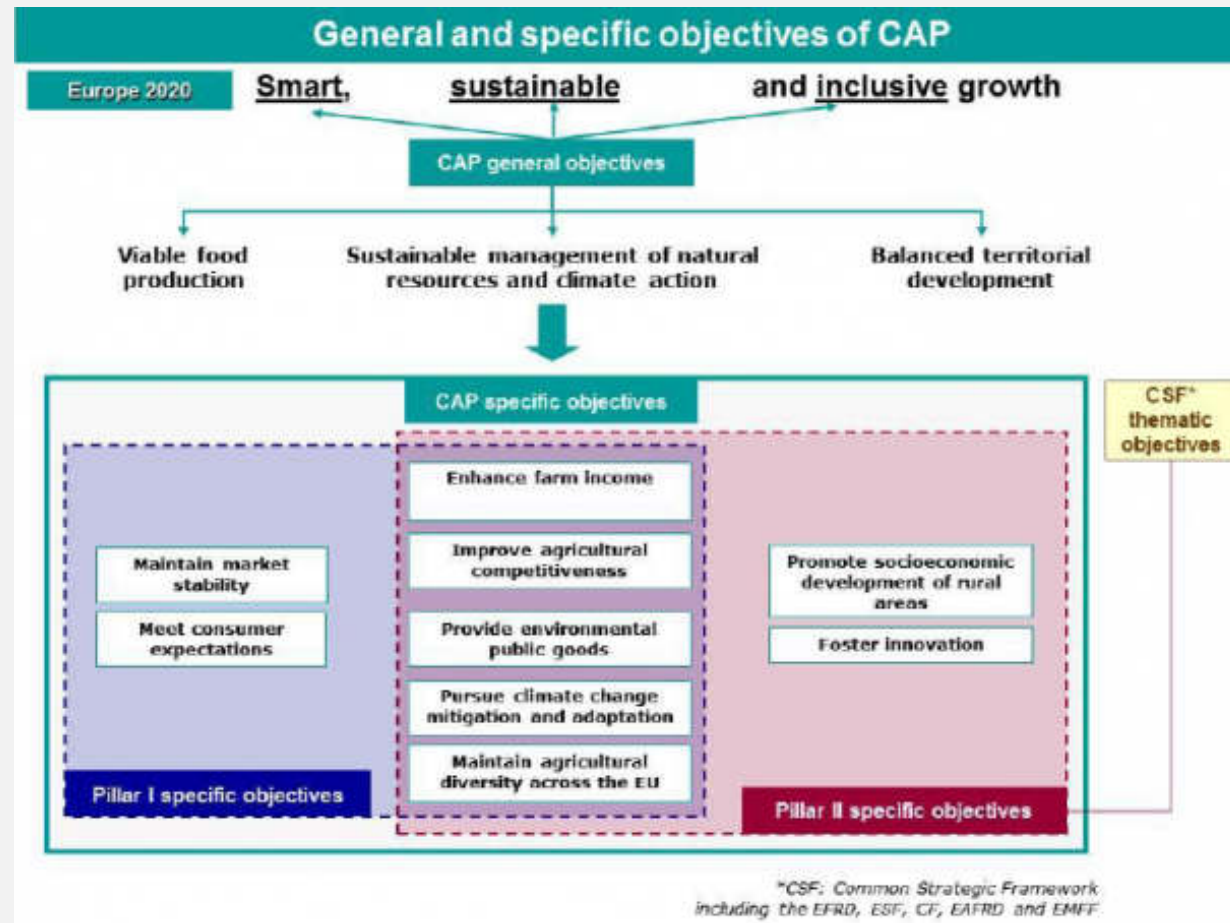
- Later on, the Human influence was stressed:

$$s = f(cl, o, r, p, t, H, \dots)$$

- But, beyond individual human action, it is necessary to consider this action in the **framework of social rules and political decisions that regulate Human Societies:**

$$s = f(cl, o, r, p, t, HS, \dots)$$

CAP/EU is an example of policies affecting soils

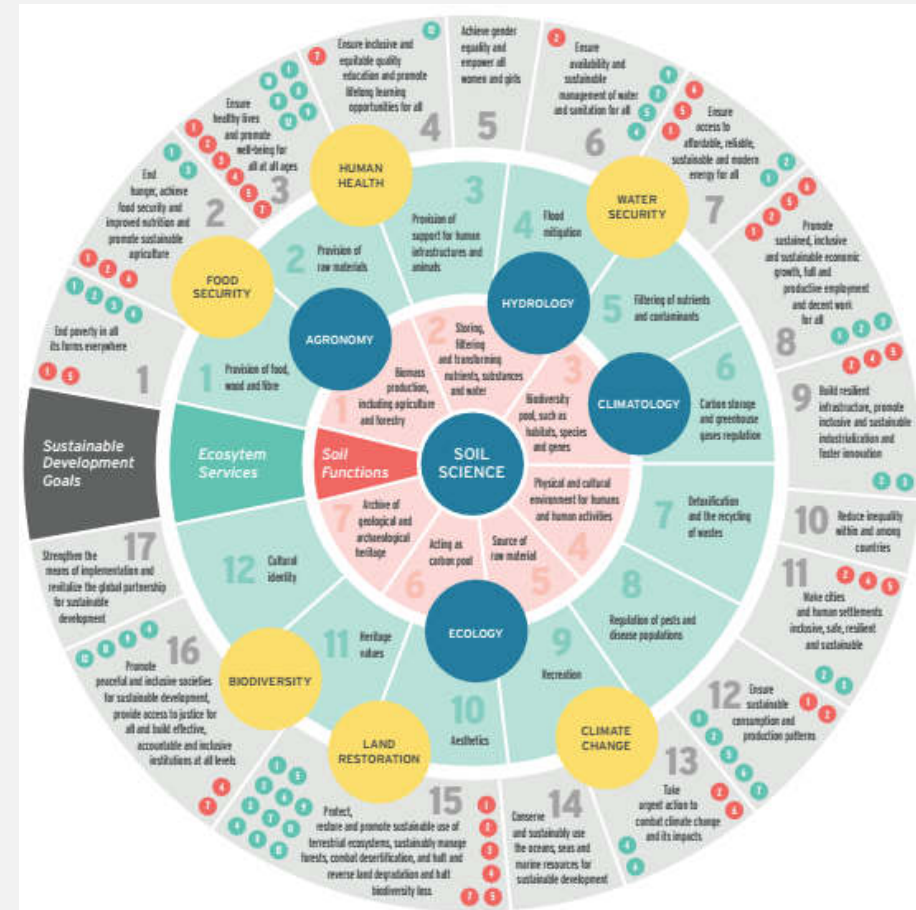


<http://capreform.eu/the-intervention-logic-of-the-cap/>

Sustainable Development Goals (SDG) & Soils

In the 17 United Nations SDGs for 2015-2030, **13 of them involve ecosystem services that depend on soil functions.**

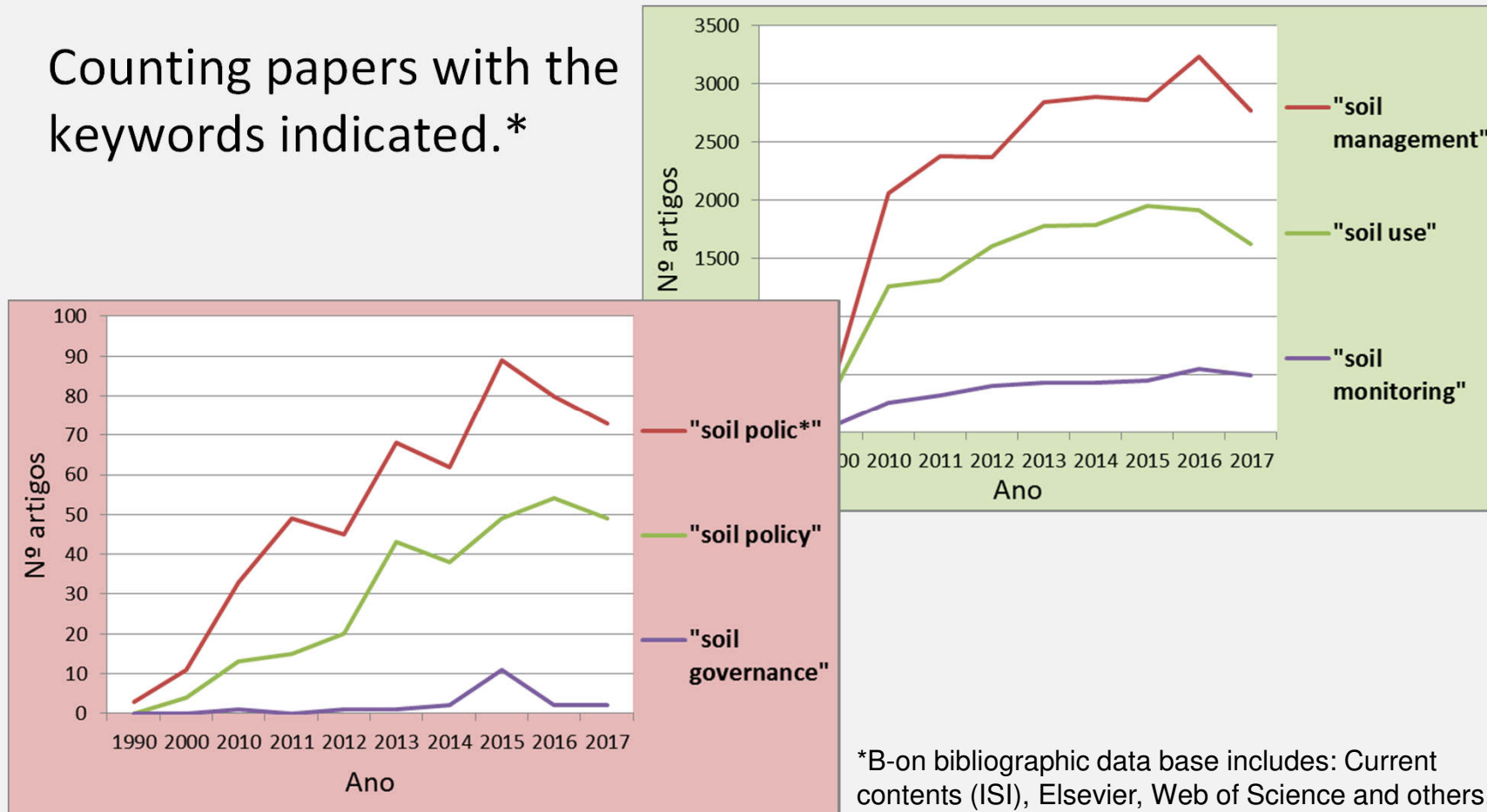
The **soil-society relationship is so entangled that more integrated public policies** for this resource are needed (namely to achieve those SDG related with the soil).



(Keesstra et al., 2016)

2015 - International Year of Soil: a positive impact that is fading away?

Counting papers with the keywords indicated.*



*B-on bibliographic data base includes: Current contents (ISI), Elsevier, Web of Science and others.

Many public policies have an impact on soils

- In general, the soil is the **direct and indirect object of several public policies**, namely:
 - Agriculture
 - Environment (in urban and rural areas)
 - Economy (industry, tourism, and others)
 - Land planning
- With this fragmentation is **more difficult to define integrated strategies** for an efficient use and protection of the soil resources.

What can be done? Greater society engagement?

Informal platforms / Forum for discussion and supporting to decision-making

Public entities:

- Central administration
- Regional administration
- Autarchies
- Schools and universities
- Research Centres
- Divulagation units
- (...)

Private entities:

- Farmer associations
- Business associations
- Companies with special local or regional impact
- Environmental associations
- Schools and universities
- Specialized communication companies
- (...)

Economic sectors represented:

- Agriculture, forestry, agroforestry, agro-silvo-pastoral
- Mineral resources exploration
- Environment, water, natural parks
- Construction, agro-food and other industries
- Health
- Teaching
- Research, development and innovation
- Information and communication technologies
- (...)

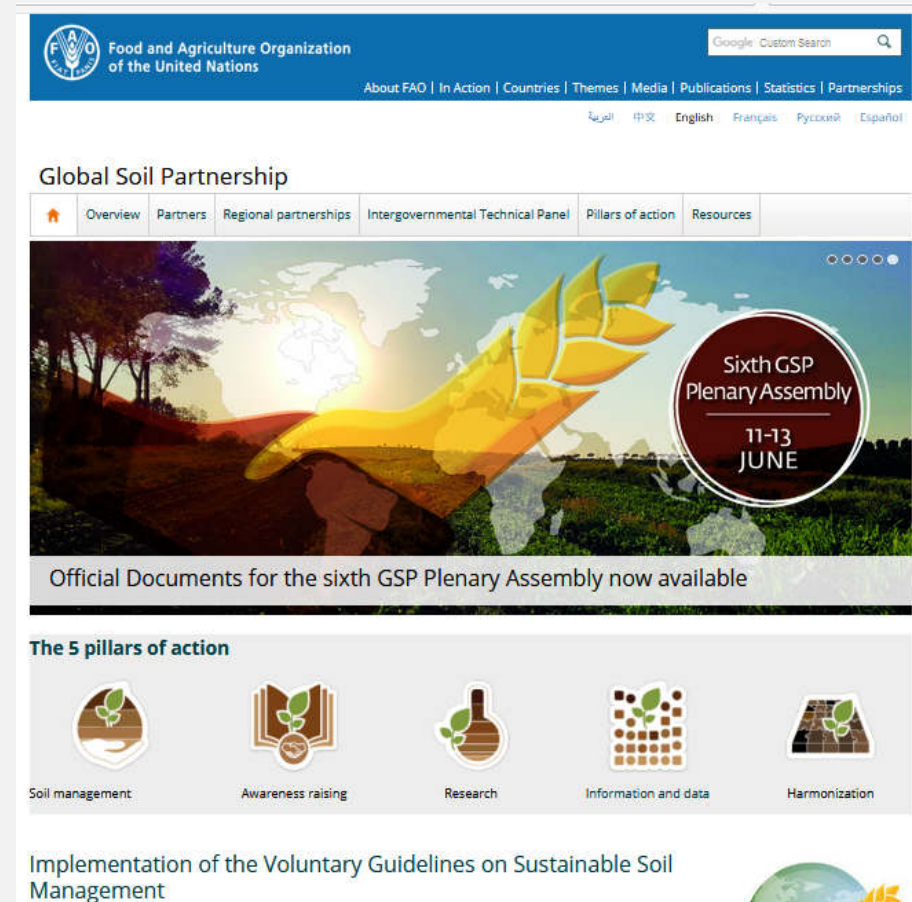


Support to (examples):

- Preparation of recommendations, standards, regulations;
- Development of tools to monitor and evaluate adopted policies;
- Articulation with equivalent initiatives from local to global scale.

A global example: Global Soil Partnership

- Adopted at the United Nations General Assembly in December / 2012.
- It is coordinated by FAO and involves other regional partnerships (approximately at continental scale).



<http://www.fao.org/global-soil-partnership/en/>

National example: Portuguese Soil Partnership

Formed in 2014 by the Directorate General of Agriculture and Rural Development (DGADR) and the Portuguese Society of Soil Science (SPCS).

2018/06: **28 partners**
(public and private entities)



The screenshot shows the website interface for 'Parceria Portuguesa para o Solo'. At the top, there is a search bar and a navigation menu with links for 'INÍCIO', 'LIGAÇÕES', 'PARCERIA', 'PAINEL TÉCNICO-CIENTÍFICO', 'ANO INTER. SOLOS', and 'RECURSOS'. Below the menu are utility links for 'Contacto', 'Mapa do site', and 'Área reservada'. The main banner features the organization's logo, which is a stylized apple with a green leaf, and the text 'Parceria Portuguesa para o Solo'. Below the banner, there are social media icons for LinkedIn, Facebook, and Twitter. A news article is displayed with the title 'Início \ Parceria Portuguesa para os Solos' and a sub-heading 'Publicado o documento das conclusões do seminário "GESTÃO SUSTENTÁVEL DO SOLO Linhas de orientação"'. The article text mentions that the document was published on February 27, 2018, and has been viewed 485 times. It also includes a small image of the document cover and a paragraph describing the event's purpose and outcomes.

<https://parceriaptsolo.dgadr.gov.pt/>

Symbolic measures are needed ...

- ... with special potential to improve society awareness about the importance of the soil, e.g.:
 - Search for and disseminate **local links between soil quality (water and food) and consumer health**;
 - Publish for the general public the **state of emblematic soils** of the edaphic heritage of a place or region;
 - Defend (and legislate in accordance with) the idea that **land rights can not admit the right to degrade soils**.
- **“In the end we will conserve only what we love; ...”**
(Baba Dioum)

FINAL REMARKS

- The exponential growth of mankind has only been possible with **increasing soil productivity, but not always sustainable.**
- Urbanization tends to **alienate people from the soil** (and nature) contrasting the **increasing dependence of humanity on this resource and on its sustainability.**
- The importance of the soil justifies that its study and policy definition can **involve the participation of interested citizens** and not only the usual professionals and stakeholders.
- The society also needs **greater involvement of the Soil Science community in defining more integrated public policies** for a more sustainable use of this vital resource.

References

- Baveye PC, Baveye J & Gowdy J. 2016. Soil “Ecosystem” Services and Natural Capital: Critical Appraisal of Research on Uncertain Ground. *Front. Environ. Sci.* 4:41. doi: 10.3389/fenvs.2016.00041
- Haines-Young, R and Potschin, MB. 2018. Common International Classification of Ecosystem Services (CICES) V5.1 and Guidance on the Application of the Revised Structure. Available from www.cices.eu (Accessed 10 April 2018).
- Keesstra et al., 2016. The significance of soils and soil science towards realization of the United Nations Sustainable Development Goals. *SOIL*, 2, 111–128. doi:10.5194/soil-2-111-2016
- Potschin, M & Haines-Young, R. 2011. Introduction to the special issue. *Progress in Physical Geography* 35(5): 571-574.



Thank you!