Soils4EU
Providing support in relation to the implementation of the EU Soil Thematic Strategy

Proceedings of Workshops 1 and 2:

"Transboundary effects of soil degradation"

"Soil ecosystems and their services"

Deliverables 3.1 and 3.2

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Title Deliverables 3.1 and 3.2 – **Proceedings of Workshops 1 and 2**

Providing support in relation to the implementation of the EU Soil Thematic Strategy is a three-year contract commissioned by the Directorate-General (DG) for Environment (ENV) of the European Commission (Service contract No 07.0201/2016/742739/SER/ENV.D.I, duration 6 Dec 2016 – 5 Dec 2019).

The overall objective is to support DG ENV with technical, scientific and socio-economic aspects of soil protection and sustainable land use, in the context of the implementation of the non-legislative pillars (awareness raising, research, integration) of the Soil Thematic Strategy and the implementation of the European Soil Partnership.

The support includes the production of six in-depth reports providing scientific background on a range of soil and soil-policy related issues in Europe, three policy briefs, logistic and organisational support for six workshops, and the organisation and provision of content to the European website and the wiki platform on soil-related policy instruments.

The work is performed by: Deltares, The Netherlands (coordinator); IUNG Institute of Soil Science and Plant Cultivation, Poland; UFZ- Helmholtz Centre for environmental research Germany; IAMZ - Mediterranean Agronomic Institute of Zaragoza, Spain; CSIC-EEAD Spanish National Research Council – Estación Experimental de Aula Dei, Spain.

These deliverables are the proceedings of two Workshops held in Brussels on 4th December 2017, for presenting and discussing Reports "Transboundary impacts of soil degradation" and "Mapping and Assessment of Soil-related Ecosystems and their Services"

References Contract no. ENV.D.1/SER/2016/0041

Document Information

Title	Proceedings of Workshops 1 and 2
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Document History

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12/12/17	1	Antonio López- Francos	(IAMZ-CIHEAM)		Concept	
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20/12/17	3	Antonio López- Francos / Lucía López Marco	(IAMZ-CIHEAM)	Henriette Otter	Final	

Contents

1.- Background and objectives of the Workshops

The contract "Providing support in relation to the implementation of the EU Soil Thematic Strategy" (hereby named Soils4EU project) envisages the organization of 6 workshops[1] over the three years of the project life for presenting and discussing thematic reports on different themes. . During the first year of the project, two workshops were to be organized:

- Workshop with a link to in depth report 1: Transboundary impacts of soil degradation
- Workshop with a link to in depth report 2: Mapping and Assessment of Soil Ecosystems and their Services This report was prepared by the SOILS4EU consortium in collaboration with the MAES soil pilot working group.

The general objective of the workshops was to increase awareness and to discuss with experts and stakeholders on scientific, technical and socioeconomic aspects of soil protection and sustainable land use and to consequently disseminate and support the European Union`s Soil Thematic Strategy.

The two workshops were held at Brussels on the 4th December 2017, as parallel events of the international conference organized by the H2020 INSPIRATION Project and the celebration of World Soil Day (5 December)[2]. The conference was attended by around 200 participants from many different European countries.

During this conference the following SOILS4EU activities took place: (i) a plenary session to present report 1 on Transboundary impacts of soil degradation and report 2 on Mapping and Assessment of soil Ecosystems and their Services; and (ii) two separate workshops for in depth discussion for each one of the two topics (see the workshops agenda for details) a joint final workshop on overarching messages.

Invitations to the workshops were sent to a group of key persons identified by the Soils4EU partners and the DG-ENV officers. This group included, among other experts and stakeholders, the members of the MAES Pilot on Soils. However, the registration to the workshops was also open to persons registering into the above mentioned Conference. A total of 138 persons attended the plenary session above mentioned and 63 participated actively in the parallel workshops; the attendees were professionals working on public administrations, EC DGs, civil society organisations and academic and research centres, from 18 countries (see section 3).

2.- Agenda of the Workshops

The two Soils4EU workshops were held in Brussels the 4th December 2017.

During the morning session of the "Inspiration Conference/World Soil Day 2017 - Land, Soils and Science", a specific time slot was dedicated to the presentation of the Soils4EU reports in a plenary session. In the afternoon, two separate workshops were run to discuss the two reports and then a

[1] The workshop organization is in the hands of IAMZ-CIHEAM, in collaboration with the report task leaders.

[2] This Conference, titled "Inspiration Conference/World Soil Day 2017 - Land, Soils and Science", was held from 4 to 6 December in Brussels with a visible contribution of Soils4EU (as it can be evidenced in the Conference specific website: www.worldsoilday2017.eu).

final combined workshop joined the participants in the previous specific workshops for exchanging their conclusions and closing the event. The detailed agenda is shown below.

The powerpoint presentations delivered during the workshops are attached as Annex 1 of this document.

11.30 – 12.30 - Soils4EU reports (plenary) **(Auditorium, IGBE Buidling))**	
11.30 – 12.00	**Transboundary effects of soil degradation – Challenges and ways ahead** (Nina Hagemann, Helmholtz Centre for Environmental Research – UFZ)
12.00 – 12-30	**Soil related ecosystem services – status, trends and value** (Suzanne van der Meulen, Linda Maring , Deltares)

Workshop 1 - Transboundary effects of soil degradation in the EU
(Room: 01.04 – Transitielab, Herman Teirlinck Building)

Chair: Nina Hagemann (UFZ)

Facilitators: Maaike Blauw (Deltares), Jorge Álvaro (CSIC), Nina Hagemann (UFZ), Josiane Masson (DG-ENV)

Time	Topic
2:00 - 2:10	Welcome and short intro of people (short round table)
2:10 - 2:15	Introduction and aim of workshop
2:15-2:40	Discussion on draft report and identification key drivers (plenum)
2:40 - 3:25	Working groups
3:25 - 3:45	Feedback from groups and discussion

Workshop 2 – Soil ecosystems and their services
(Room 01.05 - Isala Van Diest, Herman Teirlinck Building)

Chair: Linda Maring (Deltares)

Facilitators:, Bartosz Bartkowski (UFZ), Antonio López-Francos (IAMZ-CIHEAM), Nele Bal (OVAM), Bavo Peeters (DG-ENV)

Time	Topic
2:00 - 2:10	Welcome and short intro of people
2:10 - 2:15	Introduction and aim of workshop
2:15 - 2:40	Presentation key recommendations and motivations (Bartosz Bartkowski)
2:40 - 2:55	Time for questions

2:55 - 3:35	Working groups. 3 guiding questions • Do you support the recommendations? • How to implement? • Who can do what with it?
3:35 - 3:45	Wrap up: ways forward

3:45 – 4:15 30 minutes break

Combined workshop (1+2): Ways to progress and recommendations
(Room: 01.05 - Isala Van Diest, Herman Teirlinck Building)

Chair: Linda Maring (Deltares)

Facilitators: Nina Hagemann (UFZ), Maaike Blauw (Deltares), Jorge Álvaro-Fuentes (EEAD-CSIC), Bartosz Bartkowski (UFZ), Bavo Peeters (DG-ENV)

Time	Topic
4:15 - 4:25	Aim and programme
4:25 - 4:50	Report on key messages of group discussions of Workshops 1 and 2
4:50 - 5:05	Overarching messages and questions
5:05 - 5:15	Closing by DG-ENV

5:15 Drinks and Networking

3.- Participants

The plenary presentations of the reports 1 and 2 in the Inspiration/World Soil Day conference were attended by 138 attendees during the morning session of 4th December. The specific Workshops 1 (Transboundary effects of soil degradation in the EU) and Workshop 2 (Soil ecosystems and their services) counted with a number of 23 and 36 participants respectively. The combined session which followed Workshops 1 and 2 counted with 63 participants.

The type of participants matched the stated expectations, as several groups were represented: academics, decision makers (from different levels of Public Administrations), representatives of land users (farmers and urban planners) and other civil society organizations. Participants came from 18 different countries: Austria, Belgium, Czech Republic, Finland, France, Germany, Ireland, Italy, Lithuania, Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain, Switzerland, Ukraine and the United Kingdom.

The graph below shows the distribution of the different groups represented at the Workshops.

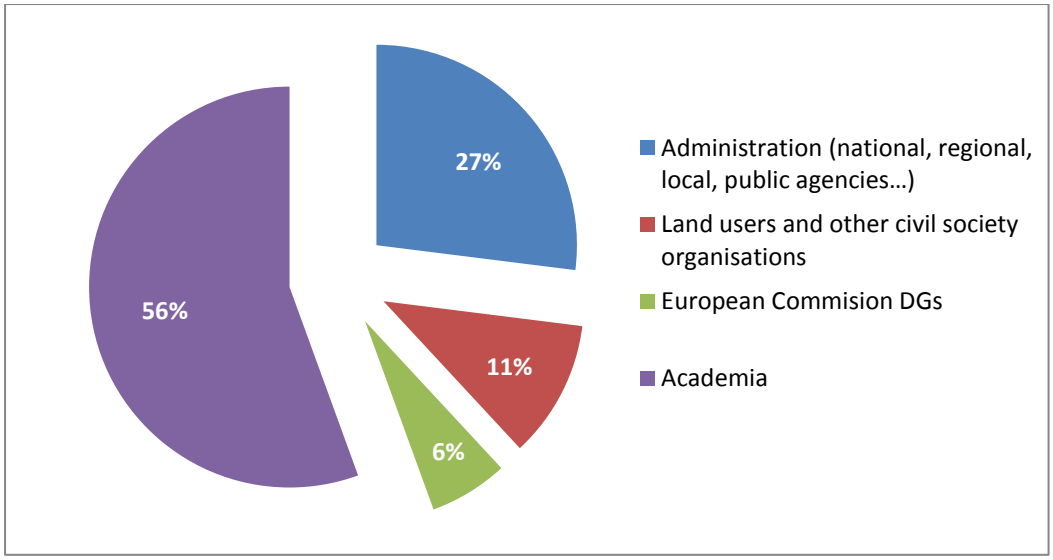


Fig. 1.- Groups of participants of Workshops 1 and 2.

The list of participants of the Workshops is provided in Annex 2.

4.- Workshop 1 - transboundary effects of soil degradation in the EU

This workshop was chaired by Nina Hagemann, from UFZ, who lead the elaboration of Soils4EU Report 1 on transboundary effects of soil degradation in the EU. Jorge Álvaro-Fuentes (EEAD-CSIC) and Maaike Blauw (Deltares), also involved in Report 1, and Josiane Masson (DG-ENV) and Lucia Lopez (IAMZ-CIHEAM), acted together with Nina Hagemann as facilitators of the workshop.

After the presentation of the group and the introduction to the workshop the participants were separated into 3 working groups:

- WG1 – Agricultural and forest soils (Facilitator: Jorge Álvaro-Fuentes)
- WG2 – Urban and industrial soils (Facilitator: Maaike Blauw)
- WG3– Climate change and carbon emissions (Facilitator: Josiane Masson)

The PWP presentation by Nina Hagemann can be consulted in Annex 1.

4.1. WG1 – Agricultural and forest soils

The discussion was structured along four questions in relation to soil degradation pressures in agricultural systems. For each question the main issues/reflections/points were highlighted.

1) Which pressures are most relevant in terms of transboundary impact? Which ones are more local? Why?

The group preferred to talk about fluxes instead of pressures. The group differentiated two types of fluxes:

- Natural fluxes: water and wind erosion processes.
- Anthropogenic fluxes: pesticide pollution; market demand.

2) Can the transboundary impact of the pressures be quantified?

All the participants consider that the pressures can be quantified with the use of models together with the support of monitoring systems providing available data.

The group also considers that not only negative fluxes must be considered but also positive fluxes. For example, they discussed about mitigation measures with a transboundary positive impact.

3) At which levels are actions required to influence the driver and the related pressures?

Mainly actions are required at local level since soil management implementation is a local action. However, there are also social and policy links that make actions international. On the other hand, regional specific conditions should be taken into account in order to establish actions and policies Education is essential to address pressures.

4) What are specific needs to take better informed decisions (scientists, policy makers, practitioners)?

Participants of the group have identified the next specific needs to take better decisions:

- Natural capital accounting
- Soil health index
- Quality indicators
- Maximum levels of pollutants in soil
- Land degradation neutrality
- Harmonized and transparent analytical methods
- Voluntary guidelines for sustainable management

4.2. WG2 – Urban and industrial soils

The discussion dealt with four questions in relation to urban and industrial soils degradation and its impacts. For each question the main issues/reflections/points were highlighted.

1) Pressures related to urbanisation with a transboundary impact

Several examples of pressures and negative impacts with transboundary relevance were pointed out.

- Soil sealing is one of the most important effects of urbanisation for soils. The main impacts are flooding downstream and shifting the food production to other areas.
- Soil and groundwater pollution in other regions is caused by air pollution by the cities and industries. This can have effects both locally and at distant areas. Waste production and disposal can be an example, with important environmental effects due to the huge energy costs of transportation and to the soil degradation in the dumpsites (sometimes far away of the point where the waste is produced).
- Less trees/forests in surrounding urban areas due to land use change lead to heat island effect in cities (more local effect) and in net CO_2 emissions (more global effect).
- Rural land abandonment/degradation happens in parallel to urbanisation of the population.

2) Can the impacts be quantified? Examples?

Quantification of the impacts of such complex phenomena is difficult. There is a lot of information on land degradation but few examples are found on specifically quantifying transboundary impacts. Some examples and recommendations where evoked.

- Soil sealing. Switzerland has data of soil sealing due to urbanisation
- Land grabbing (as an effect of increasing food demand and diminution of agricultural land).
- The combination of different data can serve for estimating effects. For example: (i) soil sealing, with speed of the river data and effects downstream → flooding; (ii) soil permeability (instead of soil sealing) with rainfall intensity

- Look first at impacts at local level, followed by regional/ national and then EU/global level (bottom up scale). Local and national data and thus impacts might be obtained more easily than at transboundary level. For example: check the conditions for a city to become climate proof, what will the effects of an extensive rainfall be (can the soil take up the water, where will it flood)? And subsequently how will this affect the region/ transboundary?
- It is hard to determine which effect comes from which cause (soil sealing/ climate change/ etc.) therefore it is very hard to quantify exactly the impact of urbanisation/ industrialisation.
- Policy impacts are to be assessed not only in relation to the objectives of the specific policy. Example: In Slovakia land is bought by German/Austrian companies. These companies get subsidy from EU for trade-offs (biofuels etc.), but the local ecosystem functions and society are distorted.

3) Which responses are required to steer urbanisation process?

It seems that responses lie on land planning and policy which should stream soils functions and services. The points highlighted were:

- Spatial planning: better organise functions, make better use of functions and plan them. Restore functions, keep unsealed soil of unseal it.
- Land policy: masterplan between villages- city, regions, transboundary. Take into account different soil ESS for different users.
- Waste policy: avoid too much transport of waste
- Definitions: urban soil, transboundary, degraded, functions…
- Communication: awareness raising and communication with decision makers

4) What are knowledge and data gaps at different levels of decision making?

There is a wide gap of knowledge for allowing optimal decision making. Although there exist data and examples, they are scattered and not easily available for planners and decision makers. Some needs and conclusions were highlighted:

- Need for statistical data on national level and supra-national level. Start at local/regional level on data and information on impacts, and go up in scale (national/EU/global)
- A repository with all the data/reports and information available would be an interesting tool for researchers and planners.
- Even if data are available, it is hard to exactly know what the impact is from urbanisation, because there are many different causes and external factors the system responses to: climate change, changes in soil functions, social changes, economic changes, mobility, etc.
- There is a need of transboundary regional planning → masterplan on different levels, crossing the borders.
- Communication between different policies and disciplines → more integrated
- Policy makers need clear messages and need figures. What are the economic drivers? How can impacts be translated into economic figures?
- Communication, data and information to enable decision making: examples, study cases, simple and short policy briefs, clear figures, products that can be understood and shared by different users with different backgrounds and objectives.

4.3. WG3 – Climate change and energy

This group worked around several questions regarding climate change, energy, their interaction and their effects on soils.

1) Climate change is a transboundary issue. Can we differentiate between local and transboundary pressures? Please specify the most relevant.

Climate change is a global process entailing many impacts on soil. Temperature increase, sea level raise, increasing orisk of natural hazards, precipitation fluctuations, etc., are aggravating soil degradation problems in many parts: water and wind erosion (e.g. dust storms are a new phenomenon in some areas), soil organic carbon losses, coastal erosion, floods and sea intrusion, changes in soil biodiversity…; however a longer vegetative season is enhancing soil productivity in some parts (so risks are not homogeneously distributed).

As for energy, important impacts of bioenergy production on soils are highlighted. Land use changes are observed inside the EU, mainly grasslands, forest and peatlands are being transformed for producing biofuel/biomass. Arable lands are also being used for bioenergy production. Besides the local effects on soils of these changes, transboundary effects are observed and the increase land footprint and land grabbing. What is the associated change in carbon balance? Example: peatlands transformed into crops entailing soils subsidence and CO_2 emissions. Renewable energy factories (solar and wind) also use fertile land, with no negligible impacts in some countries (e.g. Romania).

2) Can the transboundary impacts be quantified (especially for Europe? Examples?

Several examples were mentioned

- Peatlands conversion and degradation can be quantified. Also its effect on CO_2 emissions and soils subsidence.
- Sediment dynamics and the effects of its changes are much more difficult to quantify. Climate change has a direct effect on this.
- Soil organic carbon is a key parameter which can be measured (e.g. Lucas and other data bases/studies). But disaggregation of causes is more difficult: for example: what is the part of CC in SOC losses?

3) What are possible responses at Member States level to influence CC and energy security as drivers of soil degradation and where is global action required?

Several responses where pointed out some of them at local/national level. However global problems should have global responses so supranational actions were also evoked.

- Members states can use spatial planning instruments to address CC (adaptation, mitigation)
- An example in the Netherlands is the paradigm of not building against nature but with nature (e.g. EcoShape project)
- The 100 Resilient cities initiative is working with spatial planning for climate change preparedness and mitigation: e.g. infrastructures to protect against floods.
- In Europe, the CAP is a key instrument for adaptation to climate change and soils resilience.
- Global action is urgently required for controlling land grabbing, adapting agricultural production and trade, taking care of land food print, preventing land use changes with effects on climate changes.

4.4. Workshop 1 main highlights and conclusions

The focus on transboundary impacts raised a lot of interest because soils are not static and the drivers of soil degradation are often global. The impact also is in many cases not local but trans-border. It is relevant for relevant for many stakeholder groups, e.g. for reaching the SDGs that require collaboration. Participants see an added value of the Soils4EU Report 1 because it provides

valuable information and evidence that has so far not been collected., and gave some recommendations.

Some specific comments and ideas which could be useful for assessing the transboundary effects of soil degradation:

- A challenge is that people have **different opinions about the relevant scale**. Whereas one group is close to the soil and its interaction with other sources such as wind, water air, the other sees the greater picture and looks from a transboundary and intersectorial perspective. It is difficult to differentiate between local and transboundary effects.
- We can **hardly disentangle the different components that influence transboundary impact because of the many interlinkages**. We should also differentiate between anthropogenic and natural drivers. The issue is too complex to approach it deeply in a single report.
- We can **quantify the amount of degradation but not the impact**; this means we can say a lot about soil loss or contamination, but for example in a flood event we cannot precisely say much about the impact the soil loss has in this event (40%, 50%, …..), even though we know there is one.
- We should **clearly state why soil is an international issue**, and be more specific on the international pressure on soils (and their functions, processes and services).
- Some **approaches and methods could be useful for focusing the issue** of transboundary impacts. E.g. umbrella framework, Nexus approach (water-soil-sediment). Regarding the context, Habitat, Flood and Water Directives should be taken into account as having transboundary implications.
- For the action part:
    - **Reward upstream actions** such as flood control, nutrients, local climate effect (that is the goal)
    - **We need land use inventories**; at the moment Member States do not have a spatial planning and impact framework (so we do not know, what are the consequences of soil use?)
    - There are internationally recognized concepts that can be used to frame the issue of transboundary impacts of soil degradation. Sustainable Development Goals (**SDGs)** → reducing degradation will support reaching many of the SDGs. **Land Degradation Neutrality** as a driving force for soil protection
    - **Masterplan for cooperation** between countries, e.g. on habitat protection
    - **Green infrastructure** as a positive example of a climate change mitigation measure
- The **lack of examples that could enrich the Report 1** is remaining.

5.- Workshop 2 - Soil ecosystems and their services

This workshop was chaired by Linda Maring, from Deltares. Bavo Peeters (DG-ENV), Nele Bal (OVAM), Bartosz Bartkowski (UFZ) and Antonio López-Francos (IAMZ-CIHEAM) acted together with Linda Maring as facilitators of the workshop.

After the presentation of the group and the introduction to the workshop, the participants were separated into 4 working groups:

- WG1 – Which soil-related ecosystem services to incorporate in ESS assessment (Facilitator: Bavo Peeters)

- WG2 – Management of urban and agricultural soil systems to enhance ESS (Facilitator: Nele Bal)
- WG3 – Valuating ESS (Facilitator: Bartosz Bartkowski)
- WG4 – The availability of information on ESS capacity and use (Facilitator: Linda Maring)

The PWP presentation by Bartosz Bartkowski can be consulted in Annex 1.

5.1. WG1 – which soil-related ecosystem services to incorporate in ESS assessment

Separating the soil from the system in which it operates and only focusing on ecosystem services specifically provided by the soil, is somewhat artificial because it neglects the numerous interactions and connections within the system. It is very difficult to determine the role and specific contribution of soil to the whole system. It is nevertheless understandable to focus on soil in a separate MAES (Mapping and assessment of ecosystem services) pilot for communication and awareness-raising reasons.

Healthy soils are able to provide multiple ecosystem services. Mono-provision should be avoided as much as possible. The optimal mix of ecosystem services is depending on the preferences of land-users and stakeholders. The optimum should take the time-dimension and the future of the next generations into account. Policy makers have to determine and enforce the optimum by using a participatory approach to guarantee that the public interest is respected. Fertile soils should be protected and can only be sustainably used if its potential to deliver multiple ecosystem services is maximally respected (e.g. not for golf courses or chicken farms).

It is also important to assess the drivers of soil degradation and to reduce these in order to relieve the pressure on the condition of the soil. The Soil Thematic Strategy offers a good starting point because it lists all the key soil threats.

List of soil-related ecosystem services:

- The potential of the soil to sequester carbon is highly dependent on local conditions and varies from one country to another.
- Noise abatement and air quality regulation are not really considered as ecosystem services provided by the soil. It is advised to group the soil-related ecosystem services into two classes depending on the role of soil (quality) in the provision of the service: primary and secondary, or direct and more indirect soil-related ecosystem services.
- Cultural services are more difficult to describe, assess and valuate.
- The optimal equilibrium of soil-related ecosystem services in a rural context and in an urban setting is completely different.
- The interdependencies between the different soil-related ecosystem services should be more emphasized, e.g. crop production is also related to carbon sequestration.

Some interesting projects:

- SoilMan: http://www.biodiversa.org/989/download
- Link4Soils: http://www.alpine-space.eu/projects/links4soils/en/home
- AlpES: http://www.alpine-space.eu/projects/alpes/en/home

5.2. WG2 – Management of urban and agricultural soil systems to enhance ESS

When discussing the management of urban and agricultural soil systems to enhance ESS, it was confirmed that there is no golden management recipe; it depends on local demand and supply. The main observations pointed out were:

- For some types of land use (e.g. urban land use) it is possible to develop more or less "global" management practices (applicable through Europe) whereas for rural land use types, management practices need to be adapted to the specific situation (soil type, land use type, climate, local demand and supply of ESS, agricultural/forestry economical structures…).
- The decision for the right practices should start with an assessment on the specific land to know its history, the current situation and the possible impact of future activities on the ESS.
- For the adoption of the practices, a participatory approach on good practices is very important: stakeholders/land users must agree on the proposed practices, which have to be locally adapted. E.g. a good example is the Conservation Agriculture Practices, widely used in the Americas and other areas of the world, but not widespread in Europe. Farmers want freedom to decide what to do on their land.
- On the other hand, it is desirable that land users are intrinsically motivated and look to their land management practices "using ESS-glasses". Optimal is that they can evaluate their own practices to see their impact. Knowledge and guidelines are therefore needed so that they can control themselves.
- Well-balanced land use planning is important to conserve good soils for agriculture and protection against hazards and not to use them for other purposes. Scale (local, regional…) and trade-offs between ESS are important when talking about management. Tools that already exist: e.g. in Flanders: NARA-tools and ECOPLAN-tools.
- ESS as such is a very complex concept for stakeholders, so it is important to make it understandable for them, so that they can be convinced to use the good practices to enhance ESS. Therefore the following actions were advised: identify the practical knowledge gaps and close them, education (starting from young children, but also for farmers), incorporation of soil-ESS-measures in policy programs (e.g. CAP), good examples (e.g. show the value of wetlands) and guidelines (e.g. for city planners) were advised, incentives such as coaching/technical advice by a crosscutting team of experts or a fee to cover the costs for value creation by enhancing ESS (now not taken into account), regulation to stop critical practices (e.g. retributions).
- Awareness-raising is important so that politicians and other stakeholders can be convinced and that they "trust" the ESS-framework. If not, they stop listening. Visualize valuable areas with high potential supply of ESS is a good strategy for maintaining those ESS.
- A question remains: what is sustainable use? The stakeholders should evaluate this themselves.

5.3. WG3 – Valuating ESS

The debate turned around some general questions:

- Sensibility/helpfulness of the ESS concept? (Significant complexity reduction, but at the same time too complex for laypeople?)
- There was much debate regarding the sensibility of economic valuation, "putting € values to qualitative stuff".The context-specificity of valuation was viewed as problematic; the valuating exercise might add complexity to qualitative messages which are accepted by planners (e.g. green areas are of major importance for urban planners because of many reasons which are shared in general by citizens and politicians. Would the fact of putting a monetary value contribute to this perception? Would it be even negative if e.g. real state value is valuated as much higher? However it could be helpful to communicate the importance of soils

- (Valued) soil ESS are a potential way to bridge the gap between environmental and agricultural ministries, e.g. this approach could serve as a basis for some kind of compensation/incentives to land managers/users (payment for ecosystem services).
- Valuation data could be useful for cost-benefit analyses, for example of soil sealing and for other soil-related projects. But valuation should be done by neutral organisms/authorities (to be credible).
- An idea for valuation: costs of transforming "normal" grassland into high nature value (HNV) grassland as proxy for the latter's value. Value = cost of restoration or enhancing capacity.
- Although there is a recommendation to fund more research in this area, the participants know there is a general lack of awareness relating the importance of soils. The ESS approach and soils in general are not familiar for policy makers and there is a lack of interest by citizens. So funding is unlikely to be produced.

Open questions:

- What is the role of sediments in soil-related ecosystem services in sediments? Can the concept of ESS be applied to sediments?
- Should mixed methods be applied in the context of soil valuation? (combinations of biophysical/economic/social-participatory appraisal) How can societal preferences towards soil related ecosystem services be explicated and made explicit?

5.4. WG4 – The availability of information on ESS capacity and use

For the availability of information on ESS capacity and use, there were 4 main recommendations for future research and several general comments.

Recommendation 1: Assess the relation between change in flows of provisioning services (harvest), the potential supply of provisioning services and the role of soil in potential supply.

Use existing monitoring information to assess supply and demand on ES. Several examples were mentioned:

- Finland: monitoring forests and soil quality
- Databases on Brownfields
- Switzerland (Agroscope): There are few soil maps, but there is a program to retrieve info for soil functions using remote sensing, including different variables.
- Slovakia: land planners are a source for information on soil capacity. . A landscape plan is obligatory. Soil is taken into account explicitly. But assessment of ESS starts because e.g. for (privately owned) forests, when non-productive functions could be reimbursed for services delivered.
- FAO's Global Soil Organic Carbon Map
- Walloon Monitoring 2/3 years: loss of soil C, erosion (general) and local pollution (specific sites). There was an assessment in 90s and '00 and 2015. Because that is too costly, farmer analyses are used to assess soils (so mainly circumscribed to croplands)
- Austria, same: farmers voluntary assess soil. Urban planners use assessment of quality of agricultural soils (4 classes): pay more if you use it for building
- Czech database of contaminated soil (10.000 sites contaminated / potential contaminated / after reclamation) quality & soil erosion are also monitored. There is a tool for farmers for measures against soil erosion.
- UK: sediments data. There is data on farmland to be able to put sediment on it. (Regulation)
- AlpES project SOC capacity.
- LINKS4SOIL: new project which focuses on soil info providers and users soil functions

- Square project Ireland: Soil Quality Assessment Research Project, soil ecosystem services

Recommendation 2: For regulation and maintenance services extract the role of soil.

- Soil is part of a system. To extract its role is difficult: "what is the importance of a pelvis to a body". Soil has several roles in ES: structure, chemistry. We need details on the role of soils, quantify the services of the soil. Society does not value soils sufficiently so we need to be specific on the role of soil: for awareness and to be able to use it.
- It is necessary to make comparable measurements; we need the same methodologies and tools.
- We need to understand the system in combination with its use to do this. Quantify processes in soil to better use ESS. The use of ESS is following the quantification.
- More research is needed on processes. Maybe the info is there but not linked to ESS, we need the right level of presenting information to answer questions.

Recommendation 3: Be aware of the required level of spatial detail

- Because of soil variability, EU scale data is not sufficient and local data (e.g. detailed soil maps) are not always available. E.g. CORINE land cover data on sealed area does not help to find measures for climate change mitigation measures on a local scale, but is helpful to show trends and call for action in certain areas. Info and data is not presented on the scale needed for management practices (Soil variability)
- Inventory of data is needed. Querying existing data shows that there are spatial and temporal mismatches. We should identify the gaps.

Recommendation 4: When indicators for ESS potential are lacking, a combination of indirect indicators can provide insight in the potential.

- New maps in which these indicators are combined would be useful to be produced in the future.
- Use proxies. There are missing / no data e.g. on on soil biota, soil biodiversity. There is not always knowledge about the soil / land management. How to use new and scattered data and interpret them? Soil is not (yet) an input for many models.

As for general comments and open questions:

- It is better not to talk about capacity but about soil properties and functions independent of use. When talking about ecosystem functions it is possible to define the role of soil. Services also need labour / management and demand from humans.
- Definition of soil / subsurface is important: top-layer, aquifer, deep subsurface. What is the frontier for the soils ESS concept?
- Although specific data and studies on soil ESS are scarce, there are examples of how classic data are used to translate it to information for processes and ESS.

5.5. Workshop 2 main highlights and conclusions

Lively discussions were held during the workshop. The presented recommendations were received well and additional examples and angles were added.

The groups that discussed **which soil-related ecosystem services to incorporate in ES assessment**, confirmed that ES is a good concept to communicate with stakeholders and land use planners. It is in some cases difficult to be specific on which ESS are especially soil-related, because they are delivered by a system. In many cases we use multiple ESS, it would be advisable to determine and balance what an optimal mix of ESS is by policy makers. There is a difference in the urban and rural

ESS, it was advised to distinct in the list between primary (direct) and secondary (indirect) soil-related ESS.

When discussing the **management of urban and agricultural soil systems to enhance ESS**, it was confirmed that there is no golden recipe for management, it depends on local demand and supply. Scale and trade-offs between are important when talking about management. Very important is that the land-users agree on the practices proposed and that this happens on a voluntary base. It is complex for a lot of stakeholders, therefore the following actions were advised: education, incorporation in policy programs, good examples and guidelines were advised, incentives such as coaching. A question remains: what is sustainable use. The stakeholders should evaluate this themselves.

The conclusion on **Valuating ES** was that there is a lot of discussion on valuation of ES: is it sensible at all or nonsense. Valuation can be used to influence decision makers and users of land when used well. On the other hand not everything with value has a price, it is difficult but important to consider "soft values" as well.

When discussing **the availability of information on ES capacity and use** the importance of showing changes in use and supply was endorsed to show a sense of urgency. Also making the role of soils in delivering ES explicit contributes to awareness and better use of soil ES and management practices of soils. There is a lot of data and monitoring that can be used, (as direct or proxy indicators) but translation is needed to go from data to management practices. Scale of the data is important depending on the task:

- Monitoring on EU scale: state of ES, to show urgency
- Using information for soil management practices and use of ES, needs local data

6. Combined Workshop

In the combined workshop the two groups of the previous parallel workshops meet in the same room. The working group facilitators had prepared a list of key messages of both workshops and presented these. (PWP presentation can be found in Annex 1)

6.1. Key messages from working groups

Transboundary effects of soil degradation

Agriculture

- Pressures/fluxes are identified from both natural and anthropogenic origin.
- Harmonized methodological approaches are possible
- Actions required especially at local level
- Several options to take better informed decision – quality indicators as an example

Urbanisation and industry

- Key pressure: Sealing and pollution
- Effects: From regional to national, involving different disciplines, waste policies are relevant
- Need for data and knowledge to raise awareness.
- Decision makers needs have to be acknowledged
- Definitions are required

Climate change and energy

- Transboundary and global issue (increasing natural hazards) → soil organic carbon
- Energy security hard to approach (land use change, peatlands → CO_2).
- Renewable energy also impacts (e.g. solar energy in Romania can be built on fertile land, no laws)
- Quantification difficult because no disaggregated data
- MS level to address climate change (adaptation and mitigation)
- CAP mentioned
- Global actions for reducing footprint and land grabbing

Soil ecosystems and their services

Which ESS to be included

- Key message: Some ESS are more closely related with soils than others → Differentiate between primary and secondary soil ESS
- Matter of preference for certain ESS relevant
- Time scale is relevant
- Important role of policy makers for optimal… ?

Management of soils to enhance ESS

- Complex issue for people who have to do it
- People need to be involved because otherwise it will not be implemented
- Education, communication, incentives for people (PES), coaching and exchange of good examples

Valuation of ESS

- If we had information on economic value this information could be used for informing decision makers
- It can also inform decision making by including ESS in cost benefit analyses
- Is economic valuation a good thing or not? Conclusion: When applying it one should keep in mind that it has its limitations and is not a silver bullet.

Information on quantification

- When being able to show the change of amount of ESS, than you can show that something is happening and when demand increases you also know you have to do something
- Do we have to make the role of soil explicit? → Yes, because we need to value soils better
- A lot of data available in MS that we can use for ESS assessments
- Skill is important for the task: What are you doing with data and why? Monitoring requires different information than implementing ESS at local scale. Scale = important!!!

6.2. Discussion of the participants:

After repeating these main messages, the participants discussed on the following issues (Mainly on the valuation of ecosystem services):

- The example of peatlands matches with both topics (transboundary and ESS): wet peatlands yield CO_2 sequestration and avoid subsidence; when reclaiming peatlands for agriculture and lowering the groundwater table, the peat release CO2 in the air and subsidence occurs 8at

the same time, additional services in the form of agricultural products are provided) … so a balance is needed in these areas.

- How can you put for example regulating services into economic valuation? Using a holistic system is better (e.g pay for intact soils)
- Knowledge has to be transferred; but if you want to act you need simple solutions and simple arguments. Not monetarize everything but some figures are needed.
- It is valuable to monetarize soils and ESS and bring them into economic language. Economy is not just about money, but values and preferences. Take into account for example that there is money out there for nature protection. Not be too afraid that people won't understand or appreciate soils.
- Should we use CAP payments for ESS? This is a topic in Finland.
- If farmers proof they provide ESS they receive some additional payments = value system. This might be the easiest way because you get what you want: CAP provides money and this is linked to provision of ESS. Comparing ecosystem values does not make sense.
- We cannot solve all the issues today. Debated a lot about pros and cons. Important question: How you support farmers to apply good management practices for soils? It is not the same vision of monetarization. There is a problem with subsidies for providing ESS in CAP driven by other considerations (trade-offs among objectives). ESS will be part of the upcoming CAP.

6.3. Common points we found in the workshop - what is missing?

The attendees were asked to add to the list of common points that came up in both workshops:

- Policy makers want to have clear messages and figures, this is important when writing the reports. Measuring and monitoring is of specific importance.
- The importance of temporal and spatial scales for measuring, monitoring, use of data for different purposes. Also the availability of data is of importance. The available data we can combine and use to say something about soils (state, services, effects etc.).
- The need for a holistic approach– not isolated, processes, many impacts, both state of the soil and management / use
- The Common Agricultural Policy (CAP) provides ground for supporting the provision of ESS as well as reducing the risk of transboundary soil degradation through different measures such as the Agri-Environment-Climate Measures (AECM) as well as the Cross Compliance regulation that requires, for example, Greening measures.
- The importance of stakeholder involvement
    - Communication
    - Sense of urgency
    - Awareness raising, to persuade them to change their management practices on a voluntary basis.
- The need for definitions/ common approaches/ what do we mean with concepts

They discussed amongst each other and came with the following additions.

- *Definitions and monitoring*: We need to define the indicators that stand for ESS and effects of soil degradation to monitor and interpret. Data are necessary to show the potential or impacts. If we want to inform and convince policy makers we cannot just say "healthy soils" – we need to be specific, measure and monitor.
- If people do not see the value of soils, people will not join, therefore *it is important to value*.

- We *need integrated decision tools* on what kind of ESS are to be used use in land use planning. E.g. Solar panels in Romania is a worst practice example.
- We need a pragmatic view on things, characterize the benefits from the ESS and show the transboundary effects of soil degradation. *Move from the theoretical/concept level to a practical/problem solution level*, and involve the right stakeholders: people who actually manage the land
- *Regulations and governance are very relevant* on the process of decision making (they can constrict, they can promote…)
- *Making use of existing concepts*. In science policy interface land neutrality is important, as are the SDGs; how do we link to these concepts?
- In *communication we need to outline the positive things about soils*, highlighting the value of soil. Speaking about avoiding costs is also a positive message. Also speaking about positive fluxes (e.g. mitigation measures with a transboundary positive impact).
- Question: *How do you qualify the transboundary impact* in terms of ESS (reaction: local people define what the value is).

After the lively discussions, Bavo Peeters (DG ENV) closed the meeting by thanking all participants and invited them for drinks, further discussion and networking.

Annex 1.- Powerpoint presentations

- **Plenary presentation Report 1:Transboundary impacts of soil degradation**
- **Plenary presentation Report 2: Mapping and Assessment of Soil Ecosystems and their Services**
- **Workshop 1 presentation: Transboundary effects of soil degradation in the EU**
- **Workshop 2 presentation: Soil ecosystems and their services**
- **Presentation Combined Workshop**

Transboundary impacts of soil degradation. Plenary session

SOILS4EU:
Providing support in relation to the implementation of the EU Soil Thematic Strategy

Transboundary impacts of soil degradation

Deltares
IUNG - Institute of Soil Science and Plant Cultivation,
UFZ - Helmholtz Centre for Environmental Research
&
IAMZ - Mediterranean Agronomic Institute of Zaragoza,
CSIC-EEAD Spanish National Research Council - Estación Experimental de Aula Dei

Hagemann, N., Álvaro-Fuentes, J., Siebielec, G., Castañeda, C., Blauw, M., Dietze, V.

Service contract No. 07.0201/2016/742739/SER/ENV.D.I

Problem statement I

The **global** population could reach ca. 9 billion people in 2050 and at the same time European and global **soils degrade** further (Panagos et al., 2016; FAO, 2012).

Mean **soil loss rate in Europe** is by far higher than the soil formation rate (Panagos et al., 2015).

Global production of food has to **increase** by about **70 % to 100 %** in order to feed this predicted population (Godfray et al., 2010).

Increasing pressure on already degraded soils.

Transboundary impacts of soil degradation. Plenary session

Problem statement II

Soil degradation as a consequence of sealing, land use intensification etc.
= local or regional challenge.

Impact often not limited to the area of degradation but much broader, examples:

Salination of soils in Spanish region = loss in agricultural production, increasing prices for vegetables and increasing pressure on soils elsewhere (even outside Europe).

Soil sealing within catchments increases flood risks = impact on downstream users (economic costs, health effects due to polluted water).

Transboundary impacts of soil degradation

Objectives:

Identification and presentation of **facts and evidence** of transboundary impact of soil degradation (economic, ecological and social).

Focus on societal challenges of transboundary impacts of soil degradation, drivers and impacts.

Scale: Impacts on EU level, incl. examples from EU Member States

Target group: Policy makers (agriculture, urban land and water management)

Transboundary impacts of soil degradation. Plenary session

Report structure

1. Introduction
2. Societal challenges of transboundary impact
3. Drivers and transboundary impact of soil degradation
   - 3.1 Natural conditions (climate, topography, soil properties)
   - 3.2 Land use changes
   - 3.3 Land management (especially agricultural activities)
   - 3.4 Urbanization and development of infrastructures
   - 3.5 Consumption patterns and economic drivers
4. Identification of key challenges to address transboundary impacts
5. Recognition of transboundary impact in policies
6. Need for actions

Definitions

Soil degradation:

"Soil degradation is defined as a change in the soil health status resulting in a diminished capacity of the ecosystem to provide goods and services for its beneficiaries. Degraded soils have a health status such, that they do not provide the normal goods and services of the particular soil in its ecosystem." (FAO, 2017)

Transboundary dimensions:

Drivers (cause of degradation) are often distant and cross-borders (= transboundary).

Soil degradation is often considered as local phenomenon but soil particles move (e.g. forced by either wind or water), e.g. when mixed with water, soil may become sediment.

Degraded soils do not only affect people but can have broader economic (increasing imports), ecological (loss of biodiversity networks) or social (food security) impact

The (societal) challenges

- Climate change
- Food security and safety
- Land foot print
- Migration
- Water security
- Loss of biodiversity & ecosystem functions
- Human health

Source: Global Footprint Network

Societal challenges: Example I

Food security and safety I

Approximately 95% of global food is produced in soil (FAO, 2015).

Food demand is expected to increase up to 3 billion tonnes in 2050 (FAO, 2009).

Approximately 50% of global land area is already devoted to agriculture (about 1/3 cropland and 2/3 grazing land).

Transboundary impacts of soil degradation. Plenary session

Societal challenges: Example I

Food security and safety II

Economic importance of agriculture and food commodities for EU: 350 billion Euro trade on the internal market (for the year 2016) and 129.1 billion Euro trade in exports to third countries (in 2015) (EC, 2017).

During past 40 years about 30% of the world's cropland has become unproductive (much of this land has been abandoned) (Pimentel, 2006).

Societal challenges: Example II

Water security & quality

Flooding and droughts
Nutrient pollution

Chemical contamination
Securing water quality
……..

Source: Mohtar, 2015

Transboundary impacts of soil degradation. Plenary session

Societal challenges: Example III

Migration

Millions of people are migrating each year due to degraded land (UNCCD, 2017).

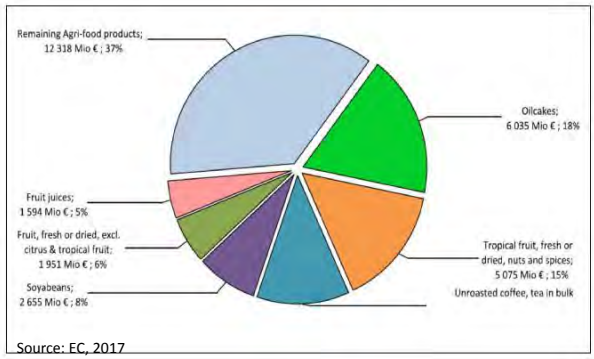
Reasons are manifold:

– Consumption patters require food imports

degradation in these countries.

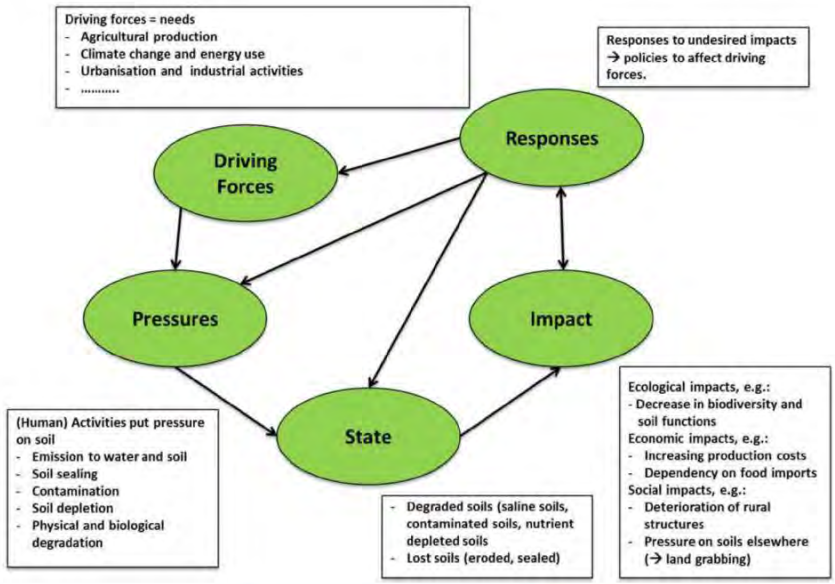
– Land grabbing (investors also from EU to produce, e.g. biofuels else-where)

EU Agri-food imports from Latin American countries (2016)



Source: EC, 2017

Drivers and impacts



Transboundary impacts of soil degradation. Plenary session

Example I: Agricultural production

Driver background:
Global/European demand and economic pressure = intensification of agricultural production

Pressure (rather local):
Diffuse contamination, compaction, soil salination (irrigation), nutrient depletion, physical and biological degradation

State (rather local):
Degraded and lost soil

Impact (rather transboundary):
Reduction in food production can have several different impacts:
- Price increase for cereals (for Italy >70% over last 10 years) (FAO, 2013)
- Pressure on agricultural land elsewhere (e.g. land grabbing)

Example II: Urban development

Driver background:
Migration from rural to urban areas (more jobs in cities, better infrastructure)
E.g. in 2020 about 80% of the EU population will be living in urban areas (EC, 2013)

Source: EC (2012)

Pressure (rather local)**:**
Soil sealing (soil often irreversible lost), soil compaction, emission to air, water and soil

Degradation (rather local):
Degraded and lost soil

Impact (local as well as transboundary):
Loss of biodiversity, water stress, pressure on agricultural land (produce more on less land), floods

Transboundary impacts of soil degradation. Plenary session

Policy framework

Different regulations with indirect soil relevance (e.g. nitrate directive, emission regulation)

EU legislation transboundary by definition, but cross-boarder in practice rarely addressed

Water Framework Directive – A role model?

- Member State need to cooperate on managing transboundary waters
- Holistic approach of management
- Cross-sectoral approach
- Policy integration
- Several challenges involved, e.g.
  - High transaction costs (e.g. exchange, negotiations and cooperation)
  - Data availability and comparability

Identified gaps

What we have:

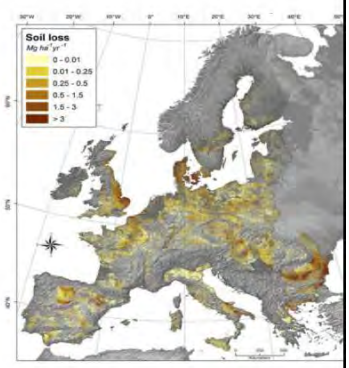
Information of the different forms of soil degradation in the EU and data on severity of degradation.

What we don´t have:

Due to the complexity of relationships it is very difficult to **measure** the proportion of **transboundary impacts and drivers.**

What is needed:

Provision of information (maps, figures, examples), especially permanently available quality-proven data.



Source: Borelli et al. (2017

Transboundary impacts of soil degradation. Plenary session

Aim of the afternoon workshop

For the report we still need evidence/information on pressures which are most relevant from a transboundary perspective.

Specific examples for and data on the transboundary impacts of degradation (e.g. urbanization soil sealing flooding damage costs).

Objectives:

- Specify and quantify pressures and impacts (ecological, economic and social) for specific drivers.
- Exchange examples
- Discuss the information and data needs to address transboundary impact of soil degradation.

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Soil ecosystem services. Plenary session

SOILS4EU:
Providing support in relation to the implementation of the EU Soil Thematic Strategy

Soil ecosystem services

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MAES Soil working group
EC DG Environment

The contribution of soil ecosystems to well being

Picture: sustainablesites.or

Soil ecosystem services. Plenary session

Ecosystem Services

Goods and services provided by ecosystems that directly and indirectly contribute to human well-being

The Common International Classification of Ecosystem Services (CICES)

- Provisioning services
- Regulation & Maintenance services
- Cultural services

Soils4EU & MAES Soil Pilot

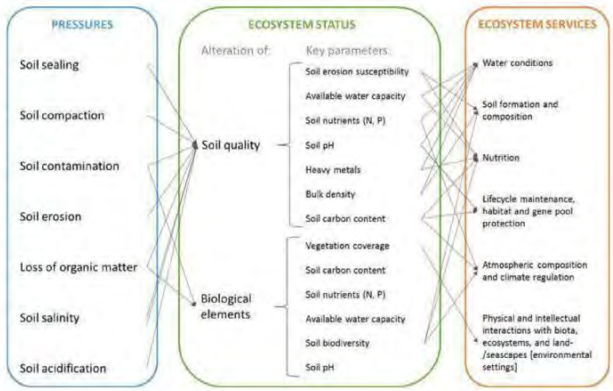
Increase awareness of the importance of soil functions, related ecosystem services and to show their value.

Show the need for protection, management and restoration of soil ecosystems and the need to make a more sustainable and efficient use of it.

EU Biodiversity Strategy - The Soil Thematic Strategy - 7th Environmental Action Programme 2014-2020

Soil ecosystem services. Plenary session

Soil ecosystem services:
the goods and services provided by ecosystems that directly and indirectly contribute to human well-being,, which are depending on soil



Picture: JRC, 2017

Soil ecosystem services

Provisioning services	Biochemical and pharmaceuticals
	Food, wood and fibre
	Fresh water
	Carrying capacity for infrastructure, buildings and animals
Abiotic provisioning services	Raw materials
	Thermal energy
Regulation and maintenance services	
Cultural services	

Soil ecosystem services. Plenary session

Soil ecosystem services

Provisioning services	Biochemical and pharmaceuticals
	Food, wood and fibre
	Fresh water
	Carrying capacity for infrastructure, buildings and animals
Abiotic provisioning services	Raw materials
	Thermal energy
Regulation and maintenance services	Water purification and soil contamination reduction
	Water regulation
	Biological control of pests and diseases
	Carbon Sequestration
	Regulation of greenhouse gasses
	Regulation of local climate/temperature
	Noise abatement
	Air quality regulation
Cultural services	

Photo by Merijn de Jong

Soil ecosystem services

Provisioning services	Biochemical and pharmaceuticals
	Food, wood and fibre
	Fresh water
	Carrying capacity for infrastructure, buildings and animals
Abiotic provisioning services	Raw materials
	Thermal energy
Regulation and maintenance services	Water purification and soil contamination reduction
	Water regulation
	Biological control of pests and diseases
	Carbon Sequestration
	Regulation of greenhouse gasses
	Regulation of local climate/temperature
	Noise abatement
	Air quality regulation
Cultural services	Recreation and tourism
	Knowledge/scientific research, Cultural heritage and education
	Spiritual and symbolic experience

Soil ecosystem services. Plenary session

Quantification of soil ecosystem services

USE  ECONOMIC VALUE 

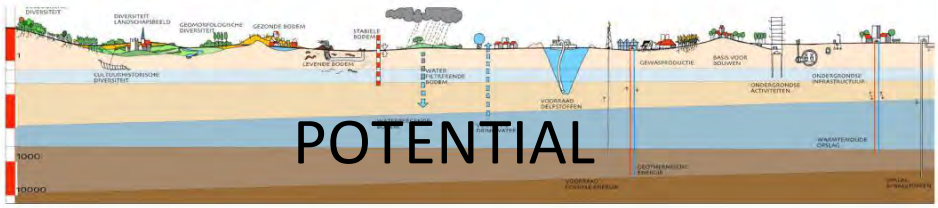
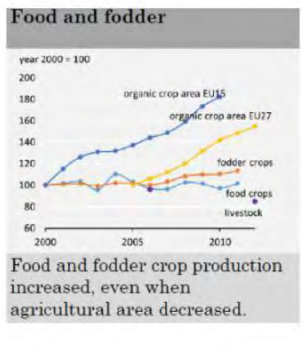
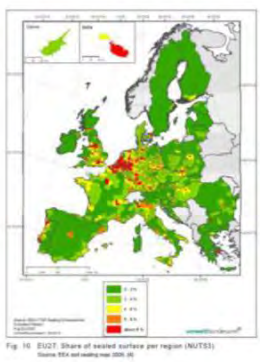


Figure subsurface: bodemvisie Groningen (Peter Dauvellier) en Ruimtexmilieu

Quantification of soil ecosystem services
some examples



Food, wood and fibre production



Regulation of local climate/temperature
Sealed surface

Knowledge/scientificresearch,Cultural heritage and education
Organics preservation capacity

Picctures: MAES et al., 2015; Prokop et al., 2011, Kibblewhite et al., 2015

Soil ecosystem services. Plenary session

Impact of land- and soil management practices on soil ecosystem services

Urban areas:

- Measures to reduce soil sealing by buildings and infrastructure
- Measures to reduce compaction
- Management of man induced soil subsidence
- Prevention and remediation of contamination and salinization
- Maintaining or increasing carbon storage in urban soils

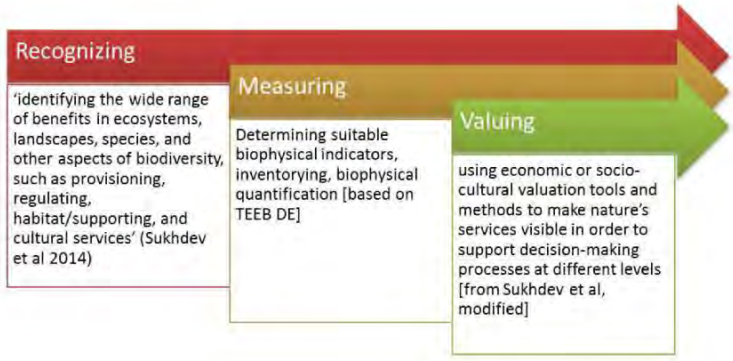
Impact of land- and soil management practices on soil ecosystem services

Agricultural areas:

- Conservation agriculture:
  Tillage reduction, crop residue management, crop rotations
- Water management
  Land management oriented to increase soil water infiltration,
  Land management oriented to decrease soil water pollution
- Grazing management

Soil ecosystem services. Plenary session

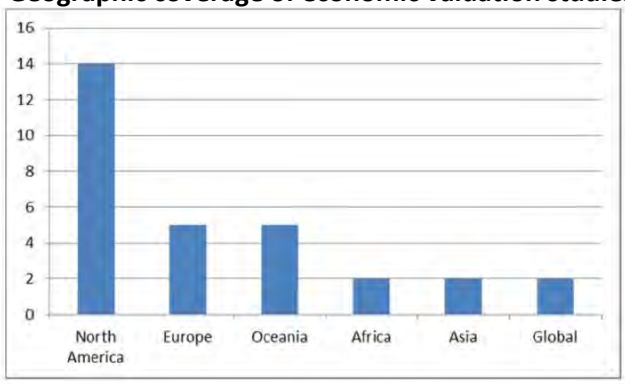
The value of benefits from soil ecosystem service



The valuation cascade from recognition and identification, through (biophysical) measurement to (economic) valuation (based on Sukhdev et al. 2014 and Natural Capital Germany – TEEB DE 2017).

Valuation studies soil ecosystem services

Geographic coverage of economic valuation studies



Distribution of economic valuation studies of soil ESS according to Jónsson and Davíðsdóttir (2016)

Soil ecosystem services. Plenary session

Conclusions

Which ecosystem services to include in a soil assessment?

- Overview of soil ESS
- Some less obvious, especially in urban context
- Cultural services: overlaps between services and the role of soil could be further elaborated

Conclusions

The impacts of land and soil management practices on ESS

- Optimal management depends on ESS demand and on local soil characteristics.
- Some practices impact many ESS or specific bundles of ESS.
- Information on the status of potential provision and demand for ESS can be used to prioritize management actions to enforce specific services.
- Stimulate management practices that enforce multiple ecosystem services or to mitigate adverse impacts.

Soil ecosystem services. Plenary session

Conclusions

The status of soil ESS: what we know about potential and use

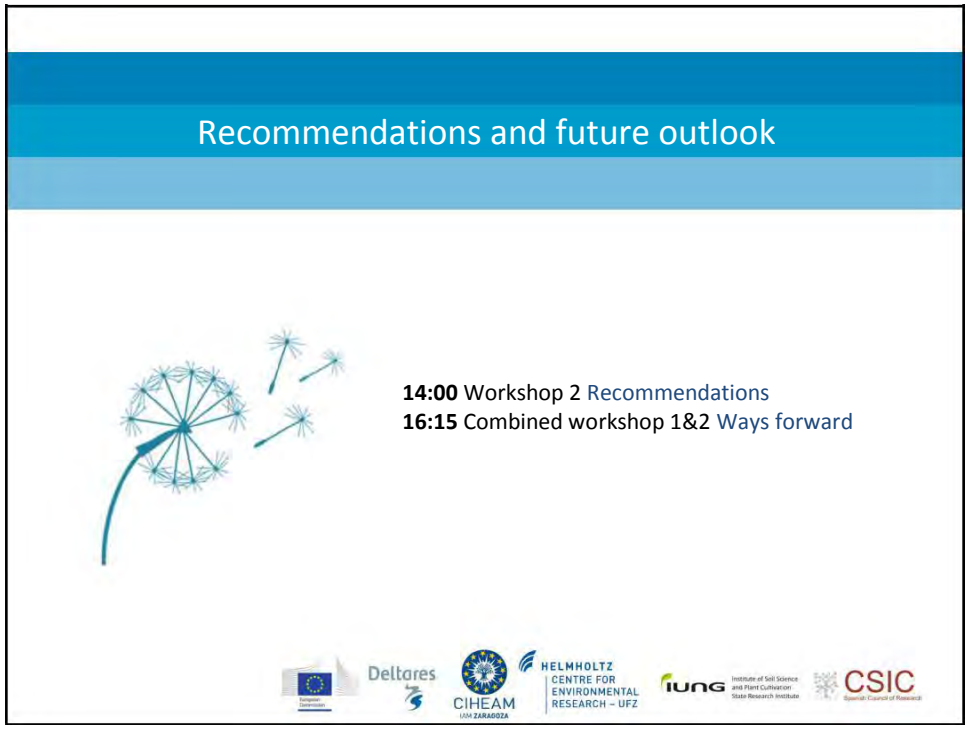
- For provisioning services, production and abstraction is well documented.
- What causes the increase or decrease and what is the role played by soil (quality)?
- Indications for unsustainable use of agricultural production
- Regulating services: the role of soil is hidden in integrative indicators
- For some regulating services required level of spatial detail is a challenge

Conclusions

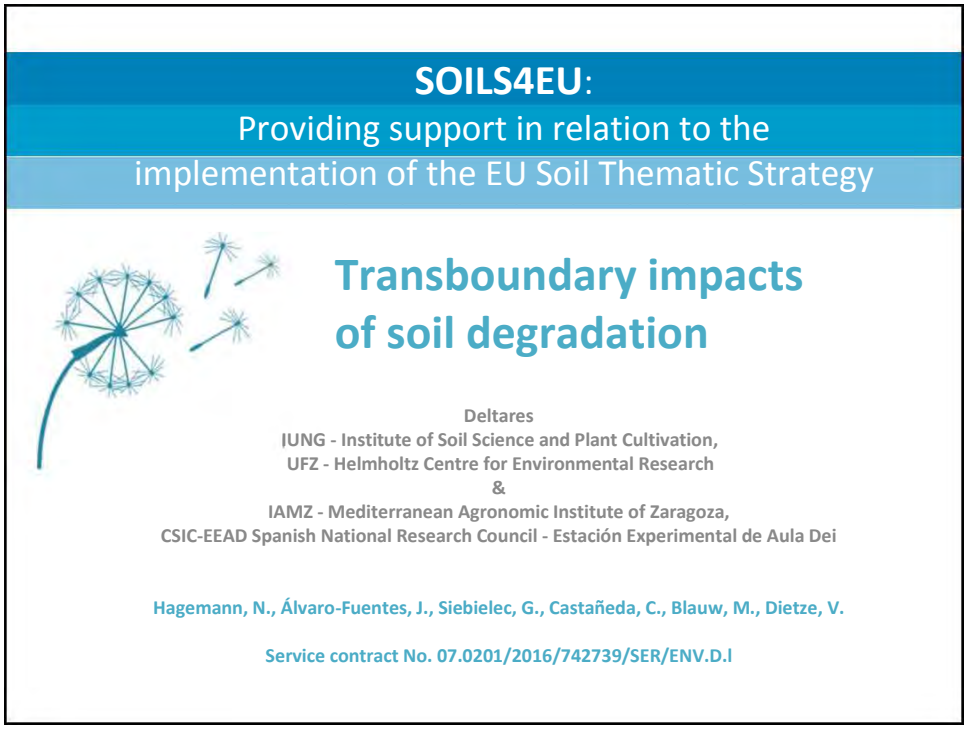
The economic impact of changes in ESS

- The estimation of the economic value of soil ESS can inform decision-making on soils
- Economic valuation of soil ecosystem services is still a nascent area of research where research gaps abound.
- Particularly, there are very few economic valuation studies of soil ESS conducted in Europe.
- Virtually all economic valuation studies of soil ecosystem services focus on agricultural contexts.
- The available studies use very diverse, qualitatively divergent methods and approaches, which makes their results hardly comparable.
- The field mainly provides insights into the economic value of soil ESS in orders of magnitude.

Soil ecosystem services. Plenary session



Workshop 1. Transboundary impacts of soil degradation



Workshop 1. Transboundary impacts of soil degradation

Background information

What we have:

Information of the different forms of soil degradation in the EU and data on severity of degradation.

What we don´t have:

Due to the complexity of relationships it is very difficult to **measure** the proportion of **transboundary impacts and drivers.**

What is needed:

Provision of information (maps, figures, examples), especially permanently available quality-proven data.

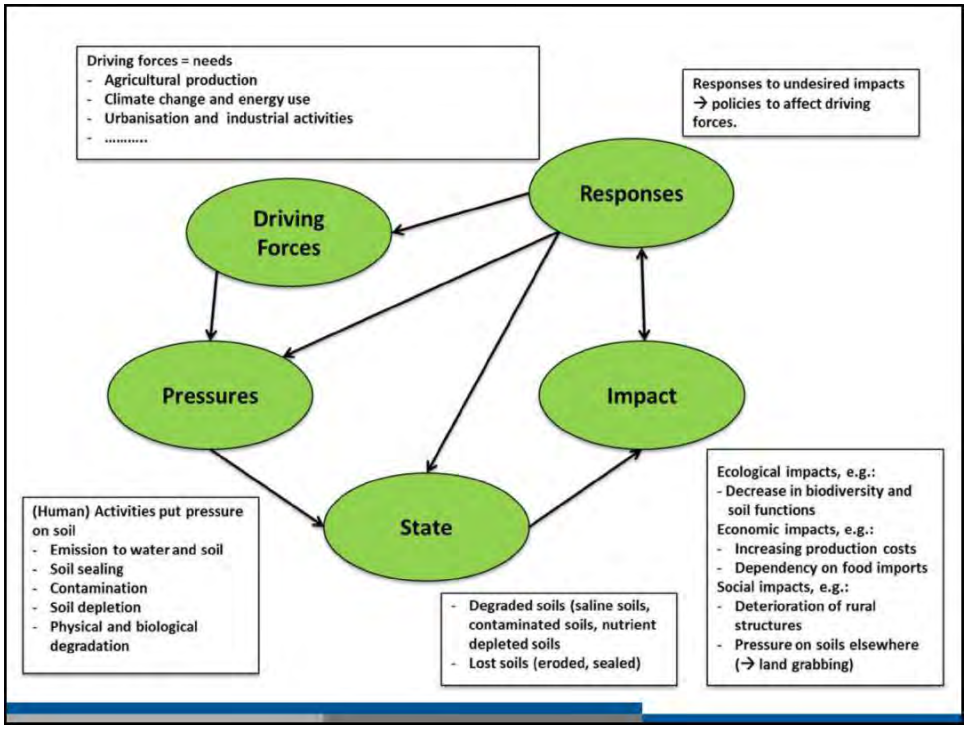
Aim of the workshop

- Specify and quantify pressures and impacts (ecological, economic and social) for specific drivers.
- Discuss examples
- Discuss the information and data needs to address transboundary impact of soil degradation.
- Format: Working groups

Workshop 1. Transboundary impacts of soil degradation

Questions on the report?

1. Introduction
2. Societal challenges of transboundary impact
3. Drivers and transboundary impact of soil degradation
   - 3.1 Natural conditions (climate, topography, soil properties)
   - 3.2 Land use changes
   - 3.3 Land management (including agricultural practices)
   - 3.4 Urbanization and development of infrastructures
   - 3.5 Consumption patterns and economic drivers
4. Identification of key challenges to address transboundary impacts
5. Recognition of transboundary impact in policies
6. Need for actions



Workshop 1. Transboundary impacts of soil degradation

Introduction to working groups I

Three groups, each working on one specific driver

- Agricultural production
- Urbanisation and industrial activities
- Climate change and energy security

Guiding questions for each table

Each table has a convenor (project team)

After 25 minutes participants can move from one table to another

Introduction to working groups II

Afterwards:

Reporting back the results of the discussion to the plenary of workshop 1 (outlining specific examples) – allowing other participants to add.

Reporting back key messages in workshop 3 (3 minutes per working group).

Workshop 2. Soil ecosystem services

SOILS4EU:
Providing support in relation to the implementation of the EU Soil Thematic Strategy

Soil ecosystem services

Deltares
IUNG - Institute of Soil Science and Plant Cultivation,
UFZ - Helmholtz Centre for environmental research
IAMZ - Mediterranean Agronomic Institute of Zaragoza,
CSIC-EEAD Spanish National Research Council - Estación Experimental de Aula Dei
MAES Soil working group
EC DG Environment

Workshop set up

time	topic	name
2:00-2:15	Welcome intro of people Aim of the workshop	Linda
2:15-2:40	Presentation key recommendations and motivations	Bartosz
2:40-2:50	Time for questions	all
2:50-3:30	4 working groups	Linda Bartosz Bavo Nele
3:30-3:45	Wrap up: key outcomes / ways forward	Group leaders

Workshop 2. Soil ecosystem services

Land- and soil management practices

Recommendations for practical soil management and policy making:

- Integrally consider the *potential* provision of ESS, *demand* for these services and *trade-offs* between ESS to determine whether the use of soil is sustainable.
- Analysis of potential supply and demand of ESS should be spatially and temporally specific.
- Stimulate practices that enhance multiple ESS

Which ecosystem services to include in a soil assessment?

Provisioning services	Biochemical and pharmaceuticals
	Food, wood and fibre
	Fresh water
	Carrying capacity for infrastructure, buildings and animals
Abiotic provisioning services	Raw materials
	Thermal energy
Regulation and maintenance services	Water purification and soil contamination reduction
	Water regulation
	Biological control of pests and diseases
	Carbon Sequestration
	Regulation of greenhouse gasses
	Regulation of local climate/temperature
	Noise abatement
	Air quality regulation
Cultural services	Recreation and tourism
	Knowledge/scientific research, Cultural heritage and education
	Spiritual and symbolic experience

Workshop 2. Soil ecosystem services

Which ecosystem services to include in a soil assessment?

Recommendations for practical soil management and policy making:

- Structural analysis on the impact of their decisions on ecosystem services for well informed decisions.
- Start with a broad analysis

Recommendations for future research:

- For consistent use of cultural soil ESS, it would be helpful to refine the definition and to further assess the role of soil.

Information quantity of potential and use of soil ecosystem services

Recommendations for future research:

- Assess the relation between change in flows of provisioning services (harvest), the potential supply of provisioning services and the role of soil in potential supply.
- For regulation and maintenance services extract the role of soil
- Be aware of the required level of spatial detail
- When indicators for ESS potential are lacking, a combination of indirect indicators can provide insight in the potential. New maps in which these indicators are combined would be useful to be produced in the future.

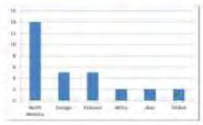
Workshop 2. Soil ecosystem services

Valuation studies soil ecosystem services

Recommendations for future research:

- Much effort in developing soil-specific approaches to economic valuation would be needed.
- More focus on non-agricultural contexts (e.g. urban soil ESS)

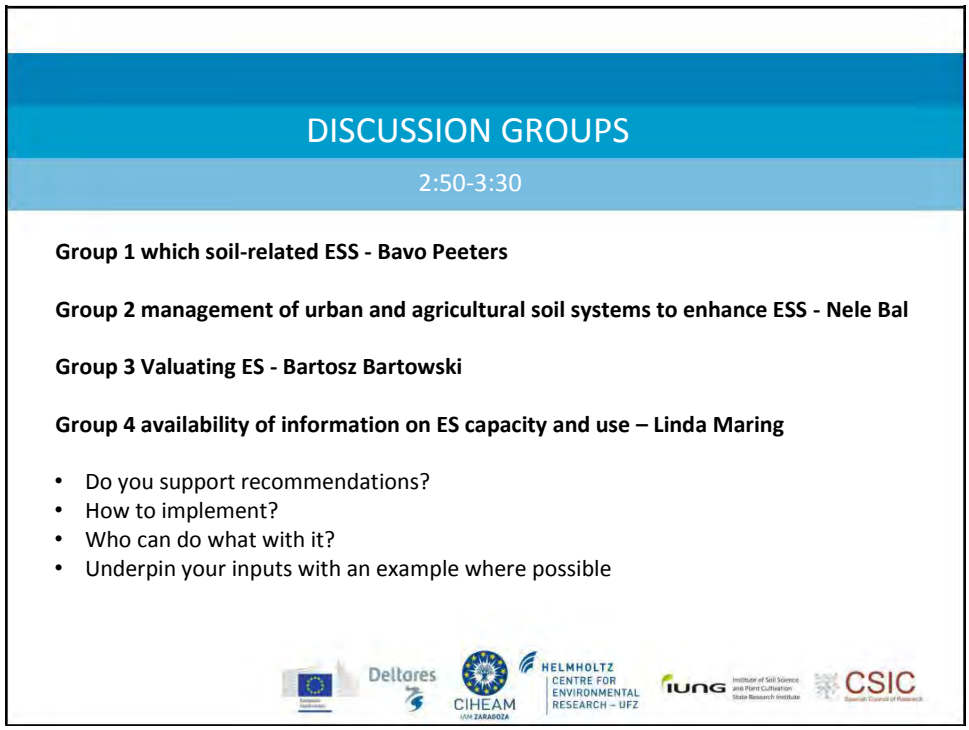
  and more research in Europe will improve the availability of information for decision makers in Europe.



TIME FOR QUESTIONS

Up to 2:50

Workshop 2. Soil ecosystem services



Combined workshop. Transboundary effects of soil degradation & Soil ecosystem services

SOILS4EU:
Providing support in relation to the
implementation of the EU Soil Thematic Strategy

Combined workshop Transboundary effects of soil degradation & Soil ecosystem services

Deltares
IUNG - Institute of Soil Science and Plant Cultivation,
UFZ - Helmholtz Centre for environmental research
IAMZ - Mediterranean Agronomic Institute of Zaragoza,
CSIC-EEAD Spanish National Research Council - Estación Experimental de Aula Dei
MAES Soil working group
EC DG Environment

Workshop set up

time	topic	name
4:15-4:25	Welcome intro of people Aim of the workshop	Linda
4:25-4:50	Key messages of group discussions WS 1 and 2	Group facilitators
4:50-5:05	Overarching messages and questions	all
5:05-5:15	Concluding remarks	DG ENV
5:15	Cocktail	

Combined workshop. Transboundary effects of soil degradation & Soil ecosystem services

KEY MESSAGES

Transboundary effects
- Agriculture - Jorge
- Urbanisation and industry - Maaike
- Climate change and energy - Josiane

ESS
- Kind of ESS to consider – Bavo
- Management of soil ess - Nele
- Valuation of ESS - Bartosz
- Availability of information - Linda

Both groups

Both groups
- Importance of temporal and spatial scales
- Holistic approach– not isolated, processes , many impacts, both state of the soil and management / use
- Stakeholder involvement
- Communication
  - Sense of urgency
  - awareness raising
- Definitions/ What do we mean with concepts

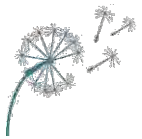
Combined workshop. Transboundary effects of soil degradation & Soil ecosystem services

CONCLUSION

- Conclusion DG ENV
- What's next

Thank you

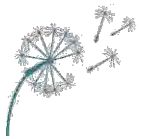
Annex 2 .- List of Participants



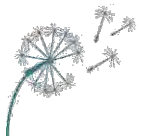
Soils4EU workshops on "Transboundary effects of soil degradation" (WS1) and on "Soil ecosystems and their services" (WS2)
4 December 2017, Brussels (Belgium)

LIST OF ATTENDANTS TO THE WORKSHOPS

	Surname	Name	Institution	Country	WS 1	WS 2	Combined
1	Alvaro-Fuentes	Jorge	CSIC - Higher Council of Scientific Research	Spain	X		X
2	Bizjak	Aleš	Slovenian Water Agency	Slovenia	X		X
3	Blauw	Maaike	Deltares	Netherlands	X		X
4	de Wit	Han	Tauw bv	Netherlands	X		X
5	Dere	Christelle	European Commission	Belgium	X		X
6	Geissen	Violette	WUR - Wageningen University & Research	Netherlands	X		X
7	Getz Escudero	Arthur	Urban PlanEat	Spain	X		X
8	Hagemann	Nina	UFZ - Helmholtz Centre for Environmental Research	Germany	X		X
9	Havlicek	Elena	Federal Office for the Environment	Switzerland	X		X
10	Horta	Maria do Carmo	Instituto Politécnico de Castelo Branco	Portugal	X		X
11	Jakisch	Gerhard	EU-Co-Fin consult	Austria	X		X
12	Jones	Arwyn	European Commission Joint Research Centre	Italy	X		X
13	Lafeuille	Christine	Métropole Européenne de Lille	France	X		X
14	López Marco	Lucía	IAMZ-CIHEAM -Mediterranean Agronomic Institute of Zaragoza	Spain	X		X
15	Masson	Josiane	European Commission, DG Environment	Belgium	X		X
16	Molenaar	Co	Ministry of Infrastructure and Water Management	Netherlands	X		X
17	Paulette	Laura	University of Agricultural Sciences and Veterinary Medicine	Romania	X		X
18	Pietola	Liisa	MTK - Federation of Agricultural Producers and Forest Owners / COPA-COGECA	Finland	X		X
19	Schneider	Christian	Leipzig University	Germany	X		X
20	Seitz	Steffen	University of Tübingen	Germany	X		X
21	Swerts	Martine	Government of Flanders	Belgium	X		X
22	Van der Meulen	Suzanne	Deltares	Netherlands	X		X
23	Visser	Saskia	WUR - Wageningen Environmental Research	Netherlands	X		X



	Surname	Name	Institution	Country	WS 1	WS 2	Combined
24	Abdul Malak	Dania	University of Malaga	Spain		X	X
25	Aleinikoviene	Jurate	Aleksandras Stulginskis University	Lithuania		X	X
26	Antunes	Maria Dulce	University of Algarve	Portugal		X	X
27	Armolaitis	Kęstutis	Institute of Forestry, Lithuanian Research Centre for Agriculture and Forestry	Lithuania		X	X
28	Bal	Nele	OVAM - Public Waste Agency of Flanders	Belgium		X	X
29	Bampa	Francesca	WUR - Wageningen University & Research	Netherlands		X	X
30	Bartkowski	Bartosz	UFZ - Helmholtz Centre for Environmental Research	Germany		X	X
31	Cappuyns	Valérie	KU Leuven - Katholieke Universiteit Leuven	Belgium		X	X
32	Chovancova	Svetlana	European Commission	Czech Republic		X	X
33	Cotič	Boštjan	Urban Planning Institute of the Republic of Slovenia	Slovenia		X	X
34	Dejonckheere	Aline	Public Service of Wallonia	Belgium		X	X
35	D'Hose	Tommy	ILVO - Institute for Agricultural and Fisheries Research	Belgium		X	X
36	Garcia Blanco	Gemma	Fundación TECNALIA Research & Innovation	Spain		X	X
37	Haavisto	Teija	Finnish Environment Institute	Finland		X	X
38	Hénault	Catherine	INRA - Institut National de la Recherche Agronomique	France		X	X
39	Hladík	Jan	Regional Development Agency of South Moravia	Czech Republic		X	X
40	Huber	Sigbert	Environment Agency Austria	Austria		X	X
41	Huysegoms	Lies	KU Leuven - Katholieke Universiteit Leuven	Belgium		X	X
42	Jackson	Karen	Canal & River Trust	United Kingdom		X	X
43	Kaipainen	Jaana	Ministry of Agriculture and Forestry	Finland		X	X
44	Kozova	Maria	Catholic University in Ruzomberok, Department of Geography	Slovakia		X	X
45	Krüger	Inken	Université de Liège	Belgium		X	X
46	Lopez-Francos	Antonio	IAMZ-CIHEAM - Mediterranean Agronomic Institute of Zaragoza	Spain		X	X
47	Maring	Linda	Deltares	Netherlands		X	X
48	Peeters	Bavo	European Commission	Belgium		X	X
49	Pons	Manon	European Institute for Energy Research	Germany		X	X
50	Potthoff	Martin	Center of biodiversity and sustainable land use, University of Göttingen	Germany		X	X
51	Rothwell	Avril	Department of Agriculture, Food and the Marine	Ireland		X	X
52	Salomez	Joost	Government of Flanders	Belgium		X	X



	Surname	Name	Institution	Country	WS 1	WS 2	Combined
53	Schroeder	Pia	Representation of the Freestate of Bavaria to the EU	Germany		X	X
54	Staehli	Ruedi	Federal Office for the Environment	Switzerland		X	X
55	Staes	Jan	University of Antwerp	Belgium		X	X
56	Trombetti	Marco	-	Italy		X	X
57	Van Looy	Kris	Agrosphäre Institute Bio- and Geosciences IBG-3, Research Center Jülich	Germany		X	X
58	Verboven	Jan	VLM - Flemish Land Agency	Belgium		X	X
59	Vojvodíková	Barbara	IURS - Institute for Sustainable Development of Settlements	Czech Republic		X	X
61	Le Guern	Cécile	BRGM - Bureau de Recherches Géologiques et Minières	France			X
60	Merly	Corinne	BRGM - Bureau de Recherches Géologiques et Minières	France			X
62	Tóth	Attila	Slovak University of Technology in Bratislava, Institute of Management	Slovakia			X
63	Zakharchenko	Elina	Sumy National Agrarian University	Ukraine			X

Annex 3 Photos

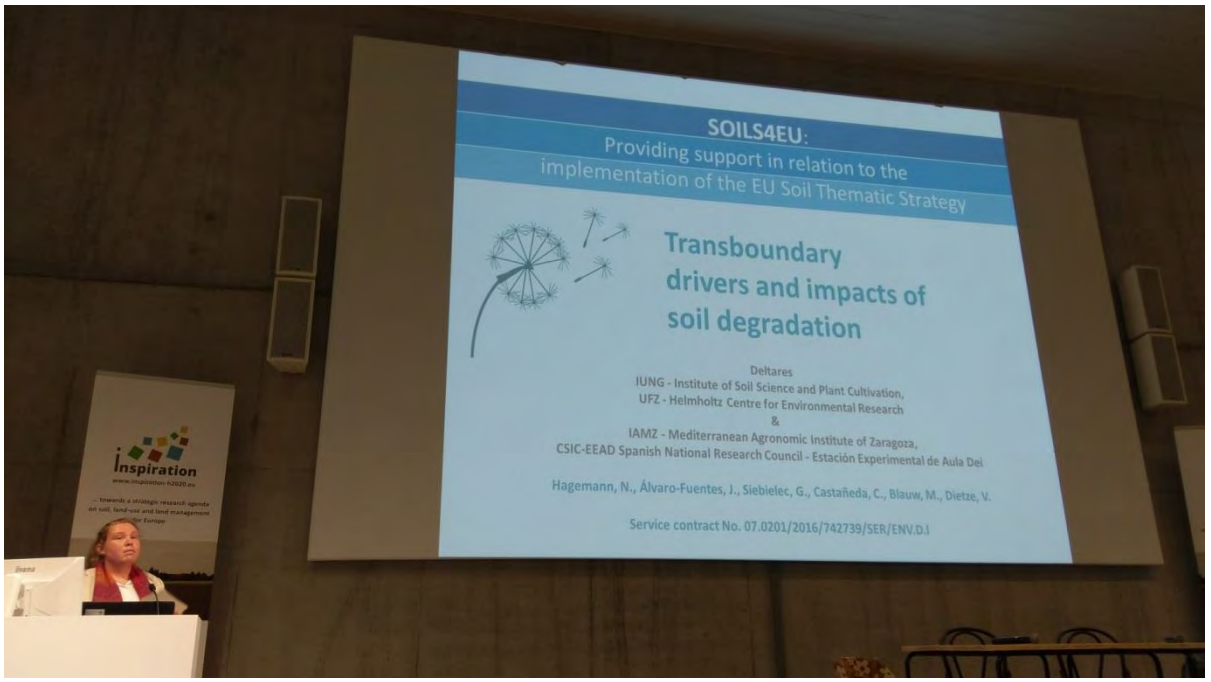


Photo 1. Nina Hagemann presents the report 1-*Transboundary efects of soil degradation – Challenges and ways ahead* to the plenary in the morning session.

Photo 2. Linda Maring introduces the report 2 - *Soil related ecosystem services – status, trends and value* to the plenary in the morning session.

Photo 3. Attendants to the morning session

Photo 4. Nina Hagemann starts the Workshop 1 *Transboundary effects of soil degradation in the EU.*

Photo 5. Maaike Blauw facilitating the discussion group on *Urban and industrial soils* (WS1).

Photo 6. Jorge Álvaro-Fuentes facilitating the discussion group on *Agricultural and forest soils (*WS1).

Photo 7. Linda Maring introduces Workshop 2 *Soil ecosystems and their services*

Photo 8. Bartosz Bartkowski facilitating the working group on *Valuating ESS* (WS2).

Photo 9. Nele Bal facilitating the working group on *Management of urban and agricultural soil systems to enhance ESS* (WS2).

Photo 10. Combined workshop.

Photo 11. People participating at the combined workshop.