Research Practice Report

Research Practice Report Law Group

Master Program of Environmental Sciences

Law For Healthy Soils

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Contents

List of abbreviations

Abbreviation	Full Name
ES	Ecosystem Service(s)
MS	Member State(s)
NUTS	Nomenclature of territorial units for statistics
EU	European Union
SDG(s)	Sustainable Development Goal(s)

1. Introduction

Part of my Masters curriculum requires the completion of an internship or research practice. During the last 4 months I worked as a research practitioner within the Law Department, helping with the “(Re-)thinking soil law across spatial and temporal scales” project. One of the outputs of my research practice is a research practice report, a document where the main points of my research are highlighted and discussed. In this report I will explain the main topic of my research practice, bridging the gap between soil science and law making. This is done through using the proposal Directive for soil monitoring and resilience as a case study to understand where uncertainty unfolds in the law-making process. This first part is then followed by some personal projects, stemming from learning goals completed during the research practice period. These project tie into the overarching research topic but have only been discussed in this report and are not part of other documentation.

To better understand why this project focuses especially on soil, the importance of safeguarding soil needs to be highlighted. Soil, defined as “the top layer of the Earth’s crust situated between the bedrock and the land surface, which is composed of mineral particles, organic matter, water, air and living organisms” (European Commission, 2023) is one of the most important living systems on our planet. With growing urgency to fight climate change and achieving sustainability, it is important to acknowledge that soils are not just a medium for crops to grow and food production. Soils serve different functions as healthy soil has been defined as being able “to function as a vital living system within ecosystem and land use boundaries to sustain plant and animal production, maintain or enhance water and air quality, and promote plant and animal health.”(Doran & Zeiss, 2000). Healthy soils are essential for human society, human health is impossible to achieve without considering soil health. This is why soil science is becoming increasingly important to also achieve sustainability goals set by international organizations (e.g. SDGs) (Lal et al., 2021).

Even putting aside human society, soil is extremely important to all life forms. According to the most recent approximations, the soil is home to at least a quarter of all living organisms on Earth, including everything from microbes to mammals, making it the singular most biodiverse habitat on Earth (Tibbett et al., 2020). Biodiversity is extremely important for soil as all the functions happening within soil would not be possible without high degrees of species diversity. At the same time, we cannot protect biodiversity without preserving soil quality.

International institutions have been active in taking measures to fight environmental issues. One of the most active has been the European Union (EU) through policy making for environmental protection (Cifuentes-Faura, 2022). Even though these are all pressing issues, soil biodiversity is barely protected through existing legal frameworks, and the current design of our legal systems is poorly equipped to deal with the scientific reality of soil system functioning (Paleari, 2017).

Current laws and policies are not accurately covering soil health, and this is also noticeable within the European Union. Soil degradation has been increasing (Jones et al., 2010) due to erosion, organic matter decline, contamination and water erosion. The biodiversity in the soil is declining (Köninger et al., 2022). There is currently no European-level framework accounting for these issues (Bowyer et al., 2017; Paleari, 2017; Vrebos et al., 2017), because soil law is diversified between member states. Every Member State has its own national legislation tackling soil-related issues. Moreover, at the Union level different aspects of soil challenges are addressed in a plethora of EU laws, not necessarily directed to soil protection, but this has not been enough to stop the current decline in soil quality (Paleari, 2017).

1.2 EU approach and proposal for a Directive

In July 2023 the EU proposed a new Directive for Soil Monitoring and Resilience. The goal of this proposal is to commit to the 2030 Agenda for Sustainable Development (European Commission, 2023). The Directive aims at creating a "solid and coherent soil monitoring framework for all soils across the EU, which will address the current gap of knowledge on soils". To do so the law also defines soil health harmonically between all the Member States and lays down guidelines about sustainable soil management. The Directive is still going through the EU legislative process. The first version was proposed by the Commission, then the Parliament suggested amendments, and now, but if approved it would be the first ever legislation to build a framework for soil around the European Union, unifying all the differences between MS.

The proposal sets some Important definitions of soil, like soil health and quality. The core part of the proposal can be summarized in three main pillars:

- Monitoring and assessment of soil health
- Sustainable soil management
- Contaminated sites

The first pillar of the proposal focuses on giving a generalized definition of "soil health", linking it to the capacity of soil to provide ecosystem services. In doing so, a set of indicators are put forward for member states, these indicators are to be used to assess and monitor the health of soils around Europe.

The second pillar lays down specific principles and practices to enable sustainable soil management. The proposal lists some key principles, and then it's up to the member states to decide which practices better represent these principles. Member States should also focus on practices that are negatively affecting soil health so that they can be avoided.

The third pillar is focused on pollution and contamination of soil. Contamination and risk are well defined within the scope of soil. Member States oversee managing risks for human health and the environment of contaminated sites while keeping them to acceptable levels.

As can be seen through the Directive Articles, the proposal makes the perfect example of an attempt to bridge soil science and law. This makes for the perfect case study for the "(Re-)thinking soil law across spatial and temporal scales" initiative, from the Law Department of Wageningen University and Research.

1.2 (Re-)thinking soil law across spatial and temporal scales.

This research practice is part of the already ongoing project called "(Re-)thinking soil law across spatial and temporal scales", proposed by Dr. Edwin Alblas and funded through the "Biodiversity-positive food systems" project from Wageningen University. The project "(Re-)thinking soil law across spatial and temporal scales" aims to bring together soil scientists and lawyers, to fill the regulatory gap surrounding soil health.

This initiative aims to deepen and expand the shared learning efforts within the WUR Soil Taskforce to (re-)think what effective soil laws could look like in light of recent advances in soil science. It builds on previous efforts to bridge soil science and legal disciplines within the task force's framework. The aim is to identify inconsistencies between the functioning of law and soils by conducting a series of interactive, in-depth workshops among experts. This will also serve as a first step towards developing principles to address the current challenges in effective soil governance.

The synthesis of findings will culminate In an agenda-setting scientific article, offering insights into the past, present, and future of soil science-supported soil health laws, along with an accessible booklet that serves to open up this debate across and between scientific, policy, and civil society communities to promote mutual learning and discussion in favor of evidence-based future legislation.

In order to build a fruitful workshop, the initial stages of this project include the creation of a positioning paper to share with the workshop's attendees. The paper has the goal to synthetize the current proposal Directive and highlight the main uncertainties with the law. This will ensure that the workshop will produce quality discussions regarding the most critical topics. The research practice will help in achieving the first stages of the project, mainly in the completion of a positioning paper to frame the current problems with soil law and share this information during the workshops.

1.2.1 Research proposal topic within the wider scientific context.

The WUR project and the Directive tackle different challenges afflicting soil sciences and law, for the sake of feasibility, the Research Practice is only focusing on some of these aspects. Within the wider scientific context of (Re-)thinking soil law across spatial and temporal scales this research practice focuses particularly on Monitoring and assessment of soil health, and how they are conceptualized within the Soil Directive. This means that the first pillar of the directive is the main subject of this Research Practice.

This report has two main sections. The first part, analyzing the Directive first pillar, is part of my work for the project and the positioning paper. This section includes a review of the current Directive articles regarding health assessment and highlights the points where the current proposal shows signs of uncertainty. This analysis was used to as a part of the positioning paper and is mainly linked to the goals of the WUR project.

The second part ties to this first section but is more related to my personal learning goals. Two 6’

main learning goals have been motivating me through this Research Practice. The former (1) regards the ability to better understand national environmental legislations, and how they are impacted by EU regulations. The latter (2) being the continuation of my Python coding learning journey. To accomplish these goals this report includes firstly (1) a comparison of current Italian and Dutch soil health assessment requirements, and secondly (2) a text analysis of the proposal Directive that has partly been done through Python coding. The next paragraphs will explain more clearly the goal and scope of such initiatives.

1.2.2 Research Question

The main question on which the project is build is the following:

How can we make soils visible before the law and enhance their protection?

This is also the research question that my Research Practice was helping answering. This research report is the summary of my work aimed at accomplishing this goal.

2. Methodology and Research scope

The research practice had different stages, associated with different project that had different methodologies. To accomplish all the goals of this research practice, the methodology is composed of (1) legal analysis (2) a literature review, (3) Python coding, (4) Qualitative text analysis. Each method is explained further in this section.

2.1 Legal analysis

The first part of the research practice, and this report, is aimed at understanding and evaluating the proposal Directive for soil monitoring and resilience. The Directive is still undergoing the policy process to be approved, this meant that during my research practice we analyzed different versions of the proposal. As can be seen in Figure x, three proposal have been discussed so far. The first one from the EU Commission, then the EU parliament proposed a new version updated with amendments. Lastly the Council published another version, that is the one that is being considered now. This legal analysis is mainly focused on the Council version of the proposal. If there are references to any other version it is promptly addressed in the text.

Date	Legislative stage	EU institution	Information
05-07-23	Legislative proposal published	EU Commission	COM(2023)0416
10-04-24	Decision by Parliament, 1st reading	EU Parliament	T9-0204/2024
17-06-24	Council's position	Council of the EU	2023/0232

Figure 1 Table with different versions of the Directive

2.2 Literature review

A literature review was conducted to build a solid knowledge base for the positioning paper and to sustain my own personal project of comparing Italy and The Netherlands. To comprehensively understand all the implications of the proposal Directive it is necessary to have a clear picture of the current situation and problems of soil science in Europe. Moreover, to further accomplish the aim of the research practice, more research is needed to understand the current health assessment framework in The Netherlands and in Italy. Research engines like Google Scholar, Scopus, and Research Gate are the main tools of finding scientific articles and academic documents, but the project is also interested in national legislation and practices. To find more information about the single countries, databases like FAOLEX, ISPRA, and National Environmental Ministries databases are used to gather the current soil management practices in each Member State.

As stated before, to accomplish my learning goals a literature review regarding soil health assessment in Italy and the Netherlands is needed. The goal of the research is to compare this information and note the differences between the two countries taken into consideration.

As it currently stands, each European country has different standards and methodologies for assessing the health of soils. These differences come from missing an overarching framework regarding soil monitoring at the EU level. Consequently, it can be expected that major differences between countries can be found in how soil assessments are performed.

The soil health assessment practices are going to be compared to what the new Directive expects of these countries. A qualitative analysis is going to be focused on understanding the current health assessment trends and comparing them. When possible, the result of this literature review is going to be compared to the soil descriptor proposed in the Directive.

2.2.1 Multiple case studies design

The choice of comparing two case studies, Italy and The Netherlands comes from the problem statement itself. There is a great difference between soils around Europe, hence a great difference in how these soils are managed. Focusing on a single case would not be suited in handling the heterogeneity of legal frameworks around Europe regarding soil health assessment and would result in narrow and incomplete results for the Directive itself. Moreover, using more than a single case study will also increase the validity of the results as they will be applicable in more contexts (Gustafsson & Gustafsson, 2017).

2.3 Python Coding

As part of my learning goals, I have attended two online courses provided by Harvard University. The first one being HarvardX: CS50's Introduction to Programming with Python and HarvardX: Using Python for Research. The former course is an introduction to programming using a language called Python. The main learning outcomes are understanding how to read and write code as well as how to test and "debug" it. The latter first reviewes the basics of Python 3, and then introduces tools commonly used in research settings such as NumPy and SciPy modules for research applications.

I have applied these new learned skills to my “bindingness analysis”, an analysis with the aim of understanding how “binding” each version of the proposal is. To do so the Python code is used to read and analyze the text of each Directive, count the number of certain words and then use these information to give a score to each proposal. The higher the score, higher the “bindingness” of the Directive.

The code lines are store in GitHub and can be found at: https://github.com/aledibe14/Research-Practice-Soil-Law

2.4 Qualitative text analysis

Even though the analysis done through Python is extremely accurate, it is not possible to fully comprehend each version with just that method. Every version has differences that are not expressed just through words, but also by longer sentences and exceptions that are impossible to capture if not by humanly analyzing each version. The Coding analysis is used as a starting point for this qualitative analysis. Thanks to the result from the Python code it is easier to understand where most changes happened, and show with more quantitative data these differences. The qualitative analysis acts as a supplement to these results, helping further understand and explain changes.

Practically this means going through the different versions of the Directive, and discussing the main changing points between the different proposals.

2.5 Soil talk

Part of my research practice has also been attending meetings and discussions regarding soil health with experts. The most important and fruitful was attending “Soil talk”, presented by dr. Maria Briones from Vigo University in Spain. The topic of the talk was mainly about how the Directive might use methodologies that are not up to date and could use more input from soil scientists currently working on these issues.

3. Result

The Directive's first pillar is focused on creating a framework for monitoring and assessing soil health. It does so by building on different concepts. For the purpose of this report the focus is on Ecosystem Services, Soil health monitoring and Soil Districts. These topics are all introduced and discussed through the first pillar of the proposal.

3.1 Health assessment in the first pillar of the Directive

Soil health is one of the cornerstones of the proposal, the Directive defines soil health as related to the ability of soil to deliver ecosystem services. As defined by the Directive, “soil health’ means the physical, chemical and biological condition of the soil determining its capacity to function as a vital living system and to provide ecosystem services (Art. 3(4))”. Ecosystem services can be conceptualized as the benefits that people or society derive from ecosystems, which are usually classified as supporting, provisioning, cultural, and regulating services (Peng et al., 2023).

Thanks to the directive, a harmonized definition of soil health has been proposed. The goal is to simplify and establish a common framework on how health assessments are conducted around Europe. So, as suggested by the directive itself, the next step is to implement a system of monitoring to ensure that predetermined levels of soil indicators are reached (Art. 3). It is rather challenging to scientifically assess and manage soil health due to the complexity and interconnectedness of soil processes, this is why the directive laid down a set of indicators in its Annexes. These Annexes create a measurable guideline that all Member States should follow.

In the Directive, soil health assessment is explained as the evaluation of the health of the soil based on the measurement or estimation of soil descriptors. These soil descriptors are parameters describing a physical, chemical, or biological characteristic of soil health. These soil descriptors are listed in the Annexes and are meant to characterize the different aspects of soil degradation (Art. 3). Each descriptor has a criteria, a measurable value that sets the limit for what is considered healthy soil.

3.1.1 Soil monitoring and sampling

Defining and monitoring soil health is a complex and costly task, as there are different aspects of soil health that all require scientifically robust indicators that need to be measured across space and over time. At the European Union level, soil properties are monitored through the LUCAS program since 2009 (Orgiazzi et al., 2022). The program entails periodic, harmonized surveys across Member States. This topsoil survey represents the first attempt to build a consistent spatial database of the soil cover across the EU. This is only a part of all the different facets of soil health monitoring, and without considering other emerging indicators like ecosystem services (Lehmann et al., 2020).

Soil monitoring conceptualized in the Directive

The Directive lays down descriptors associated with criteria and methodologies for monitoring soil health. In the proposal, soil health is defined as the physical, chemical and biological condition of the soil determining its capacity to function as a vital living system and to provide ecosystem services (Art. 3). Within the Directive, soil monitoring is done following criteria for healthy soil conditions. Soil conditions are characterized through soil descriptors, each one of them having a criteria.

In the Council version, to follow the gradual approach of the Directive, soil descriptors are split into non-binding sustainable target values and operational trigger values (Recital 27a).

So, for soil health assessment, as stated in Article 7, Member States shall use criteria for healthy soil condition. The criteria for healthy soil condition shall consist of:

a) non-binding sustainable target values listed in Annex I, Parts A and B;
b) and operational trigger values.

As explained in Recital 27a, the long-term aspirational goal of this Directive is reflected in the non-binding sustainable target values, which do not impose any duty on the Member States to take action. Instead, these target values represent the ideal state in which there will be no noteworthy harm to the environment or human health and soil's ability to deliver ecosystem services, as determined by current scientific knowledge.

Since there is a need for efficiency and resources are limited, these measures need to be prioritized and implemented gradually. To respect these needs, the proposal introduces operational trigger values. These values set in motion appropriate measures to maintain or regenerate soil health. For each aspect of soil degradation, one or several proportional and feasible trigger values are set.

Setting the trigger values at Member State level ensures that local conditions and practices, soil use, and current policies can be fully considered. Moreover, Member States could decide to set the trigger value for one or more soil degradations at the same level as the target value for these soil degradations. This statement implies that usually Member State would set two different values for each criteria. One being non binding and representing the aspirational goals of the Directive (target values), and the other being the value that triggers measures to maintain healthy soil status trigger values). Sometimes, MS can choose to have these two values to coincide, so having just one value that would be both a target value and a trigger value.

3.1.2 Ecosystem Services

An important part of soil monitoring and health assessment are Ecosystem Services (ES). As can be seen also in the previous chapter, ES are used in different part of the Directive and are at the base of some of the key articles in the proposal.

Introducing Ecosystem Services

Following the guidance of the European Environment Agency and international standards, ecosystem services (ES) are defined as the '**contributions of ecosystems to human well-being**'. This means ecosystems services generate benefits that humans derive from ecosystems and use in economic and other human activity (Biodiversity, 2024).

Ecosystem services (ES) have a long history, first introduced in the 1980s (Hasan et al., 2020). Thanks to the Millennium Ecosystem Assessment, a scientific assessment of the consequences of ecosystem change for human well-being (Percy et al., n.d.), in 2005 four categories of ecosystem services were identified: (1) supporting services, (2) provisioning services, (3) regulating services, and (4) cultural services. Since the introduction of the term in the 1980s, there have been many different conceptualizations. The European Environmental Agency (EEA) uses the CICES framework to evaluate ecosystem services. In this classification there are only three categories: (1)

provisioning, (2) regulation and maintenance, and (3) cultural. Moreover, these three groups are also divided between biotic and abiotic. As can be seen, there are different classifications and frameworks for ES, but none of these have been clearly adopted in the Directive.

Ecosystem services in the proposed Directive

In the proposal, ecosystem services are placed in strong relation to the goals of the Directive. For instance, “healthy soils” are defined as soils that can provide ecosystem services that are vital to humans and the environment. The definition of ES given in the Directive is simply “direct or indirect contributions of ecosystems to the economic, social, cultural and other benefits that people derive from those ecosystems” (Art. 3). Throughout the Directive, ES are mentioned in a variety of points, mostly as a goal to reach. For example, soil regeneration and soil renaturation bring degraded soils back to healthy condition. The end goal is to get as close as possible to the natural functioning of the soil and its optimal ecosystem services provision. Nature-based solutions or engineering of new soils are possible ways of achieving this goal (Recital 41).

Ecosystem services are also defined as soil services that do not necessarily need an ecosystem to be provided (Recital 2b). Soil also provides services like acting as a physical platform for infrastructures and human activities, as a source of raw materials, or an archive of geological, geomorphological and archaeological heritage. These services are most of the time incompatible with the other soil ecosystem services as these inherently entail a degradation of the soil. As such, it is important to find a balance between these two types of soil ecosystem services (Recital 2b). Soil degradation affects ecosystem services provided by soils, with negative impacts to human health and the environment (Recital 2c).

This is why in the Directive there is a call for a balance between economic and demographic growth, and the provision of ecosystem services, applying the principle of reduction of the impact (Recital 30e). One way of trying to balance the importance of ecosystem services and economic growth might lie in the tradeoffs systems proposed in the Directive. While expressing the importance of Ecosystem Services, there are also mentions to a system of tradeoffs and offsetting measures for ecosystem services that are lost due to land take, soil sealing and soil destruction.

These offsetting measures need to be “geographically as close as possible to the source of the loss of ecosystem service” (Recital 30e).

As listed beforehand, there are different types of ecosystem services, but in the Directive they do not seem to hold the same position. No ES type is mentioned directly, but it can be understood how more emphasis is put on regulating or provisioning services rather than cultural. This can be seen on how in the Directive more interest is given to soil organic carbon (SOC), as an enabler of ecosystem services. In Recital 19a, it is stated that soil organic matter is crucial for the provision of “soil ecosystem services”. Soil organic matter, generally measured through soil organic carbon, affects soil biodiversity and can increase the amount of carbon sequestered in soils and therefore the soil organic carbon stocks, thereby contributing to climate change mitigation and adaptation. Another example is what is then stated in (Council, Art.3), in which “soil ecological functions” are linked with carbon sequestration. Here again another instance of Ecosystem services being used to talk about regulating services. But throughout the Directive there was never a mention about cultural or supporting services.

3.1.3 Soil Districts and Soil Units

Another important topic introduced with the Directive are Soil Districts and Soil Units. To create an effective soil monitoring system, there is a section of the Directive that is focused on implementing a system that divides MS territories into smaller units that are easier to monitor. This is one of the most discussed parts of the Directive as substantial changes have been made throughout the legislative process. In the proposal soil districts are the part of the territory of a Member State, as delimited by that Member State in accordance with this Directive (Art.3).

Soil Units

A “soil unit” is a spatially discrete area within a soil district resulting from the intersection of spatial data used as criteria for statistical homogeneity within that soil district (Council, Art.3).

Soil units are the smaller units, used to represent all the differences within a soil district. Soil districts encompass more soil units and are bigger administrative territories. This is explicitly stated in the Directive, as soil units should be under the management of governance structures and “Soil districts reflect the administrative territories under the responsibility of these governance structures and cover one or several entire soil units.” (Recital 24). One or more competent authorities can be appointed for each soil district (Recital 25).

Soil units have different criteria to follow:

1. Soil type
2. Land use
3. Soil districts

If necessary, these soil units may consist of non-adjacent areas.

As reported in Article 4, MS shall establish at least one soil district (1) and soil units that cover the entire territory to enable soil health reporting and the monitoring design (2).

The monitoring changes between soil units and soil districts, as soil health shall be monitored in each soil unit, but soil sealing and soil destruction only in each soil district (Art. 6).

Then, based on the assessments of soil health, the authorities “identify, in each soil district, the areas where individual criteria for healthy soil condition are not satisfied and where measures are required to improve the soil health” (Council, Art. 9).

Reflections

The work presented in paragraph 3.1 is the culmination of my research for the “Law for Healthy Soil” project. My main activity during this project was to help design a positioning paper to introduce these topics to the workshop’s attendees. The workshop is aimed at sparking fruitful discussions regarding bridging soil science with law, the analysis of the directive allowed to highlight points of uncertainty in the Directive that make for the perfect discussion starters. Soil health monitoring is at the center of the Directive, but there are still many unclear dispositions in the proposal. Setting sustainable target values and trigger values seems like a challenge that has not been completely addressed in the Directive, leaving responsibility to Member States but without fully accounting for their great differences in both soil types and monitoring systems. Always in the context of soil monitoring, ecosystem services are given the spotlight in many subjects (e.g. the definition of soil health). However, in the Directive a clear structure to account for such services is missing. It is not clear which one of the different classification systems will be used and how some more measurable ES (provisioning services) can be compared to more volatile ones (cultural services).

3.2 Soil assessment in Italy and The Netherlands

European countries have major differences in how they manage soils, especially a difference between Northern countries and Southern countries. The main difference lies down at the scale, northern countries usually have established national-level monitoring (eg. Netherlands), but Southern countries focus more on the regional level (eg. Italy) (Cornu et al., 2023). It is not uncommon to compare two or more countries regarding soil practices, soil quality or other indicators (Van Leeuwen et al., 2017), but due to the great differences between types of soils in the EU, there is still much more to understand. In order to facilitate a deeper understanding of the potential implications of the SMD, this report includes a comparison of two countries' current practices. The research entails an overarching study about metrics, indicators, and standards that have been considered so far for monitoring soil in the two different EU member states, which ones are the ones used in the Soil Directive.

3.2.1 Results from Italy

Italian soils are characterized of high variability throughout its territory(Costantini & L'Abate, 2009). This is also reflected in how environmental responsibilities are divided between the State and Regions. In each region there is an Environmental institute that carries out environmental assessment, soil health assessment is one of the issues that is treated at the regional level. The Italian monitoring framework is complex as some issues regarding soil are monitored at regional level, other issues at national level.

National level

At the National level is possible to find information on the Superior Institute for Environmental Protection and Research (ISPRA, 2024). The aspect of soil degradation that are studied are:

- Soil use
- Soil Organic Carbon
- Soil Degradation

- Soil impermeability
- Water erosion
- Contaminated sites
- Soil Consumption impact on agriculture

These indicators are all periodically evaluated, but there is no overarching framework providing targets to reach. Each indicator is measured, and then compared to the past measurement so that a trend is calculated.

Regional level

At a regional level the indicators evaluated vary based on the region's level of interest in the matter, specific environmental issues, funding and politics. This can be seen by taking into consideration the case of the region Emilia Romagna and Campania.

This region has a detailed assessment framework, that can be even more detailed than the one available at National level. Some of the indicators that are monitored in this regions are pH, Salinity, Organic carbon, Water retention, density, biologic diversity, erosion, contamination by both heavy metals and organic compounds(Regione Emilia Romagna, 2024).

On the other hand, for the region Campania, the indicators measured are only land take, contaminated sites, with specific interest for agricultural waste(ARPA Campania, 2024).

Both these regions have indeed monitoring structures in place, but there are not evident signs of target values that are being pursued.

3.2.2 Results from The Netherlands

The Netherlands has numerous laws and regulations. Two pivotal laws forming the foundation of Dutch soil policy are the Soil Protection Act (Wet bodembescherming - Wbb) and the Environmental Protection Act (Wet milieubeheer - Wm). The Soil Protection Act (Wbb) provides general rules to prevent soil contamination. The Environmental Protection Act (Wm), being the most significant environmental law, mandates that permits must be acquired before conducting certain activities(Rijkswaterstaat Environment, 2024). These permits are issued by the competent authorities and, concerning soil policy, must specify the measures companies must take to protect the environment and land. Additionally, companies may be required to restore the soil to its original state. In most instances, municipalities and/or provinces issue these permits.

Dutch laws and regulations are rooted in principles set out in the Soil Protection Act and the Environmental Protection Act. Key legislation in the current soil policy, aimed at addressing soil pollution and ensuring sustainable soil management, includes the Soil Quality Decree (Besluit bodemkwaliteit) and the Soil Quality Regulation (Regeling bodemkwaliteit) (Rijkswaterstaat Environment, 2024).

The Soil Remediation Circular 2013 (July 2013) supplements the Soil Protection Act, aligning with the new soil management policy outlined in the Soil Quality Decree, and applies to dry land. This circular provides guidelines for using remediation criteria and determining remediation goals in cases of soil pollution. Municipalities and provinces can use these criteria to assess the pollution severity and determine if a site requires urgent remediation (Rijkswaterstaat Environment, 2024).

In these different regulations some indicators can be found:

- Inorganic contaminants
- Organic contaminants (Rijkswaterstaat, 2024)
- Biological indicator for Soil Quality (rivm, n.d.)
- Land use (CBS, 2017).

Reflections

This part of the report is mainly focused on achieving my personal learning goals of learning more about the ability to better understand national environmental legislations, and how they are impacted by EU regulations. Thanks to this experience I was able to better understand how different environmental regulations can be between European countries. Italy has a more fragmented approach to soil health monitoring; this is reflected also in how their data is shared and published. Some areas might have a deeper understanding of soil health issues and take appropriate measures to monitor the status of soils, other areas struggle to have the same level of detail. At the national level some indicators can be found, but these indicators are mainly used to create trends rather than assess the health of soils compared to set standards. In the Netherlands more information are available at the National level, with different regulations managing soil health. For some soil health descriptors there are set indicators with standards. With the possible approval of the Directive, some of these monitoring systems will have to adapt to new practices.

3.3 Bindingness analysis

The proposal Directive for Soil monitoring and resilience has undergone a plethora of changes through the EU legislative process. Starting with the proposal from the Commission, then the Parliament proposing Amendments and lastly the Council with the final version.

Even though the overarching goal of the different versions remains the same, some key elements have changed during this process. This influences the responsibilities allocated by the Directive and might undermine the policy effectiveness. Since one of my personal learning goals was to use Python coding for research purposes, this topic is a perfect case to apply this new skill.

To better understand what changed between the different versions, a quantitative and qualitative text analysis was done, aimed at quantifying the "binding power" of each version. In the writing rule for EU legislation there are guidelines for expressing "imperative", so that something is an obligation, and "permission" to express possibly (European Commission, 2024).In this report binding power means how much the directive version is actually imperative rather than just giving permissions. This analysis has been an important part of the internship as it feeds both into the positioning paper and in my personal goals. Understanding which parts of the Directive were the most contested and discussed helps in creating discussion points for the positioning paper.

The different proposals have been examined in English, the rules for English writing states that auxiliaries like would, should, could, must and might are often unchanged. To express imperative EU legislation uses shall. In this case it is used as a must. To express permission EU legislations uses may (European Commission, 2024)

The coding analysis was performed through Python programming. Thanks to the code it was possible to evaluate how many times shall, may or other auxiliaries were used. Then with this data give a score to each version to estimate the binding power of each version. This analysis is quite limited as it's a purely mathematical calculation and ignores the context of some of these words.

However, it gives a great baseline for a further qualitative analysis that tries to understand the deeper changes in the legislative process.

The quantitative analysis shows variability in the binding power of the three different versions. The first version, being the one of the Commission shows a binding power of 0.51. Compared to the one of the Parliaments with the Amendments with a binding power of 0.57, there was an increase of 0.06. Then the final version that is now being discussed as a binding power of 0.44, that is lower than both precedent versions. The quantitative analysis shows a decrease in binding power over the legislative process, suggesting that the Directive has become less restrictive over time. To better pinpoint the areas where this change took place, the results of the qualitative analysis have to be discussed.

To better understand these results, a deeper analysis is required. The second part of this section is focused on a qualitative text analysis to give more context to these previous results. The qualitative analysis is the result of a textual analysis of the more contested points through the Directive. Following the coding analysis, it is easier to understand where most changes were done. This analysis gives more context to the results of the previous analysis and offers more insights on the changes done the Directives.

3.3.1 Changes around soil health assessment

The first instance that can be seen through this analysis are the changes surrounding health assessments. In Article 7 and in the Annexes a lot of changes have been made, but are hardly noticeable by just analyzing the single words.

In the Commission version of the Directive, soil descriptors and soil criteria are listed in Annex I. Member States shall apply those criteria when monitoring soil health (Commission, Art. 7). The annex is made of soil descriptor, linked to a respective criterion to measure them. Some criteria are set at EU level, some at Member States level and others do not have a criteria altogether.

The new version proposed by the Parliament builds on these concepts but introduces a Tier system.

The Parliament proposal offers a new approach to the monitoring system. A Tier system has been introduced to respect the autonomy of each MS. Member States should be able to choose between among 3 monitoring tiers. This system was proposed to increase the number of soil descriptors assessed and the level of autonomy of MS (Amendment 16, Recital 27b). Each Tier comes with a set of descriptors and methodologies for sampling, to be followed to be considered as part of that Tier.

The minimum requirement would be to follow soil descriptors in Tier 1, so Tiers 2 and 3 are designed for MS that voluntary want to do a more comprehensive assessment. This is already a great topic for discussion as there is no mention of incentives for MS that want to move to a higher tier. What is the purpose of having three Tiers if MS are not going to adhere to higher Tiers since there is no concrete motivation except the willingness of the State itself.

Each Tier comes with specific Soil Descriptors. Soil descriptors are parameters describing a physical, chemical, or biological characteristic of soil health (Parliament, Art. 3). The descriptors for each Tier are as they follow:

Tier 1	Tier 2	Tier 3
Soil erosion	Salinization	Soil contamination *
Loss of SOC	Land take	Soil biomass
Soil compaction	Soil contamination *	Community traits of roots
Excess nutrient content in soil (N) (P)	Soil compaction	Taxonomic diversity
Soil contamination *[1]	Nutrient cycle	Population abundance
Reduction of water retention	Soil aggregation	
Acidification	Enzymatic activity	
Soil aggregation	Soil biomass	
Soil respiration	Taxonomic diversity	
Soil biomass	Population abundance	
Taxonomic diversity		
Population abundance		
Soil structure		

Figure 2 Soil descriptors divided in Tiers as proposed by the Parliament version of the Directive.

As it can be seen, Tier 1 has the majority of descriptors, and it is also the Tier that every MS should follow. A MS qualifies for Tier 1 monitoring design when it includes all the soil descriptors and meets the following criteria.

These are all part of older versions of the Directive, as it currently stands the proposal being discussed is the one of the Council. The Council version has already been discussed in Paragraph

[1] *Soil contamination refers to different contaminants in each Tier

3.1, but now it is easier to see how health assessment evolved through the legislative process. As of now, the Tier system is not being discussed and it has been replaced by trigger and target values.

3.3.2 Changes around Soil Districts

Another heavily changed topic in the Different versions of the Directive are Soil Districts. In the Commission version of the Directive, soil districts should at least correspond to the number of NUTS 1 territorial units (Commission, Recital 24). The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU. These units are purely statistical units and are based mostly on population and already existing delineation (regional, provincial) (Eurostat, 2023).

After the Amendments of the Parliament the current distribution of soil districts is based on different criteria, there is not anymore, a minimum threshold to be followed (Amendment 221/rev1, Article 4). Instead, Member States can choose to implement Soil Districts based on NUTS 2 units in their countries, to better reflect the competencies of local authorities. Moreover, MS may consider these criteria when setting up their soil districts: (1) river basin districts and water bodies used in the WFD, (2) remote archipelagic regions, (3) use of Copernicus for delimitation (Amendment 63, Art.4).

In the proposal for a Directive of the Parliament, soil districts are introduced as the basic administrative units for Member States to carry out evaluations and samplings (Recital 24). Soil districts are defined as the part of the territory of a Member State or several Member States. As delimited by those MS in accordance with the Directive (Amendment 52, Art.3). Soil districts have been conceptualized as a mean to adequately reflect pedoclimatic conditions and soil variety of a whole territory (Amendment 11, Recital 24).

This concept has been translated into practice with the introduction of NUTS territorial units. The NUTS classification is a hierarchical system for dividing up the economic territory of the EU for the purpose of:

- the collection, development and harmonization of European regional statistics
- socio-economic analyses of the regions

- NUTS 1: major socio-economic regions (3-7 million inhabitants).
- NUTS 2: basic regions for the application of regional policies (800.000 and 3 million inhabitants).
- NUTS 3: small regions for specific diagnoses (150.000 to 800.000).

- In many cases the classification ties in with the administrative structure of the Member States. In most – but not all – countries each NUTS level corresponds to a certain administrative level or an aggregation of administrative units. (+)

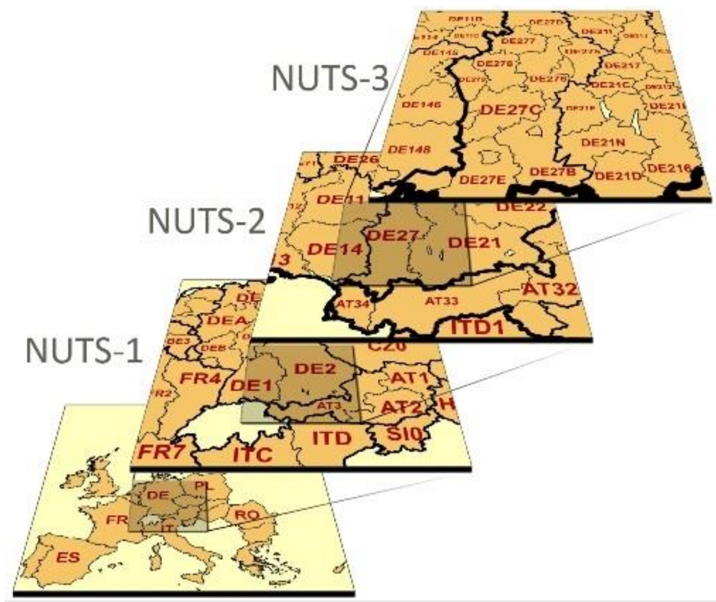

Figure 3 From Eurostat website on NUTS classification.

In the first version of the Directive, soil districts should at least correspond to the number of NUTS 1 territorial units (Recital 24). These units are purely statistical units and are based mostly on population and already existing delineation (regional, provincial).

After the Amendments of the Parliament the current distribution of soil districts is based on different criteria, there is not anymore, a minimum threshold to be followed (Amendment 221/rev1, Article 4). Instead, Member States can choose to implement Soil Districts based on NUTS 2 units in their countries, to better reflect the competencies of local authorities.

As for soil monitoring, these are all past Articles that are not considered anymore in the Council version of the Directive. The NUTS classification has been substituted by a system of Soil Districts and Soil Units.

3.3.3 Changes in Articles 9, 10, 12, 17

The Parliament version of the Directive shows an initial higher "binding power" than the version proposed by the Commission. The qualitative text analysis helps to explain this value. In Article 9, 10, 12, and 17 there are added parts expressing impositions to MS and to the Commission. Most of these articles are either referring to how the information of the soil assessment should be used and shared or imposing responsibilities to the Commission in aiding MS. This means that even though there are many uses of words like "shall" that would make the value grow higher, the Directive is not necessarily more binding on some of the more pressing issues like soil monitoring. This is also in line with what has been said by dr. Maria Briones during the "Soil talk", in which she expresses concern that the Directive is being modified to be more and more flexible through the legislative process, starting with the Parliament version.

4. Discussion and conclusion

These analysis can be pieced together for an overarching discussion on the Directive and how it changed over time. In the analysis of the first pillar is possible to dive deeper into the framework envisioned for soil health monitoring. This system is built upon concepts like “target values”, “ecosystem services” and “soil districts”, but these same concepts leave space for uncertainty. During the legislative process these same topics have been the most discussed. Thanks to the coding and textual analysis of the different versions of the Directive it was possible to better understand what the main changing points in the proposal were.

Soil monitoring underwent drastic changes, from the first Directive proposing soil descriptors and criteria to follow, to a tier system that was then discarded for target and trigger values.

Soil districts were also a contested topic, probably due to the difficulty of accurately characterizing all the diverse territories of the European Union.

This uncertainty is sometimes reversed on MS, when they are called to establish indicators and target values healthy soil conditions. Even though this is done for the sake of acknowledging the diversity of soil types around Europe, it seems difficult to accomplish looking at cases like The Netherlands and Italy.

Comparison of case studies

Comparing the current soil health assessment framework in Italy and the Netherlands has been more of a challenge than expected. More often than initially believed, finding accurate information has been complex. Due to the nature of the study this is still worth noting. Taking into consideration these two countries, it is hard to establish a baseline for the current soil health status. The soil degradation factors that the countries are accounting for are different or at a different scale. Moreover, most of the indicators that are assessed are not necessarily compared to indicators to make sure that values are within range. The approval of the Directive would mean many changes in these countries, but each MS would probably face different challenges.

The current proposal is still being discussed and there are probably going to be many more challenges ahead of its approval. Thanks to my research practice in the Law Department, I was able to comprehend these difficulties. My personal learning goals seamlessly merged with the scope of the project, and allowed for a thorough analysis of the Directive.

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