# A TECHNICAL REPORT OF DIGITAL SOIL MAPPING OF DENMARK

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**ABSTRACT**

Soil mapping is the process of delineating and classifying natural bodies of soils, and capturing soil property information for interpreting and depicting soil spatial distribution on a map. Soil maps are essential tools for land use planning, sustainable agriculture, environmental management, and natural resource conservation.

Traditional soil mapping methods involve collecting soil samples in the field and then classifying the samples based on their physical and chemical properties. However, these methods can be time-consuming and expensive, and they are not always accurate due to the variability of soil properties over space.

Digital soil mapping (DSM) is a more recent approach to soil mapping that uses spatial data and statistical models to predict soil properties at un sampled locations. DSM has several advantages over traditional soil mapping methods, including: It can be used to map large areas more quickly and efficiently.

- It can be used to map areas that are difficult or impossible to access in the field.
- It can be used to map soil properties that are difficult to measure in the field.
- It can provide more accurate predictions of soil properties.

## **INTRODUCTION**:

The aim of soil mapping is to create a map that shows the distribution of different soil types in an area. The objectives of soil mapping can vary depending on the specific needs of the user, but they typically include:

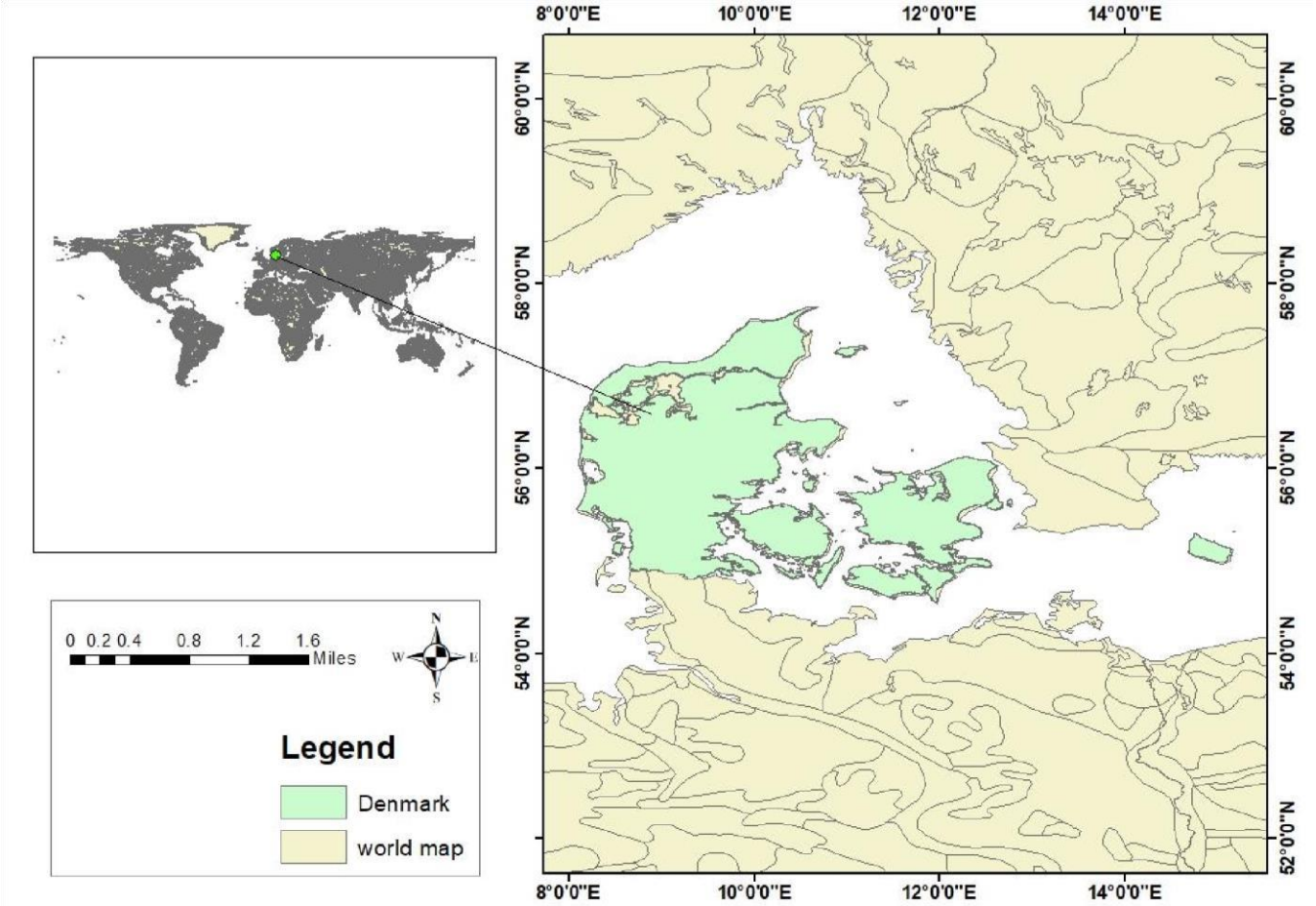
- Identifying and classifying soil types
- Describing the physical and chemical properties of soils
- Delineating areas of land that are suitable for different types of land use
- Assessing the potential for soil degradation

To identify areas of land that are suitable for agriculture: Soil mapping can be used to identify areas of land that have the right combination of soil properties for growing crops. This information can be used to plan agricultural practices and to improve crop yields.
To assess the potential for soil degradation: Soil mapping can be used to identify areas of land that are at risk of soil degradation, such as erosion or salinization.

To identify areas that need to be protected: Soil mapping can be used to identify areas of land that are important for biodiversity or that have special cultural or historical significance. This information can be used to develop plans to protect these areas.

## STUDY AREA

Denmark is situated in the northern part of Europe, bordered by Germany to the south and connected to Sweden via a bridge-tunnel. It also includes several islands, the largest of which is Zealand, where the capital city Copenhagen is located. It covers an area of 42,916 km², the country has a population of 5.7 million people. Capital and largest city is Copenhagen. Spoken languages are Danish and some German.



## METHODOLOGY:

You can download the **World Soil Data Map** from the Food and Agriculture Organization of the United Nations (FAO) website. The map is available in a variety of formats, including PDF, shape file, and GeoTIFF.

To download the map, go to the FAO website and search for "World Soil Data Map". The map will be available in the "Products" section of the website.

Once you have found the map, you can download it by clicking on the "Download" button. You will need to create an account with the FAO website in order to download the map

**The Harmonized World Soil Database (HWSD)**: is a global soil property database that provides information on the physical, chemical, and biological properties of soils. The HWSD is a valuable resource for understanding the soil resources of the world and can be used for a variety of purposes, such as land use planning, environmental management, and natural resource management.

To map soil parameters with the HWSD, you will need to:

Download the HWSD data. The HWSD data is available in a variety of formats, including GeoTIFF and shapefile. Open the HWSD data in a GIS software program.

Import other spatial data, such as topography or vegetation, into the GIS software program.

Overlay the HWSD data with the other spatial data.

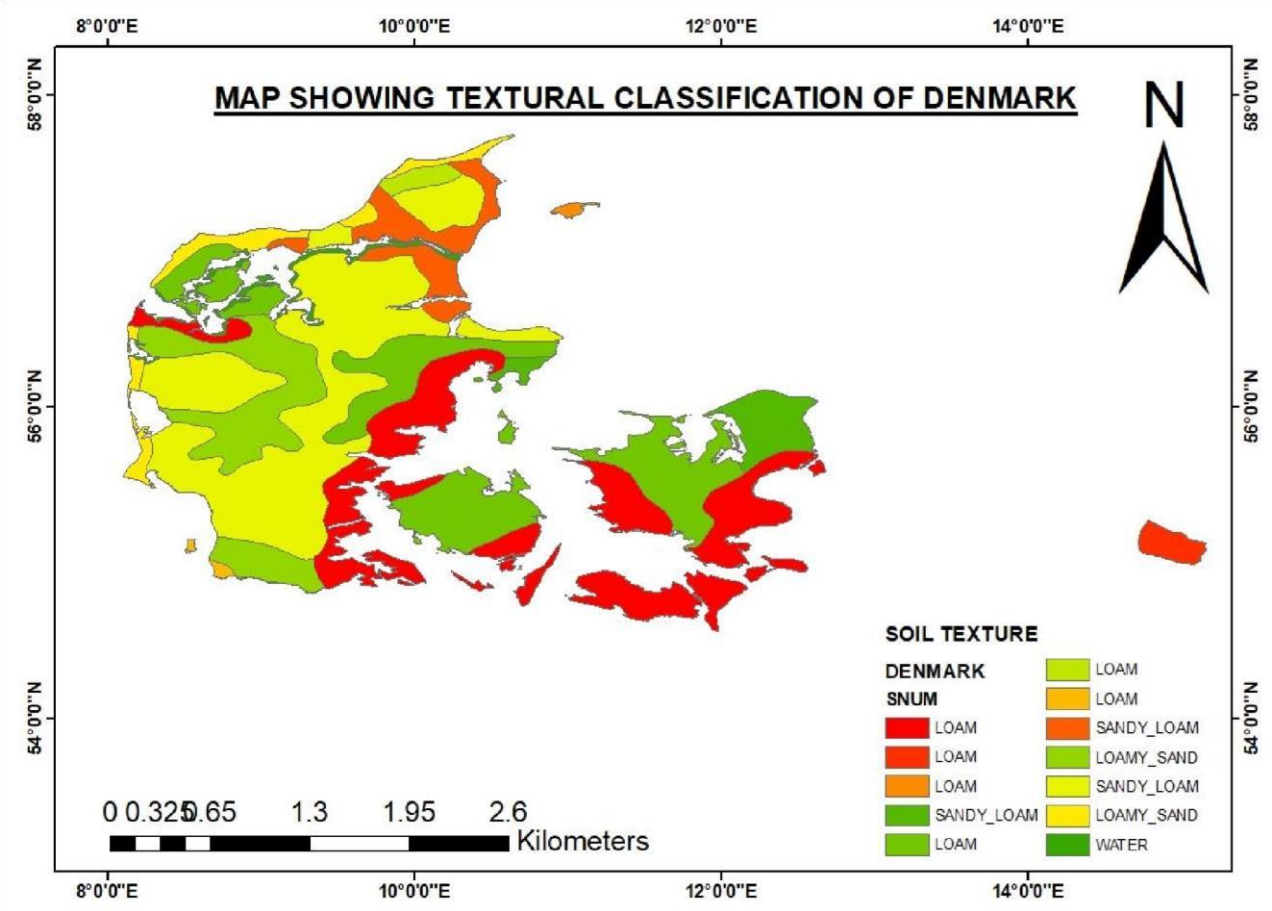
Use the GIS software program to create a map of the soil parameters.

### Soil Texture Mapping:

Soil texture mapping is the process of creating a map that shows the distribution of different soil textures in an area. Soil texture is a measure of the relative

proportions of sand, silt, and clay particles in a soil. The three main types of soil texture are:

- Sand: Soils that are composed of mostly sand particles are called sandy soils. Sandy soils are loose and well-drained, but they do not hold water or nutrients very well.
- Silt: Soils that are composed of mostly silt particles are called silt soils. Silt soils are finer than sandy soils and they hold water and nutrients better than sandy soils.
- Clay: Soils that are composed of mostly clay particles are called clayey soils. Clayey soils are very fine and they hold water and nutrients.
- Loam is a soil texture that contains a moderate amount of sand, silt, and clay particles. Loam is composed of 7 to 27% clay, 28 to 50% silt, and 50% sand.



**SOIL PARAMETERS:**

Soil parameters are the physical, chemical, and biological properties of soil that can be measured and used to describe the soil.

Soil parameters are an important part of soil science. They can be used to understand the soil and its properties, and they can be used to improve soil quality and manage soil resources.

Some of the most important soil parameters include:

## Bulk density

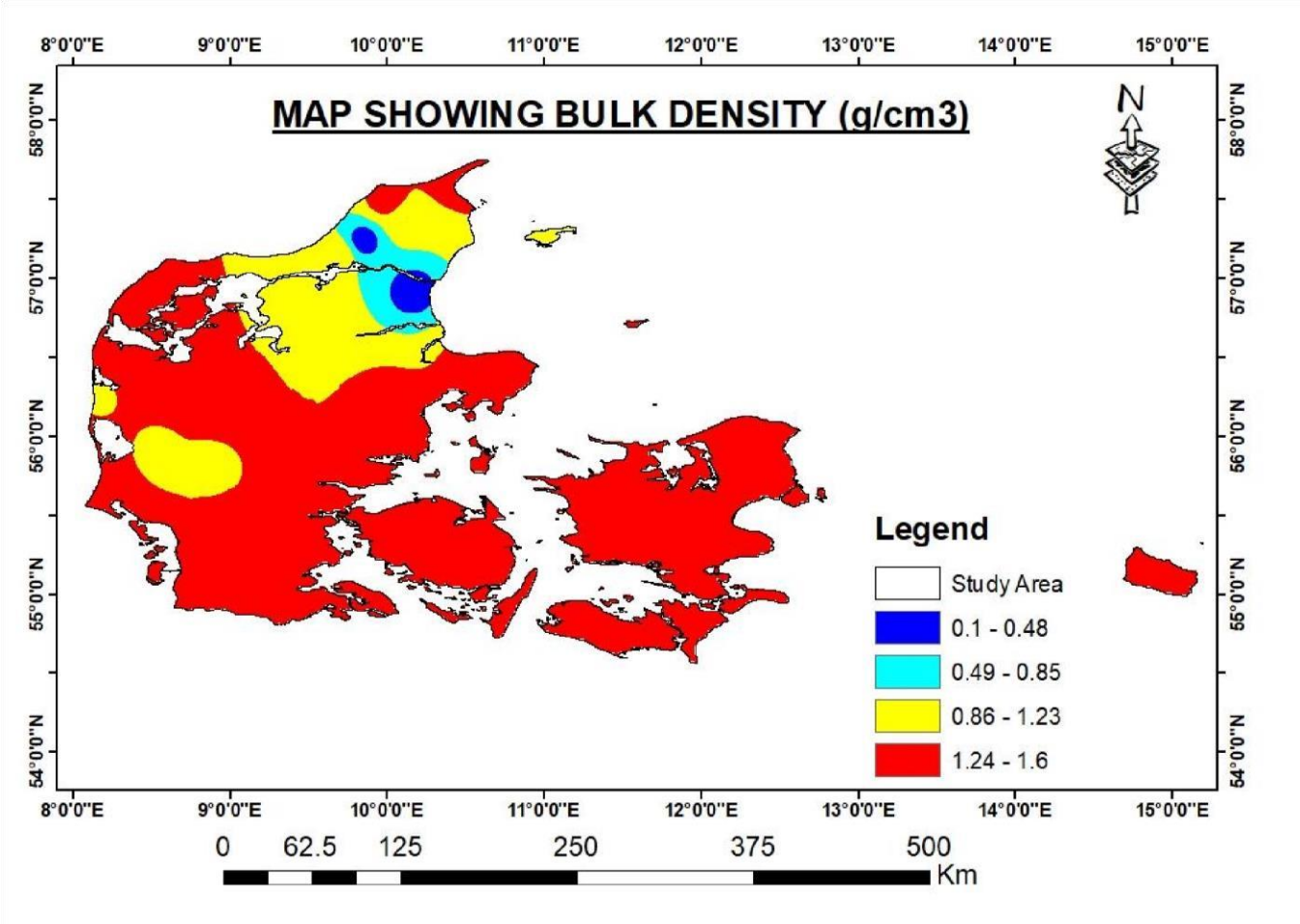
Bulk density is the mass of a given volume of soil. It is calculated by dividing the mass of the soil by its volume. Bulk density is expressed in units of grams per cubic centimeter (g/cm3) or kilograms per cubic meter (kg/m3).

Bulk density is an important soil property because it affects the ability of the soil to hold water, air, and nutrients. Soils with high bulk density have a low pore space, which means that they hold less water and air. This can make it difficult for plants to grow. Soils with low bulk density have a high pore space, which means that they hold more water and air. This can make them more suitable for plant growth.

The bulk density of a soil refers to the mass of the soil per unit volume. The bulk density of a soil affects its ability to hold water and air, as well as its resistance to erosion.

Bulk density is an important soil property that can be used to assess the suitability of the soil for different uses. It can also be used to monitor the changes in soil properties over time.

# The map shows bulk density distribution of Denmark.



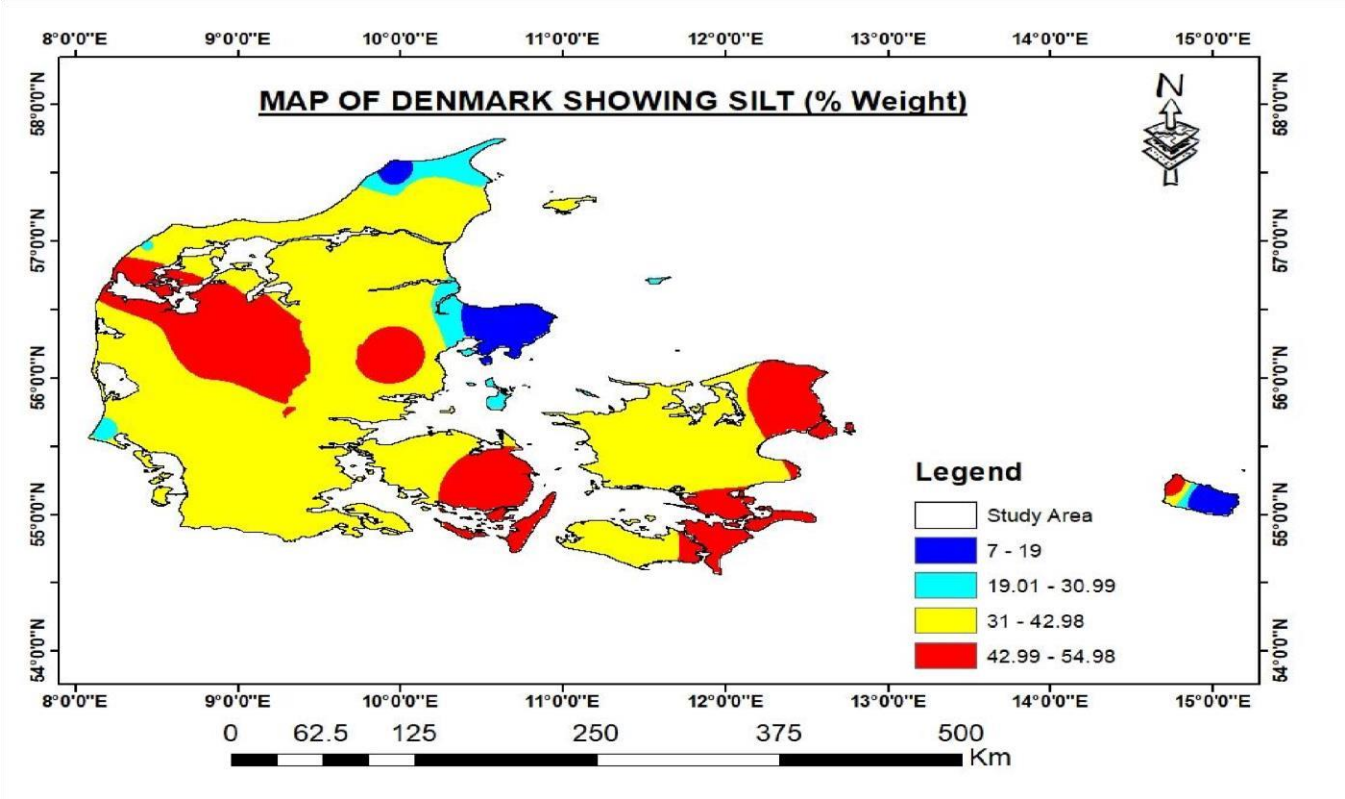

**SILT**

Silt content refers to the proportion of fine particles, specifically silt-sized particles, in soil or sediment. Silt is a granular material with particle sizes between those of sand and clay. It is an important factor in determining the soil's texture and its ability to retain water and support plant growth.

**Properties of Silt**

- Silt particles fall within the size range of 0.002 to 0.05 mm in diameter, which places them between sand particles (larger) and clay particles (smaller).

- Soils with higher silt content tend to have better water retention capabilities compared to sandy soils. This can be advantageous for supporting plant growth, as silt helps hold water near plant roots.
- Silt can contribute to soil fertility due to its ability to hold nutrients. It provides a favorable environment for soil microorganisms, which aid in nutrient cycling.




**The map shows distribution of Silt (% weight)**

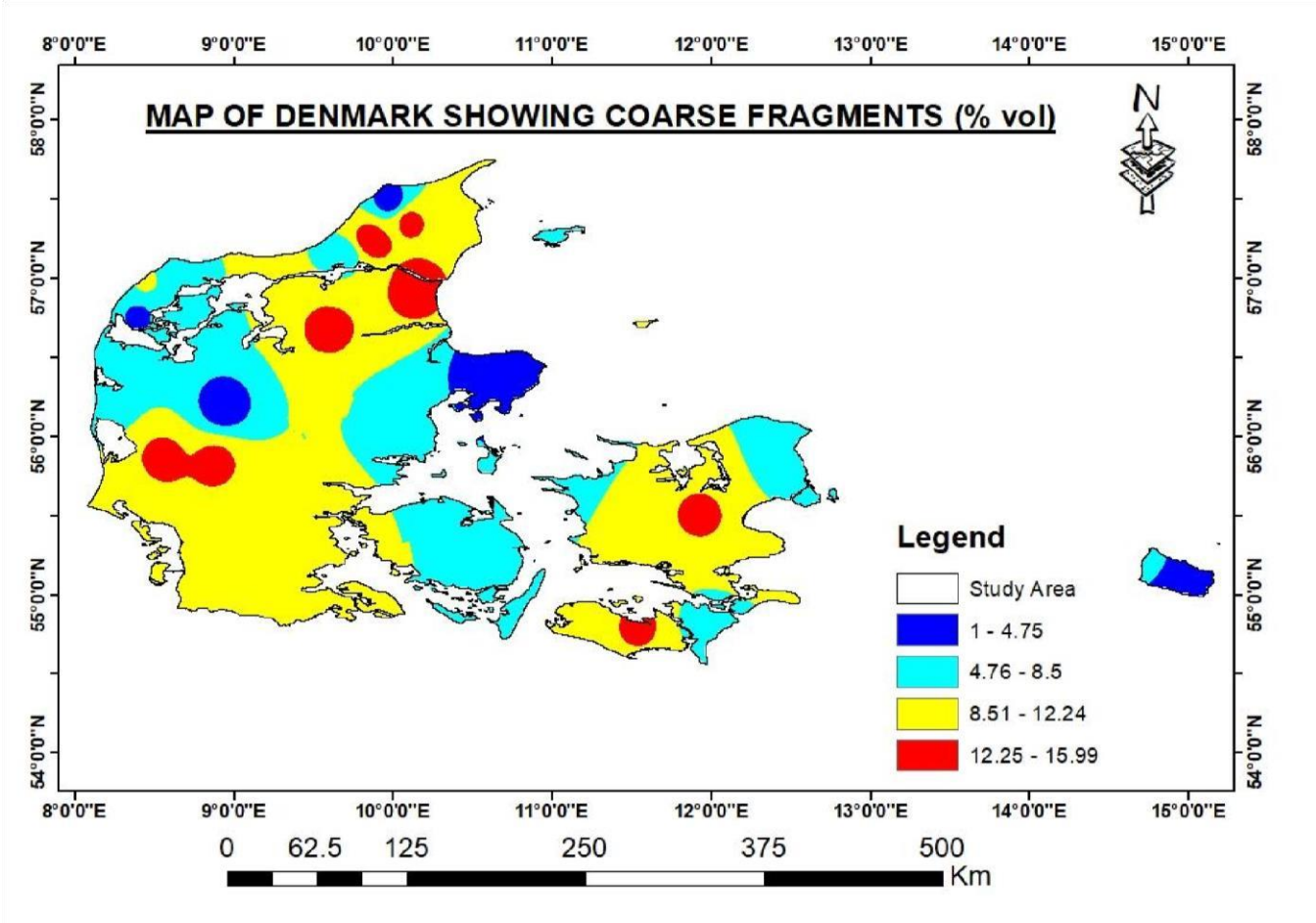
## Coarse Fragment:

Coarse fragments, also known as rock fragments or gravel, are larger pieces of rock material present in soil. These fragments are larger than the fine particles such as sand, silt, and clay that make up the soil matrix

A soil coarse fragment is any primary soil particle with a nominal diameter greater than 2 millimeters. Some definitions exclude boulders, which are larger than 250 millimeters. Coarse fragments can be made up of a variety of materials, including:

- Rocks: the most common type of coarse fragment
- Cobbles: smaller than rocks but still larger than 2mm
- Pebbles: smaller than cobbles but larger than sand

- Sand: smaller than cobbles




## The map shows coarse fragments

**Total Nitrogen content:**

The total nitrogen content of soil is the amount of nitrogen present in the soil, both in organic and inorganic forms. Nitrogen is an essential nutrient for plants, and it is also important for soil health.

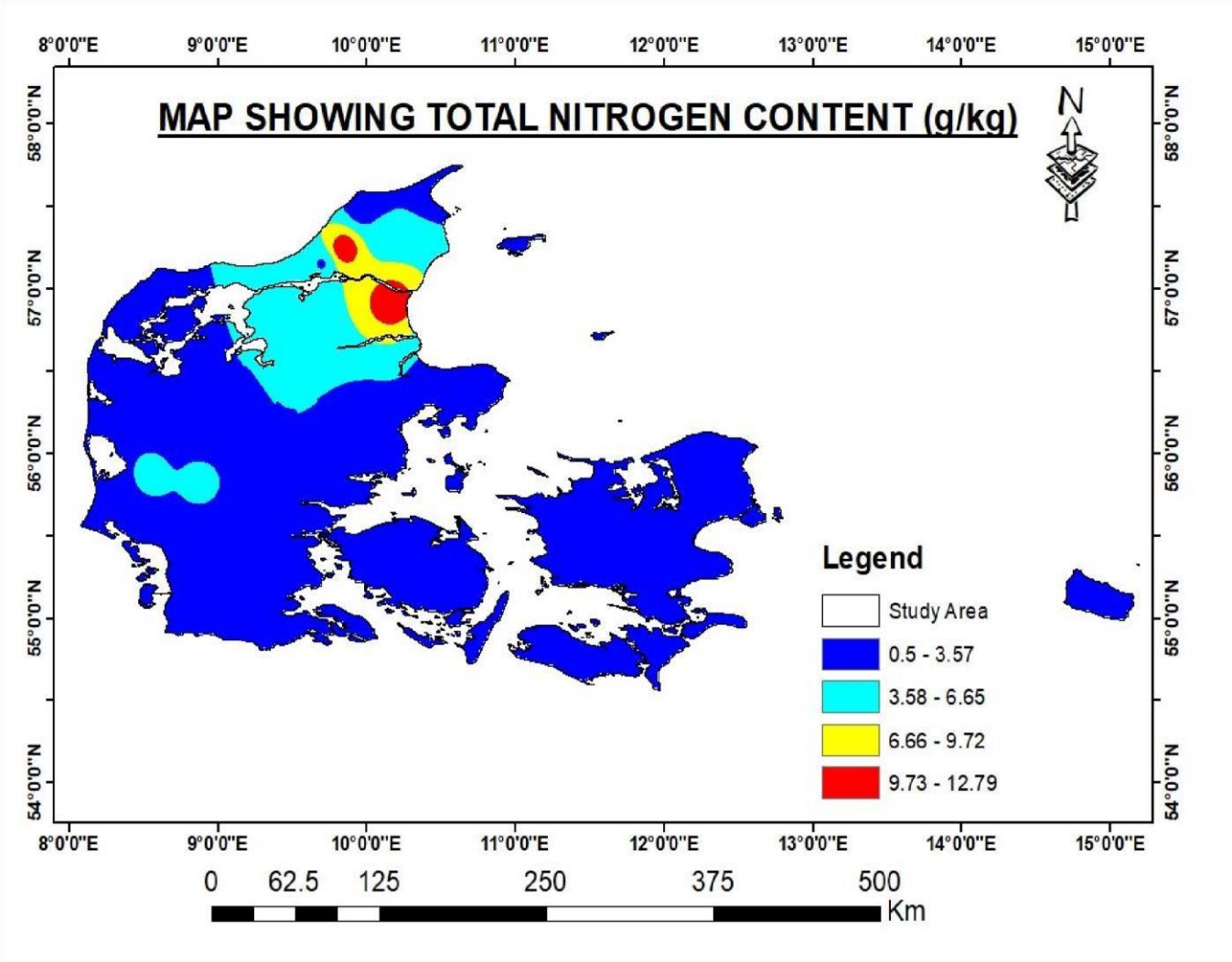
Here are some of the benefits of having a high total nitrogen content in soil:

- Improves plant growth: Nitrogen is an essential nutrient for plants, and it is needed for photosynthesis and other plant processes.
- Improves soil structure: Nitrogen helps to bind soil particles together, which improves soil structure.

- Increases water infiltration: Nitrogen helps to increase the water infiltration rate of soil, which helps to reduce erosion.
- Improves soil aeration: Nitrogen helps to improve the aeration of soil, which helps to improve plant growth.
- Reduces the risk of plant diseases: Nitrogen helps to reduce the risk of plant diseases by improving plant health.

Increasing the total nitrogen content of soil can be done by a variety of methods, including:

- Adding organic matter: Organic matter is a good source of nitrogen for soil. Organic matter can be added to soil by using compost, manure, or other organic materials.
- Fertilizing: Fertilizers can be used to add nitrogen to soil. Fertilizers can be either organic or inorganic.
- Cover cropping: Cover cropping is the practice of planting a cover crop, such as legumes or grasses, in the fall or winter. Cover crops help to increase the amount of nitrogen in the soil.




**The map shows nitrogen content**

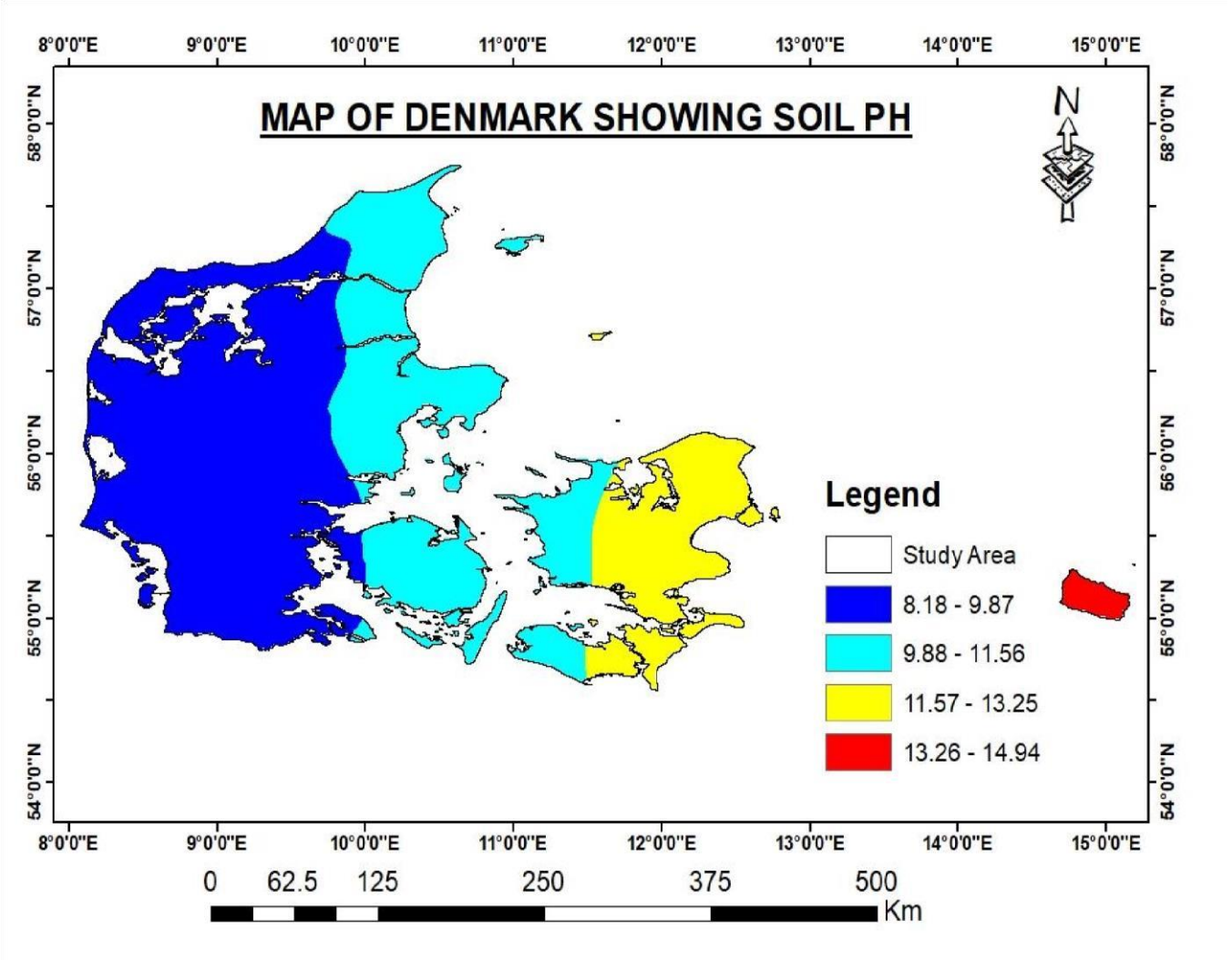
## Soil PH:

Soil pH is a measure of the acidity or alkalinity of soil. It is a scale from 0 to 14, with 7 being neutral. A pH below 7 is acidic, and a pH above 7 is alkaline.

The ideal pH for soil varies depending on the type of plants that are being grown. For example, most plants prefer a slightly acidic soil, with a pH of 6.5 to 7.0. However, some plants, such as blueberries, prefer a more acidic soil, with a pH of 4.5 to 5.5.

The pH of soil can be affected by a variety of factors, including:

- Parent material: The parent material is the material from which the soil was formed. Soils formed on limestone will typically be more alkaline than soils formed on other materials.
- Climate: Soils in warmer climates tend to be more alkaline than soils in colder climates.
- Vegetation: The vegetation that grows in an area can affect the pH of the soil. For example, trees and shrubs tend to make the soil more acidic.
- Management practices: Management practices, such as the use of fertilizers and liming, can also affect the pH of soil.




**The map shows PH value**

## CONCLUSION:

Soil mapping is the process of creating a map that shows the distribution of different soil types in an area. Soil maps are used for a variety of purposes, including:

- Land use planning: Soil maps can be used to identify areas that are suitable for different types of land use, such as agriculture, forestry, or construction.
- Environmental management: Soil maps can be used to identify areas that are vulnerable to erosion, pollution, or other environmental problems.

Soil mapping is a complex process that involves collecting and analyzing soil data. The data can be collected in a variety of ways, including:

- Direct sampling: This involves collecting soil samples from the field and analyzing them in a laboratory.
- Remote sensing: This involves using satellite images or aerial photographs to identify different soil types.
- GIS-based modeling: This involves using geographic information systems (GIS) to combine soil data with other data, such as topography or vegetation, to create a soil map.

Here are some of the benefits of soil mapping:

- It helps to identify areas that are suitable for different types of land use. This information can be used to plan for future development and to protect sensitive areas.
- It helps to identify areas that are vulnerable to erosion, pollution, or other environmental problems. This information can be used to develop strategies to prevent or mitigate these problems.

## RECOMMENDATION:

I recommend that you consult with a soil scientist or other qualified professional to get specific recommendations for your soil. They will be able to assess your soil conditions and recommend the best practices for improving your soil health and productivity.

- Add organic matter: Organic matter is essential for healthy soil. It helps to improve soil structure, water retention, and drainage. You can add organic matter to your soil by composting, using manure, or planting cover crops.
- Manage acidity: The pH of your soil affects the availability of nutrients to plants. If your soil is too acidic or alkaline, you may need to adjust the ph. You can do this by adding lime or sulfur to your soil.