TAMA

Iowa State Soil

SOIL SCIENCE SOCIETY OF AMERICA

Introduction

Many states have a designated state bird, flower, fish, tree, rock, etc. And, many states also have a state soil–one that has significance or is important to the state. The "Tama" is the Iowa State Soil. Let's explore how the Tama is important to Iowa.

History

In 1917, Tama soils were first described in Black Hawk County, Iowa. Since then the soil has been mapped (that is, located and described) in the nearby states of Illinois, Minnesota, and Wisconsin.

What is Tama Soil?

Tama soils are very deep, well drained soils. The *topsoil* (the layer of soil that we plow and plant seeds in) can be up to 36 cm (14 inches) thick with 3-4% organic matter. It has a *soil texture* that is *usually a silt loam or silty clay loam*, and has a very dark grayish brown to black color when moist. The combination of sand, silt and clay particles affect how the soil feels and determines many soil properties. The *subsoil*, below where a farmer plows, is silty clay loam or silt loam down to at least 100 cm deep (almost 4 feet). Even at that depth, the soil is home to roots of old prairie plants and grasses. The *subsoil* has a yellowish-brown color, less organic matter than the *topsoil* and loses some properties which make it good for growing crops. For this reason preventing erosion is important for plant growth! The different horizontal layers of the soil are called *soil horizons*. Tama soils typically have about 5 *horizons* **(Figure 1)**.

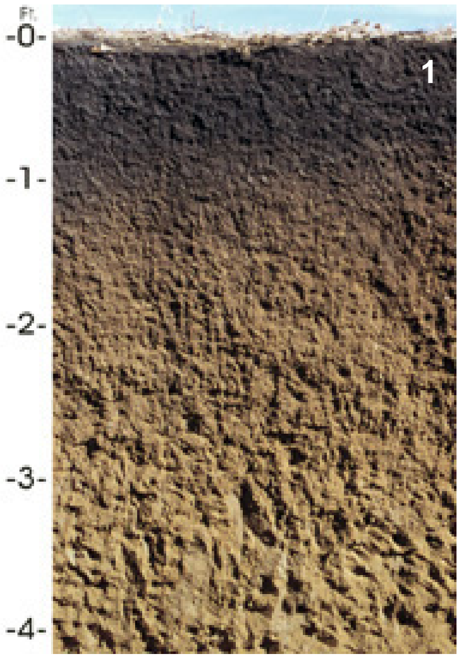
Where to dig a Tama

Tama soil covers more than 377,572 hectares (933,000 acres) and occurs in 28 counties in Iowa. The soils are primarily found on gentle slopes, on uplands and stream terraces in river valleys. Tama soils are highly productive agricultural soils because of their modest slopes, high organic matter concentration, good drainage, and high water-holding capacity. Other common soils found in Iowa include Clarion, Nicollet, Muscatine, Marshall, Monona and Sharpsburg series.

Importance

Most Tama soils are used for crop production and were once prairie grasslands. The prairie grasslands once covered millions of acres in the Midwest, supported range animals like the American bison, and were home to birds like Grouse and Meadowlarks. The native vegetation included big bluestem, little bluestem, switchgrass, and other tall grass prairie species. Today this highly productive soil is used for growing corn, soybeans, and small grains for food and feed for livestock.

Photo by Chip Clark/Smithsonian Institution



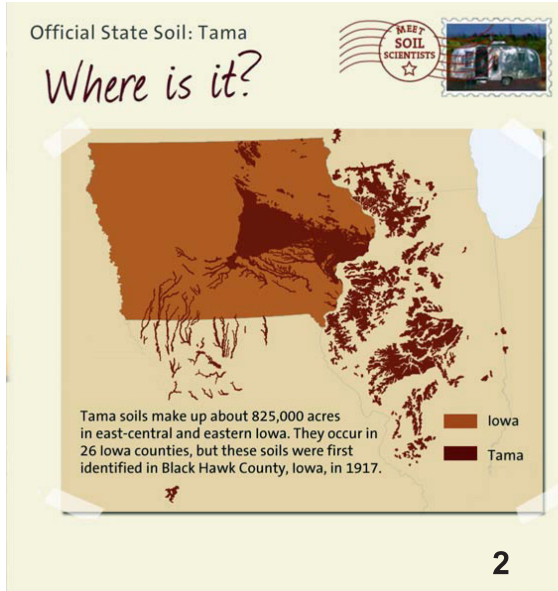


Fig. 1 Tama Soil Profile.

Fig. 2 Location of the Tama soil series in Iowa and surrounding Midwest states. http://forces.si.edu/soils/interactive/statesoils/index.html

Fig. 3 The Tama soil is rich in nutrients and ideal for agriculture. Credit: USDA-NRCS.

Soils that have very favorable properties for growing grain, feed, and fiber production often have few limitations for non-agriculture uses. Tama soil properties are ideal for residential and small commercial building development. These favorable properties include the high silt content of the Tama parent material, its depth to less desirable parent materials, and being well-drained. Tama soils also have low to moderately low shrink-swell potential which can cause the foundation of buildings to crack. The use of the Tama soil for basements, sidewalks, driveways, parking lots, on-site waste treatment and playgrounds require less engineering and remediation compared to many other soils types. **(Figure 2)**

Uses

Tama soils are highly productive agricultural soils **(Figure 3)** because of their modest slopes, high organic matter concentration, good drainage, and high water-holding capacity.

Limitations

Soil Scientists studied Tama soil and determined that it is well suited for agriculture. However because it is primarily silty the soil can be easily eroded. This means that over time and with excessive tillage the soil can be blown away by wind or carried down slopes by heavy rains into nearby streams and rivers. The result is that a soil rich in nutrients can be degraded over time, making it less able to hold water and nutrients. Tama is a rich soil resource that should be well managed and protected. Without good management practices, soils such as Tama are highly vulnerable.

Many farmers are now converting to "no-till" farming. No till farming does not use a plow to turn over the surface 15-20 cm (6-8 inches) of soil. The result of no-till farming includes better soil structure, increased organic matter, and better water holding capacity. The result of these improvements in soil properties is a reduced chance of *erosion*.

Management

Tama soils are rich in organic matter, silt and have high levels of plant nutrients from hundreds of years of grassland growth and decomposition. Tama soils are also slightly to strongly acidic. As a result, lime needs to be added to make the soil less acidic, and help plant growth. Since Tama soils have silt loam to silty clay loam textures, water, lime, and fertilizer are held near the soil surface and easily accessible to plants. The soil does not normally become saturated because it is *permeable* and rain water can readily *percolate* or flow through the *profile*. This also makes it excellent for agriculture.

Tama Soil Formation

There are five major factors that are responsible for forming soils. These are **Cl**imate, **O**rganisms, **R**elief, **P**arent material and **T**ime – ClORPT, for short. ClORPT is responsible for the development of soil profiles and chemical properties that differentiate soils. So, the characteristics of Tama soil (and all other soils) are determined by the influence of ClORPT. Weathering happens when environmental processes such as rainfall, freezing, and thawing act on rocks and minerals, causing them to fracture and break into pieces. ClORPT acts on rock and mineral pieces, marine sediments, and plant materials to form soils.

Climate – Temperature and precipitation influence the rate at which parent materials weather, and dead plants and animals decompose. They affect the chemical, physical and biological relationships in the soil. Over time, as a result of climate, weathering and decomposition of plant material in soils develop different colors at different depths. Tama soils developed under a humid climate with cold winters and hot summers and abundant rainfall.

Organisms – A soil is home for many plants and animals. Plant roots spread, animals burrow, and microorganisms decompose the tissues of dead plants. These and other soil organisms speed up the breakdown of large soil particles into smaller ones. Plants and animals also influence the formation and differentiation of soil horizons. Plants determine the kinds and amounts of organic matter that are added to a soil under normal conditions. Microorganisms break down complex organic compounds into small ones and in so doing add organic matter to soil. Before they were used for agriculture by European settlers in the 19th century, Tama soils supported tall grass prairies over thousands of years. The result is that Tama soils are dark brown, rich in organic matter and nutrients that can support abundant plant growth.

Farmering also affects Tama soil development. This is easily seen because cultivated Tama soils have a characteristic "plow layer." Plow or till layers in the surface 15-20 cm (6-8 inches) can look and feel different from the rest of the soil as a result of a farmer annually tilling the soils in preparation for planting new crops.

Relief – Landform position or relief describes the shape of the land (hills and valleys). The direction a slope faces makes a difference in how much sunlight the soil gets and how much water it keeps. Thicker soils often form at the bottom of the hill than at the top because gravity and water move soil particles downhill. Tama soil has excellent drainage because it is located at higher positions in the local landscape **(Figure 4)**.

Parent material – Just like people inherit characteristics from their parents, every soil inherited some traits from the material from which it forms. Some parent materials are transported and deposited by glacier, wind or water. Some parent materials are just deposited by gravity (for example, volcanic lava).

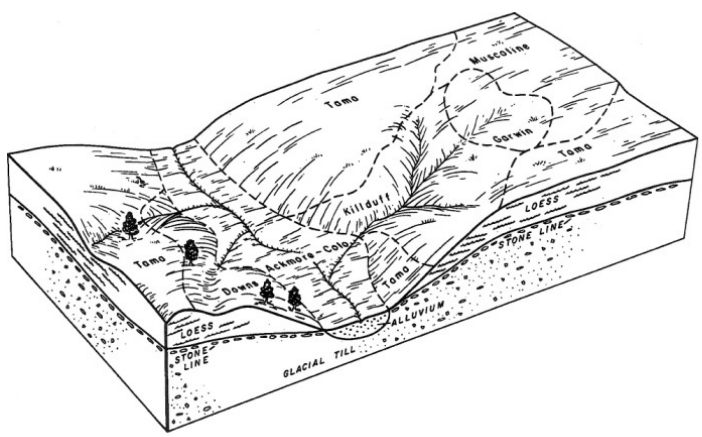


Fig. 4. Relationship of soils, landform position (relief) and parent material. Tama soils are located on the gentle slopes and stream terraces in river valleys. Credit: USDA-NRCS. Soil Survey of Jasper County, Iowa.

Tama soils are formed from "*loess*"(pronounced "luss"). Loess is primarily silt-sized particles that are carried by the wind over hundreds of miles and deposited downwind from the original source. During the last Ice Age in North America, glaciers (which were more than 1.6 kilometer or 1 mile thick!) pushed south from Canada. As the glaciers melted, they deposited loose silty material on the river floodplains. Over time winds picked up that silty material, carried it many miles, and dropped it in areas where Tama soils are now found. Loess deposits can be over 61 meters (200 feet) thick!

Time – All the factors act together over a very long time to produce soils. As a result, soils vary in age. The length of time that soil material has been exposed to the different soil-forming processes makes older soils different from younger soils. Generally, older soils have better defined horizons than younger soils. Less time is needed for a soil profile to develop in a humid and warm area with dense vegetative cover. More time is required for the formation of a well-defined soil profile in fine textured material than in a coarse-textured soil material.

The effect of time on Tama soils can be seen in many ways, including deposition of loess materials many centimeters deep, multiple soil horizons, and dark colors as a result of plant decomposition. The material composing Tama soils was deposited over a period, from about 29,000 to 14,000 years ago. The characteristics of Tama soils are the result of 3,000 to 5,000 years of development. Tama soils were heavily influenced by native prairie grasses, a humid climate, and the loess parent material.

Glossary

Erosion: The process of eroding or being eroded by wind, water, or other natural agents

Organic matter: Material derived from the decay of plants and animals. It contains compounds of carbon, nitrogen, and hydrogen.

Loess: a loosely compacted deposit of windblown silt-sized sediment.

Percolate: the movement of a liquid through a porous surface or substance.

Permeability: The ease to which gases, liquids or plant roots penetrate or pass through a layer of soil

Silty Clay Loam: Soil material that typically contains between 50-80% silt, 27-40% clay and 1-10% sand.

Soil Horizon: A layer of soil with properties that differ from the layers above or below it.

Soil Profile: the sequence of natural layers, or horizons, in a soil. It extends from the surface downward to unconsolidated material.

Soil Scientist: A soil scientist studies the upper few meters of the Earth's crust in terms of its physical and chemical properties; distribution, genesis and morphology; and biological components. A soil scientist needs a strong background in the physical and biological sciences and mathematics.

Soil Texture: The relative proportion of sand, slit, and clay particles that make up a soil. Sand particles are the largest and clay particles the smallest. Learn more about soil texture at www.soils4teachers.org/physical-properties

Subsoil: Horizon subsurface zone that has been transformed by soil-forming processes, often including transfers of particles from the horizons above it. Not present in all soils.

Topsoil: (A horizon) – The uppermost zone of a soil where organic matter has accumulated at the land surface.

Water table: The uppermost surface of a zone in a soil where soil pores are completely filled with water. This surface can move up or down during different seasons.

Soil Science Society of America
5585 Guilford Road
Madison WI 53711-5801
Tel. 608-273-8080 • Fax 608-273-2021
www.soils.org • headquarters@soils.org

This state soil booklet was developed under the auspices of the Soil Science Society of America's K-12 Committee —their dedication to developing outreach materials for the K-12 audience makes this material possible.

Additional Resources

Lindbo, D. et al. 2008. *Soil! Get the Inside Scoop*. Soil Science Society of America, Madison, WI.

Lindbo, D. L., D. A. Kozlowski, and C. Robinson (ed.) 2012. *Know Soil, Know Life*. Soil Science Society of America, Madison, WI.

Web links for more information

Soil Links

Resources for Teachers, www.soils4teachers.org

Have Questions? Ask a Soil Scientist,https://www.soils.org/ask

Soil Science Society of America, https://www.soils.org/

Natural Resources Conservation Service, State Soils Homepage http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=stelprdb1236841

NRCS Links

Natural Resources Conservation Service, Educational Resources, http://soils.usda.gov/education/resources/k_6/

Natural Resources Conservation Service, USDA. *Tama – Iowa State Soil*.

USDA Natural Resources Conservation Service. 2010. *From the Surface Down: An Introduction to Soil Surveys for Agronomic Use.* 2nd Edition. ftp://ftp-fc.sc.egov.usda.gov/NSSC/

USDA Natural Resources Conservation Service. 2007. *From the Ground Down: An Introduction to Iowa Soil Surveys*. ftp://ftp-fc.sc.egov.usda.gov/IA/news/GroundDown.pdf

Authors:
Bradley W. Miller
Reviewed and edited by Thomas E. Fenton and Gerald A. Miller.