# Soil Science

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МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ  РОССИЙСКОЙ ФЕДЕРАЦИИ
ФЕДЕРАЛЬНОЕ АГЕНТСТВО ПО ОБРАЗОВАНИЮ

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МЕТОДИЧЕСКИЕ УКАЗАНИЯ
ПО АНГЛИЙСКОМУ ЯЗЫКУ

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Методические указания предназначены для использования на практических занятиях по английскому языку и для самостоятельной работы студентов второго курса специальности « Почвоведение»

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# Введение

Данные методические указания по английскому языку предназначены для студентов 2 курса специальности « Почвоведение». Целью методических указаний является подготовка студентов к использованию иностранного языка в их будущей профессиональной деятельности. Тематический отбор материала позволяет ознакомить студентов с терминологией по специальности «Почвоведение». Методические указания предназначены для использования на практических занятиях и для самостоятельной работы. Указания состоят из 3 разделов. Первый раздел включает тексты и упражнения по вопросам изучения, классификации, эксплуатации почв. Второй раздел содержит тексты, описывающие типы почв на разных континентах. Третий раздел состоит из текстов для дополнительного чтения. Также имеется словарь, содержащий лексику по данной теме.

# 1 Unit 1 My Speciality

**1.1 Read and translate the text A. Pay attention to the words and word-combinations from the Ex.1.2**

**Text A My Speciality**

*Where do you study and what is your future speciality?*

I study at Orenburg State University, the Faculty of Chemistry and Biology. Our faculty was organized in 2006 on the basis of the Faculty of Natural Sciences. Our Faculty includes five departments:

– Department of Biology;
– Department of Bioecology;
– Department of Microbiology;
– Department of Chemistry;
– Department of Soil Science.

I belong to the Department of Soil Science and my future speciality is Pedology. Our department is concerned with the scientific study of all aspects of soils. These include the physical, chemical and biological processes which explain soil behaviour. Specific topics include field studies to improve land utilization, detection of changes imposed on the soil microbial population, chemical assessment of both beneficial and toxic elements and the movement of water and gases through soil . The soil science includes soil classification, spatial distribution and soil-forming processes, soil management, soil conservation, soil – environment interactions.

*What subjects do you study?*

The academic program is composed of general subjects and such specialized ones as:

*Pedology* concentrates on the processes involved in soil formation and the identification and mapping of soils;

*Soil Chemistry* is concerned with the constitution of soil materials, and with the related surface chemistry which affects the availability of plants nutrients;

*Soil Physics* considers those properties of soil which are of imporfance to soil stability, and aggregation; movement and retention of water and air in soils;

*Soil Microbiology* provides an understanding of the microorganisms present in soils, the transformations which they bring about and the techniques necessary for their investigation.

Courses are also arranged in soil management subjects : soil restoration, drainage, irrigation and erosion control. Besides we are taught such subjects as geoecology, geoinformational systems and modeling. It is necessary for forecasting and evaluation of ecological state of environment. Much time is devoted to practical work in the laboratory or in the field.

*Why soil studying is of such importance now?*

Soil is the fundamental natural resource, providing water and nutrients for all terrestrial plants, both natural and cultivated, and acting as a filter for an increasingly complex array of waste materials. The utilization of soil by agriculture, animal husbandry, and forestry is often termed ’’soil exploitation’’. Soil is necessary for dwellings, highways, recreation areas; it also provides many other essential functions.

Soils are of great importance to people. Compared with the total volume of the earth, the soil forms a very thin layer from a few centimeters to several meters in thickness. Yet this layer of soil produces most of our food supply. This productive topsoil upon which agriculture depends have taken hundred of years to develop, but if it is misused it can destroyed within a very short time. Winston Churchill said: “ To build may have to be the slow and laborious task of years. To destroy can be thoughtless act of a single day”. That’s why the main topic of our studying is ecology of soil.

*What job opportunities do you have?*

Graduates in Soil Science can obtain posts in a wide range of organizations such as: agencies concerned with the soil survey and land evaluation; local authority posts involved in conservation, land reclamation and pollution problems; government research organizations; schools, agricultural and technical colleges, universities; biotechnological firms.

### 1.2 Words and word-combinations to the text A. Pronounce them correctly and mind their meaning

pedology- почвоведение
utilization- использование
detection -обнаружение
assessment- оценка
beneficial-полезный
toxic- токсичный
spatial- пространственный
conservation-охрана
identification- идентификация
mapping- картирование
availability- пригодность, наличие
nutrients- питательные вещества
aggregation- накопление
retention- удержание, сохранение
investigation- исследование
restoration- восстановление
drainage- дренаж, осушение

irrigation-ирригация, орошение
erosion- эрозия
forecasting- прогнозирование
evaluation- определение, оценка
terrestrial plants- наземные растения
waste materials- отходы
food supply- запасы пищи
to misuse- злоупотреблять
to destroy- разрушать
survey-обследование
reclamation- мелиорация

**1.3 Comlete the following sentences**

1. Department of Soil Science forms a part of... .
2. Scientific study of soil includes... .
3. Specialized subjects include... .
4. To forecast and evaluate ecological state of environment one should study... .
5. “Soil exploitation ” means... .
6. Graduates of our department can work as... .

**1.4 Get ready to speak on the topic “My Speciality”**

**1.5 Read and translate the text B. Pay attention to the words and word-combinations from the Ex. 1.6**

**Text B What is Soil**

Soil is the layer of mineral and organic material that covers most of the earth’s land surfaces. The soil has five basic components: mineral particles formed by the breakdown of rock; decayed organic materials; water which has soaked into the ground as a result of precipitation; air; living organisms such as earthworms and many others.

Soil is the product of two major processes. They are *the decomposition of rock and the decay of plant and animal life.* The processes of chemical and physical weathering are responsible for breaking down the bedrock into fragments. These rock fragments provide the original material for the formation of soils. It is colonized by living things (organisms). Decayed plants and animals form *humus,* which makes up the top level. Soil rich in humus is usually fertile and is black or dark brown. Below humus lies a layer of mineral particles that washes down from the humus. Finally there is a layer of parent material , or solid rock. This section down through a soil from the surface to the underlying rock is called the *soil profile.* Different soil profiles are found under different conditions, and soils are recognized and classified on the basis of the parts of the profile which are present.Soil profiles tell soil scientists whether land is best for agriculture, wildlife habitat, forestry, pasture, or recreation. They also tells us how suitable soil might be for various other uses such as home building and highway construction. In a mature soil, profile usually consists of successive (coming one after the other) layers – horizons.

Soil scientists recognize five major horizons. The uppermost **O horizon**, or litter layer, a thin layer of organic waste from animals and detritus, is a zone of organic decomposition characterized by a dark, rich color. Plowing mixes it in with the next layer.

The **A horizon**, or topsoil, varies in thickness from 2.5 centimeters (1 inch) in some regions to 60 centimeters (2 feet). This horizon is generally rich in inorganic and organic nutrients and is economically important because it supports crops. The A horizon is darker and looser than the deeper layers. It holds moisture because of its organic material, the humus, and is quite porous. The A horizon is also known as the "zone of leaching," since nutrients are leached out of it as water percolates through it from the surface.

The **B horizon**, or subsoil, is also known as the "zone of accumulation," because it receives and collects minerals and nutrients from above. This layer is lightly colored and much denser than the topsoil because of lack of organic matter.

The **C horizon** is a tranzition zone between the parent material below and the layers of soil above.

The **D horizon** is the parent material from which soils are derived. Not all horizons present in all soils; in some the layering may be missing altogether.

### 1.6 Words and words-combinations to the text B. Pronounce them correctly and mind their meaning

breakdown- распад
rock- порода
to soak – впитывать(ся)
precipitation- осадки
earthworm- земляной червь
decomposition- разрушение
decay – гниение
weathering- выветривание
bedrock –коренная подстилающая порода; почва (залежи)
humus -гумус
fertile- плодородный
parent material – материнская порода
solid rock- твердая порода
underlaying rock – основная порода

soil profile – почвенный профиль
habitat- место распространения (животных, растений)
forestry- леса; лесоводство
pasture- пастбище
mature soil- зрелая почва
horizon- горизонт
litter layer- подстилающий слой
detritus- детрит, обломочный материал
plowing - вспашка
moisture- влага
porous- пористый
leaching- выщелачивание
to percolate-просачивать(ся)

### 1.7 Answer the following questions

1. What is soil?
2. What are five basic components of soil?
3. What two major processes form soil?
4. How is humus formed?
5. What is soil profile?
6. What can soil profile tell pedologists?
7. What are horizons?
8. What horizons do soil scientists recognize?
9. What horizon is also known as ''zone of leaching''?
10. All horizons are present in all soils, aren't they?

### 1.8 Retell the text ''What is soil?''

### 1.9 Read and translate the text C. Pay attention to the words and word-combinations from the Ex. 1.10

## Text C Factors influencing soil development

The climate is the most important factor of soil formation. It affects soil type both directly through the weathering effects, and indirectly as a result of its influence upon plant life. In tropics temperatures are high throughout the year, and as a result weathering takes place much more rapidly than it does in places which are further from the equator. It has been estimated that in tropical regions the effectiveness of weathering is almost ten times that of polar regions, and more than three times that of temperate regions. As a result deeper weathering is characteristic of tropical regions.

In the areas which have very heavy rainfall for much of the year there is a downward movement of water in the soil. The water dissolves the soluble materials and soluble humus in the soil, and carries both downwards. This process is known as ***leaching.*** The materials carried downwards by the water are re-deposited at a lower level in the soil. In the areas which have long and severe dry season, evaporation is greater than precipitation for a large part of the year, and so water tends to move upwards by capillary action. On reaching the surface the water evaporates, leaving behind those salts which were dissolved in it.

Both plants and animals influence soil development. The amount of plant material which is returned to the soil, obviously depends to a great extent upon the kind of vegetation cover. Soils of forest areas generally have much higher humus content than those of savanna areas. Dead plants provide nitrogen and other elements such as phosphorus, calcium and potassium, which are broken down from decaying plant by bacteria, and which plants can absorb again by their roots. The influence of animals on the soil is largely mechanical. Earthworms are particularly important as they change the texture and chemical composition of the soil as it passes through their digestive system. Ants and burrowing animals also disturb and rearrange the soil making it more porous and sponge-like, so that it can retain water and permit the passage of air.

In many parts of the world, people play an important part in modifying the soil by their methods of farming.

### 1.10 Words and word-combinations to the text. Pronounce them correctly and mind their meaning

to affect - влиять
influence- влияние
polar regions- полярные регионы
temperate regions- умеренные широты
tropical regions- тропики
soluble- растворимый
evaporation-испарение
capillary- капиллярный
to dissolve- растворять
vegetation cover- растительный покров
savanna- саванна
nitrogen- азот
phosphorus- фосфор
calcium- кальций
potassium- калий
bacteria- бактерии
to absorb - поглощать
roots- корни
texture- строение, структура

digestive system- пищеварительная система
ants- муравьи
to burrow- рыть норы
sponge-like- губчатый
to modify- изменять

### 1.11 Complete the following sentences

1. Tropical regions are characterized by... .
2. Leaching is... .
3. The water evaporates when... .
4. Plants can absorb different elements by... .
5. People play an important part in... .

### 1.12 Answer the following questions

1. How does climate affect soil type?
2. What does the effectiveness of weathering depend on?
3. How is soil formation influenced by precipitation?
4. How does vegetation affect soil development?
5. What part do animals play in soil formatoin?

### 1.13 Read and translate the text D. Pay attention to the words and word-combinations from Ex.1.14

## Text D Soil Classification

In classifying soils, pedologists identify ways in which soils differ. Color and texture help distinguish one soil from another. Pedologists recognize 175 color variations within the basic soil shades of black, red, brown, yellow, gray, and white. Although color can provide clues to a soil's fertility, it can also be misleading. A dark soil often contains humus (an organic material that makes soil fertile). Infertile soil, however, like that formed from volcanic ash that is acidic, can also be dark. On some regions a red color indicates soil fertility. In other areas it may indicate leaching (the washing out of mineral nutrients, which results in an infertile soil).

The texture of a soil affects its fertility, its ability to hold moisture, and the ease with which it can be cultivated. Texture is determined by the sizes of mineral particles into three groups. From largest to smallest, the particles are sand, silt, and clay. *Sandy soils* dry out quickly. *Clayey soils* are usually more fertile because they retain moisture and nutrients, but they are hard when dry and sticky when wet. *Loams* - mixtures of almost equal amounts of sand, silt, and clay are more fertile, retain moisture, and easy to cultivate. In general, loams are best soil in which to grow plants.

The age of a soil - how long the soil has been forming - often affects its depth and fertility. The kind of parent material affects the chemical composition and texture of a soil. For example, when limestone is the parent material, the soil may be rich in calcium and other essential elements. Shale, a fine grained rock, can produce a smooth, clayey soil that resists penetration by water and air. Sandstone, on the other hand, can produce a loose easily penetrated sandy soil that is low in fertility.

Topography, or surface features, plays a role in the kind of soil that forms. On expanses of flat land, soils are usually deeper because of increased water movement through them. The water deposits mineral down through the soil, allowing soil to form at a rate exceeding that of wind and water erosion. On slopes, less water moves through the soil, erosion is greater, and layers remain shallower.

The question of soil classification is controversial since pedologists, engineers, agriculturalists classified different kinds of soil, each group according to its own special knowledge of interests. But there is no doubt that classification should be based on categories that exist in nature, rather than on arbitrary creations of a classification systems.

In a natural classification, groups are recognized and subseguently arranged in a system; the system may change, but the groups will pass almost unchanged from one system to another. Pedologists have approached soil classification in such a manner. Observing that some soils have an ashy surface horizon, resting on another darker in colour and richer in fine earth, pedologists called them podsols (ashy soils). Other soils with a deep, dark horizon rich in organic matter and well satured with calcium were termed chernozems (black soils). Soils of rarher undifferentiated profile and of red colour were named krasnozems (red soils). In this way, groups of soils have been recognized and arranged in classification system; although opinions differ as to how these groups should be arranged within a system, essentially the same groups exist for all pedologists.

### 1.14 Words and word- combinations to the text D. Pronounce them correctly and mind their meaning

misleading - ошибочный
volcanic – вулканический пепел
acidic- кислотный, кислый
to hold- сохранять
to cultivate- обрабатывать
sand- песок
silt- ил
clay- глина
sticky- липкий, клейкий

loamy- суглинок
limestone- известняк
shale- сланец
fine- мелкий
grained- зернистый
smooth- однородный, гладкий
to penetrate- проникать
sandstone- песчаник
loose- рыхлый
to exceed - превышать
slope- склон
controversial- спорный
arbitrary- произвольный
saturated- насыщенный

**1.15 Read and translate the following classification of soil types. Make up a diologue using this information.**

**Major Soil Types ( According to New Encyclopedia Britannica)**

1.Ando (rich in amorphous clays)
2.Brunisolic ( braunified or acid horizons)
3. Chernozemic (deep neutral dark humus horizons)
4. Cinnamonic (reddish colour; rich in dehydrated iron oxides)
5. Dark clays (clays; rich in expanding clays; well saturated with bases)
6.Gleisolic (gray - blue colours or mottles due to waterlogging)
7. Kaolinitic (tropical;may have undifferentiated profile, or horizons rich in iron concretions or laterite)
8. Lessive (clay illuviation produced by organic matter)
9. Organic (extremely rich in organic matter; may have peaty and /or organic horizon
10. Podsols (eliviation of alumina and iron, usually producing ashy sandy surface horizon and illuvial horizon rich in amorphous clay)
11. Planosols (clay eluviation produced by sodium; illuvial horizon not natric)
12. Rankers (humic horizon resting on rock or permafrost)
13. Raw (undifferentiated soil profile)
14. Rendzinas (high lime content)
15. Solonchaks (rich in salts such as chlorides, sulfate, etc; related to gypsisoils, rich in gypsum)
16. Solonetz (clay illuviation produced by sodium; natric illuvial horizon )

### 1.16 Answer the following questions

1 What factors help distinguish one soil from another?
2. How many color variations of soil are recognized?
3. Does a red color of soil indicate fertility or leaching?
4. What soil features are affected by texture?
5. How can soils be grouped according to texture?
6. In what way does the kind of parent material affect soil?
7. What role does topography play in the kind of soil that forms?
8. In what way should the groups of soil be recognized and arranged in a system?
9. What soils are named podsols ? chernozems? krasnozems?
10. What other classifications of soils do you know?

### 1.17 Read and translate the text E. Pay attention to the words and word-combinations from Ex.1.18

## Text E Soil Erosion

Soil erosion is the most critical problem facing agriculture today, both in the poor developing countries and in the much wealthier industrial nations. **Erosion** is the process by which rock and soil particles are detached from their original site by wind or water, transported away, and eventually deposited in another location. **Natural erosion** generally occurs at a slow rate, and new soil is usually generated fast enough to replace what is lost. **Accelerated erosion**, resulting from human activities such as overgrazing, decreases soil fertility, causing a decline in agricultural production. In the long term accelerated erosion can destroy land permanently. Soil erosion affects distant sites. For instance, pesticides may adhere to soil particles and be transported to nearby waterways. Sediment deposited in waterways increases flooding, destroys breeding grounds of fish and other wildlife, and increases the need for dredging harbors and rivers.

The economic damage from soil erosion in the United States, for example, is estimated to be more than 6 billion a year. Erosion annually destroys about 500,000 hectares (1.25 million acres) of US cropland. According to recent estimates, erosion exceeds replacement on nearly half of the country's farmland. All told, about three billion tons of topsail are lost from American farms each year. Experts predict that if these trends continue, crop production will fall by 10% to 30% in the next 30 years. In the long run the US agricultural system could falter. Restoring topsail on abandoned land could take 300 to 1000 years.

Unfortunately, little information is available on soil erosion rates throughout the world. Experts agree, however, that the problem is significant in many regions. In China, the Yellow River annually transports 1.6 billion tons of soil from badly eroded farmland to the sea. The Ganges in India carries two times that amount. One conservative measure of topsoil loss puts the global figure at nearly 21 billion tons. Unfortunately, those countries with the fastest growing populations usually have the least money for soil conservation and the worst problems. Farmers in most developed and developing countries have done little to reduce erosion. In the developing world farmers struggle to meet their most basic needs and have neither the time nor the means to care properly for the land.

Economics impairs soil-erosion control in the developed nations. Caught between high production costs and low prices for grains, farmers may ignore the long-term effects of soil erosion while synthetic fertilizers artificially help them maintain yield in the short term.

Protecting land from soil erosion is an important task. Erosion can be controlled by a variety of techniques. Among them such strategies as:

1) minimum tillage;
2) contour farming;
3) strip cropping;
4) terracing;
5) gully reclamation;
6) shelterbelts.

These measures may raise the cost of farming in the short term, but they make good economic sense in the long run.

### 1.18 Words and word-combinations to the text. Pronounce them correctly and mind their meaning

to detach - отделять(ся)
to accelerate - ускорять
decline - упадок
permanently – постоянно
to adhere – прилипать
nearby – близкий, соседний
sediment – осадок, осадочная порода
flooding – подъем воды, разлив
breeding grounds – места размножения

dredging – углубление
harbor – гавань
damage – ущерб
to estimate – оценивать
to impair – ослаблять, ухудшать
fertilizers – удобрения
tillage – обработка почвы
contour – контурный
strip – полоса
terrace – терраса
gully – глубокий обрыв, лощина
reclamation – уменьшение
shelter – укрытие, защита

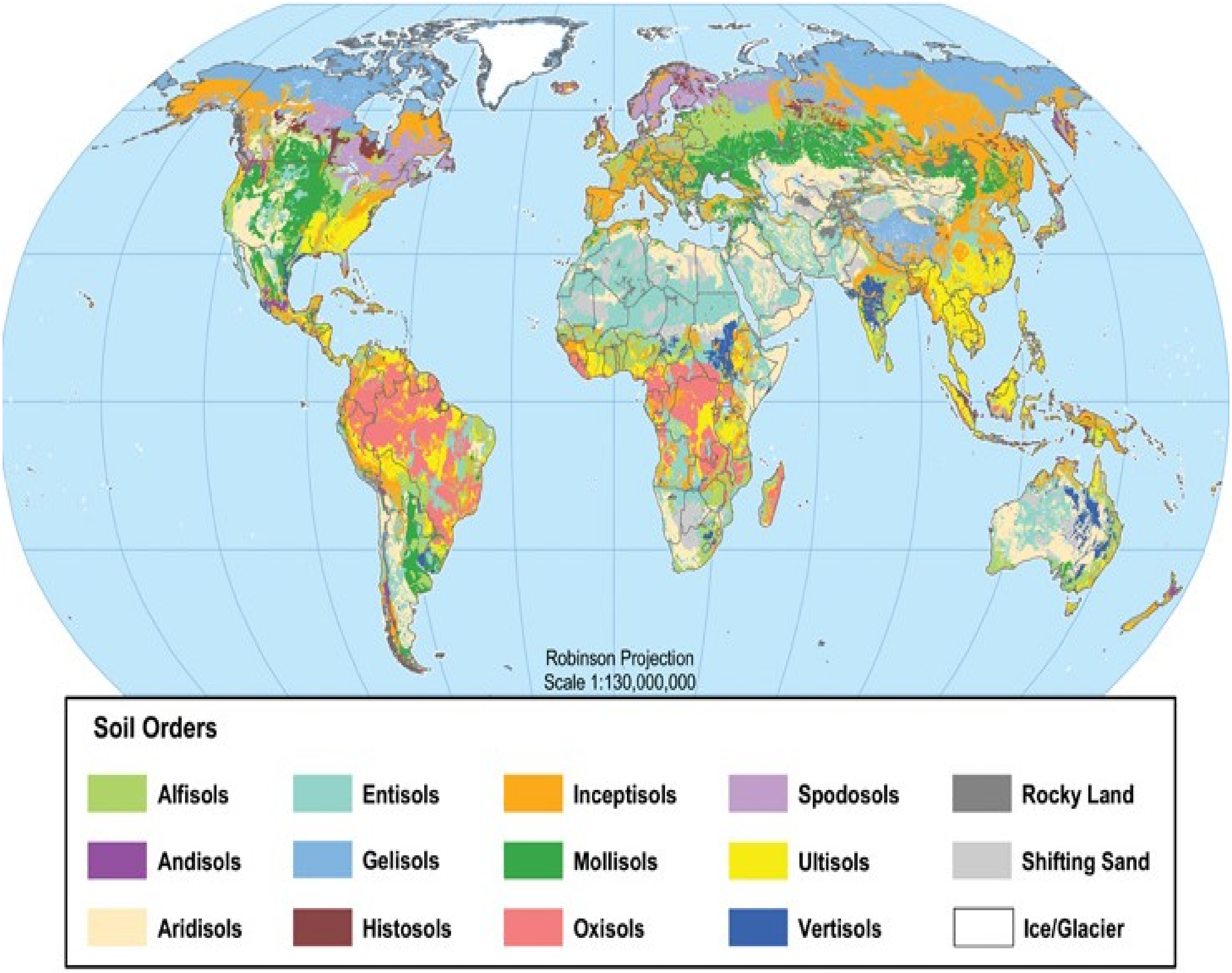
**1.19 Read the text and answer the question: “Какие меры были предприняты правительством США по контролю за эрозией почв?’’**

Governments can promote conservation of soil through a variety of measures. In 1985 the US Congress passed a farm bill that contains some important controls on soil erosion. The law denies any federal farm loans, subsidies, or even crop insurance to farmer who plows highly erodible land. The law also creates a land conservation program in which the federal government will pay farmers to remove highly erodible land from crop production for ten years and plant trees, grasses, or cover crops to stabilize the land and rebuild the soil. Farmers had “retired” an estimated 12 million hectares by 1989, cutting erosion by 800 million tons per year.

**1.20 Answer the following questions**

1. What is the most critical problem facing agriculture today?
2. What is erosion?
3. What is the difference between natural and accelerated erosion?
4. How does erosion affect soil?
5. How is the economic damage from soil erosion in the US estimated?
6. What are the prognoses of soil experts?
7. What problems are on the agenda in China and India?
8. How is the problem of soil erosion solved in developing and developed countries?
9. What six strategies are used for protecting land from soil erosion?
10. What other protective measures do you know?

# 2 Unit 2 Global Soil Regions




## Text 2.1 Soils on the territory of the former USSR

For the major part of the grasslands in the country - practically for that part which is regarded as a steppe type the chernozem soils are typical. The latter are represented by different types depending upon the sublayering geological deposits, climatic conditions and the texture of the vegetation cover.

The steppe provinces in the Eastern-European plain can be subdivided with respect to peculiarities of their soil cover into several belts in the north-south direction. Each belt is characteristic of its own soil varieties which, in the past when the spontaneous vegetation had not been disturbed by man, have been matched by their own associations of steppe vegetation. The northern belt is represented by extensive chernozems wherein the humus horizon extends vertically as deep as

0.8-1.0m. The humus content is frequently as high as 10 % or even higher. The soils in question are characteristic of the most diverse and productive grass-stand. Numerous mesoxerophilous grasses contribute to the formation of these. To the south the belt of moderate chernozem is situated. There the extension of the humus horizon and the per cent of the humus content is not so great. There soils are typical for the tuft-grass herbage. Still farther to the south one finds the belt of southern chernozems represented by soils with relatively moderate humus content (about 4 %) where the extension of the humus horizon is usually no more than 25 cm.

The extensive chernozems are characteristic of optimal water relations providing sufficient amount of water supporting considerable biomass production and the subsequent decomposition of it down to the stage of humus formation. A certain water deficit is found in the moderate chernozems. This becomes very pronounced in the southern chernozems. Farther to the south of the above mentioned chernozems a belt of chestnut soils is situated. The light-coloured varieties of these soils are typical for semi-deserts with sagebrush-grass interrupted grass-stand. All the chernozems contain carbonates. The most abundant accumulation of carbonates proceeds during soil formation in the chestnut soils, which in some places are the products of the process of soil formation.

In the west of the steppe zone (Ukraine, the Kuban lowland) the soils remain practically unfrozen in winter and microbiological processes are maintained in these throughout the whole year. In the autumn-winter period these soils become deeply watered. This accounts for the fact that easily soluble salts become absent from these soils down to considerable depth. In the east of the steppe zone the chernozems become frozen in winter. It is in Eastern Siberia that this freezing goes particularly deep. This freezing paralyzes microbiological processes and the drainage of deep soil horizons.

The whole chernozem belt in Western Siberia displays considerable salinity. Solonetzes and solonchaks are abundant there which account for the 20-30 per cent of the area. The extensive and moderate chernozems can be characterized by good agricultural indices.

The phosphoric acid, nitrogen, and potassium content is high. The small-grain structure of these soils allows for penetration of water and air. These features account for the fact that these soils in plains are almost everywhere cultivated.

Mountain chernozems in the steppe type grasslands are frequently sublayered by cobble at a shallow depth. These chernozems despite very shallow depth are featured by high humus content. Certain varieties of the mountain chernozems are to a greater or lesser degree leached by the waters coming down from the slopes.

Somewhat separately one finds the soils in the subtropical steppes (pseudosavannes) in the foothills and low mountains in the Tjan-Shan and Pamiro-Altai. These are considered among the grey soils and, as a rule, develop on the loesses. In the

Tjan-Shan the grey soils are typical also for the steppe grasslands dominated in the cover by xerophilous grasses. The depth of the grey soils varies from place to place and the humus content in the upper layer (up to 5 cm thickness) is 2 to 6 per cent. Deeper the humus content becomes dramatically low. If sufficiently irrigated the grey soils are rather fertile. Under natural conditions (without artificial irrigation) these are optimally watered only in the winter-early-spring period.

Soils of the alpine and subalpine grasslands are the acid tuft soils. Depending on the situation they are more or less thick. The degree of cobble content in these soils and the content of humus depends on the sharpness of slope and its geological texture. In contrast to the chernozems the alpine and subalpine soils always display acid reaction. The greatest depth of these is found in humid high-mountains reached by the masses of Atlantic air. Under continental conditions (Tjan-Shan, Pamiro-Altai) the lower limit of the alpine soils is found high in the mountains. In the sub-oceanic provinces (Western Caucasus, Kamchatka) these develop at lower altitudes.

There can be recognized three groups in the soils in question: (1) mountain-meadow plat soils (the alpine grassland); (2) mountain-meadow soddy soils (the subalpine grassland); (3) mountain-meadow chernozem-like soils (developing on the calcareous mountain bed and have a neutral or slightly acid reaction), in some respects these are transitory to the mountain steppe soils.

To the north of the steppe provinces a narrow belt of grey forest soils is found in plains. Still farther to the north it is replaced by the soddy-podzolic soils referred to also as tuft-meadow soils.

Grey forest soils develop under the broad-leaved forests. In many respects these are intermediate between the chernozems and the podzolic soils. The carbonates in these are leached to a considerable depth. In grasslands these soils are rapidly transformed; the major part of these is at present cultivated.

The tuft-meadow soils are more typical for grasslands. Genetically these are related to the southern taiga forests with a well developed grass layer. These forests having been cut down the grasses occupy the area and a productive grassland develops. The latter is particularly stable in case it is employed as a hay meadow.

This accounts for the fact that the belt of distribution of tuft-meadow soils is sometimes called forest-meadow belt. An alternation of forests, grasslands, and ploughed fields is found there.

The pattern of tuft-meadow soils is markedly influenced by the geological deposits found under these. On the carbonate deposits the tuft layer in these soils is as thick as 20-35 cm. The alkaline reaction in these soils is formed at a shallow depth, and sometimes even at the surface (rendzinas). On the carbonate-free rocks the tuft-meadow soils always display podzolization to a greater or lesser degree. In the majority of cases, however, the soil reaction is only slightly acid and in places neutral.

Specific features of the tuft soils in flood plains should be mentioned. Most frequently these are covered by grass vegetation. The tuft-meadow soils with two humus horizons are often found in Western Siberia. In the Far East (Kamchatka) the soddy acid humus soils are common. These develop on a volcanic material and are covered by grass forests. The grass bogs are formed on peat soils often oversaturated with water.

Assignments to the text

1. Make up questions to the text and ask your groupmates to answer them.
2. Make up a plan of the text.
3. Get ready to speak on the content of the text

## Text 2.2 Soil types of Asia

There are various soil types in Asia: chernozem, chestnut soil, brown soil in the desert-steppe, and grey-brown soil in the desert of northern Asia (west and north-east China and Mongolia). Also there are subtropical soil types such as grey-cinnamon, cinnamon, yellow and red soils in middle Asia (Lesser Asia, Near East, central and south China, Korea and Japan), and tropical soil types such as desert soil and lateritic soils in southern Asia (the Arabian Peninsula, Indian Peninsula, Indochina Peninsula, and Indonesian islands).Scientists point out the relationship between soil types and climate. The continental climate is seen most conspicuously in Asia compared with other continents. But because the Asian continent is so large, its relief and coastline are very characteristic, and it has a special geographic relationship to the Pacific, Indian, and Arctic Oceans regarding the distribution of temperatures, anticyclones, and humidity. The interior of the continent, particularly Central Asia, West Asia, and Near East, has arid landscape and physiognomy under the influence of arid climate. Statistically, desert soil and semi-desert soil are distributed as widely as humid soils. Besides this, horizontal distribution of soils, high mountains have mountain grey forest soil, mountain moor soil, mountain podzol soil, and brown forest soil, among others.

Regarding the soils of China, various types have been recognized and are listed as follows:

*I.Pedocals and other calcium soils*

1.Black earths

2.Chestnut earths

3.Poorly drained pedocals

4.Desert soils

5.Soils of recent alluvial and lacustrine origin calcareous alluvium and saline alluvium

6.Alkali soils.

*II. Pedalfers and other leached soils*

1.Podzolic soils

2.Slightly podzolic soils

3.Red soils (including podzolic paddy soils and some rendzinas)

4.Yellow soils (including podzolic paddy soils and some rendzinas)

5.Soils of recent alluvial and lacustrine origin

Japanese soils are divided into four zonal types as follows: l)podzolic soils; 2) brown forest soils; 3)yellow-brown forest soils; 4)red and yellow soils.

Intrazonal soils with 18 soil types are classified into two categories: (1) volcanic ash soils and (2) hydromorphic soils under the influence of saturated water for lowland rice cultivation.As azonal, immature soils, there are row warp soils, polder soils, volcanic ash soils, regosols and lithosols. Among them, immature volcanic ash soils with A—C horizon are widely distributed in Japan.

Japanese semi-natural grasslands are mostly distributed in areas with the soils that have originated from volcanic ash soils. These soils have large amounts of humus and nitrogen, particularly in the surface layer. There is much nitrogen in the form of ammonia, but almost none in the form of nitrate. Available phosphate is also very little or almost none. In the case where there is available phosphate, it is contained only in the surface layer. The existence of water-soluble aluminium is very characteristic, and the ratio $Si0_2/Al_20_3$ is small. The $P_20_5$-absorptive power is very large, and humus always exists excessively. Exchangeable bases are generally little, but calcium, magnesium, and potassium are accumulated in the surface layer. The degree of base saturation is very low except in the surface layer. In the soils of tall-grass meadows dominated by *Miscanthus sinensis,* the humus layer is thicker and contains large amounts of water, humus, total nitrogen, available nitrogen, exchangeable bases, etc. than in the soil of shortgrass pastures dominated by *Zoysia japonica.* However, the total and available nitrogen, particularly in the form of nitrate, and available $P_2O_5$ increase in shortgrass pastures under moderate grazing.

Assignments to the text

1. Make up questions to the text and ask your groupmates to answer them.
2. Make up a plan of the text.
3. Get ready to speak on the content of the text.

### Text 2.3 Soil types of Europe

The development of the attributes of the various soils of Europe is not only influenced by the present climate and the geological substrates, but also by the climatic situation of the former periods (e. g. , hot tertiary and cold pre-glacial Pleistocene environments, some post-glacial millennia drier than now). The prevalent zonal types of Mediterranean climatic areas are the meridional brown soils and of the cold temperate regions the podsol (= podzol) soils. In the cool temperate areas, the various forms of the brown soils (=brown forest soils) are mainly the zonal types. But besides them, namely on sand substrates, soils occur frequently approaching podsol types (partially termed podzolic turf soils). The fertile black soils (chernozems), occurring in ample parts of southeastern and central Europe also in potentially natural forest areas, originated mainly during post-glacial periods with climates drier than now. Calcareous substrates cause mostly specific soil types important for particular groups of grassland vegetation are mentioned below.

The main substrate types of mesophytic grasslands of temperate Europe are the brown soils (= brown forest soils, either eutrophic or oligotrophic) or transitional forms to podsol soils and to various moderate wet soil types.

The meridional (= mediterranean) brown soils are the group of substrates developing under present Mediterranean climates. But reddish fossil latosols (terra rossa etc.) are very frequent, relics of former periods with hotter climates (e.g. during tertiary periods). Generally Mediterranean soils have certain attributes promoting erosion. Beyond that, the early development of civilization in these areas (e.g. antique Hellas, centers of Roman Empire) disturbed the vegetation cover already since unusual long times. Therefore heavily eroded slopes are frequently the site of mediterranean grasslands.

The soils of alpine and arctic grasslands are mostly more or less shallow, due to the cold climates and to heavy erosion by water and wind. Often certain structural features (polygons, stripes etc.) are remarkable. The humus contents are very high mostly under these grasslands. Therefore, the substrates are united under the term “alpine or arctic humus soils” (belonging to the rendzina group on basic rocks and to the ranker group on silicatic substrates).

European grasslands on wet sites grow on various soil types determined by high water tables and by temporare flooding. Among the temporally flooded valley soils, scientists differentiate the types of rambla, paternia, borowina, vega, and smonitza. The mineralic gley soils have permanently rather high water tables. In fens and bogs, the upper parts of the soils consist of more or less thick horizons of purely organic material (peat).

European grasslands on wet sites are determined by predominantly moist or wet soils impregnated with water rich in sodium and mostly also chloride ions, to sodium-chloride sources or to conditions created by certain semi-arid climatic characters.

The coastal saltmarsh soils are rich in sodium chloride. In the continental plains, sodium carbonate ($Na_2CO_3$) and sodium sulphate ($Na_2SO_4$) occur also in these soils (e.g. in certain solonchak soils).

Assignments to the text

1. Make up questions to the text and ask your groupmates to answer them.
2. Make up a plan of the text.
3. Get ready to speak on the content of the text.

## Text 2.4 Soil types of Africa

Africa is essentially formed by an ancient Precambrian shield 570 to 4,000 million years old. Leaching rainfall is high in the tropics, even in climates with a long dry season, moreover climate varied during this time. As a consequence leaching and weathering are deep, and soil predominantly oxic, even recent alluvial soils are often old, because the materials had been deeply weathered in their place of origin. Even in the desert or badly drained areas we often encounter oxic soils that have been calcified, alkalinized or salinized later.

Soils of Northern Africa are young (illitic), clays prevail, and cation exchange capacity is relatively high; due to the climate cinnamonic soils, with reddish colours, prevail; many are calcic.

There are also volcanic (andic) soils in Cameroon, Ethiopia, and elsewhere; due to their high cation exchange capacity they are the most productive and population piles up around volcanoes.

So that we may distinguish in Africa 4 fundamental soil regions:

1) The ancient shield with relatively high leaching rainfall, although the dry season may be long; soils are predominantly oxic or acric (oxisols, kaolinitic, ferrallitic).
2) The deserts and almost desertic areas, where oxic soils prevail, but they are often recalcified, salinized, etc.
3) Mediterranean North Africa, with illitic soils, usually rhodic, often calcic.
4) The volcanic areas.

Gneiss and granite rocks abound in the African shield. Weathering of these rocks is rapid at the surface, but does not advance in depth; the resulting gravely soil is waterlogged during the humid season, and intensely dried during the dry one. Iron is reduced, put in solution, leached downwards and precipitated on the surface of gravel at some depth, within the rhizosphere; the coat formed is almost impermeable, and protects gravel from further weathering. As a result the greater part of African soils are "ferruginous", having ferruginized gravel and rock brash at some depth. Since leaching is more or less impeded by the forementioned coat, and drainage bad, these soils are usually eutrophic (not so poor in bases), and they permit to grow exigent species, as cocoa, yams, etc. But some are dystrophic (poor in bases).

Assignments to the text

1. Make up questions to the text and ask your groupmates to answer them.
2. Make up a plan of the text.
3. Get ready to speak on the content of the text

**Text 2.5 Soils types of Australia**

In Australia the range of climates, the presence of rocks of all types and degrees of weathering, and a range of land forms combine to produce a great range of soils. While most of the major soil groups have equivalents elsewhere in the world there is the difference between major grassland soils of the southern hemisphere and those of the northern. Scientists list 5 sets of features that differentiate Australian soils from those of the northern hemisphere. They are: (1) Low nutrient status especially with regard to phosphorus and nitrogen. (2) Poor physical conditions of surface soils leading to problems of water entry. (3) Large areas with strong texture contrasts down the profile. (4) The climatic zonal concept of soil distribution does not apply. (5) There is a prominence over large areas of soil microrelief - the "gilgai" pattern of mounds and hollows with associated profile differences.

Much of the present continental surface dates from the Tertiary when widespread peneplanation and intense weathering produced an extensive cover of deep (up to 60 m thick) laterite profiles. Many of the present soils relate to the extent of stripping and modification of the original laterites. Over much of the western two thirds of the continent are extensive low tablelands variously dissected and weathered. Here the commonest soils are infertile modified relic lateritic soils of many forms. To the east (e.g. in western Queensland) there are extensive undulating to flat fertile self-mulching grey and brown soils formed from Cretaceous sediments after stripping of the older profile. Elsewhere are large areas of soils formed on deeper horizons of the original soil exposed by truncation. Thus a great many present Australian soils reflect a long history of leaching and consequent infertility. A further factor that reduces fertility over large areas is the presence of excessive salinity (of still unknown origin) leading to the poor physical properties and infertility associated with solonisation. In the broad belt of highlands along the eastern coast complex geology (including extensive areas of basalt) and variety of landform combine with higher rainfall to produce a range of more fertile soils.

In general Australian vegetation is dependent on soil type rather than a determinant of it, and this applies to the grasslands, e.g. there are many areas where it is reasonable to suspect that the absence of trees is due as much to soil water relations directly affecting seedling establishment, as to increased competition from vigorous grasses responding to improved mineral nutrition.

The major soil groups supporting grassland are discussed below.

The hummock grasslands occur chiefly on *red earthy sands and ironstone gravel soils.* The earthy sands are coherent sands and sandy loams deriving their red to reddish brown colour from grain coating of iron oxides. There is little profile development apart from a weakly developed a horizon; they are porous, acid, and very infertile. The ironstone gravel soils are characterized by large surface accumulations of ironstone gravel with some massive laterite in a variable matrix, commonly of earthy sand, underlain by various mottled or pallid zone clays of the original laterite profile from which they derive. They are shallow, grossly infertile and have poor water relations. They occur on broad undulating or dissected tablelands, and are commonest astride the tropic in the inland of western Australia.

The tussock grasslands occur on a range of clay soils with the common characteristics of flat to gentle relief, clays that crack deeply (cracks can be 1 m deep by up to 10 cm wide), self-mulching surfaces, mild leaching and fertility that is moderate to high. The *grey and brown clays* occur on broad riverine plains or on gently rolling uplands over a range of sedimentary rocks. They are moderately fertile, while pH in many of them changes from slightly acid at the surface to strongly alkaline in the subsoil (they may be over 5 m deep); but there are some that are alkaline and calcareous in the upper profile, but strongly acid (pH 4.5 to 5) below. Some of them have gilgai microrelief in which water ponds into the profusion of basin shaped hollows commonly 5 to 10 m wide and up to 1 m deep. *The black earths* are the other major group of clay soils carrying grassland. While generally similar in many characteristics to the grey and brown clays they are mainly on alluvial plains or low hilly land of basic igneous and sedimentary rocks. They show more profile development than the grey and brown clays and calcium and phosphorus contents are generally higher. Gilgais are characteristic features. These are the most fertile of Australian grassland soils. In all of these clays water entry to the deeper layers tends to be slow except for entry down the cracks before sealing and the clays have high permanent wilting points. This means that many of them tend to provide water for only short bursts of growth under the variable rainfall where they are common.

The temperate and sub-tropical grasslands occur on a wide variety of soils, as do the grassy woodlands. In contrast to the mildly leached and moderately fertile soils of the tussock grasslands the soils of these grasslands are moderately to strongly leached with strong differentiation down the profile in various forms of podzolic and lateritic development. They are acid throughout the profile and generally infertile especially with regard to nitrogen and phosphorus.

The sub-alpine grasslands occur on a variety of acid humus, meadow, prairie, and silty bog soils. The saline coastal grasslands occur on infertile solonchaks notable chiefly for their high salinity and lack of distinctive morphology.

Assignments to the text

1. Make up questions to the text and ask your groupmates to answer them.
4. Make up a plan of the text.
5. Get ready to speak on the content of the text

**Text 2.6 Grassland soils of New Guinea and New Zealand**

Scientists state that in the Wabag-Tari area (typical of the extensive mountainous areas) "there does not appear to be any type of vegetation associated with a particular base-rock. Limestones, basalts, siltstones and sandstones have no mineral influence". They also indicate that topography is probably more important in governing distribution of vegetation than soils, partly through its influence on drainage and partly through its effect on local climate, e.g. frost-hollows.

Probably the commonest soils under montane grasslands are the humic brown clay soils formed over parent material ranging from volcanic ash to limestone. Another group common under *Miscanthus* grassland are the humic olive ash soils which are considered to be deep poorly drained counterparts of the humic brown clay soils on ash. The montane grassland soils are generally infertile since much of the nutrient capital held in the humic upper layers of the forest soil is either used or lost during the gardening phase preceding grasslands. The subsequent frequent burning must induce further losses, especially of nitrogen. The majority is acid to strongly acid, low in nitrogen and available phosphorus, and of low base saturation.

The lowland grasslands of the Port Moresby region occur on a range of alkaline to neutral olive and grey silty clays on brown fine sands, or on dark cracking clays. The savannas occupy a wide range of soils on rising to hilly land with the commonest soils being acid red to brown clays, neutral brown lithosols and alkaline dark lithosols.

**Grassland soils of New Zealand**. Being on the mobile margin of the Pacific Basin, New Zealand has a long history of tectonic activity and intermittent vulcanism with a wide variety of rocks from almost every geological period since the Precambrian. The soils of the South Island are generally younger than those of the north reflecting destruction during the Pleistocene ice ages. The parent rocks are chiefly greywackes, argillites and schists of various ages with solifluction deposits and loess being widespread in lower areas.

Many of the tussock grassland soils are formed on loessial or alluvial deposits. This combines with a variety of parent rock elsewhere and a wide range of landform and climatic conditions to give a very complex range of soils.

New Zealand soils do not fit readily into the older schemes of classification developed in the northern Hemisphere and so a new system of classification has developed with emphasis on soil forming processes as well as profile, and with a distinctive system of nomenclature. Finally, the soils do not seem to relate simply to the broad vegetal groupings that can be distinguished in the grassland vegetation. The three important broad soil groupings mentioned below are only an indication of the range of variation to be expected in soils under grassland.

The *yellow-grey earths* have a general soil profile of about 30 cm of greyish brown granular silt loam over yellowish compact silt loam to clay loam. Many of them are stony and fertility is low to moderate. Short tussock grasslands are common on them while some areas of silver tussock occur nearby on rendzinas of black deep granular clay loams over limestone.

With increasing rainfall and decreasing temperatures (i.e. increasing altitude) the yellow-grey earths grade into *yellow-brown earths.* With these the general profile is of a brown or greyish brown granular or crumb topsoil and yellow brown very friable subsoils; no claypans are evident.

In the driest parts of the tussock grassland the general soil grouping is of *brown-grey earths* with platy structured thin topsoils and pale yellowish brown subsoils with a distinct claypan. Accumulations of calcium, carbonate occur in the subsoil and in places soluble salts give rise to solonetzic morphology.

Many of the grassland soils are stony and most of them seem very susceptible to erosion.

Assignments to the text

1. Make up questions to the text and ask your groupmates to answer them.
2. Make up a plan of the text.
3. Get ready to speak on the content of the text

**Text 2.7 Soils of North America**

The soils of the grassland region have been formed on a variety of geological deposits, including clayey, loamy and sandy glacial and outwash deposits, weathered sandstones and loam stones, ancient river deposits, clay shales, loess, and old alluvium on high ancient river terraces. The zonal soil characteristics of these grasslands have been determined by the influence of climate and the degree of vigour of the grass cover. Under the dry subhumid to semiarid conditions that prevail, the soil-forming process has been calcification. The resultant soils vary in colour from black to brown to grey, depending on the content of organic matter. The depth to the lime layer (beyond which moisture seldom penetrates) decreases from as much as 2 metres (if even present) in the black soils to a few centimetres in the serozems of the Desert Plains Grassland.

East of the Rocky Mountains, three broad soil zones extend from southern Canada to northern Mexico. The westernmost of these is affected most by the rain shadow of the mountains and is comprised of brown soils with solum depth commonly in the range of 30 to 45 cm. East of this lies a zone somewhat more favorable to the growth of grasses, and the resultant higher organic matter content provides a dark brown colour in the surface layer. The extent of these two soil zones corresponds closely with that of the Mixed Prairie and roughly with that of the grassland portion of the Great Plains. Eastward (in the Central Lowland) the soils are black in colour and support True Prairie communities. In the western portion of this belt a lime layer is present, but this increases in depth eastward to 2 metres and finally (with increasing precipitation and vigour of vegetation) disappears. This gradation in the intensity of leaching has resulted in the recognition of the western portion as chernozems and the eastern as prairie soils. The broad transition from grassland to forest soils (podzolic) that occurs in these eastern grasslands is not found northward. In southern Canada the northernmost extension of the brown soils is rimmed on the east, north and west, successively by belts of dark brown and black soils, each averaging 75 to 100 km in width. The zonation northward is associated with increasing precipitation and lower temperatures, as is the case westward, wherever foothill development provides extensive areas at elevations between those supporting Mixed Prairie and mountain forests. Fescue Prairie and black soils occur in such areas. Southward the Mixed Prairie usually extends to higher elevations and gives way rapidly to montane forest of the lower mountain slopes.

West of the Rocky Mountains, the most extensive area of grassland is the semi-desert type of New Mexico, Arizona and northern Mexico. This region has soils of the desertic group, particularly serozems, non-calcic brown soils, and reddish brown soils. These are low in organic matter and degree of leaching. The valley grasslands of California are occupied by a mosaic of chernozems, prairie, chestnut and desertic soils, depending on topography, elevation and climate. In the Palouse Prairie of Washington, Idaho and British Columbia the black to light-brown profiles are classified as chernozem, prairie, chestnut and brown soils.

In well developed soils of these temperate grasslands periodic low supply of moisture is the most important factor in affecting the physiognomy of the natural vegetation. Thus the distribution of trees and shrubs and of tall, mid and short grasses is determined, within each grassland subclimate, by habitat characteristics that modify soil moisture content. Among these is the texture of the soil, which is important in relation to the rate at which rain water penetrates, thereby reducing the loss from runoff and evaporation. Soil texture is also of consequence in determining the depth, to which the soil profile is moistened. As a result of these relationships, the coarser (sandy) soils favour woody components and the taller grasses (which are also deeper rooted), while areas of fine soil characteristically support stands of short grasses with fewer shrubs.

These grasslands have been converted by man to ranges for domestic livestock and to the production of field crops. The proportion of the area that is cultivated is determined in the more favorable subclimates (dry subhumid) by stoniness, topography, soil texture, and salinity. In semiarid grasslands climatic factors have retarded the spread of arable agriculture, except where water is accumulated in sufficient quantity to irrigate crops. Thus, in black soil areas more than 70 percent of the landscape is in cropland (e.g. the State of Iowa), while in the brown soil regions the cultivated portion is less than 25 percent over extensive areas. The desertic grassland soils have been cultivated only locally.

Tillage of these land systems (particulary in semiarid parts) has created many problems requiring improvisation in management techniques. The most obvious difficulties have been in the control of erosion of surface soil, particularly by wind during periods of drought. Retardation of this degradation process has been achieved by abandonment of tillage in the most credible soils and by strip cropping and stubble mulch procedures, but in prolonged drought inability to grow such protective plant materials causes continuing concern. Other major changes that are less obvious are taking place within the soil subsystem of tilled fields. Some of these have not yet received serious attention because they have not reduced crop yields. Among the changes that have been noted is the rapid decline in content of soil organic matter, which was reduced by 35 to 40 percent in the first 35 to 40 years of tillage. Efforts have failed to maintain organic matter levels in soils by rotation with seeded perennial grasses and legumes.

Assignments to the text

1. Make up questions to the text and ask your groupmates to answer them.
2. Make up a plan of the text.
3. Get ready to speak on the content of the text

## Text 2.8 Soil types of South America

The soils developed under grass vegetation of South America belong to a variety of groups, being Latosols the most important, considering the area of territory covered by them. Almost two-thirds of South America lies in the tropical and sub-tropical belt. Here, high annual rainfalls and high temperatures are the most important soil forming factors. Therefore, laterization is widespread, giving rise to Latosols and soils related to them. These soils developed from a variety of parent materials: the most important are igneous and metamorphic rocks of Precambrian age, clayed and sandy deposits of Pleistocene age, old continental and delta deposits of alluvial origin, basic rocks, and recent clastics deposits little or non-consolidated of sands, clays, schists, etc.

The region of latosolic soils lies from 12°S to near 28° S. South of the 28° S., a different type of soil formation occurs. From 28° S. to near 37° S. a temperate humid to sub-humid and semi-desert and desert type of climate prevail. From the viewpoint of grass vegetation, the most important soils of this area are Brunizems, Chestnuts and Alluvial soils. Vertisols are also important, although the area covered by these soils is much smaller than those mentioned in the first place. Here also a variety of parent materials give rise to the different soils. It should be mentioned at this time that the most important soil parent material of this region is the recent deposits of aeolian origin known as loess. On these deposits develop the Brunizems and Chestnuts and other important grasslands soils.

South of the 37° S. begins a new and entirely different area, characterized by low to very low rainfalls and low temperatures. Under these climatic conditions, a desert type of soil formation prevails, except in the most southern part where rains are higher, giving rise to other types of soils such as Brunizems and Chestnut soils (in Tiera del Fuego island). In this region, known as the Patagonia tableland, soils parent materials are also formed from a variety of rocks.

In the highlands of the Andes Cordillera, in the western part of South America, soils are poorly developed. A desert type of soil formation also exists due to either low rainfalls or low to very low temperatures or the combination of both. Soil parent materials come from volcanic rocks mainly, mixed with volcanic ashes.

Assignments to the text

1. Make up questions to the text and ask your groupmates to answer them.
2. Make up a plan of the text. 3. Get ready to speak on the content of the text.

# 3 Unit 3 Additional texts

**Vasiliy Dokuchaev (1846 - 1903)**
**The founder of Russian Soil Science**

The distinguished schoolboy of Dokuchaev V.Vernadskiy wrote per anniversary of death of Dokuchaev: «There are a few people, which can be put in a line with Dokuchaev on influence, what they have rendered on process of scientific work, on depth and originality of their generalizing idea in a history of natural sciences in Russia during XIX of century».

Thousand pages are written about V. Dokuchaev life and creativity. To him the monuments are established, the art film is removed, the institutes are called a Dokuchaev`s name, Central soil museum in St.-Petersburg. The scientists are regularly awarded with a golden medal and premium of V.Dokuchaev for distinguished achievement in Soil Science. The grant of V.Dokuchaev is founded. Even there is a city Dokuchaevsk on Ukraine. We can not in detail tell all, that is connected with Dokuchaev and only we shall look through pages of this great life.

V.Dokuchaev was born on March 1, 1846 in village Milukovo of Sichovskiy region of Smolenskaya area of Russia in family of the priest. The first scientific work of the candidate of the St.-Petersburg university of physical and mathematical faculty began from study quaternary and newest depositions of a valley of the small river Kachnya in village Milukovo, small Native land of V.Dokuchaev. From then on the idea " Studies of a native Land " will accompany with any scientific undertakings Dokuchaev, such as complex researches Nizhegerodskaya of area, organization of museums and public lectures on an agriculture, and program of researches Layel of St.-Petersburg and its environs.

Dokuchaev was named Russian by the contemporaries for a cycle of classical works on dynamic and quarternary geologies and it is considered as one of the founders of Russian school of geomorphology (L.Prasolov, 1949).

The invitation of the Ministry of the state-owned property in 1875 to participation in constituting a soil card of the European part of Russia became the basic moment in scientific creativity and in the further destiny of Dokuchaev. Dokuchaev should develop classification of soils for a card and give the description of chernozem soils. It is known, that the state of a science is reflected in the concentrated kind in a card as in a mirror. What has seen Dokuchaev at the analysis of cartography of Russian soils? Dokuchaev writes: (V.Dokuchaev, 1919) "... The following grouping of soils was accepted: a) chernozem, b) clay soils c) sand, d) loam or (?) sandy loam, e) silty soil, f) saline soil, g) chalk soil, h) stony soil. That the executives understood the given grouping, it is not clear". And further continues: " Till now anybody, who was engaged chernozems, such as the village owners, agriculturists theorists, the naturalist biologists not only have not given exact scientific definition chernozem, but did not attempt at all seriously to put the given question. The strange and funny mess in concepts was result of such relation to business... However, the reasons of the given phenomenon are completely clear. First of all it is necessary to notice, that it is impossible to define and to assort what we do not know …" (V.Dokuchaev, 1919).

For the first time Dokuchaev has developed principles of soil cartography and has defined directions of its development. As a whole it there was a first scientific program in study of soils of Russia. The scales and complexity of tasks in study of soils of Russia have resulted of Dokuchaev in an idea on necessity of creation " of special soil establishment, with a museum and laboratory at it, which one in state to execute above what so it is a lot of and long Ministry of the state-owned property worked " (V.Dokuchaev, 1919).

«The Question about chernozems» has got the especially important value in activity of the Free Economic Society. It is no wonder, that the study of chernozems was entrusted to Dokuchaev in connection with droughts 1873 and 1875. At this time to him there were 30 years. He had eight summer months of field researches in 1877-1878. Studied soils and history of district, sampled on the chemical analyses and collected soil collections. Studied a geologic structure and relief. The area of his researches was about 10000 versts (1verst = 3.500 feet) on Chernozem region of Russia. It was the huge work.

"Russian chernozem" was published in 5 years after dazzling protection of the doctor's dissertation in works of the Free Economic Society. The descendants recognize, that appearance of results of research of chernozems has marked birth of a new science - genetic soil science. Vernadskiy wrote in 1904: "Chernozem has played the same distinguished role in a history of soil science, what frogs had in a history of physiology, calcite in crystallography, benzol in organic chemistry".

Dokuchaev has proved existence of soil as independent natural and historical body. he has defined the laws of development of soil, has offered a method and methodology of soil researches in the book «Russian chernosem". Let's address to appreciation of the followers Dokuchaev. The academician Polinov in 1949 wrote: "First, he has proved at first for chernosem and then for any other soil, that it is a mirror of the nature environmental it. Secondly, he has shown methodology of such researches, which result in skill to see in this mirror this nature". The words of the academician Lavrenko to this are conformable (1949): «Dokuchaev has shown with absolute clearness existence of the connected laws in distribution of climates, vegetation, soils, so also of landscapes on our planet”.

One scientific research had not time (was in time) still to be finished, as Dokuchaev begins new more difficult, even more unknown. In 1882 he begins complex research of lands of Nizhegorodskaya region with the purpose of their qualitative valuation by the invitation of government of this region: "The similar work is the first experience in Russia... I had no the ready tested method... Nevertheless, considering vast state value of a correct valuation of lands in such truly agricultural country, as Russia... I have decided to undertake this task ".

Dokuchaev went each day early in morning within five years of all period of researches of Nizhedorodskaya region on memoirs P.Zamyatchenskiy, his schoolboy and participant of that expedition. What had supply his forces? He gives the answer to it: "The love to business should serve a greatest condition of success of forthcoming researches, love not only to the people, but also to the nature, and solid confidence in success" (Dokuchaev, 1994). Zamyatchenskiy emphasized: "He worked disinterestly, for the sake of idea, and we did (made) same".

Researches of Nizhedorodskaya region have given a science a new complex method of study of the nature, method of a qualitative valuation of land, which the scientific value keep even now. In this period formation of scientific school of soil science and others directions of natural science, such as science about landscape, geobotany, science about natural communities, the geochemistry, forestry etc. began. It is even more important. Genetic soil science has received a bull pulse to the development.

The results of scientific researches were published in 14 volumes. It has not satisfied of Dokuchaev: "Unfortunately, all these really valuable treasures of a science remain inaccessible to the people and do not bring to him benefit, which can from them be expected... it is necessary to reduce all available scientific riches in one connected whole and to state the given results by popular language." (Dokuchaev, 1994)

In 1885 in Nizhniy Novgorod the natural - historical museum under the initiative by Dokuchaev and chairman of local government A.Bazhenov was open. The schoolboy and colleague of Dokuchaev N.Sibircev was assigned as a head.

Dokuchaev was on the Poltava expedition later. It is 16 volumes of the published materials and organization of a regional natural - historical museum in Poltava. Then "The Special expedition of Forest department". These materials are published in 18 volumes. Then research of soils of Bessarabia and Caucasus and opening of the law wide and vertical distribution of zones. Then the publication of numerous operations, including monography " Our steppes before and now " etc. Vernadskiy in the letter of 8 September 1897 writes: "Your life has passed in such intensive huge work, which is accessible to little...».

Dokuchaev has given back all energy to study of a correlation and interaction, constant connection, which exist between all forces, bodies and phenomena of nature. The explanation of such correlation constitutes the essence of scientific researches.

In this connection we want to pay attention to the law open by Dokuchaev, which establishes connection between soils and factors of formation of soil. This law is equivalent to the periodic law of Mendeleev on the value in natural sciences. Dokuchaev wrote, that if all elements, which form soil are identical, then the soils will be identical also; and on the contrary, the discrepancy of these elements (all or one) gives different soils. If to know all elements of formation of soil in the given district, easily predict what soils will there.

However Dokuchaev well understood, that despite of all achievement of a soil science and its) further development, use of scientific potential can not be successful without organization of state soil institute and improvement of agricultural education. They were contributed changes to the organization of agricultural meteorology, stated on Meteorological convention in 1900. They were exposed soil exposures of collections of russian soils in Chicago, Paris, Moscow, Nizhniy Novgorod. Private public courses on the agriculture were an open under the Petersburg university.

## Soil Museum

The Central Soil Museum was open in 1904 at the Free Economic Society. The Museum became the first research establishment in Russia. Then the museum was a part Dokuchaev Soil Committee. Since 1925 Museum was a part at the newly founded Soil Institute of an Academy of Sciences of USSR. In 1946 the Museum to become independent establishment and research works, which were discharged in the Museum began to acquire wide popularity in Russia and abroad.

The scientific researches in the Museum developed in three directions: geography; genesis and fertility of soils; biochemistry and microbiology of soils.

Known soil scientist and geographer Z.Shokalskaya has headed the Museum. She worked in soil cartography. She prepared soil maps of India, China, Phyllipine and Zonde islands, Australia, Africa, Southern America.

In the fifties the prof. A.Zavalishin supervised geographical researches in Museum. The works on study podzol soils and process of podzolization were made. The soil maps of Kareliya, Karelian isthmus, Kaliningrad area were formed.

Prof. V.Zolnikov, then doctor V.Pestryakov headed a Museum in 1960 and in the seventies. In this period the soil map of Leningrad region (scale 1:300 000) was formed. The study of genesis and agricultural conversion of podzolik soils was continued.

Researches in a Museum for this period: T.Rozhnov "Soil cover of the Karelian isthmus" (1963); Zavalishin and Nadezhdin "Soils of the Kaliningrad area"; Zolnikov "Soils and natural zones (theoretical analysis of some problems of soil science and geography)" (1970); "Soils of the Leningrad area", Zavalishin "Researches of genesis grey forest and podzol soils" (1973). The researches, executed in a museum, are printed in the digests of a Museum, in the periodic issuings, in the digests of works of conferences, and congresses.

Two research laboratories were created in a Museum in fiftieth. Their purpose was development of a biological direction of soil science.

Prof. B.Ponomareva became the chief of laboratory of biochemistry of soils.

The questions of the common theory of soil processes and their displays were developed in laboratory. Penetrating study of biochemistry of soil processes, specially in study of process of podzolization was made. The role of humus substances in soils formation was convincingly exhibited.

The results of researches are published in the monography of Ponomareva "The theory of process of podzolization (biochemical aspects)" 1964, and in the digest of articles "Biogeochemical processes in podzol soils" 1972.

Ponomareva gives an interesting and original reasoning about connection of vegetation type and type of soil formation as uniform functioning system.

Ponomareva has stated the sights on formation of a humus profile of mainest types of soils in the book "Humus and formation of soil" 1980 (co-author Plotnikova).

Ponomareva has generalized methodical and analytical experience of study of soil organic matter in paper "The methodical instructions on definition of the contents and composition of humus in soil (mineral and peat)" 1975. These works widely make use in soil establishments of Russia.

The study of microbiology of soils formation processes has arisen and successfully developed in a museum in middle fiftieth. It was an original direction in biology of soils, which prof. T.Aristovskaya has created and has headed. Her concept about a role of microorganisms of soil in soil profile formation is worded in the monographies: "Microbiology of podzol soils" 1965, "Microbiology of soil formation processes" 1980, and in works "The methodical management on study of microbiology of soil formation processes" 1986.

The researches on the International Biological Program in soil microbiology were developed in seventieth. Scientific works digests became a result of these researches: "Questions of number, biomass and productivity of soil microorganisms" 1972, and "Laws of soil microorganisms development" 1975.

Interesting ecological and geographical researches in soil microbiology be ordered in laboratory. The monography of S.Parinkina became a result of these researches "A microflora of tundra soils" 1989.

The scientific researches under the management B.Aparin (head of Museum from 1976 up to the present) develop in several directions: genesis of soils of humid landscapes, structure of a soil cover as a basis of lands types study; fertility of soils, and sustainable land use in Russia.

The first direction included organization, conducting and generalization of regional researches (in expedition and laboratory) of properties and soils regime, which are generated on binomial parent material. The researches were conducted in the Arkhangelsk area, Vologda area, Kirov area, republic Komi and Kareliya, Leningrad area and other of Northwest part of Russia, in Baltik region countries, in Byelorussia. A large scientific problem of genesis and classification of soils on binomial parent material, which during many years was debatable and involved attention of the numerous researchers was decided. The results of researches are generalized by B.Aparin in two monographies: "Soils formation features on binomial parent material of Northwest part of Russian plain" 1975, and "Geographical bases of rational use of soils" 1982.

The new scientific direction in geography of soils develops. This is a study of lands types on the basis of study structure of a soil cover. The theory of zonal structure river water yields is developed. It is applied to all natural zones. Is proved, that 5 types of water exchange and appropriate by them 5 types of territories in boundaries river water yields of humid landscapes precipitate out. This territories differ on complexity and contrast of structures of a soil cover. The laws of development and evolution of a soil cover of each of isolated zones, and water yields as a whole, are connected to managing influence of more high level geosystem. This original scientific direction has wide prospects for engineering the models of influence of technical force on natural complexes and it is interesting for adjoining scientific disciplines. The materials of researches are published in a magazine " The Soil Science ", and in the monography "The evolutionary models of soils fertility" 1997.

The cycle of researches, which develop last decade, is devoted to knowledge of soil fertility essence and laws of its formation and variability. The methodological and methodical bases of research of fertility podzol, carbonaceous, marsh podzol and other types of soils, model of two forms of fertility (potential and efficient), passport of the regional model high fertility of soil are developed, which realization provides steady high productivity of agricultural plants. The system of measures for achievement such parameters is developed.

The interrelation of evolution of different soils types with development of geosystems in various natural zones (tundra, forest and steppe zone) for the first time is established. Dependence between parameters of soil fertility and natural conditions, to which the dimensional and temporary variability of fertility is connected and the demurs in productivity of agricultural plants are revealed. B.Aparin has developed the patterns of the forecast of soils fertility change under influence of human factor and nature factor. The analysis of influence of warm current Golfstreem on weather conditions of Northern Europe was made. The features of its dimensional and temporary variability for the first time were exhibited. The forecast of influence of Golfstreem on evolution of soils and change of soil fertility was given. Works of this direction are the significant contribution to development the theory of soils fertility. These researches are generalized in the monography "The evolutionary model of soils fertility" 1997.

Offered by B.Aparin the concept of soil formation fields (gravitational, power, biological, technical and other) is development of Dokuchaev`s theory about the factors of soil formation. Engineering of the theory of hydrological fields of soil formation, which make use for construction of the models of chemical elements migration in the landscapes, natural and changed by the human, has received the most completed form to the present time.

The study of a problem of sustainable land use in Russia as bases of sustainable development is favorite direction of researches. It is connected to sharp development of soil resources crisis in Russia, and in the world. The national safety of Russia depends on a solution of this problem.

## Quotes from Understanding the Soil Processes

Most of us will agree that the soil is the major natural resource available to mankind. Yet it is and has been abused by us to the point of self destruction. Many past civilizations have perished due to their abuse of the soil (like Mesopotamia and the Mayan civilization).

Why didn't anyone stop the destruction? The soil destruction process takes time and the changes in each generation are "small" so no one cared-and most of us still don't.

The soil in which we plant crops today has been self perpetuating for millions of years without man's help. It will continue to do so if we do not disturb its natural cycle.

In the soil there are nutrients and trace elements both of which plants require for growth. They are essential.

Soil moves continually in a natural cycle aided by oxygen, water, minerals and decomposing animal and plant matter. These elements create life in the soil, which is ongoing if not disturbed. We speak of healthy soil if it works well and nutrients continue to be available to the plant.

Good soil consists of 93% mineral and 7% bio organic substances. The bio organic parts are 85% humus, 10% roots, and 5% edaphon.

Edaphon is itself a "world" of life and consists of microbes, fungi, bacteria, earthworms, microfauna, and macrofauna as follows:

– The Edaphon consists of:
- fungi/algae..............................................40 %;
- bacteria/actinomycetes...........................40 %;
- Earthworms............................................12 %;
- Macrofauna..............................................5 %;
- micro/mesofauna.....................................3 %;

## Definition of soil organic matter

Agriculturists since ancient times have recognized significant benefits of soil organic matter (SOM) to crop productivity. These benefits have been the subject of controversy for centuries and some are still debated today.

Many of the benefits of SOM have been well documented scientifically, but some effects are so intimately associated with other soil factors that it is difficult to ascribe them uniquely to the organic matter. In fact, soil is a complex, multicomponent system of interacting materials, and the properties of soil result from the net effect of all these interactions.

One of the major problems in communicating in the field of humic substances is the lack of precise definitions for unambiguously specifying the various fractions. Unfortunately, the terminology is not used in a consistent manner. The term **humus** is used by some soil scientists synonymously with **soil organic matter, that** is to denote all organic material in the soil, including humic substances. Contemporary, the term **humus** is frequently used to represent only the humic substances.

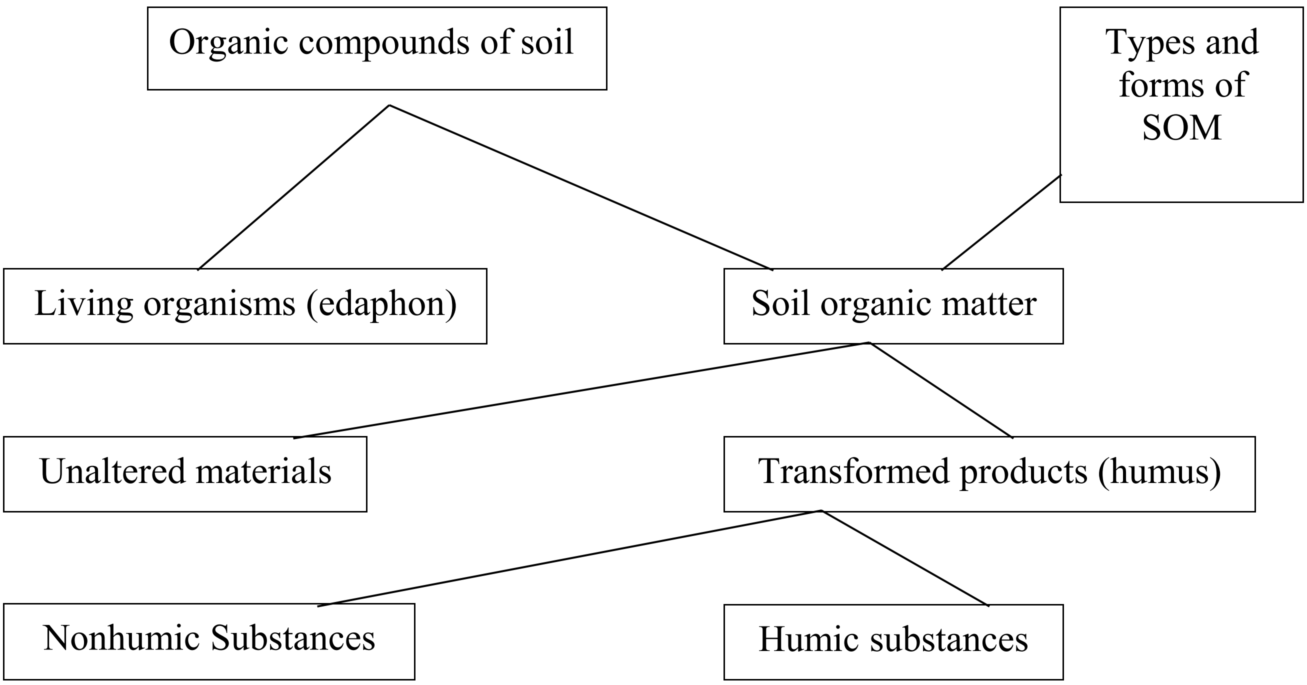
The term **SOM** is generally used to represent the organic constituents in the soil, including undecayed plant and animal tissues, their partial decomposition products, and the soil biomass. Thus, this term includes:

1) identifiable, high-molecular-weight organic materials such as polysaccharides and proteins;
2) simpler substances such as sugars, amino acids, and other small molecules;
3) humic substances.

It is likely that SOM contains most if not all of the organic compounds synthesized by living organisms.

SOM is frequently said to consist of **humic substances** and **nonhumic substances**. Nonhumic substances are all those materials that can be placed in one of the categories of discrete compounds such as sugars, amino acids, fats and so on. Humic substances are the other, unidentifiable components.

Distribution of SOM is shown on the picture:




**Organic compounds of soil** - live organisms and their undecomposed, partly decomposed and completely decomposed remains as well as products of their transformation.

**Living organisms** alive – edaphon.

**Soil organic matter** - non-living components which are a heterogeneous mixture composed largely of products resulting from microbal and chemical transformations of organic debris. Soil organic matter can exist in different morphological patterns, which are the bases of the classification of so called forms and types of humus.

**Unaltered materials** - fresh and non-transformed components of older debris.

**Transformed products - (humus)** - bearing no morphological resemblance to the structures from which they were derived. These transformed components are reffered to as the humification process products.

**Humic substances** - a series of relatively high-molecular-weight, brown to black colored substances formed by secondary synthesis reactions. The term is used as a generic name to describe the colored material or its fractions obtained on the basis of solubility characteristics:

– humic acids (HA);
– folic acids (FA);
– humins;

**Nonhumic substances** - compounds belonging to known classes of biochemistry, such as:

– carbohydrates;
– lipids;
– amino acids.

The chemical and colloidal properties of SOM can be studied only in the free state, that is, when free of inorganic soil components. Thus the first task of the researcher is to separate organic matter from the inorganic matrix of sand, silt, and clay. Methods for the extraction of soil organic matter have evolved from the research and thinking of many scientists.

## Humus

The natural life cycle of our fields must be kept functional through the addition of organic matter after the residues from the previous crop have been depleted in order to build new Bio-Organo-Mineral nutrition for our next crop. This action can not be replaced with the water soluble salts or overdoses of chemical fertilizer which destroy soil life, not build it.

During the growing season, as the plants fix carbon dioxide by photo syntheses, about 10-25 % of this fixed carbon, finds its way back to the soil through the roots (root exudates) this is even if all residues including roots are removed. This is very important in bio-organic farming.

The production of humus is a complex process. In general cyclic substances like phenol groups and also other like organic acids and vitamins (humus is also related to crude oil) are polymerized with help of enzymes, like phenol oxides. These cyclic compounds are both from plant parts (like lignin) and are also produced by the microorganisms. Mostly fungi, actinomycetes (Streptomycets) seem to be responsible for humus formation. Aspergillus, Pisolithus, Rhizoctonia, Streptomycets are only but a few examples of microorganisms actually capable of synthesizing cyclic (aromatic) compounds and form them into humus from non-cyclic materials.

**It is impossible for man to produce stable humus synthetically. Man can properly cultivate the field, supply organic matter and so encourage the development of stable humus in the soil. Soil with stable humus must always be protected to maintain the fertility and productivity of the soil.**

The production and maintenance of stable humus in the soil should be the primary goal of every farmer. Good stewardship of the land is necessary to protect and maintain mankind's most important asset, fertile soil.

For nearly one hundred years soil science in most schools of higher learning (especially in agricultural colleges) has been primarily concerned with the physical and mechanical aspects of soil structure. Biological thinking has become a major concern only in the last few years.

The new approach considers not only the physical properties and mineral structure of the soil, but also the process by which organic matter is transformed into humus by microorganisms.

## Organic Transformation

### *Humification*

Humification, the transformation of organic matter into humus, is a fascinating process.

Organic materials such as manure or field wastes , when disked into the upper three to six inches of topsoil, will undergo several changes. The humification process involves first catabolism, then anabolism. These are not truly correct terms as they are usually used for same functions within living organisms, but we may consider soil as one living organism.

### *Catabolism*

The first stage in the break down process is important to be started by fungi, these make the debris "pre-digested" for many animals in the macro and mesofauna. Many of these animals lack needed enzymes for the start of the decomposition process (springtails, millipedes, earthworms, etc.) The debris is fragmented into smaller parts and chemical changes occur in breaking up of cellulose, chitin, etc.

Most plant parts already contain fungi within (seed, leafs, stems all are inhabited by fungi): these are going to start the decomposition process. Many fungi residing within seeds are known and seeds (or plant parts) carry only certain fungi, that will actually start the decomposition process (sometimes they also carry pathogens.)

If bacteria start the decomposition process instead of fungi, this may happen because of several reasons, the one most common would be water logging (too moist), the process turns to putrefaction. During this stage toxic substances are produced (methane, formaldehyde, hydrogen sulfide) which are harmful to soil and retard the growth of plants.

Please do not misunderstand-bacteria and fungi are decomposing all at the same time, we mean predominance of one over the other not that the other is not involved at all.

The excrements of the macrofauna are a very suitable medium for growth of bacteria, algae, and nematodes. These multiply rapidly and again draw the mesofauna, as it feeds on the bacteria. Many new animals are involved in this stage, some are the same as in the first decomposition.

Slowly the materials are broken into smaller parts, at the same time many are again combined and used for building hormones, enzymes, proteins for the rapidly multiplying microfuna. Antibiotics are produced to secure an area for growth, form other microorganisms.

Carbon dioxide is evolved back to the atmosphere and only about 20-30% of carbon originally found in the plant parts makes it to humic complexes. In case of carbohydrates as starting point the carbon percentage that makes it to humus is less than 20%. If the starting point is lignin, tannins, or other phenolic groupings (mostly found in wood and leaves) the percentage may reach 75%.

Mineralization is the process of freeing minerals from organic molecules (carbon bonds).

During humiliation there are two possible and products for atoms within the starting molecules. Minerals may either be build up stable humus or be in free form, carbon either tied within humus or evolve in form of carbon dioxide. The following is a summarizing table where atoms end up after humification: All minerals within organic compounds 80% freed up and 20% in humus Carbon from carbohydrates 80% evolves as carbon dioxide and 20% goes to humus formation. Carbon from lignin, aromatic type amino acids (tyrosine, tryptophan...) and like compounds (fats, hydrocarbons like waxes...) 25% evolves as carbon dioxide and 75% goes to humus formation Nitrogen will remain to 50% in humic form.

The micro, meso, and macrofauna is so closely interwoven that one could say, if areas have small amounts of earthworms, beetles, etc. the microbial population will be small.

## *Anabolism*

The second half of soil metabolism-anabolism now begins, starting with the synthesis of soil plasma. It is in this process of plasmolysis that the catabolized organic matter becomes plasma building material for new plant life. This is the least understood of all the processes that go on in the soil.

Soil plasma is the liquid portion of the soil. It contains proteins, salts, degraded organic compounds and water. It is like the liquid part of the blood which, although without corpuscles, is much more than water.

Soil plasma is that substance in the soil that can spin catabolized remnants of former life into vital threads that are woven together into the fabric of new life through the processes of anabolism.

In the anabolism process the plasma is transformed into stable humus.

This plasma also contains the decomposed cell walls of organic residues and has become a spongy, gelatinous substance that bonds the surface of the clay crystals together. In this manner, clusters of clay crystals form aggregates that are resistant to being broken apart. This gives the soil the ideal structure farmers refer to as tilth. The combination of plasma and clay forms what is known as stable humus.

The presence of stable humus allows air, water and essential mineral nutrients to be held in the aggregates. The chemical nutrients are in the form of ions-atoms carring positive or negative electrical charges. In science, they, are referred to as swarm ions.

The spongier the soil the more pores or open spaces are within it. Like Swiss cheese reduced to an infinitesimal scale, each of these holes or pores has an inner surface mat that coated with plasma. The greater the porosity of the soil the more capacity it has to accumulate and hold air, water and nutrients and prevent them from being washed away.

Consequently, we can imagine that a loss of this porosity with all its inner surfaces represents a catastrophe to the soil. With the loss of stable humus, the mineral particles of the soil come together almost like concrete. The porosity is lost and with it the ability of the soil to retain air, water and nutrients. As this capacity diminishes, the fertility of the soil is reduced and productivity declines.

When we have stable humus, we have all the ideal conditions we are seeking for our soils.

We have the inner protected porosity, the glued together clay crystals coated with plasma containing the decomposed organic matter holding air, water and chemical nutrients-swarm ions.

In this ideal environment the third phase of stable humus, plant feeder roots develop. It is here the dormant power and original resource of soil fertility comes to life. This is the secret of rebuilding the energy and fertility of "Mother Earth".

Here the living matter, which was originally buried in the soil to decay, celebrates the birth of new life; the re-births of organic matter for germinating and growing plants.

Stable humus, ideal stage of fertile soil, could be considered the connection link or connector of life. Here decomposition ends the last stage of death: and new life begins. Through this process, we can understand the fertility of the soil depends on the ability of Nature to create living, organic order from inorganic disorder.

Many farmers are imprisoned in a way of thinking that is only concerned with levels of chemical fertilizers and must be re-educated to begin considering the biological processes occurring within the soil. Balanced soil fertility is a condition which cannot be measured by chemical or physical tests. The farmer who strives to maintain the bio-organo-mineral complex in correct balance in his fields can achieve the high test agricultural production levels as a result of these biological processes.

**Today's popular chemical tests of soil do not tell anything about the decisive life processes. They are merely a yardstick of the mineral content of the soil and do not help farmers in knowing how to treat the fields for future productivity and healthy crops. The whole process misses the basic point that the true purpose of agriculture is to recycle life to capture the life factor from decomposing organic material and channel it into new growing plants. It is only by doing this that vital healthier life can be maintained in plant, animal and man.**

When the farmer decides to begin a biologically balanced fertility program, soil analyses show minimal values of nutrient reserves and indicate that large amount of fertilizers should be applied to meet the needs of the crop. However, after a few years of successful biological fanning, analyses can show high residual levels of available nutrients, although the farmer has not used any chemical fertilizers during that time.

The absurdity of conventional chemical thinking is revealed in the mistaken notion that larger quantities of nutrients will continue to result from the aid of chemical fertilizers. But the truth is, that by the activity of microbes, the nutrients are biologically enriched, accumulate in the pores of the soil aggregates as swarm ions, and will become available to the growing plants. The farmer who implements the balanced fertility program can achieve needed levels of nutrients in the soil in a less expensive way, can achieve the highest possible yields, and a higher quality harvest. By using the wrong fertilizers, excessive chemicals and heavy machinery we are destroying our soil, our fields, our farms and our future.

Plants supplied with this kind of nutrient require less water. This assures the biological farmer a significant saving of water in the production of crops, an especially important consideration in arid zones and in dry seasons elsewhere.

We can not outwit Nature. Nature does not allow a wasting or loss of living matter in the restless process of mineralization, the procedure for impregnating the soil solution with the mineral elements required for plant growth. In the final stage of decomposition the remnants of plasma still contain the essential elements of the life processes. These remnants are then transformed into soil plasma in the process of producing stable humus.

**Stable humus is the crucial center, the focal point of the life cycle. Adhering to farming practices that assure the production of stable humus thus becomes the farmer's main objective.**

## Soil fertility

Over 130 years ago (1855) Justus von Liebig's discovery that plants are fed by water soluble substances started a revolution in agriculture.

However this revolution went in a different direction far from the original thinking of von Liebig.

Von Liebig's discovery reads:

**"Plants take up water soluble nutrients"**

This discoveries became internationally understood, but unfortunately, a single word has been added to the Liebig statement and his sentence and the meaning changed as follows:

**"Plants take up water soluble nutrients only"**

There is a great difference between his original statement and his interpretation by the addition of the single word "only".

The single addition changed the truth of his discovery. First to recognize the important misunderstanding was von Liebig himself. However, the huge agro-chemical industry built their fort based on the word "only".

Science neglected his best discoveries and findings which are as follows:

1. Man must regard nature as one unit, a whole and everything that occurs in nature works together as knots in a net.
2. Diseases of plants are diseases of the soil.
3. We must treat the prime origin of the disease, not the symptom.

It is important to understand that if the soil is living and healthy, the plants will be strong and healthy with natural resistance against disease. This opinion is the basic pillar of organic biological farming.

Fertilizer facilities prospered and became firmly established as the base of a huge, new agro-industry.

Ammonia taken up by plants is utilized directly, but nitrates have to be converted to ammonia, within the plant to be utilized. If soil is high in nitrates that are taken up by the plant in higher amounts than needed they will not be formed into ammonia, but will stay in nitrate form and this is toxic to animals (carcinogenic compounds may be easily created under certain cooking conditions.)

Liebig actually discovered that plants take up solutes, these are dissolved substances. Well dissolved substances is a very broad statement, it does not mean in water only. Many things can be dissolved in substances other than water. The actual meaning of solutes in the biological sense is that the molecules are in fluid state, independent of each other, there may or may not be other substances present (solubilizing agents, like water). The word *dissolved* means broken up into molecules, or ions in salts. The molecules only have to be disassociated to be solutes.

Good soil is a world of working microbes. One gram of soil can contain over ten million bacteria. "Around the roots of a healthy growing plant a dense coating of microbes may contain a population of from 100 to 200 million microbes. The life span of a single microbe in this environment is approximately one half hour.

Microbes live in colonies and are very mobile. In their rapid life cycle from creation to death they develop tremendous metabolic activity and steadily improve the structure of the soil.

Some microbes excrete antibiotics. They metabolize phosphorus and iron bonds which are difficult to dilute efficiently without this microbial activity. The earthy odor of the soil is due to them. They create two thirds of the soil carbons, attack cellulose and mineralize nutrients.

We have another important grouping of life in the soil. These are mites, nematodes, centipedes, worms, and insects. All preying on or eating plant and animal residues, eating each other, producing dung and other excrements. As death they leave important waste. They work on stages in the formation of humus in the soil.

## Soil conservation

When Americans came to the new continent, they found "a land of unlimited forests and fertile plains". But the thin forest soils were unwisely converted to cropland and when they failed to yield well after a few years, people abandoned the farms or sold them to later comers and moved westward - to start new farms on cutover forest land. A state of Ohio, for example, was nearly 95 % forest-covered in 1788. It was still 54 % woodland in 1853. And only a declining rate of DEFORESTATION saved it from going below 14 % in 1940. It has not changed much since then. The removal of the forests in Ohio and in much of the Ohio River Valley has resulted in a denuded soil which simply can not soak up the heaviest rains. Once the millions of trees, each with thousands of leaves, broke the force of pounding rain, cascading the raindrops downwards from one leaf to another until they tumbled gently onto the deep, spongy humus mat of the forest floor, where drops continued to fail and to be absorbed for hours after the rain had stopped. Now rain drops fall with force on bare or sparsely covered soil which, through long years of erosion has had much of its humus removed, leaving behind a hard pavement-like surface of close-packed soil and pebbles. Wherever rain falls on bare soil, on soil made hard by erosion of its spongy upper layer, on soil laid bare by the teeth of too great a concentration of cattle or sheep, on soil laid bare by fire, the water can not soak in readily. Much of it runs off, carrying with it a load of the finest materials and leaving behind an increasingly unabsorbent surface. The compacted soil now sheds 50% or more of the rainfall, which may run off in great sheets into small gullies and then large ravines.

Whether the erosion starts on forestland unwisely converted to crops, or on arid grassland that is overgrazed and therefore fails to reseed itself, the result will be equally tragic. When most of the fertile topsoil is gone the land becomes unfit for any kind of agricultural crop. Tine weathering of the mined soil, the eventual capture of the surface by pioneering plants, and the decay of plants and animals will eventually restore the soil fertility - but only after thousands of years. Perhaps some new civilization will make a fresh start then and use the soil more wisely. Fertility can be lost locally even where soil practices are good. During great dust storms fertile tracts have been covered inches deep with the sterile dust and sand blown from overexploited areas or carefully tended farms may be covered with soil wash arid pebbles from flooded areas upstream. Sometimes "badlands" are created by industrial processes, as from the poisonous fumes or copper smelters or steel plants. Strip mining in Pennsylvania removes the fertile surface and then dumps and buries so deeply that the land becomes unfit for agriculture. In Illinois and elsewhere, such stripped areas have been replanted to trees, which can grow on land that will not support crops. The trees slow the erosion and stabilize the soil so that natural processes can begin the slow renewal of surface fertility.

At present time one-third of total topsoil in the country has been removed by erosion. Some of it went in steady week-by-week attrition. Much went in great floods. The 1936 flooding in Ohio River Valley removed 300 million tons of topsoil from the land - about as much as the Mississippi River removes in a whole year. Some of the topsoil loss is widely distributed over the country, resulting in a shallower topsoil and lowered fertility. Some of it is concentrated loss, complete enough to rule out any agriculture. Of such completely ruined land there are 200 million acres - an area four times the size of Nebraska! The country still has at present 450 million acres of good land. About one-fourth of this is receiving proper care by enlightened farmers; the remaining 3/4 is, still being slowly or rapidly ruined. We have already made a good start on research in farm practices, and some of what has been learned is already part of enlightened farm practice through the country. CONTOUR PLOWING and STRIP PLANTING are two of the most: effective devices for delaying the runoff of water from the soil and so minimizing the load of silt that can be carried off. TERRACING, which is practiced with great skill in Asia and in Europe, is being used in modified forms, on American slopes. Quantitative knowledge of the effectiveness of different kinds of vegetative cover in controlling erosion can be obtained experimentally. Crops are planted in parallel strips on a hillside near an agricultural station. Water is then collected from below each strip, and the volume of runoff, together with the amount of contained silt, is recorded. Fallow soil is the worst from the point of view of erosion, corn and cotton a close second, grass and alfalfa fairly good holders of soil and water.

## Stopping the Spread of Desert in China

China is a nation in trouble. With a growing population already well over one billion people, China's land is quickly falling into ruin. Centuries of overgrazing, poor agricultural practices, and deforestation have resulted in severe erosion and rapidly spreading deserts that gobble up the once-productive countryside.

The spread of deserts effects the lives of millions of peasants in China. In the highland of northern China, for example, the land is cut with gullies, some hundreds of meters deep. Erosion from the raw, parched earth is an astounding 30-40 tons per hectare (12-16 tons of topsoil per acre ) per year- far above replacement level. In all, some 1.6 billion tons are carried into the Yellow River annually, making it one of the muddiest rivers in the world.

According to one estimate, an area larger than Italy has become desert or semidesert in China in the last 30 years. Agricultural officials have begun to plant a 6,900-kilometers " green wall " of vegetation to stop the spread of desert in the northern region. The Yulin District is one of China's success stories. Before 1949, more than 400 villages and six towns had been invaded or completely covered by the encroaching sand. Today four major tree belts have been planted in the area, decreasing the southward push of the desert by 80%. Towering sand dunes now peep through poplar trees, and rice paddies sparkle in the sunshine. Grain production has been replaced by a diversified agriculfrural system, including animal husbandry, forestry, and crop production. The trees provide shade and help reduce the shifting sand dunes. Shrubs and grasses now thrive on land once stripped of its rich vegetative cloak. Trees and shrubs grow in gullies and grasses carpet slopes, helping hold the soil in place and reversing the climate local change. Local residents have built a diversified desert economy in what was once simply a desert. Juice from the desert cherry tree, which thrives in the desert climate and is extremely rich in vitamin C and amino acids now used to produce softs drinks, preserves, and beer. Twigs of the desert willow are used to make wicker baskets that earn local residents two million dollars in US currency every year.

Despite the encouraging signs in China, a report by the Shanghai-based World Economic Tribune says that, while nearly 10 million hectares are planted every year, twice that amount is still being lost in the northern province Hellongjiang, home of China's largest concentration of virgin forest, loggers have reduced the tree cover from 50% to 35% in just 30 years. Government pricing policies promote overcutting. The reforestation project is also plagued by a shortage of money and technical expertise. Because of short- sighted land use practices, some experts believe that China's Yangtze River, the nation's longest, could turn into a second Yellow River. Each year, its tributaries are turning muddier.

Reforestation is needed throughout the world to help reverse centuries of land abuse that have lead to the spread of deserts and the gradual deterioration of the earth's soil. Forest replanting can also reduce global warming that now threatens the world climate.

# 4 Словарь

Soil ~ 1. Почва, грунт, земля 2. Тип почвы 3. Почвенный слой, насос 4. Компост: органическое удобрение 5. Кормить (скот) зелеными кормами

ABC ~ почва с профилем ABC, почва с полноразвитым профилем и иллювиально-глинистым горизонтом B
Abnormal ~ см. disturbed soil
AC ~ неразвитая почва
Acid ~ кислая почва
Acid peat ~ кислый торфяник
Active ~ (биологически) активная почва
Adobe ~ (амер). почва адобе, наносно-глинистая почва
Adult ~ см. mature soil
Aeolian — эоловая почва
Aerobic - аэробная почва
AG ~ почва с гумусовым и глеевым горизонтами
Agricultural ~ см. arable soil
Agrogenic ~ см. arable soil
Air dry ~ воздушно-сухая почва
Alkali ~ см. solonetz soil
Alkali-affected ~ см. solonetzized soil
Alkaline ~ щелочная почва
Alkali-saline ~ солончаковато-солонцеватая почва, щёлочно-засолённая почва
Alkalized ~ см. solonetz-like soil
Allitic ~ аллитная почва
Allitized ~ аллитизированная почва
Allochthonal ~ см. allogenic soil
Allogenic ~ аллохтонная почва
Alluvial ~ 1. аллювиальная (наносная, пойменная) почва, почва на аллювии 2. аллювий
Alpine ~ альпийская (высокогорная) почва
Alpine humus ~ альпийская (высокогорная) гумусовая почва
Alpine meadow ~ альпийская луговая (горно-луговая) почва
Amorphous ~ аморфная почва
Amphoteric ~ амфотерная почва
Anaerobic ~ анаэробная почва
Ancient ~ реликтовая почва; древняя почва
Ando ~ андосоль, высокогумусированная почва на (вулканическом) пепле
Anomalous ~ аномальная почва
Aquatic ~ аквальная почва
Aqueous ~ водонасыщенная почва
Arable ~ пахотная почва; старопахотная почва, старопашка
Arctic ~ арктическая почва, почва арктической области
Arid ~ почва аридной зоны
Artifical ~ искусственная почва
Azonal ~ азональная (интерзональная, неразвитая) почва
Basin ~ польдерная почва
BC ~ почва с профилем BC, эродированная почва
Bioturbic ~ почва с горизонтами, перемешанными почвенной фауной
Black ~ почва чёрного цвета; чёрная почва

Black alkali ~ (амер.) солонец, гумусированный солонец, столбчатый солонец; чёрная щелочная почва
Black bog ~ болотная низинная почва
Black cotton ~ (инд). чёрная хлопковая (монтмориллонитовая) почва, регур
Black earth ~ почва чёрного цвета, чернозём
Black meadow ~ гумусированная луговая почва
Black prairie ~ чёрная (гумусированная) почва прерий
Black tropical ~ чёрная тропическая почва
Bleached meadow ~ луговая осолоделая почва
Bog(gy) ~ болотная почва
Boldery ~ завалуненная почва
Border ~ естественная почва в грунтовой теплице
Bottom ~ подпочва
Brown ~ бурая почва
Brown desert steppe ~ бурая пустынно-степная почва
Brown forest ~ бурая лесная почва, бурозём
Brown isohumic ~ бурая изогумусовая почва
Brown meadow steppe ~ бурая лугово-степная почва
Brown steppe ~ бурая степная почва
Brunizem ~ брунизём (почва прерий)
Buried ~ погребённая почва, погребённый горизонт почвы
Calcareous ~ карбонатная почва
Calcimorphic ~ кальцеморфная почва
Carbonate ~ см. calcareous soil
Carried ~ см. transported soil
Casing ~ покровная почва (в шампиньоноводстве)
Chalk ~ меловая почва
Chernozem ~ чернозёмная почва, чернозём
Chernozem-like meadow ~ лугово-чернозёмная почва
Chestnut~s каштановые почвы
Chestnut-like meadow ~ лугово-каштановая почва
Cinnamonic ~ коричневая почва
Clay ~ глинистая почва
Clayed ~ оглиненная почва
Close-settled ~ см. compressed soil
Coarse ~ крупнокомковатая почва
Coarse gravelly ~ галечниковая почва
Colluvial ~ коллювиальная почва
Compact(ed) ~ слитая почва
Composite ~ почва со сложным профилем
Compressed ~ уплотнённая почва
Consolidated ~ осевшая почва
Cryogenic ~ криогенная (мерзлотная) почва
Cryomorphic ~ криоморфная почва
Cultivated ~ окультуренная почва; пахотная почва, старопахотная почва, старопашка
Cultured ~ см. cultivated soil
Dal ~ дэльсоль (голландское название торфяных почв, имеющих песчаную подпочву,покрытую слоем комковатого молодого торфа)
Dark chestnut ~ тёмно-каштановая почва
Dead~s «мертвые» почвы (покрытые сверху слоем торфяных комков)
Decalcified ~ декальцинированная почва
Deep ~ мощная почва, почва с глубоким пахотным слоем

Degraded ~ деградированная почва
Deluvial ~ делювиальная почва
Denuded ~ смытая почва
Depleted ~ истощенная почва
Derno-podzolic ~ дерново-подзолистая почва
Desert~s почвы пустыни
Desertified ~ опустыненная почва
Disturbed ~ почва с нарушенным сложением
Drained ~ дренированная (осушенная)почва
Drift ~ намытая; наносная почва
Duplex ~ неоднородная почва
Dwarf ~ карликовая (маломощная) почва, почва с укороченным профилем
Ectodynamorphic ~ эктодинаморфная почва
Eluvial ~ элювиальная почва
Embryonic ~ первичная почва, почва с неразвитым профилем
Endodynamorphic ~ эндодинаморфная почва
Eroded ~ эродированная почва, смытая почва
Erodible ~ эрозионная почва
Erratic ~ см. transported soil
Eutrophic ~ насыщенная (основаниями) почва
Exhausted ~ см. depleted soil
Fallow ~ залежь; залог; перелог
Fat ~ см. fertile soil
Fen ~ низинное болото
Fermented ~ спелая почва, почва, готовая для обработки или посева
Ferrallitic ~ ферраллитная почва
Ferrimorphic ~ ферриморфная почва
Ferruginous ~ ожелезненная почва
Fersiallitic ~ фер(ро)сиаллитная почва
Fertile ~ плодородная почва
Fibrous loam ~ слоистая глинистая почва
Fine ~ мелкокомковатая почва; мелкозем
Firm ~ плотная почва; осевшая почва
Flooding ~ см. flood plain soil
Flood plain ~ пойменная почва
Fossil ~ реликтовая почва
Foundation ~ грунт основания
Free ~ рыхлая почва
Fresh ~ вновь освоенная почва; свежевспаханная почва
Garden — садовая почва
Gilgal ~ (австрал.) почва гильгай, засолённая полигональная почва
Glacial ~ почва на ледниковом отложении, ледниковая почва
Gley ~ глеевая почва, почва с глеевым горизонтом
Gleyed ~ оглеенная почва
Gleyic ~ глееватая почва
Gley-like ~ глеевидная почва
Gley-podzolic ~ глеево-подзолистая почва
Gley swamp ~ глеево-болотная почва
Grassland ~ почва пастбищ, луговая почва
Gravelly ~ гравийная почва
Gray ~ серая почва
Gray-brown desert -серо-бурая пустынная почва
Gray-brown podzolic ~ серо-бурая оподзоленная почва

Gray-cinnamon ~ серо-коричневая почва
Gray wooded ~ (кан.) серая лесная оподзоленная почва
Groundwater ~ почва грунтового увлажнения, грунтово-глеевая почва
Gypsic ~ гипсовая почва
Half bog ~ полуболотная (полугидроморфная) почва; заболоченная оподзоленная почва
Halogenous - галогенная почва
Halomorphic ~ галоморфная почва
Heavy - тяжелая почва, почва тяжелого механического (гранулометрического) состава
High moor ~ почва верхового болота
Hight veld prairie ~ почва прерий высокого вельда (в Африке)
Hotbed ~ парниковая земля
Humic - см. humus soil
Humic gley ~ перегнойно-глеевая (гумусово-глеевая) почва
Humus ~ гумусовая (перегнойная) почва
Humus carbonate ~ гумусово-карбонатная почва
Humus fen ~ перегнойно-болотная почва (низинных болот)
Hydrogenic ~ гидрогенная почва
Hydromorphic ~ гидроморфная почва
Illuvial ~ иллювиальная почва, вмытый (кольматирующий) грунт
Immature ~ слаборазвитая (незрелая) почва
Impermeable ~ непроницаемая почва
Impervious ~ см. impermeable soil
Incrusted ~ почва, покрытая коркой, коркообразующая почва
Infantile ~ неразвитая почва
Infertile ~ неплодородная почва
Infested - инфицированная (заражённая) почва
Inorganic ~ см. mineral soil
Intergrade - переходная почва
Intrazonal ~ интразональная почва
Irrigated ~ орошаемая почва
Isohumic ~ изогумусовая почва
Laterite ~ латеритная почва
Lateritic ~ см. laterite soil
Laterized ~ латеризованная почва
Leached ~ выщелоченная почва
Leached saline ~ промытая засолённая почва
Lean ~ тощая почва
Lessive ~ (фр.) лессивированная почва
Light ~ легкая почва, почва легкого механического (гранулометрического) состава
Light-chestnut ~ светло-каштановая почва
Lime ~ известковая почва
Limestone ~ известняковая почва
Limy ~ см. lime soil
Lithic ~см. lithogenic soil
Lithogenic - литогенная (скелетная) почва
Lithosolic –(амер.) см. lithogenic soil
Loam(y) - суглинистая почва
Loess - лёссовая почва
Loose - рыхлая (несвязная) почва
Low-fertility - малоплодородная почва

Low-humic ~ малогумусовая почва
Low moor ~ почва низового болота
Mangrave ~ мангровая почва, почва мангрового болота
Man-made ~ антропогенная почва
Marl ~ мергелевая почва
Marsh(y) ~ маршевая почва, почва маршей
Mature ~ зрелая (развитая) почва
Meadow ~ луговая почва
Meadow alluvial ~ пойменная луговая почва
Meadow-boggy ~ см. meadow-swamp soil
Meadow-chernozem(ic) ~ лугово-чернозёмная почва
Meadow chestnut ~ см. chestnut-like meadow soil
Meadow-cinnamon ~ лугово-коричневая почва
Meadow-desert ~ лугово-пустынная почва
Meadow-forest ~ лугово-лесная почва
Meadow-swamp ~ лугово-болотная почва
Mediterranean ~ почва Средиземноморья
Medium acid ~ среднекислая почва
Mellow ~ хорошо разделенная мягкая почва
Mildly alkaline ~ слабощелочная почва
Mineral ~ минеральная почва
Mold ~ см. humus soil
Moor ~ см. bog(gy) soil
Mountain ~ горная почва
Mountain chestnut ~ горно-каштановая почва
Mountain forest ~ горно-лесная почва
Mountain meadow ~ горно-луговая почва
Mountain meadow steppe ~ горно-лугово-степная почва
Mountain tundra ~ горно-тундровая почва
Muck ~ см. humus soil
Mud ~ илистая почва
Mull ~ мюллевая почва
Native ~ см. natural soil
Natural ~ естественная (неокультуренная) почва
Neutral ~ нейтральная почва, почва с нейтральной реакцией
New ~ см. virgin soil
Night ~ фекальное удобрение
Nonalkali ~ несолонцеватая почва
Nonplastic ~ см. loose soil
Nonsaline alkali ~ (амер.) солонцеватая почва, незасолённый солонец
Normal ~ (амер.) зональная почва
Old(-arable) ~ старопахотная почва, старопашка
Oligotrophic ~ олиготрофная (ненасыщенная кислая) почва
Organic ~ органогенная (органическая) почва
Padaung ~ подзолистая почва грунтового увлажнения
Paddy ~ рисовая почва; почва затопляемого рисового поля
Pan ~ почва с плотным горизонтом
Peat ~ торфяная почва; перегнойная почва
Peat-bog(gy) ~ торфяно-болотная почва
Peaty-gley ~ торфяно-глеевая почва
Permeable ~ проницаемая почва
Pervious ~ см. permeable soil
Planting ~ см. garden soil

Plastic ~ пластичная почва
Plow ~ плужная подошва
Plowed-out ~ выпаханная почва
Podzolic ~ подзолистая почва, подзол
Podzolic boggy ~ подзолисто-болотная почва
Podzolized ~ оподзоленная почва
Polder~s польдерные почвы; почвы польдеров
Polygonal ~ полигональная почва
Pool ~ почва торфяных разработок
Poor ~ бедная (неплодородная) почва
Poorly graded ~ равнозернистый грунт
Prairie ~ (амер.) (бескарбонатная) почва прерий
Prairie gray ~ лугово-серозёмная почва
Primary ~ первичная почва
Pseudogley ~ псевдоглеевая почва, почва с псевдоглеем; поверхностно-глеевая почва
Pseudomycelium ~ псевдомицеллярная почва
Pseudopodzolic ~ псевдоподзолистая почва, контактно-глеевая почва
Puddled ~ почва в бесструктурном состоянии, загрубевшая почва (результат преждевременной вспашки)
Pumice ~ почва вулканического происхождения
Raw ~ примитивная почва, слаборазвитая почва
Recent ~ современная почва
Reclaimed ~ окультуренная почва
Red ~ красная почва, краснозём
Red desert ~ красноватая почва кустарниковой пустыни, красная пустынная почва
Reddish brown ~ красновато-бурая почва
Reddish prairie ~ красноватая почва прерий
Red ferralitic ~ красная ферраллитная почва
Red podzolic ~ красная подзолистая почва
Red savanna ~ красная саванная почва
Red-yellow ~ красно-жёлтая почва
Regenerated ~ восстановленная почва
Rego ~ реговая почва, регосоль
Relict ~ см. fossil soil
Residual ~ остаточная почва, почвоэлювий 2.см. plowed-out soil
Rice ~ рисовая почва, почва рисовников
Rich ~ плодородная(тучная) почва
River basin ~ см. riverside soil
River plain ~ см. riverside soil
Riverside ~ пойменная почва, почва пойм
Rough ~ см. coarse soil
Saline ~ засолённая почва
Saline-alkali ~ солонцевато-солончаковая почва; солончак-солонец
Salinized ~ см. saline soil
Salt-affected ~ вторично засолённая почва
Sandstone ~ песчаник
Sandy ~ песчаная почва
Saturated ~ насыщенная почва
Schor~s шоровые почвы
Sea-marsh ~ см. marsh(y) soil
Secondary ~ вторичная почва, почва сложного генезиса

Sedimentary ~ аллохтонная почва; осадочная почва
Self-mulching ~ самомульчирующаяся почва
Semibog(gy) ~ полуболотная почва
Semidesert ~ почва полупустыни
Semihydromorphic ~ полугидроморфная почва
Semimature ~ см. young soil
Senile ~ см. mature soil
Serozem-like ~ серозёмовидная почва
Shallow ~ маломощная почва; почва на маломощном наносе
Shinglic ~ см. coarse gravelly soil
Siallitic ~ сиаллитная почва
Siliceous ~ кремнистая почва
Skeletal ~ скелетная почва
Skeleton ~ см. skeletal soil
Skeletonless ~ бесскелетная (мелкозёмистая) почва
Slightly acid ~ слабокислая почва
Slik~s почвы периодически затапливаемых приморских земель; слики
Slimy-gley ~ иловато-глеевая (перегнойная) почва
Soaked ~ см. gley soil
Sod ~ дерновая почва, почва с дерновым горизонтом
Sodic ~ см. sodium soil
Sodium ~ натриевая (содовая) почва
Solod ~ солодь
Solodic ~ осолоделая почва
Solodized ~ см. solodic soil
Solonchak ~ солончак
Solonchak-like ~ солончаковатая почва
Solonetz ~ солонец
Soonetzized ~ осолонцованная почва
Solonetz-like ~ солонцеватая почва
Stagnogley ~ грунтово-глеевая почва
Steamed ~ пропаренная почва, почва, стерилизованная паром
Steppe ~ степная почва, почва степи
Sticky ~ липкая почва
Sticky clay ~ вязкая глинистая почва
Stiff ~ грубая почва
Stony ~ каменистая почва
Strongly acid ~ сильнокислая почва
Strongly alkaline ~ сильнощелочная почва
Structureless ~ бесструктурная почва
Subsurface ~ подпахотный слой почвы
Superaquatic ~ супераквальная почва
Surface ~ верхний (пахотный) слой почвы
Swamp ~ см. bog(gy) soil
Swamp-podzolic ~ болотно-подзолистая почва
Swampy ~ заболоченная (полуболотная) почва
Swampy-gley ~ болотно-глеевая почва
Sward-podzolic ~ дерново-подзолистая почва
Szik - шик, засолённая почва, щелочная почва (в Венгрии)
Takyr(ic) ~ такырная почва, почва такыра
Takyr-like ~ такыровидная почва
Thin ~ маломощная почва
Tight ~ плотная почва; непроницаемая почва

Tilth-top ~ пахотный слой почвы
Tirs ~ почва тирсов, тёмная глинистая почва (в Африке)
Top ~ см. surface soil
Transitorial ~ переходная почва
Transported ~ наносная почва
True ~ (амер.) почвенная толща
Truncated ~ эродированная почва; почва без верхних горизонтов
Tundra ~ почва тундры, тундровая почва
Unbroken ~ см. virgin soil
Underwater ~ почва грунтового увлажнения
Undisturbed ~ почва с ненарушенным строением
Unfertile ~ см. infertile soil
Unfixed ~ незакреплённая почва
Unirrigated ~ неорошаемая почва
Unproductive ~ непроизводительная почва
Unsaturated ~ ненасыщенная почва
Upland ~ почва плакорных условий; почва возвышенных территорий
Vadi ~ почва вади
Valley ~ см. riverside soil
Vegetable ~ дёрн; гумусовый горизонт; растительная земля; перегной
Virgin ~ целинная почва; целина, новь
Volcanic ~ вулканическая (вулканогенная) почва
Warmed ~ утеплённый грунт
Warp ~ намытая почва
Washed-out ~ промытая почва; смытая почва
Water-logged ~ переувлажнённая почва
Weakly developed ~ слаборазвитая почва
Wet ~ заболоченная почва; мокрая (сырая) почва; влажная почва
Wet meadow ~ см. meadow alluvial soil
White alkali ~ белая щелочная почва
Xeromorphic ~ ксероморфная почва
Yellow ~ желтозём
Young ~ молодая почва; слаборазвитая почва
Zonal ~ зональная почва

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