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**Т. М. Карлова, Г. А. Черненко**

**FORESTS AND FORESTRY**

**ЛЕСА И ЛЕСНОЕ ХОЗЯЙСТВО**

*Учебное пособие  
для студентов специальностей «Лесное хозяйство» и «Лесное дело»  
всех форм обучения*

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Учебное пособие предназначено для студентов специальностей «Лесное хозяйство» и «Лесное дело», изучающих иностранный язык в специальном вузе на последнем этапе обучения. Материалы пособия обучают говорению, чтению и пониманию иноязычной информации, устному и письменному переводу, расширяют специальный и общенаучный вокабуляр и лексику общего пользования. Грамматические упражнения предусматривают повторение и углубление пройденного грамматического материала.

Пособие может использоваться широким кругом специалистов в области лесоводства, а также всеми, кто интересуется указанной тематикой.

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## ПРЕДИСЛОВИЕ

Настоящее учебное пособие предназначено для студентов второго курса специальностей «Лесное хозяйство» и «Лесное дело» и включает материалы, обучающие специальному английскому языку. Цель учебного пособия заключается в том, чтобы научить студентов работать с профессионально значимой информацией на иностранном языке и высказываться по проблемам лесоводства, обосновывая положения своего высказывания.

Учебное пособие «Лес и лесное хозяйство» состоит из восьми разделов. Основной материал представлен двумя текстами, из которых извлекается рабочий тематический словарь (рекомендуемый для отработки и запоминания). Кроме того, довольно объемный вокабуляр (слова и словосочетания) представлен в конце книги (в алфавитном порядке). Как правило, слова предлагаются с переводом, а перевод дан с несколькими значениями. Лексические упражнения рассматривают различные аспекты словообразования (суффиксацию, префиксацию, конверсию), синонимию и антонимию, многозначность, сочетаемость и т. п. Большое внимание уделяется терминам, определениям, формулированию и употреблению основных определений и понятий. Многие основополагающие понятия выделяются в тексте и закрепляются в упражнениях.

Грамматические упражнения во всех разделах определяются языковыми явлениями, содержащимися в текстах, или необходимостью их использования для выполнения речевых заданий. В учебном пособии нет грамматики как таковой, но упражнения сопровождаются напоминаниями основных правил. Предполагается, что основные разделы грамматики уже изучены, а на данном этапе происходит совершенствование «грамматического» навыка. В целом, в пособии отрабатываются все основные разделы грамматики, значимые в точки зрения практической работы со специальными информативными материалами.

На основе предлагаемых текстов организуется обучение различным видам чтения. Как правило, тексты содержат предтекстовые задания, помогающие восприятию и общему пониманию, а также и нахождению конкретной информации. Послетекстовые задания проверяют понимание и ориентируют на выполнение задания в соответствии с установкой, предоставляя возможность высказаться по проблемам, связанным с будущей специальностью студентов. Тексты акцентируют актуальные проблемы специальности, которые уже апроби-

рованы в работе. Материалы получены из надежных источников, многие интересны тем, что в них представлен нетрадиционный для нашей страны подход. В определенной степени тексты подверглись сокращению, а также и компиляции за счет современных материалов из электронных ресурсов.

Перевод не представлен как вид речевой деятельности, которому обучаются студенты, но по усмотрению преподавателя можно сформулировать задания на полный письменный перевод и различные виды сокращенного перевода на основе текстов уроков. Упражнения на перевод включены во все разделы, поскольку, с нашей точки зрения, они способствуют более полному пониманию языкового явления и речевого материала.

Предлагаемые материалы предусматривают, главным образом, аудиторную работу с преподавателем. На каждый раздел требуется не менее 8 часов аудиторного времени, но успешность работы предполагает значительный объем самостоятельной работы студента по материалам данного издания или по другим рекомендуемым материалам.

Приложения включают в себя дополнительные тексты по различным аспектам лесоведения (например, Seed Setting), которые не нашли отражения в основной части. Некоторые тексты дополняют уже изученные материалы и могут использоваться для домашнего чтения или как вспомогательная информация для обсуждений, высказываний и презентаций.

В учебном пособии «Лес и лесное хозяйство» отражены программные требования по предмету «Иностранный язык».

Несомненно, материалы предлагаемого пособия могут заинтересовать специалистов, а также широкий круг лиц, изучающих английский язык.

Авторы выражают благодарность рецензентам и коллегам за поддержку и ценные рекомендации.

*Авторы*

## **ВВЕДЕНИЕ**

Настоящее пособие актуально в связи с тем, что рекомендует материалы для изучения специального английского языка. Оно предназначено для будущих специалистов в области лесоводства и учитывает их профессиональные потребности в иностранном языке для дальнейшей практической и научной деятельности. Материалы учебного пособия гарантируют усвоение значительной доли профессионально значимой лексики, что, безусловно, облегчит дальнейшую самостоятельную работу по совершенствованию владения иностранным языком и самостоятельную работу с иноязычной информацией.

Наше пособие ориентировано на будущих специалистов, с которыми мы работаем в Сыктывкарском лесном институте, а, следовательно, мы учитываем задачи и условия преподавания английского языка в данном вузе.

## UNIT 1. WHAT IS A TREE?

*Do we fully understand how a tree works? What force pumps the sap from the roots to the crown? What enables some trees to achieve their enormous size, consuming nothing, but sunlight and ground-water? The texts to follow explain some of the essential processes.*

*Before reading Text 1 study the topical vocabulary and then do some exercises.*

### Topical Vocabulary

**seed** — семя;

**embryo** ['embriəu] — зародыш, эмбрион;

**growth hormone** ['hɔ:məun] — гормон роста;

**enzyme** ['enzaim] — энзим (фермент);

**starch** — крахмал;

**dextrose** ['dekstrəuz] — декстроза (*уст.*) = глюкоза;

**protein** ['prəuti:n] — протеин, белок;

**amino acids** — аминокислоты;

**germinating embryo** — прорастающий зародыш;

**seed shell** — оболочка, скорлупа семени;

**shoot** — росток, побег;

**root** — корень;

**seedling** — (лесной) сеянец;

**nutrients** ['nju:triənt] — питательные вещества;

**stem tip** — верхушка ствола;

**cambium** ['kæmbiəm] — камбий (образовательная ткань между древесиной и лубом);

**wood** — *зд.* древесина;

**bark** — кора;

**girth** [gɛ:θ] — окружность ствола; обхват;

**cell** — клетка;

**bast** [bæst] — лыко;

**sieve tube** — ситовидная трубка;

**foliage** ['fəuliɪdʒ] — листва;

**storage tissue** ['tɪsju: / 'ti:ʃu:] — запасящая ткань, паренхима;

**annual ring** — годичное кольцо;

**cross section** — поперечное сечение;

**hardwood** (= deciduous) **tree** — лиственное дерево;

**vessel** ['vesl] — сосуд;

**conifer** ['kɒnɪfə] (= softwood tree) — хвойное дерево;

**cellulose** ['seljələus] (= pulp) — целлюлоза; клетчатка;

**cellobiose** [,seləu'biəiəs] — целлобиоза;

**lignin** — лигнин;

**resin** — смола;

**tannin** — танин (дубильная кислота).

## **TEXT 1. A TREE IS A LIVING THING**

From the seed that in the autumn falls to the ground and is covered with leaves and soil, a tree is born.

In the spring, when the soil gets warm enough and moisture is abundant, deep changes begin to take place in the dormant seed, already conditioned by the low winter temperatures. The embryo tree awakens from its sleep and begins to grow. What causes this awakening of life is not exactly known, and what is known is complicated, indeed. The growth hormone is activated; the enzymes, whose part is to direct and hasten living processes, start their work feverishly. The insoluble stored fats and starch begin to break down to soluble sugars, mainly dextrose. The stored proteins are split by the enzymes into some 20 soluble compounds called amino acids. Both sugars and amino acids are rushed to the growing points, where still different enzymes rearrange them into building material to be used by the germinating embryo. Proteins are formed again from the amino acids, and dextrose is partly used for building the body of the tree and partly burned up to provide necessary energy for the process.

The embryo grows fast. Soon the seed shell becomes too small and splits open. The newly born tree emerges above the ground. Its shoot begins to grow straight up and its roots straight down. The root has important work to do, it provides water for the young seedling. As soon as the little root of a seedling penetrates the ground, the tree is permanently anchored, for better or for worse, to the place, where, unless it is transplanted, it has to stay all its life. From now on the tree has to depend on the nutrients available in that particular place and to develop under climatic conditions found there, which cannot be changed. In nature, however, a seedling generally begins its life in a place where its ancestors have been growing for a long time, so the little tree is well adapted to the existing conditions.

Besides the root and stem tips, another important growing region is soon established in the seedling. It is called the cambium layer and is found between the wood and the bark. It makes the tree grow in girth. The cambium consists of a single layer of cells that retain their capacity to divide throughout the life of the tree. This single layer of cells has a peculiar property in that it gives origin both to the wood and to the bark. In the spring, when the cambium layer becomes active, it begins to split off rows of wood cells to the inside and rows of bark cells to the outside. Generally speaking, the bark part of the tree is much thinner than the woody part, or the stem. Bark continuously sloughs off, while the wood accumulates. In the soft inner bark, or bast, are formed sieve tubes, through which manu-

factured sugar dissolved in water flows from the foliage to storage tissues in stem and root.

The wood formed in the spring consists of light-colored, thin-walled cells, toward the end of the season smaller cells are formed, their walls are heavier and darker and thus summer wood is formed. This alternation of spring wood and summer wood causes the concentric structure of the tree trunk known as annual rings, they are seen clearly on the cross section of a tree, one can determine fairly closely its age. When growth conditions are favorable and food and water are abundant, the rings are wide. When drought occurs, the growth slows down and the rings are narrow. By reading a cross section of an old tree, one can determine what growth conditions prevailed during any particular year of the past.

In the cross section of the hardwood trees there may be seen numerous dots. These are canals, so-called vessels, that serve for conducting water along the trunk. In the conifers, like pines or firs, there are no vessels and water moves painstakingly up the trunk through minute holes from one cell to another.

Sixty percent of the wood of a tree is cellulose — by far the most important ingredient. The structure of cellulose is well understood and is rather simple: molecules of dextrose are linked in pairs to form a more complex sugar, cellobiose, and these units are hooked up to form long chains of cellulose molecules. This structure of cellulose may be easily changed by action of even a weak acid, cellulose then falls apart into the original dextrose molecules, providing an enormous source of sugar that can be used for many purposes, from fattening hogs to production of industrial alcohol. Most of the cellulose used at present, however, is converted into pulp and paper. The rest of the wood consists mostly of lignin; which is a binding material composed, like the cellulose, of carbon, oxygen, and hydrogen, but of an entirely different and more complicated chemical structure than cellulose. Lignin is not so useful as cellulose at present, but there is little doubt that valuable products will be made from it.

Besides cellulose and lignin, wood contains a small quantity of different substances — starch, fats, sugar, resins, tannins, and many others — and is literally saturated with water.

About 10 percent of the wood mass of a tree is found underground in the form of roots. The root system of a large tree is enormous. The total length of all roots of a big spreading oak tree amounts to many hundreds of miles. The function of the root is to provide water and minerals for the tree and to anchor it securely to the ground. It is important to keep in mind that the roots are part of a living organism and they need air, food, and water

for growing. Mistreatment of roots, such as tramping the soil above them, flooding them for long periods of time, or burying them too deeply, will affect the welfare of the whole tree.

## EXERCISES

*Exercise 1. Study the negative prefixes and suffixes, their meaning and use, and supply the following words with suitable negative components.*

important	useful
soluble	existing
known	available
easy	changed
securely	different
favourable	established
necessary	living
active	

*Exercise 2. Find in the text words opposite in the meaning (antonyms).*

inner	slow down
warm	simple
up	soluble
better	minute
soft	hardwood
single	light
wide	

*Exercise 3. Conversion is a productive form of word-building, when the word acquires the meaning and functions of a different part of speech. Consult the dictionary to make sure you can translate the word both as a noun and a verb.*

shoot — to shoot; sleep — to sleep; cause — to cause; store — to store; form — to form; condition — to condition; manufacture — to manufacture; anchor — to anchor; amount — to amount; flood — to flood; affect — to affect; transplant — to transplant.

**Exercise 4.** *Suffixes and prefixes change the part of speech and they change the meaning of the word. Translate the words with different word-building affixes. Are any other forms possible?*

to grow — growth; bark — to debark — debarker; to store — storage; nutrient — nutrition — nutritious; conifer — coniferous; to act — active — to activate; to emerge — emergence — emergency; to penetrate — penetration; to plant — to transplant; to divide — division — subdivision; to accumulate — accumulation — accumulator; fat — to fatten; to solve — solution — solvent — soluble — insoluble.

**Exercise 5.** *You know synonyms for the suggested words. What other words are similar in meaning? (e. g. to start — to begin; stem — trunk).*

Hardwood; conifer; important; dormant; to emerge; to split; to convert; to solve; minute; soil; moisture; soft.

**Exercise 6.** *Insert the right word or word combination from the list below.*

***anchor; annual rings; amino acids; cellulose; dextrose; dormant; enzymes; hardwood; layer of cells; nutrients; seedling; sieve tubes.***

1. In the spring, when the soil gets warm enough and moisture is abundant, deep changes begin to take place in the ... seed.

2. The ... , whose part is to direct and hasten living processes, start their work feverishly.

3. The stored proteins are split by the enzymes into some 20 soluble compounds called ... .

4. ... is partly used for building the body of the tree and partly burned up to provide necessary energy for the process.

5. The root has important work to do, it provides water for the young ... .

6. The tree has to depend on the ... available in that particular place.

7. The cambium consists of a single ... that retain their capacity to divide throughout the life of the tree.

8. In the soft inner bark, or bast, are formed ... , through which manufactured sugar dissolved in water flows from the foliage to storage tissues in stem and root.

9. The alternation of spring wood and summer wood causes the concentric structure of the tree trunk known as ... .

10. In the cross section of the ... trees there may be seen numerous dots, so-called vessels.

11. The most important ingredient, sixty percent of the wood of a tree is ... .

12. The function of the root is to provide water and minerals for the tree and to ... it securely to the ground.

## TEXT 2. WOOD IN THE MAKING

*Read text 2 and 1) give definitions to the words in italics and 2) answer the following questions:*

- *What is the function of the leaf?*
- *What is the function of the cambium?*
- *What is the function of the root?*

Like all green plants, trees make the materials for growth in their leaves by a process known as *photosynthesis*. Deriving its energy from sunlight, it is a complex chemical reaction in which carbon dioxide from the air combines with water taken from the ground to form sugars. The reaction takes place in the presence of *chlorophyll* — the green substance which gives leaves their characteristic colour.

Carbon dioxide passes directly into the leaf through tiny openings called *stomata*, but the water has a long journey from the ground to the chemical factory in the leaf. It passes into the roots through the root hairs by *osmosis* — the flow of water from a solution of low salt concentration, as is normal in the ground, to one of high salt concentration, as in the hair cell. The sap then flows through the *xylem*, or sapwood, to the crown of the tree.

But wood has other important functions in addition to the conduction of sap. It provides mechanical strength to support the weight of the crown of the tree, and stores food created by the leaves. Food is moved in solution from the leaves, to all parts of the tree through the inner bark, or *phloem*, and is used, either immediately or after a period of storage for the generation of new growth.

New wood is produced by a specialized cell layer called the *cambium*, lying between the wood and the phloem. The wood cambium is completely enclosed in the living parts of the tree and during the periods of active growth the cambial cells divide to produce new wood cells on the inside and phloem cells on the outside; thus new wood is laid down on a core of existing wood. If part of the year is unfavourable for growth because of

cold or drought, wood is laid down as seasonal increments which are seen as growth rings. If growth is continuous, as in tropical regions, no growth rings are produced in the wood. Two important functions, sap flow and food storage, occur in the most recently formed wood, called sapwood. However there comes a time when the innermost sapwood is so far removed from the active growth region that it dies and the cell contents undergo chemical change. The new substances produced may colour the wood to form a distinctive heartwood.

### ***Majestic Maturity***

The tree has the longest life-span of all Earth's higher forms of life and during its life may produce literally millions of progeny. To maintain its remarkable existence it has highly specialized organs. The roots anchor the trees in the earth and absorb water and mineral salts. The stem conducts the nutrient sap to the leaves, where food is manufactured, and then carries the food to all parts of the tree. Fruits produced each year ensure the healthy survival of the species.

### ***The leaf***

The leaf has a protective outer layer, the epidermis, a middle mesophyll, which contains the chloroplasts needed for photosynthesis; and the central vascular bundles of xylem and phloem cells, which carry nutrients to and from the leaf.

### ***Stem***

A tree grows in thickness by the activity of a single layer of cells called the cambium. This produces sapwood, or xylem, on the inside, and bark, or phloem, on the outside. As the cambium continually divides, the first-formed xylem cells become progressively detached from the cambium, undergoing chemical and physical changes to form the distinctive heartwood.

### ***Root***

Small hairs on the roots extend into soil and take up moisture by the process of osmosis. Mineral salts essential to growth are also absorbed and pass into the water stream. The solution enters the xylem vessels of the roots and is distributed throughout the tree. Ninety-nine per cent of the water is lost through the stomata of the leaves by evaporation. There is, therefore, a continuous movement of water through the tree and on a summer day an oak may take up more than 100 gallons.

*Note:* 1 gallon = 4,546 л (Великобритания) или 3,785 л (США).

## Topical Vocabulary

**photosynthesis** [ ,fəʊtə'sɪnθə'sɪs] — фотосинтез;  
**chlorophyll** ['klɔːrəfɪl] — хлорофилл;  
**stoma** ['stəʊmə] (*pl.* stomata) — устьице (дыхательное отверстие листа);  
**root hairs** — корневые волоски;  
**osmosis** [ɔːz'məʊsɪs] — осмос;  
**hair cell** — волосовидная клетка;  
**sap** — заболонь; сок растений;  
**sapwood** — заболонь древесины;  
**xylem** ['zaɪləm] (= sapwood) — ксилема (основная проводящая ткань);  
**crown of the tree** — крона дерева;  
**conduction of sap** — проводимость сока;  
**inner bark (phloem)** — внутренний слой коры;  
**cambial** ['kæmbɪəl] **cells** — клетки камбия;  
**phloem** ['fləʊəm] **cells** — клетки флоэмы;  
**core** — сердцевина, ядро;  
**seasonal increment** ['ɪŋkrɪmənt] — сезонный прирост;  
**sap flow** — передвижение сока;  
**food storage** — запас питательных веществ;  
**the innermost sapwood** — самый глубокий слой заболони;  
**cell contents** ['kɒntənt] — содержимое клетки;  
**to colour wood** — окрашивать древесину;  
**heartwood** ['hɑ:twʊd] — сердцевина, ядро; ядровая древесина;  
**progeny** ['prɒdʒəni] — потомство;  
**mineral salts** — минеральные соли;  
**maturity** [mə'tjuəri:ti] — созревание; зрелость;  
**nutrient** ['nju:triənt] **sap** — питательный сок;  
**outer layer** — внешний, наружный слой;  
**epidermis** [epɪ'de:mi:s] — эпидермис, кожица (наружная покровная ткань листа);  
**mesophyll** ['mesəʊ,fi:l] — мезофилл (фотосинтезирующая паренхима);  
**chloroplast** ['klɔːrəʊ,plæst] — хлоропласт (зеленые пластиды растительной клетки);  
**vascular** ['væskjʊlə] **bundle** — сосудистый пучок;  
**xylem** ['zaɪləm] **vessels** — сосуды ксилемы;  
**evaporation** [ɪ,væpə'reɪʃn] — испарение.

## EXERCISES

*Exercise 7. Match the word (numbers 1—12) with its definition (letters A—L).*

1. photosynthesis	A. the juice which circulates through the woody plant carrying water, food, etc.
2. phloem	B. the green substance which gives leaves their characteristic colour
3. osmosis	C. the cell layer lying between the wood and the phloem, from which new bark and wood develop
4. cambium	D. the hard wood at the core of a tree trunk
5. stomata	E. the woody tissue through which the sap flows
6. chlorophyll	F. the most recently formed wood responsible for sap flow and food storage
7. heartwood	G. seasonal increments which are seen in the cross section of the tree
8. xylem	H. tissue which provides mechanical strength to support the weight of the crown of the tree (having some other functions too)
9. sap	I. a complex chemical reaction in the leaves by which all green plants make the carbohydrates for growth from water and carbon dioxide
10. growth ring	J. the inner bark, the cell tissue serving as a path for the distribution of nutrients in the plant
11. sapwood	K. tiny openings in the leaf taking in carbon dioxide; breathing pores in plants
12. wood	L. the flow of water from a solution of low salt concentration, as is normal in the ground, to high salt concentration, as in the hair cell

**Exercise 8.** Translate the sentences into Russian. Pay attention to the functions of the verb **to be** (notional verb, link verb, modal verb and auxiliary verb).

1. What causes this awakening of life is not exactly known, and what is known is complicated, indeed. 2. The growth hormone is activated; the enzymes, whose part is to direct and hasten living processes, start their work feverishly. 3. When growth conditions are favorable and food and water are abundant, the rings are wide. 4. Most of the cellulose used at present is converted into pulp and paper. 5. Lignin is not so useful as cellulose at present, but there is little doubt that valuable products will be made from it. 6. The function of the root is to provide water and minerals for the tree and to anchor it securely to the ground. 7. New wood is produced by a specialized cell layer called the cambium. 8. If growth is continuous, as in tropical regions, no growth rings are produced in the wood. 9. The sapwood is to perform two important functions, sap flow and food storage. 10. The small hairs on the roots are extending into soil and taking up moisture by the process of osmosis. 11. Small hairs on the roots extend into soil and

take up moisture by the process of osmosis. 12. There is, therefore, a continuous movement of water through the tree and on a summer day an oak may take up more than 100 gallons.

**Exercise 9.** *Translate the sentences with the modal verbs. Pay attention to the form of accompanying infinitives.*

1. As soon as the little root of a seedling penetrates the ground, the tree is permanently anchored, for better or for worse, to the place, where, unless it is transplanted, it has to stay all its life. 2. From now on the tree has to depend on the nutrients available in that particular place and to develop under climatic conditions found there, which cannot be changed. 3. This alternation of spring wood and summer wood causes the concentric structure of the tree trunk known as annual rings, they are seen clearly on the cross section of a tree, one can determine fairly closely its age. 4. By reading a cross section of an old tree, one can determine what growth conditions prevailed during any particular year of the past. 5. In the cross section of the hardwood trees there may be seen numerous dots. 6. This structure of cellulose may be easily changed by action of even a weak acid, cellulose then falls apart into the original dextrose molecules, providing an enormous source of sugar that can be used for many purposes, from fattening hogs to production of industrial alcohol. 7. The new substances produced may colour the wood to form a distinctive heartwood. 8. The tree has the longest life-span of all Earth's higher forms of life and during its life may produce literally millions of progeny. 9. There is a continuous movement of water through the tree and on a summer day an oak may take up more than 100 gallons. 10. The age of trees could be told by the rings of the outer bark nearly as well as by those of the wood.

**Exercise 10.** *Translate the sentences with the Participle (Participle I and Participle II). Define their syntactical function (attribute, adverbial modifier, part of the predicate).*

1. In spring deep changes begin to take place in the dormant seed, already conditioned by the low winter temperatures. 2. The insoluble stored fats and starch begin to break down to soluble sugars, mainly dextrose. 3. The stored proteins are split by the enzymes into some 20 soluble compounds called amino acids. 4. In nature a seedling generally begins its life in a place where its ancestors have been growing for a long time, so the little tree is well adapted to the existing conditions. 5. The alternation of spring wood and summer wood causes the concentric structure of the tree trunk known as annual rings, they are seen clearly on the cross section of a

tree. 6. Most of the cellulose used at present is converted into pulp and paper. 7. The rest of the wood consists mostly of lignin; which is a binding material composed of carbon, oxygen, and hydrogen, but of an entirely different and more complicated chemical structure than cellulose. 8. The total length of all roots of a big spreading oak tree amounts to many hundreds of miles. 9. Deriving its energy from sunlight, it is a complex chemical reaction in which carbon dioxide from the air combines with water taken from the ground to form sugars. 10. It provides mechanical strength to support the weight of the crown of the tree, and stores food created by the leaves. 11. New wood is produced by a specialized cell layer called the cambium, lying between the wood and the phloem. 12. During the periods of active growth the cambial cells divide to produce new wood cells on the inside phloem cells on the outside; thus new wood is laid down on a core of existing wood. 13. If growth is continuous, as in tropical regions, no growth rings are produced in the wood. 14. Two important functions, sap flow and food storage, occur in the most recently formed wood, called sapwood. 15. Fruits produced each year ensure the healthy survival of the species.

*Exercise 11. Translate the text into English, sentence by sentence. Then speak about the anatomy of softwood and comment on the suggested description.*

Внутренняя анатомия стебля хвойных достаточно типична. Большую часть его объема составляет древесина, а кора и сердцевина развиты относительно слабо. Особенно это характерно для старых деревьев. Вся ксилема хвойных состоит из трахеид, а сосуды у них не обнаружены. Причем в течение тысячелетий происходило последовательное уменьшение длины трахеид.

Подобно ксилеме, флоэму относят к сложным тканям, так как она образована клетками нескольких типов. Основными из них являются проводящие элементы флоэмы (ситовидные клетки). Если проводящие элементы ксилемы образованы мертвыми клетками, то у флоэмы они живые в течение всего периода функционирования. По флоэме осуществляется отток веществ от фотосинтезирующих органов.

Между ксилемой и флоэмой располагается камбий, обеспечивающий хвойным вторичное утолщение стебля. А поскольку в условиях сезонного климата деятельность камбия зависит от времени года, в стеблях большинства хвойных образуются хорошо выраженные кольца ежегодного прироста древесины.

***Questions and tasks for discussion***

1. Describe the processes happening in the forest tree seeds in spring.
2. What substances facilitate germination and growth?
3. What work does the root do?
4. Can the growth conditions be changed?
5. What is the cambium responsible for?
6. How is the bark formed?
7. How does wood obtain its concentric structure? Does it always have it?
8. What do vessels look like and what is their function?
9. What is cellulose and what does it consist of?
10. What is lignin?
11. What are the functions of the wood for the life of the tree?
12. What does the mistreatment of the wood imply?

***For more information study text *The Tree from the Supplement.****

## UNIT 2. FOREST

*Forests are priceless, unique basic resource that Man can renew. Do you know what makes the forest and who inhabits it? How do forest plants and animals interact? What does forest need for survival and prosperity?*

*Before reading Text 1 study the topical vocabulary and get ready to do some exercises.*

### Topical Vocabulary

- interconnected communities** — взаимосвязанные сообщества;  
**fungus** ['fʌŋɡəs] (*pl.* **fungi**) — гриб; грибок; плесень;  
**mammal** ['mæməl] — млекопитающее;  
**microscopic realm** [reɪlm] — микроскопическое царство;  
**perspective** [pə'spektɪv] — ракурс, проекция; перспектива;  
**variables** ['vɛərɪəbl̩] — переменные (величины);  
**needle-leaved** — хвойный;  
**juniper** ['dʒu:nɪpərə] — можжевельник;  
**vine** — вьющийся стебель, лоза, плеть;  
**buttressed trees** — дерево, поддерживаемое (подпорами);  
**woodland** — лес; (лесо)насаждение; лесная площадь;  
**fragile network** — хрупкая (тонкая) взаимосвязь, организация;  
**web of interactions** — сеть, система взаимосвязей;  
**intricate** ['ɪntrɪkət] — запутанный, сложный, замысловатый;  
**complex** — смешанный, многосоставный; сложный;  
**habitat** ['hæbɪtət] — место обитания; местожительство;  
**survival** — выживание; долговечность;  
**disastrous consequence** ['kɒnsɪkwəns] — гибельный, пагубный результат (последствие);  
**to appreciate** [ə'prɪʃɪeɪt] — понимать, ценить по достоинству;  
**appreciation** — признательность, оценка, понимание;  
**to upset the balance** — нарушать равновесие;  
**extinction** [ɪk'stɪŋkʃn] — уничтожение;  
**conquer** ['kɒŋkə] — завоевывать, покорять; подавлять;  
**cut down** — рубить (деревья);  
**clear-cut** — проводить сплошную рубку леса;  
**cause flooding** — вызывать наводнение, потоп;  
**breathe out** — выдыхать;  
**exhale** [eks'heɪl] — выдыхать; производить выдох;  
**carbon dioxide** — диоксид углерода, углекислый газ;  
**take in** — поглощать;  
**fossil fuels** — ископаемое топливо;  
**greenhouse effect** — парниковый эффект;  
**build up** — накапливать(ся);  
**yew tree** — тис;  
**anti-cancer agent** — противораковый препарат.

## TEXT 1. WHAT MAKES THE FOREST?

When most people look at a forest, they see a large number of trees close together. But forests are much more than that.<sup>1</sup> They are interconnected communities of diverse organisms — bacteria and fungi, gigantic trees, birds, shrubs, ants and beetles, fish, and mammals. Forests cover about 30 % of the earth's land masses, and the forests can be viewed from the microscopic realm to a global perspective.

Variables such as climate, sunlight, rainfall, soil and elevation determine the character of a forest — whether it consists of small needle-leaved juniper, pine, spruce, or dense tropical vegetation thick with vines and buttressed trees, or open, dry woodland dominated by giant Ponderosa pine.

When people think of animals that live in forests, creatures such as bears, eagles, gorillas, tigers are usually what come to mind. Forest plants, other than trees, are often ignored. And many people are unaware of the fact that organisms such as bacteria and fungi are just as important to the forest as the trees themselves.

Inorganic materials are also crucial to the living organisms. Green plants — everything from trees to the most delicate ferns — form the base of all forest ecosystems. These plants require clean air, soil, water, and sun to grow and support the fragile network of life in a forest.

An enormous variety of creatures inhabit the forest. Some are spectacular, others are hidden somewhere beneath the canopy of countless billions of leaves. The web of interactions between individuals and species is intricate and complex; nothing about a forest is simple, and humans are only just beginning to understand any part of these ecosystems.

Forests are some of the most diverse habitats on the planet. Biodiversity is not simply something that's "nice" to have.<sup>2</sup> All species, including humans, are dependent on all other species for survival. The extinction of even one organism — a monkey, a flowering plant, a water flea — will have unpredictable and often disastrous consequences.

Forests and people are connected, and have been since ancient times. We have always had a special relationship based on survival. It was a delicate chain of existence that we once treated with respect and appreciation. But people began to upset this balance. They saw the forest not as a part of them but as something to be conquered. They used the seemingly limitless forest, cutting down millions of trees. But now it is coming to our attention that the forests *do* have limits<sup>3</sup> and it is time to bring them back into balance.

There is still much we don't know about forest ecosystems but each

day is leading to new discoveries. Each animal, insect and plant contains its individual genetic material that has been evolving for thousands of years. Protecting the forests does not just mean saving a lot of trees, it is preserving a process of life that started billions of years ago. Forests protect our waters and manage our climate. When it rains in the forests, the leaves allow the water to slowly drip to the ground. When a forest has been clear-cut, the rain pours down hard on the unprotected soil. The dirt then washes into streams, muddying the waters. This is unhealthy for the fish, and can cause flooding. Also, without trees, the moisture in the air evaporates quickly, changing the climate of nearby forests. This process prevents trees from receiving the water they need.

People enjoy and appreciate fresh air, clear water, beautiful scenery and wildlife. So, places with all of the above are ideal tourist spots. Also, businesses like to be located in areas of such serene beauty.

Without the forests we would have much less oxygen. One acre<sup>4</sup> of forest provides over 6 tons of oxygen per year! This is because trees (and all green plants) use a process called photosynthesis, during which they take in carbon dioxide and, as a by-product, produce oxygen. Plants "breathe" carbon dioxide, like we breathe oxygen. There has been a balance between species that breathe out carbon dioxide and take in oxygen, and species that take in carbon dioxide and exhale oxygen. Since the 1800's this balance has been upset. Fossil fuels, when burned, create carbon dioxide, so carbon dioxide levels have risen dramatically. Unfortunately, this gas, in large amounts, acts like an insulator and keeps heat near the surface of the Earth. This is called the "greenhouse effect." Unlike clouds, "Greenhouse gases", are invisible and build up in the atmosphere.

In addition to the other important aspects of the ancient forests, some individual species, such as the yew tree (*Taxus brevifolia*), have shown great importance in the medical field. The bark of the yew tree provides taxol, an anti-cancer agent. It helps treat ovarian, lung and breast cancer. This property of the yew tree was only discovered in recent years, and if the forests that are home to the yew trees are lost, other medical treatments may also be lost as well.

*Notes:*

<sup>1</sup> But forests are much more than that. — Но леса гораздо сложнее (богаче).

<sup>2</sup> something that's "nice" to have — нечто, что было бы неплохо иметь.

<sup>3</sup> the forests *do* have limits — леса тем не менее (все-таки) имеют свои пределы (не являются нескончаемыми).

<sup>4</sup> acre — акр (= 0,4 га).

## EXERCISES

**Exercise 1.** Study the suffixes, making up adjectives, make sure you know their meaning and use, and supply the following word with suitable adjectival components.

microscope  
globe  
to vary  
to ignore  
giant  
disaster  
to count  
to prevent  
to limit

use  
attention  
health  
beauty  
differ  
fortune  
importance  
to create  
medicine

**Exercise 2.** Find in the text words similar in the meaning (synonyms):

different; huge; bush; to occupy; to view; ground; to define; fragile; below; milliard; intricate; to disappear; awful; result; harmful; fast; to value; quantity; forest.

**Exercise 3.** Find in the text compound words in addition to those suggested below. Translate them. What other compound words do you know?

sunlight; needle-leaved; network; biodiversity; clear-cut; nearby; by-product; everything; without.

**Exercise 4.** Find in the text the compound verbs (phrasal verbs) given below. Translate them. What other phrasal verbs do you know?

to pour down; to cut down; to build up; to take in; to breathe out.

**Exercise 5.** Write out  $N + N (+ N)$  word combinations and translate them into Russian.

*Model:* forest plants ‘лесные растения’; tourist spots ‘места, посещаемые туристами’; vegetation community ‘сообщество растений’.

## TEXT 2. WHAT IS THE FOREST?

*Read text 2 and 1) give definitions to the words in italics and 2) answer the following questions:*

- Which forest is more species-rich, broadleaf or needleleaf?
- How are forests classified?
- What is the difference between the forest and the woodland?

The 2005 Forest Resource Assessment is the most comprehensive assessment of forests to date. It tells us that forests cover 30 % of the land area of planet Earth and range from undisturbed primary forests to forests managed and used for a variety of purposes.

A forest is an area with a high density of trees. These plant communities cover approximately 9.4 % of the Earth's surface (or 30 % of total land area) and function as habitats for organisms, hydrologic flow modulators, and soil conservers, constituting one of the most important aspects of the Earth's biosphere.

Forests can be found in all regions capable of sustaining tree growth, at altitudes up to the tree line, except where natural fire frequency is too high, or where the environment has been impaired by natural processes or by human activities. As a general rule, forests dominated by *angiosperms* (broadleaf forests) are more species-rich than those dominated by *gymnosperms* (conifer, or needleleaf forests).

Forests sometimes contain many tree species within a small area (as in tropical rain and temperate deciduous forests), or relatively few species over large areas (e. g., taiga). Forests are often home to many animal and plant species, and biomass per unit area is high compared to other vegetation communities. Much of this biomass occurs below ground in the root systems and as partially decomposed plant *detritus*. The woody component of a forest contains lignin, which is relatively slow to decompose compared with other organic materials such as cellulose or carbohydrate.

Forests are differentiated from woodlands by the extent of canopy coverage: in a forest the branches and foliage of separate trees often meet or interlock, although there can be gaps of varying sizes within an area referred to as forest. A woodland has a more continuously open canopy, with trees spaced further apart, which allows more sunlight to penetrate to the ground between them.

Among the major forested biomes are: rain forest (tropical and temperate), taiga, temperate hardwood forest, tropical dry forest.

Forests can be classified in different ways and to different degrees of specificity. One such way is in terms of the "*biome*" in which they exist,

combined with leaf longevity of the dominant species (whether they are evergreen or deciduous). Another distinction is whether the forests composed predominantly of broadleaf trees, coniferous (needle-leaved) trees, or mixed.

*Boreal* forests occupy the subarctic zone and are generally evergreen and coniferous.

Temperate zones support both broadleaf deciduous forests (e. g., temperate deciduous forest) and evergreen coniferous forests (e. g., temperate coniferous forests and temperate rainforests). Warm temperate zones support broadleaf evergreen forests, including laurel forests.

Physiognomy classifies forests based on their overall physical structure or developmental stage (e. g. old growth vs. second growth).

Forests can also be classified more specifically based on the climate and the dominant tree species present, resulting in numerous different forest types (e. g., ponderosa pine / Douglas-fir forest).

Temperate needleleaf forests mostly occupy the higher latitude regions of the northern hemisphere, as well as high altitude zones and some warm temperate areas, especially on nutrient-poor or otherwise unfavourable soils. These forests are composed entirely, or nearly so, of coniferous species (Coniferophyta). In the Northern Hemisphere pines, spruces, larches, silver firs, Douglas firs and hemlocks make up the canopy, but other taxa are also important.

Globally two broad types of forests can be identified: natural and anthropogenic.

*Natural forests* contain mainly natural patterns of biodiversity in established seral patterns, and they contain mainly species native to the region and habitat. The natural formations and processes have not been affected by humans with a frequency or intensity to change the natural structure and components of the habitat.

*Anthropogenic forests* have been created by humans or sufficiently affected by humans to change or remove natural seral patterns. They often contain significant elements of species which were originally from other regions or habitats.

## Topical Vocabulary

**comprehensive** [ˌkɒmprɪ'hensɪv] **assessment** — полная, комплексная оценка;

**primary forests** — первобытные (девственные) леса;

**density of trees** — плотность, густота деревьев;

**habitats (for organisms)** — естественная среда обитания (организмов);

**hydrologic flow modulator** — модулятор гидрологических (водных) потоков;

**to sustain** — поддерживать; способствовать;

**natural fire** — естественный пожар;

**impair** [ɪm'peɪə] — ухудшать(ся), портить(ся); причинять ущерб;

**angiosperms** [ˌændʒaɪə'spiːm] — лиственные (листопадные) деревья;

**broadleaf forest** — широколиственный лес;

**gymnosperms** ['dʒɪmnəspeɪm] — голосеменные растения;

**arid** — сухой, засушливый; безводный; аридный;

**tropical rain forest** — тропический влажный лес;

**biomass** ['baɪəʊ,mæs] — биомасса; энергетическое сырьё;

**plant detritus** [dɪ'traɪtəs] — детрит (кашицеобразный продукт распада тканей);

**canopy** ['kænpəri] **coverage** — укрытие из полога (навеса);

**to decompose** — гнить, портиться, разлагаться;

**carbohydrate** [ˌkɑ:bə'hɑɪdreɪt] — углевод;

**forested biome** — лесной биом (совокупность видов растений и животных);

**leaf longevity** [lɒn'dʒevɪtɪ] — долговечность листа;

**dominant species** — господствующий; главный, основной, преобладающий вид (порода);

**boreal** ['bɔːrɪəl] **forest** — бореальный (северный) лес;

**evergreen** — вечнозеленый;

**temperate** ['tempərət] **zone** — зона умеренного климата;

**physiognomy** [ˌfɪzɪ'ɒnəmi] — учение о живой природе;

**old growth** — спелое (лесо)насаждение

**second growth** — молодое насаждение; вторичный (производный) лес; второй ярус;

**nutrient-poor soil** — бедная (питательными веществами) почва;

**unfavourable soil** — неблагоприятная почва;

**taxon** ['tæksən] (*pl.* **taxa**) — таксон, таксономическая карта, систематическая категория

**anthropogenic** [æn,θrəpəu'dʒenɪk] — антропогенный, созданный человеком; обусловленный влиянием человека;

**seral pattern** — сукцессионная, серийная модель.

## EXERCISES

*Exercise 6. Insert the right word from the list below.*

<b>anthropogenic; biomes; boreal; detritus; habitats; humans; physiognomy; seral; species; support.</b>
---

1. Forests function as ... for organisms, hydrologic flow modulators, and soil conservers.
2. Much of the biomass occurs below ground in the root systems as partially decomposed plant ....
3. The major forested ... are rain forest (tropical and temperate), taiga, temperate hardwood forest, tropical dry forest.
4. ... forests occupy the subarctic zone and are generally evergreen and coniferous.
5. Temperate zones ... both broadleaf deciduous forests and evergreen coniferous forests.
6. ... classifies forests based on their overall physical structure or developmental stage.
7. Globally two broad types of forests can be identified: natural and anthropogenic...
8. Natural forests contain mainly natural patterns of biodiversity in established ... patterns.
9. Anthropogenic forests have been created by ... or sufficiently affected by them.
10. They often contain elements of ... which were originally from other regions or habitats.

*Exercise 7. Supply the necessary forms of the words taken from texts 1 and 2.*

Verb	Noun (thing, property, etc.)	Noun (person)	Adjective
—	ecology		
manage			
evolve			
			developmental
continue		—	
	elevation		
	creature		
support			
inhabit			
			predictable
	discovery		

*Exercise 8. Translate the sentences into Russian. Pay attention to the functions of the verb **to have** (notional verb, modal verb and auxiliary verb, part of a set expression).*

1. Biodiversity is not simply something that's "nice" to have.
2. For-

ests and people are connected, and have been since ancient times. We have always had a special relationship based on survival. 3. Forests are some of the most diverse habitats on the planet. 4. Without the forests we would have much less oxygen. 5. Fossil fuels, when burned, create carbon dioxide, so carbon dioxide levels have risen dramatically. 6. Each animal, insect and plant contains its individual genetic material that has been evolving for thousands of years. 7. A woodland has a more continuously open canopy which allows more sunlight to penetrate to the ground between them. 8. By the root the tree is permanently anchored to the place, where, unless it is transplanted, it has to stay all its life.

**Exercise 9.** *Translate the sentences with the adjectives and adverbs in different forms (positive, comparative and superlative).*

1. The 2005 Forest Resource Assessment is the most comprehensive assessment of forests to date. 2. Many people are unaware of the fact that organisms such as bacteria and fungi are just as important to the forest as the trees themselves. 3. Economically the boreal forests are still the most important of all forests. 4. Forest plant communities constitute one of the most important aspects of the Earth's biosphere. 5. Forests make up one of the largest ecosystem types in the world, currently covering some 3500 million hectares of land surface. 6. Without the forests we would have much less oxygen. 7. Forests dominated by angiosperms (broadleaf forests) are more species-rich than those dominated by gymnosperms (conifer, or needleleaf forests). 8. A woodland has a more continuously open canopy, with trees spaced further apart, which allows more sunlight to penetrate to the ground between them. 9. Forests can also be classified more specifically based on the climate and the dominant tree species present, resulting in numerous different forest types. 10. Temperate needleleaf forests mostly occupy the higher latitude regions of the northern hemisphere.

**Exercise 10.** *Translate the sentences with the infinitive. Define the syntactical functions (subject, object, attribute, adverbial modifier, part of the predicate).*

1. The forests can *be viewed* from the microscopic realm to a global perspective. 2. Protecting the forests does not just *mean* saving a lot of trees, it is preserving a process of life that started billions of years ago. 3. Green plants require clean air, soil, water, and sun *to grow* and *support* the fragile network of life in a forest. 4. When it rains in the forests, the leaves allow the water *to drip* to the ground. 5. If the forests that are home to the yew trees are lost, the medical treatments may also *be lost* as well. 6. For-

ests can *be found* in all regions capable of sustaining tree growth. 7. Nothing about a forest is simple, and humans are only just beginning *to understand* any part of these ecosystems. 8. People saw the forest not as a part of them but as something *to be conquered*. 9. Forests can *be classified* in different ways and to different degrees of specificity. 10. Now it is coming to our attention that the forests do *have* limits and it is time *to bring* them *back* into balance. 11. The natural formations and processes have not been affected by humans with a frequency or intensity *to change* the natural structure and components of the habitat.

*Exercise 11. Translate the text into English, sentence by sentence. Then speak about the classification of stands and comment on the suggested approach.*

Древостой — основной биологический компонент лесного сообщества и важнейший объект хозяйственного внимания и использования. Один древостой может отличаться от другого по многим признакам, прежде всего по составу пород. Если древостой состоит из одной породы (например, сосны), он называется чистым, если из нескольких (сосна, ель) — смешанным. В практике чистым древостоем условно считается и тот, в котором кроме одной породы имеется еще примесь других, но не более 0.2 общего запаса.

Породу, преобладающую в составе, обычно называют господствующей. Так, в древостое с составом 7С/3Е господствующей (преобладающей) породой является сосна. От господствующей необходимо отличать главную породу, представляющую наибольший хозяйственный интерес, т. е. породу, которая при данных экономических и лесорастительных условиях наилучшим образом отвечает хозяйственным целям.

Кроме состава различают еще форму древостоев. Если все деревья в древостое имеют примерно одинаковую высоту (с примерными колебаниями от средней до 15 %), вследствие чего образуется как бы один общий ярус, то это будет простой древостой. Если же образуются два (и более) яруса то это пример сложного древостоя. В природе часто встречается, например, 2-ярусный древостой, когда верхний ярус занимает береза или осина, а в нижнем ярусе растет ель.

Важное биологическое и хозяйственное значение имеет возраст древостоя, с которым связаны этапы роста.

Древостой различают по возрасту. Одновозрастными условно принято считать древостой, деревья которых отличаются друг от друга не более как на один класс возраста. Абсолютно одновозрастные древостой образуются обычно в результате одновременно проведен-

ной посадки или посева. Иногда они возникают и в естественном лесу — после пожара в год обильного урожая семян.

Древостой отличаются также по своему происхождению, т. е. прежде всего в зависимости от того, образовались ли они естественным путем или же искусственно созданы человеком. Эти древостой могли произойти двумя главными путями: от семян или же вегетативным способом. Семенное размножение присуще всем нашим хвойным и лиственным породам.

### ***Questions and tasks for discussion***

1. What is the forest's share on the globe?
2. What determines the character of the forest?
3. How are forests classified? Make up a chart, which could present different classifications.
4. What do forests need for their growth and development, do you think?
5. What living organisms inhabit the forest? How do they interact?
6. What are the functions of the forest?
7. What might happen if forests disappeared?
8. How can people use forests for multiple purposes?
9. Do forests consume or produce oxygen? How do they do it?
10. Where is biomass accumulated in the forest?
11. What is specific about the anthropogenic forests?
12. What is 'primary forest'? What values has it got?
13. Speak about the values of the forest (biospheric and social).

***For more information about plant and animal communities study text The Earth's Biosphere from the Supplement.***

### ***Comment on the definitions and description of biodiversity***

Biodiversity is the variation of life forms within a given ecosystem, biome or for the entire Earth. Biodiversity is often used as a measure of the health of biological systems.

The most straightforward definition is "variation of life at all levels of biological organization". A second definition holds that biodiversity is a measure of the relative diversity among organisms present in different ecosystems. "Diversity" in this definition includes diversity within a species and among species, and comparative diversity among ecosystems.

A third definition that is often used by ecologists is the "totality of genes, species, and ecosystems of a region".

For ecologists, biodiversity is also the diversity of durable interactions among species.

## UNIT 3. TAIGA

*The Russian Federation has 22 % of the world's forest area. Russia's vast taiga forests are a natural resource of global importance, both ecologically and economically. The forests already serve Russia and the rest of the world as a source of timber, as a symbol for wilderness and as a critical stabiliser of the global climate. Do we fully understand the importance of this treasure?*

*The texts to follow disclose some of the universal biological, economic and social values.*

*Before reading Text 1 study the topical vocabulary and then do some exercises.*

### Topical Vocabulary

**latitude** ['lætɪtʃu:d] — широта (географическая);

**inland** — внутренняя часть страны; территория, удаленная от моря или границы;

**terrestrial biome** ['baɪ,əɪm] — наземный биом; живущий на земле или в земле;

**barren** ['bærən] — бесплодная земля;

**genus** ['dʒi: nəs] (*pl.* genera) — род;

**alder** ['ɔ:ldə] — ольха;

**willow** — ива;

**aspen** — осина;

**deciduous** [dɪ'sɪdʒuəs] — лиственный, листопадный;

**larch** — лиственница;

**cope (with)** — справиться; выдержать;

**northern hemisphere** ['hemɪsfɪə] — северное полушарие;

**maple** — клен;

**elm** — вяз, ильм;

**scatter** — разбрасывать, раскидывать; рассыпать;

**disturb** [dɪs'tɜ:b] — нарушать; повреждать;

**intact** [ɪn'tækt] — нетронутый; невредимый; целый;

**headwaters** ['hedwɔ:təs] — главный водосбор;

**subtundra forest** — лесотундра;

**harsh climate** — суровый (о климате);

**ice cap** — ледниковый покров;

**humid** ['hju:mɪd] — влажный;

**isotherm** ['aɪsəuθɜ:m] — изотерма;

**warmth-loving species** — теплолюбивый вид;

**merge (into, with)** ['mɛ:dʒ] — сливать(ся) (в...); соединять(ся) (с...);

**mixed temperate forest** — смешанный лес умеренного климата;

**precipitation** [prɪ,sɪpɪ'teɪʃn] — выпадение осадков; осадки;

**evaporation** [ɪ,væpə'reɪʃn] — испарение;

**northernmost** ['nɔ:ðənməʊst] — самый северный;

**organically-enriched** — обогащенный органикой;

**profile** ['prəʊfaɪl] — вертикальный разрез; сечение;

**moss** — мох; плаун; лишайник;  
**moist climate** — сырой, влажный климат;  
**acid** ['æsid] — кислота;  
**leach soil** — выщелачивать почву;  
**lichen** ['lɪkən] — лишайник.

## **TEXT 1. TAIGA'S GROWTH CONDITIONS**

The taiga is found throughout the high northern latitudes, between the tundra, and the steppes.

Taiga is a biome characterized by coniferous forests. Covering most of inland Alaska, Canada, Sweden, Finland, inland Norway and Russia (especially Siberia), as well as parts of the extreme northern continental United States, northern Kazakhstan and Japan (Hokkaidō), the taiga is the world's largest terrestrial biome. In Canada, boreal forest is the term used to refer to the southern part of this biome, while "taiga" is used to describe the more barren northern areas of the Arctic tree line.

Since North America, Europe and Asia were connected by the Bering land bridge, a number of animal and plant species (more animals than plants) were able to colonize both continents and are distributed throughout the taiga biome. Others differ regionally, typically with each genus having several distinct species, each occupying different regions of the taiga. Taigas also have some small-leaved deciduous trees like birch, alder, willow, and aspen; mostly in areas escaping the most extreme winter cold. However, the deciduous larch is coping with the coldest winters on the northern hemisphere in eastern Siberia. The southernmost part of the taiga also has trees like oak, maple, and elm scattered among the conifers.

Up to 70—75 % of taiga forests in Russia have remained close to their natural state. Despite the relative richness of the natural forests in European Russia, the taiga as a whole is relatively disturbed by various human activities, including forestry. Few substantial areas of intact natural forest remain. The remaining areas include the Pechora Ylych region and its headwaters in the Republic of Komi, the forests along the Karelia—Arkhangelsk and Arkhangelsk—Komi borders, the subtundra forests in the Arkhangelsk, Komi and Yamal-Nenets autonomous regions and the eastern part of the Kola peninsula.

Taiga soil tends to be young and nutrient-poor; it lacks the deep, organically-enriched profile present in temperate deciduous forests. The thinness of the soil is due largely to the cold which hinders the development of soil, as well as the ease with which plants can use its nutrients.

Fallen leaves and moss can remain on the forest floor for a long time in the cool, moist climate, which limits their organic contribution to the soil; acids from evergreen needles further leach the soil. Since the soil is acidic due to the falling pine needles, the forest floor has only lichens and some mosses growing on it. It is not good for farming because it is nutrient poor.

Taiga, the world's largest biome, has a harsh continental climate with a very large temperature range between summer and winter. Aside from the tundra and permanent ice caps, it is the coldest biome on Earth. High latitudes mean that for much of the year the sun does not rise far above the horizon. Winters last at least 5—6 months, with average temperatures below freezing. Temperatures vary from  $-50\text{ }^{\circ}\text{C}$  to  $30\text{ }^{\circ}\text{C}$  throughout the whole year, with eight or more months of temperatures averaging below  $10\text{ }^{\circ}\text{C}$ . The summers, while short, are generally warm and humid. In general, taiga grows south to the  $10\text{ }^{\circ}\text{C}$  July isotherm, occasionally to the  $9\text{ }^{\circ}\text{C}$  July isotherm. The southern limit is more variable. In these warmer areas, the taiga has higher species diversity with more warmth-loving species such as Korean Pine, Jezo Spruce and Manchurian Fir, and merges gradually into mixed temperate forest.

The taiga experiences relatively low precipitation throughout the year (200—750 mm annually), primarily as rain during the summer months, but also as fog and snow; as evaporation is also low for most of the year, precipitation exceeds evaporation and is sufficient for the dense vegetation growth. Snow may remain on the ground for as long as nine months in the northernmost extensions of the taiga ecozone.

## EXERCISES

*Exercise 1. Transform the suggested nouns (A) and adjectives (B) into verbs, removing or adding suffixes or prefixes, if necessary. Make changes where necessary. Consult the dictionary in case you are not sure.*

**A**  
connection  
colony  
development  
use  
contribution  
range  
diversity  
evaporation

**B**  
various  
different  
rich  
moist  
sufficient  
acidic  
characteristic  
close

**Exercise 2. Enumerate:**

- the countries which are said to possess tundra and boreal forests;
- the territories of undisturbed natural territories in European Russia.

**Exercise 3.** Find in the text sentences containing words and word-combinations suggested below and translate them into Russian.

terrestrial biome; low precipitation; barren areas; headwaters; small-leaved deciduous trees; permanent ice caps; scatter; undisturbed natural forest; northern hemisphere; northernmost.

**Exercise 4.** Specify the nouns which are used to describe climatic conditions. Which adjectives can accompany these nouns? Translate these word groups into Russian.

Model: summer — short, warm, humid.

What other adjectives can be used to describe climatic conditions?

## **TEXT 2. FLORA AND FAUNA**

**Read text 2** and 1) give definitions to the words in italics (give examples where possible); and 2) find the answers to the following questions:

- What are the dominant species in taiga? Why do they dominate, do you think?
- How does the cold climate affect the tree growth?
- What other types of plants contribute to the biodiversity?
- Are there large or small animals in taiga forests? How do they adapt to the cold?
- Are there any non-migratory birds? If yes, how many are they?

There are two major types of taiga, *closed forest*, consisting of many closely-spaced trees with mossy ground cover, and *lichen woodland*, with trees that are farther-spaced and lichen ground cover; the latter is more common in the northernmost taiga.

The forests of the taiga are largely coniferous, dominated by larch, spruce, fir, and pine. *Evergreen* species in the taiga (spruce, fir, and pine) have a number of adaptations specifically for survival in harsh taiga winters, though larch, the most cold-tolerant of all trees, is deciduous. Taiga trees tend to have shallow roots to take advantage of the thin soils, while many of them seasonally alter their biochemistry to make them more resistant to freezing, called "*hardening*". The narrow conical shape of northern conifers, and their downward-drooping limbs, also help them shed snow.

Because the sun is low in the horizon for most of the year, it is difficult for plants to generate energy from photosynthesis. Pine and spruce do not lose their leaves seasonally and are able to photosynthesize with their older leaves in late winter and spring when light is good but temperatures are still too low for new growth to commence. The adaptation of evergreen needles limits the water lost due to transpiration and their dark green color increases their absorption of sunlight. Although precipitation is not a limiting factor, the ground freezes during the winter months and plant roots are unable to absorb water, so desiccation can be a severe problem in late winter for evergreens.

Although the taiga is dominated by coniferous forests, some *broadleaf* trees also occur, notably birch, aspen, willow, and rowan. Many smaller herbaceous plants grow closer to the ground. Periodic stand-replacing wildfires (with return times of between 20—200 years) clear out the tree canopies, allowing sunlight to invigorate new growth on the forest floor. For some species, wildfires are a necessary part of the life cycle in the taiga; some, e. g. Jack Pine have cones which only open to release their seed after a fire, dispersing their seeds onto the newly cleared ground. Grasses grow wherever they can find a patch of sun, and mosses and lichens thrive on the damp ground and on the sides of tree trunks. In comparison with other biomes, however, the taiga has a low biological diversity.

*Coniferous* trees are the dominant plants of the taiga biome. A very few species in four main genera are found: the evergreen spruce, fir, and pine, and the deciduous larch or tamarack. In North America, one or two species of fir and one or two species of spruce are dominant. Across Scandinavia and western Russia the Scots pine is a common component of the taiga.

The taiga is home to a number of large *herbivorous* mammals and smaller rodents. A number of wildlife species threatened or endangered with extinction can be found in the Canadian Boreal forest including woodland caribou, grizzly bear and wolverine. Habitat loss due to destructive development, mostly in the form of logging, is the main cause of decline for these species.

The animals have adapted to survive the harsh climate. Some of the larger mammals, such as bears, eat during the summer in order to gain weight and then go into hibernation during the winter. Other animals have adapted layers of fur or feathers to insulate them from the cold.

Due to the climate, carnivorous diets are an inefficient means of obtaining energy; energy is limited, and most energy is lost between trophic

levels. However, predatory birds (owls and eagles) and other smaller carnivores, including foxes and weasels, feed on the rodents. Larger *carnivores*, such as lynxes and wolves, prey on the larger animals. *Omnivores*, such as bears and raccoons are fairly common, sometimes picking through human garbage.

A considerable number of birds such as Siberian thrush, white-throated sparrow and black-throated green warbler, migrate to this habitat to take advantage of the long summer days and abundance of insects found around the numerous bogs and lakes. Of the perhaps 300 species of birds that summer in the taiga, only 30 stay for the winter. These are either *carion-feeding* or large raptors that can take live mammal prey, including golden eagle, rough-legged buzzard, and raven, or else seed-eating birds, including several species of grouse and crossbills.

Areas untouched by man are rarer but there are still considerable areas where human influence is slight, and many natural values are present, e. g. areas with a diverse flora, rich in herbs; lakes and marshy areas of *ornithological* value with resting places for migrating birds.

Many species in the Red Data Books (endangered lists) for Sweden and Finland still exist in viable populations in the Northwest of Russia. The main reason is that the forests, although intensively used or disturbed in many places, have not been subject to the same systematic and intensive forestry methods applied in neighbouring Finland and Sweden.

### Topical Vocabulary

**closely-spaced** — с небольшим просветом;

**farther-spaced** — с большим просветом;

**cold-tolerant** — хладостойкий, морозоустойчивый;

**shallow roots** — поверхностные корни;

**resistant to freezing** — морозоустойчивый;

**hardening** — закалка; закаливание;

**downward-drooping** — ниспускающийся, нисходящий;

**transpiration** [ˌtrænspraɪə'reɪʃn] — испарение;

**desiccation** [ˌdesɪ'keɪʃn] — высыхание; высушивание; обезвоживание;

**rowan** ['rəʊən] — рябина;

**herbaceous** [hɛ:'beɪʃəs] **plants** — травянистые растения;

**invigorate** [ɪn'vɪgəreɪt] — давать силы, укреплять; вселять энергию;

**wildfires** — лесные пожары;

**tamarack** — лиственница американская;

**Scots pine** — сосна обыкновенная;

**herbivorous** [hɛ:'bɪvərəs] **mammals** — травоядные млекопитающие;

**rodent** — грызун;

**threaten / endanger with extinction** — подвергать опасности исчезновения;  
**caribou** — карибу; канадский олень;  
**grizzly bear** — медведь гризли;  
**wolverine** ['wʊlvəri:n] — росомаха;  
**weasel** — куньи, куницы, куницеобразные (*Mustelidae*);  
**hibernation** [haɪbə'neɪʃn] — спячка;  
**carnivorous** [kɑ:'nɪvərəs] — плотоядный;  
**trophic level** — уровень питания;  
**trophy** — трофей; добыча;  
**predatory** — хищный;  
**owl** — сова; сыч; филин;  
**eagle** — орел;  
**carnivore** ['kɑ:nɪvɔ:] — плотоядное (хищное) животное;  
**weasel** — ласка, горноста́й;  
**feed (on)** — питаться (чем-л.), кормиться;  
**lynx** — рысь;  
**wolf** (*pl.* wolves) — волк;  
**prey (on)** — ловить, охотиться (на);  
**omnivore** ['ɒmnɪ,vɔ:] — всеядное животное;  
**raccoon** [rə'ku:n] — енот;  
**Siberian Thrush** — дрозд сибирский;  
**sparrow** — воробей;  
**warbler** ['wɔ:blə] — певчая птица;  
**carrion-feeding** — падальщик;  
**raptor** — хищник;  
**prey** — добыча;  
**buzzard** ['bʌzəd] — канюк;  
**raven** — ворон;  
**grouse** — куропатка;  
**crossbill** — клёст;  
**herb** — трава, растение;  
**marshy** — болотный; болотистый, топкий;  
**Red Data Books** — Красная книга;  
**viable** ['vaɪəbl] **populations** — жизнеспособные популяции;  
**subject (to)** — подвергать(ся) склонный, предрасположенный (к чему-л.).

## EXERCISES

*Exercise 5. Find in the texts words opposite in the meaning (antonyms).*

disturbed  
 herbivorous  
 small-leaved  
 viable / common  
 northernmost  
 coniferous  
 mild (climate)

non-resistant  
 deep  
 fertile  
 nutrient-rich  
 efficient  
 black-throated  
 evergreen

**Exercise 6.** Match the word or word-combination (numbers 1—10) with the definition (letters A—J).

1. evergreen species	A. the animals of a specified region or time
2. hardening	B. flesh-eating
3. flora	C. a woody plant of cone-bearing trees or shrubs, usually evergreen
4. fauna	D. feeding on decaying flesh of a dead body
5. herbaceous plant	E. feeding chiefly on grass or other plants
6. coniferous trees	F. trees having green leaves throughout the year, as most of the conifers
7. herbivorous mammal	G. the plants of a specified region or time
8. carnivorous	H. eating any sort of food, both animal and vegetable food
9. omnivorous	I. any annual seed plant as different from woody plant
10. carrion-feeding	J. exposing plants to cold to make them stronger and more resistant to freezing

**Exercise 7.** How are animals and birds inhabiting the taiga grouped? Give examples of species in each category:

- mammals,
- rodents,
- herbivorous
- carnivorous,
- predatory,
- omnivorous,
- carrion-feeding,
- seed-eating,
- hibernation,
- threatened (endangered),
- migratory (birds),
- non-migratory.

**Exercise 8.** Translate the pairs of sentences with the words in italics in different functions (noun, verb, adjective).

1. The adaptation of evergreen needles *limits* the water lost due to transpiration and their dark green color increases their absorption of sunlight. // Taiga grows south to the 10 °C July isotherm; and its southern *limit* is more variable, depending on rainfall. 2. Taiga has a harsh continental climate with a very large temperature range between *summer* and winter. // Of the perhaps 300 species of birds that *summer* in the taiga, only 30 stay for the winter. 3. In Sweden mean temperatures *range* from 14—17 °C in July to between +1 and –14 °C in January-February. // Taiga, the world's largest biome, has a harsh continental climate with a very large temperature *range* between summer and winter. 4. Larger carnivores, such as lynxes and wolves, *prey* on the larger animals. // These birds are either carrion-feeding or large raptors that can take live mammal *prey*. 5. Winters last at least 5—6 months, with *average* temperatures below freezing. // Temperatures vary from –50 °C to 30 °C throughout the whole year, with eight or more months of temperatures *averaging* below 10 °C. 6. *Covering* most of inland Alaska, Canada, Sweden, Finland, Norway and Russia, the taiga is the world's largest terrestrial biome. // One of the major types of taiga, closed forest, consists of many closely-spaced trees with mossy ground *cover*. 7. Maples *flower* in late winter or early spring, in most species with or just after the leaves appear. // Maple *flowers* are green, yellow, orange or red; though individually small, the effect of an entire tree in flower can be striking.

**Exercise 9.** *Translate the sentences with the Participial constructions. Find absolute Participial constructions among them and specify the difference.*

1. The boreal forests in the Northern Hemisphere form a continuous belt extending from Europe to Siberia. 2. The new Forest Law has many specific propositions and requirements, most of them concerning the maintenance of the biological diversity in forests. 3. The forests of the taiga are largely coniferous, dominated by larch, spruce, fir, and pine. 4. Taiga trees tend to have shallow roots to take advantage of the thin soils, while many of them seasonally alter their biochemistry to make them more resistant to freezing, called "hardening". 5. Other species differ regionally, typically with each genus having several distinct species, each occupying different regions of the taiga. 6. The adaptation of evergreen needles limits the water lost due to transpiration and their dark green color increases their absorption of sunlight. 7. Temperatures vary from –50 °C to 30 °C throughout the whole year, with eight or more months of temperatures averaging below 10 °C. 8. Areas untouched by man are rarer but there are still con-

siderable areas where human influence is slight, and many natural values are present. 9. The main reason is that the forests, although intensively used or disturbed in many places, have not been subject to the same systematic and intensive forestry methods applied in neighbouring Finland and Sweden. 10. Covering most of inland Alaska, Canada, Sweden, Finland, inland Norway and Russia and the northern continental United States, northern Kazakhstan and Japan (Hokkaidō), the taiga is the world's largest terrestrial biome. 11. A number of wildlife species threatened or endangered with extinction can be found in the Canadian Boreal forest. 12. Much of the area currently classified as taiga was glaciated.

*Exercise 10. Translate the complex sentences having different conjunctions. Define the type of the subordinate clause.*

1. *Because* the sun is low in the horizon for most of the year, it is difficult for plants to generate energy from photosynthesis. 2. *Since* North America, Europe and Asia were connected by the Bering land bridge, a number of animal and plant species were able to colonize both continents. 3. *Despite* the relative richness of the natural forests in European Russia, the taiga as a whole is relatively disturbed by various human activities, including forestry. 4. Evergreen species in the taiga (spruce, fir, and pine) have a number of adaptations specifically for survival in harsh taiga winters, *though* larch, the most cold-tolerant of all trees, is deciduous. 5. Taiga trees tend to have shallow roots to take advantage of the thin soils, *while* many of them seasonally alter their biochemistry to make them more resistant to freezing, called "hardening". 6. *Although* the taiga is dominated by coniferous forests, some broadleaf trees also occur, notably birch, aspen, willow, and rowan. 7. Grasses grow *wherever* they can find a patch of sun, and mosses and lichens thrive on the damp ground and on the sides of tree trunks. 8. Areas untouched by man are rarer but there are still considerable areas *where* human influence is slight, and many natural values are present.

*Exercise 11. Divide the complicated constructions (complex, compound sentences) into two or more simple sentences.*

1. In Canada, boreal forest is the term used to refer to the southern part of this biome, while "taiga" is used to describe the more barren northern areas of the Arctic tree line. 2 The taiga experiences relatively low precipitation throughout the year (200—750 mm annually), primarily as rain during the summer months, but also as fog and snow. 3. Although precipitation is not a limiting factor, the ground freezes during the winter months

and plant roots are unable to absorb water, so desiccation can be a severe problem in late winter for evergreens. 4. For some species, wildfires are a necessary part of the life cycle in the taiga; some, e. g. Jack Pine have cones which only open to release their seed after a fire, dispersing their seeds onto the newly cleared ground. 5. Since the soil is acidic due to the falling pine needles, the forest floor has only lichens and some mosses growing on it. 6. A considerable number of birds migrate to this habitat to take advantage of the long summer days and abundance of insects found around the numerous bogs and lakes.

*Exercise 12. Translate the text into English, sentence by sentence. Then speak about the functions and values of the forest and comment on the suggested approach.*

Леса занимают на земном шаре более 4 млрд га, что составляет около 1/3 всей поверхности суши. Площадь, покрытая лесом, приблизительно равна 3 млрд га. Около половины лесов мира произрастают в тропическом поясе, другую половину составляют леса умеренного пояса северного полушария.

Хвойные леса холодной зоны встречаются только в северном полушарии, образуя широкий лесной пояс, тайгу, окружающую земной шар. Кстати, сибирское слово 'тайга' широко вошло в международную терминологию и было бы более удобным и правильным называть этот пояс хвойных лесов земного шара таежной зоной или таежными лесами. Этот гигантский пояс проходит по территории России, Финляндии, Швеции, Норвегии, Канады, США (Аляска), Японии. Отличительная особенность породного состава лесов тайги — небольшое количество древесных пород.

Главные породы, имеющие наибольшее экономическое значение, представлены елью обыкновенной и сосной обыкновенной в Европе и на северо-западе России (включая не только его европейскую часть, но и Урал и обширные районы Сибири, где преобладает сибирская ель), и лиственницей в северо-восточных районах России. Для Сибири характерны также кедр сибирский, пихта сибирская, для Дальнего Востока — кедр корейский, имеющие для нашей страны также важное экономическое значение. Из хвойных пород севера Америки выделяются как главные породы ель белая, черная ель и бальзамическая пихта. Древесина хвойных таежных пород отличается сравнительной однородностью строения и длинным волокном, т. е. высоким качеством.

***Questions and tasks for discussion.***

1. What territories do taiga forests occupy?
2. Is there a wide range of forest plants on these territories?
3. Where are the undisturbed taiga forests to be found in Europe? What is special about those forests?
4. Why are the tree roots shallow? Characterise the taiga soils.
5. What kind of climate is there in the taiga zone? What are the summer and winter like? What are the temperature characteristics like?
6. Is precipitation a limiting factor? What kind of precipitation is there?
7. Can the trees obtain energy and nutrients from photosynthesis all year round?
8. What deciduous trees can you find in taiga? Where do they grow?
9. What other plants are characteristic of these forests?
10. How is the problem of energy shortage solved by taiga animal species?
11. Are there more herbivorous, carnivorous or omnivorous animals, do you think? Why?
12. How about the ornithological variety of taiga?

***Project “Forest Biome (Taiga)”***

Divide into teams of 4 or 5 students. Choose any aspect of the problem of the forest biome (taiga, tropical forest, broadleaf forest, etc.). Jointly arrange a presentation of the materials collected in form of Power-Point demonstration. Try to illustrate your points of presentation with slides and pictures.

***Comment on the following information:***

Over 11,000 species of vascular plants (of which 461 are classified as endangered by the Red Data Book, but some 2000—3000 are estimated as being under threat), 320 mammals (64 endangered), about 730 birds (109 endangered), 75 reptiles (11 endangered), about 30 amphibians (4 endangered) and 270 fresh-water fish (9 endangered) species may be found in Russia. This constitutes about 8 % of global vascular plant flora, 7 % of the mammal fauna and almost 8 % of the bird fauna.

## UNIT 4. WHAT IS FORESTRY AND WHAT DOES IT DO?

*Forestry is the art, science, and practice of studying and managing forests and plantations and related natural resources. A practitioner of forestry is known as a forester. Silviculture, a related science, involves the growing and tending of trees and forests.*

*What do you know about sustainable forest management? The texts to come explain some details of the concept of sustainability in forest management and describe some of the practices of forestry.*

*Before reading Text 1 study the topical vocabulary.*

### Topical Vocabulary

**sustainable forest management** — устойчивое лесоправление;

**dominant species** — преобладающая порода;

**complementary** — дополнительный, дополняющий; комплиментарный;

**barren** ['bærən] **soil** — бесплодная, тощая земля;

**thrive** — процветать; пышно расти, разрастаться;

**endangered species** — исчезающий вид; вид, находящийся под угрозой исчезновения;

**rot** — гниль; гнить;

**fertility** [fɛ:'tɪlɪtɪ] — плодородие;

**nutrient poor** — бедный (питательными веществами);

**natural regeneration** — естественное восстановление; естественное лесовозобновление, самосев;

**seedling** — сеянец; саженец, рассада; зернышко;

**undergrowth** — подлесок; подрост;

**sprout** — давать почки, пускать ростки, давать побеги, расти;

**site preparation** — расчистка территории;

**plough** [plau] — вспахивать, пахать;

**scarifying machine** (scarifier ['skærɪfaɪə]) — культиватор-рыхлитель;

**scalping** — обнажение (почвы), удаление растительного слоя;

**treat** — подвергать (технологической) обработке, обрабатывать; очищать

**digger** — землеройное орудие; культурный плужный корпус;

**thinning** — прореживание (леса); рубка ухода;

**cleaning** — очистка, осветление; рубки осветления;

**tending young stands** — уход за молодым древостоем;

**final treatment** — последняя обработка; окончательные рубки ухода;

**pest** — вредитель, паразит;

**disease** [dɪ'zi:z] — болезнь, заболевание;

**final tending operation** — последняя рубка ухода;

**clearing saw** — пила для рубок ухода;

**stand** — лесонасаждение; древостой;

**stunt growth** — останавливать рост;

**growing conditions** — условия произрастания;

**rotation** — ротация, чередование;

**standing trees** — деревья на корню;

**subsequent** ['sʌbsi:kwənt] **thinnings** — последующее прореживание (леса);

**ecological thinning** — экологические рубки ухода;

**pruning** — обрезание ветвей, удаление сучьев;

**clear wood** — бездефектная древесина;

**branch stub** — обрубленный конец ветки;

**knot-free lumber** — пиломатериалы без сучков.

## **TEXT 1. FOREST MANAGEMENT**

The scientific study of forest species and their interaction with the environment is referred to as forest ecology, while the management of forests is often referred to as forestry. Forestry is the art of growing rotational crops of timber trees in forests and woods. It may be defined in principle as the management of forests to insure maximum benefit to mankind.

While the continuous production of timber products is generally the main objective, secondary benefits such as recreation, wildlife protection, and watershed maintenance are almost always involved. Forest management has changed considerably over the last few centuries, with rapid changes from the 1980s onwards culminating in a practice now referred to as sustainable forest management. Foresters who practice sustainable forest management focus on the integration of ecological, social and economic values.

The concept of forest management has acquired a broader content than it used to have and now relates more to caring for the forest environment as an integrated totality. The actions and methods employed in wood production are nowadays designed to ensure that the requirements of the natural environment are taken into consideration during all stages of the forest's growth.

Likewise in forest regeneration, the alternatives now chosen have the farthest-reaching effects on both wood production and environmental protection.

**Forest regeneration.** Regeneration is an inseparable aspect of sustainable use of forests. Generally conifer stands are regenerated at an age of 60—120 years (depending on growth site) in the central parts and at 80—160 years in the north of Russia. The corresponding recommendation for birch stands is 60—80 years, but they can be regenerated earlier if the tree trunks are stout enough.

In most cases, regeneration is intended to create a mixed forest, in which the dominant species is pine or spruce, with birch in a complemen-

tary role. Forests on the most barren soils, where hardwood species do not thrive, are an exception. The main tree species and regeneration method used are chosen primarily on the basis of soil type and fertility. Especially on nutrient-poor soils, the first option to be considered is natural regeneration. It is the least expensive and easiest alternative — when it succeeds. In the event of enough seedlings failing to spring up spontaneously, expensive and labour-intensive efforts to redress the matter — such as supplementary planting and removing grass and other undergrowth — must be resorted to.

Site preparation is of decisive importance in forest regeneration. Exposing mineral soil gives planted seedlings a better chance of thriving and promotes the natural sprouting of, especially, birch as a supplementary species. Gentler soil-preparation methods have been adopted in recent years and deep ploughing has been almost completely abandoned. Today, about two-thirds of the area treated is gone over by scarifying or scalping machines and the remainder mounded using tractor-diggers or excavators. Interest in controlled burning is reviving, but the areas on which this method is practised are still small.

***Management of young stands.*** The species balance in young tree stands is regulated by means of cleaning and thinning. This involves removing shrubs and other undergrowth likely to interfere with the growth of the main species.

The guidelines for tending young stands have been revised in recent years. The main changes are that now the aim is to have more hardwoods and to delay final treatment of the young stand. Having hardwoods mixed with the main softwood species improves soil properties, reduces pest and disease damage and increases biodiversity. Hardwoods also improve the quality of softwoods, especially pine, by retarding the growth of branches. Stands of young trees usually need tending once or twice during their first fifteen years of life. In the final tending operation, the stands are thinned to a density of, depending on species, 1,600—2,000 trees per hectare and then left to grow on until it is time for the first thinning.

Undergrowth is removed with a clearing saw; herbicides are nowadays rarely used. There is growing interest in using biomass obtained when older seedling stands and young forests are thinned as fuel.

***Thinning.*** The purpose of thinning is to control the amount and distribution of available growing space, to replicate the forest's natural development and ensure an even age structure. Removing trees whose growth has been stunted or which are diseased or otherwise of poor quality gives the others more room in which to grow. Depending on growing conditions and

species, a stand is usually thinned 1—3 times during a rotation. The frequency of thinning has been reduced to improve the economy of these operations and lessen the damage done to standing trees.

The first thinning is done 30—35 years after regeneration, when the trees are 12—14 metres tall, and reduces the number per hectare to around 1,000. First thinnings ought to be carried out considerably more often than at present. Neglecting them decisively reduces the profitability of wood production. Second and subsequent thinnings cut the density to 450—550 per hectare and these trees are allowed to grow on until the area in question is due for regeneration.

Ecological thinning is where the primary aim of forest thinning is to increase growth of selected trees, favoring development of wildlife habitat (such as hollows) rather than focusing on increased timber yields.

**Pruning.** Pruning, as a silvicultural practice, refers to the removal of the lower branches of the young trees so clear knot free wood can subsequently grow over the branch stubs. Clear knot-free lumber has a higher value. Pruning in landscaping and gardening is the practice of removing diseased, non-productive, or otherwise unwanted portions from a plant.

## EXERCISES

*Exercise 1. Study the prefixes and suffixes, making up verbs; make sure you know their meaning and use. Transform the following words into verbs using suitable verbal components, where necessary. Translate the derivatives. To make sure consult the dictionary.*

integrity; dominant; danger; operation; alternative; scarification; excavator; practice; rotation; less; regeneration; productive.

*Exercise 2. In Unit 4 we often come across words with prefix re-. Make sure you know all these words and can understand them in context.*

*A) Translate the following words*

*Verbs:* to renew; to redress; to reestablish; to restore; to recreate; to remove; to replace; to restrict; to recycle; to revive; to replant.

*Nouns:* reforestation; renewal; restocking; removal; recovery.

*B) Find the sentence containing the derivatives with prefix re- in text 1 and translate them into Russian.*

*C) Make up your own situations with the words from the suggested list.*

**Exercise 3.** Insert into the sentences the right word from the list in the box.

*a clearing saw; deep ploughing; density; dominant; fertility; final treatment; first thinnings; growing conditions; integration; pruning; tree trunks; wildlife habitat.*

1. Foresters who practice sustainable forest management focus on the ... of ecological, social and economic values.
2. The recommendation for birch stand regeneration is 60—80 years, but it can be regenerated earlier if the ... are stout enough.
3. In most cases, regeneration is intended to create a mixed forest, in which the ... species is pine or spruce, with birch in a complementary role.
4. The main tree species and regeneration method used are chosen primarily on the basis of soil type and ... .
5. Gentler soil-preparation methods have been adopted in recent years and ... has been almost completely abandoned.
6. The main changes in tending stands are that now the aim is to have more hardwoods and to delay ... of the young stand.
7. Undergrowth is removed with a ... ; herbicides are nowadays rarely used.
8. Depending on ... and species, a stand is usually thinned 1—3 times during a rotation.
9. ... ought to be carried out considerably more often than at present.
10. Second and subsequent thinnings cut the ... to 450—550 trees per hectare and these trees are allowed to grow on until harvesting.
11. Ecological thinning is to increase growth of selected trees, favoring development of ... (such as hollows) rather than focusing on increased timber yields.
12. ... is the removal of the lower branches of the young trees so clear knot free wood can subsequently grow over the branch stubs.

**Exercise 4.** Many verbs take prepositional objects. It is recommended to memorise such verbs as word groups. Translate the sentences with some of such verbs and nouns related to verbs.

1. The scientific study of forest species and their interaction with the environment *is referred to* as forest ecology, while the management of forests *is often referred to* as forestry.
2. Foresters who practice sustainable forest management *focus on* the integration of ecological, social and economic values.
3. The concept of forest management has acquired a broader content than it used to have and now *relates more to caring for* the forest

environment as an integrated totality. 4. In the event of enough seedlings failing to spring up spontaneously, expensive and labour-intensive efforts to redress the matter — such as supplementary planting and removing grass and other undergrowth — must *be resorted to*. 5. This involves removing shrubs and other undergrowth likely *to interfere with* the growth of the main species. 6. *Depending on* growing conditions and species, a stand is usually thinned 1—3 times during a rotation. 7. Forest management has changed considerably over the last few centuries, with rapid changes from the 1980s onward, *culminating in* a practice now *referred to* as sustainable forest management. 8. The alternatives now chosen have the farthest-reaching *effects on* both wood production and environmental protection. 9. Regeneration is an inseparable aspect of sustainable *use of* forests. 10. There is growing *interest in* using biomass obtained when older seedling stands and young forests are thinned as fuel.

## **TEXT 2. FOREST REGENERATION PRACTICES**

**Read text 2** and 1) give definitions to the words in italics and 2) find the answers to the following questions:

- *What are the major functions of the forest?*
- *What forest regeneration practices are foresters involved in?*
- *What is the difference between reforestation and afforestation?*
- *What are the advantages and disadvantages of natural forest regeneration (of managed regeneration)?*
- *What is the main purpose of plantations?*

Forest ecosystems have come to be seen as one of the most important components of the biosphere, and forestry has emerged as a vital field of science, applied art, and technology.

*Sustainable forest management* means following ecologically sound practices that maintain the forest ecosystems' integrity, productivity, resilience and biodiversity. That involves sustaining a wide range of ecological processes through which plants, animals, microorganisms, soil, water and air interact.

As a result of these processes, forests provide many functions essential to life on this planet. They maintain the chemical balance of soil, air and water, stabilize the climate, recycle nutrients, break down pollutants, clean the air and water, and are vital to watershed protection, soil formation, carbon storage and the habitat for wildlife. The products of forest growth may be harvested on a sustainable basis, and even enhanced through silvicultural practices, as long as the forests' inherent biological limits are respected.

*Forest regeneration* is the act of renewing tree cover by establishing young trees naturally or artificially, generally promptly after the previous stand or forest has been removed. The method, species, and density are chosen to meet the goal of the landowner. Forest regeneration includes practices such as changes in tree plant density through human-assisted natural regeneration, enrichment planting, changes in tree genetics or tree species. *Human-assisted natural regeneration* means establishment of a forest age class from natural seeding or sprouting after harvesting through selection cutting, shelter (or seed-tree) harvest, soil preparation, or restricting the size of a clear-cut stand to secure natural regeneration from surrounding trees. *Enrichment planting* means increasing the planting density (i. e., the numbers of plants per hectare) in an already growing forest stand.

Silvicultural regeneration methods combine both the harvest of the timber on the stand and re-establishment of the forest. The proper practice of sustainable forestry should mitigate the potential negative impacts, but all harvest methods will have some impacts on the land and residual stand. The practice of sustainable forestry limits the impacts such that the values of the forest are maintained in perpetuity.

*Reforestation* is the restocking of existing forests and woodlands which have been depleted, with native tree stock. The term reforestation can also refer to *afforestation*, the process of restoring and recreating areas of woodlands or forest that once existed but were deforested or otherwise removed or destroyed at some point in the past. The resulting forest can provide both ecosystem and resource benefits and has the potential to become a major carbon sink.

*Natural reforestation* can occur naturally if the area is left largely undisturbed. Native forests are often resilient and may re-establish themselves quickly. Conceptually, it involves taking no active role in reforesting a de-forested area, but rather just letting nature take its course.

*Managed reforestation.* One debatable issue in managed reforestation is whether or not the succeeding forest will have the same biodiversity as the original forest. If the forest is replaced with only one species of tree and all other vegetation is prevented from growing back, a *monoculture forest* similar to agricultural crops would be the result. However, most reforestation involves the planting of different seedlots of seedlings taken from the area. More frequently multiple species are planted as well. Another important factor is the natural regeneration of a wide variety of plant and animal species that can occur on a clearcut. In some areas the suppression of forest fires for hundreds of years has resulted in large single aged and single specied forest stands. The logging of small clearcuts and or prescribed burning, actually increases the biodiversity in these areas by creat-

ing a greater variety of treestand ages and species.

Reforestation need not be only used for recovery of accidentally destroyed forests. In some countries, such as Finland, the forests are managed by the wood products and pulp and paper industry. In such an arrangement, like other crops, trees are replanted wherever they are cut. In such circumstances, the cutting of trees can be carefully done to allow easier reforestation. In Canada, the wood product and pulp and paper industry systematically replaces many of the trees it cuts, employing large numbers of summer workers for treeplanting work.

Plantation. Reforestation is controversial when plantations are established in place of natural forest. In tropical American nations such as Costa Rica and Panama, many thousands of acres of ex-cattle pasture are being planted with economically valuable tropical timber species, often with the help of generous local government incentives. Unlike in the US and Canada, where plantations are established for wood pulp and paper, in Costa Rica and Panama and other nations in Central America, plantations are being established to grow timber.

For example, in just 20 years, a teak plantation in Costa Rica can produce up to about 400 m<sup>3</sup> of wood per hectare. As the natural teak forests of Asia become more scarce or difficult to obtain, the prices commanded by plantation-grown teak grow higher every year. Other species such as mahogany grow slower than teak in Tropical America but are also extremely valuable. Faster growers include pine and eucalyptus.

### Topical Vocabulary

**sustainable** [sə'steɪnəbl] **forest management** — устойчивое лесоуправление;

**watershed protection** — охрана водораздела;

**soil formation** — образование, формирование почвы;

**carbon storage** — хранение; накопление углерода;

**habitat for wildlife** — место обитания живой природы;

**forest growth** — рост, прирост леса;

**to harvest** — заготавливать древесину;

**silvicultural** ['sɪlvi,kʌltʃərəl] **practices** — лесоводческая практика, деятельность;

**previous** ['pri:vɪəs] **stand** — предыдущий; предшествующий древостой;

**to remove** [ri'mu:v] — удалять, устранять;

**density** — плотность, концентрация, густота;

**to meet the goal** — удовлетворять, отвечать, соответствовать цели;

**landowner** ['lændəʊnə] — землевладелец;

**human-assisted** — с участием человека;

**natural regeneration** — естественное лесовозобновление, самосев;

**enrichment** — расширение; увеличение; обогащение;

**sprouting** — всход; росток; побег; давать ростки, распускаться (о листьях);

**selection cutting** — выборочные рубки;  
**seed-tree** — семенное дерево, семенник;  
**soil preparation** — подготовка земли;  
**clear-cut** — сплошная рубка;  
**to secure natural regeneration** — обеспечивать естественное возобновление;  
**silvicultural** ['silvi,kʌltʃərəl] — лесоводческий;  
**re-establishment of forest** — восстановление прежнего леса;  
**proper practice** — правильная, подходящая практика;  
**sustainable forestry** — устойчивое лесное хозяйство;  
**residual stand** [ri'zɪdjuəl] — остаточный древостой;  
**restocking (of forest)** [,ri:'stɔ:kɪŋ] — возобновление запасов;  
 лесовозобновление, лесовосстановление;  
**native tree stock** — фонд местных деревьев;  
**reforestation** [,ri:fɔ:rɪ'steɪʃən] — лесовосстановление; насаждение лесов,  
 восстановление лесных массивов;  
**afforestation** [æ,fɔ:rɪ'steɪʃən] — облесение; посадка леса, лесоразведение;  
**restoring** — восстановление;  
**deforest** [dɪ'fɔ:rɪst] — вырубить леса; обезлесить;  
**resulting forest** — полученный лес;  
**benefit** — выгода; польза; преимущество; прибыль;  
**carbon sink** — приёмник углерода; колодец, поглощающий углерод;  
**disturbed** [dɪ'stɜ:bd] — нарушенный, возмущённый;  
**native** — местный, родной, исконно присущий;  
**re-establish** — восстанавливаться; восстанавливать;  
**managed reforestation** — управляемое лесовозобновление;  
**succeeding forest** — последующий лес;  
**original forest** — начальный, первоначальный, исходный лес;  
**monoculture** ['mɒnəu,kʌltʃə] forest — монокультурный лес;  
**seedlot** — посевной участок (земли);  
**clear-cut** — сплошная рубка; лес, вырубаемый сплошной рубкой;  
**single aged stand** — древостой из деревьев одного возраста;  
**single specied stand** — древостой из деревьев одной породы;  
**prescribed burning** — заданное; предписанное выжигание, сжигание;  
**to replant** [,ri:'plɑ:nt] — пересаживать (растение); снова засаживать (растениями);  
**to establish plantations** [plæn'teɪʃn] — основывать, создавать лесопосадки;  
**teak** — тик, тиковое дерево;  
**mahogany** [mə'hɒɡəni] — красное дерево;  
**eucalyptus** [ˌju:kə'liptəs] — эвкалипт.

## EXERCISES

*Exercise 5. Match the word (numbers 1—14) with its definition (letters A—N).*

1. forest ecology	A. removing shrubs and other undergrowth to promote the growth of the main species
2. sustainable forest management	B. process of restoring and recreating areas of woodlands which once existed but were deforested or otherwise removed or destroyed
3. forest regeneration	C. forest thinning to increase growth of selected trees favouring the development of wildlife habitat
4. cleaning	D. ecologically sound practices that maintain the forest ecosystems' integrity, productivity, resilience and biodiversity
5. thinning	E. art and science of controlling the establishment, growth, composition, health, and quality of forests
6. monoculture forest	F. removing slowly growing, diseased and poor quality trees, controlling the amount and distribution of available growing space
7. pruning	G. scientific study of forest species and their interaction with the environment
8. enrichment planting	H. a forest with only one species of tree and all other tree vegetation prevented from growing
9. forestry	I. restocking of existing depleted forests with native tree stock.
10. site preparation	J. re-establishing a forest, renewing tree cover by establishing young trees naturally or artificially
11. ecological thinning	K. exposing mineral soil to promote natural sprouting and give planted seedlings a better chance of thriving
12. reforestation	L. removal of the lower branches of the young trees for growing clear knot-free wood
13. afforestation	M. art, science, and practice of studying and managing forests and plantations and related natural resources
14. silviculture	N. increasing the planting density in an already growing forest stand

**Exercise 6.** Translate the sentences with attributive word combinations.

1. The *forest management operations* are becoming ecologically more and more sound. 2. The current *forest biodiversity* is the result of *long-term evolution* and environmental changes. 3. The resulting restored forest can provide both *ecosystem and resource benefits* and has the potential to become a major *carbon sink*. 4. The main *tree species* and *regeneration method* used are chosen primarily on the basis of *soil type* and fertility. 5. Having hardwoods mixed with the main softwood species improves *soil properties*, reduces *pest and disease damage* and increases biodiversity. 6. *Forest regeneration* includes practices such as changes in *tree plant density* through human-assisted natural regeneration, *enrichment planting*, changes in *tree genetics* or *tree species*. 7. In Canada, the *wood product*

and *pulp and paper industry* systematically replaces many of the trees it cuts, employing large numbers of *summer workers* for treeplanting work. 8. Thinning, a silvicultural technique used in *forest management*, is a *stand manipulation operation* designed to modify *tree growth*. 9. In the *seed-tree regeneration method*, 2—12 seed trees per acre (5—30/ha) are left standing in order to regenerate an even-aged forest. 10. *Forest certification* assures the consumer that the *paper product* is made from *wood fibre* originating from a well-managed forest.

**Exercise 7.** *The word one has many functions and uses. Translate the sentences and comment on the use.*

1. Forest ecosystems are *one* of the most important components of the biosphere, and forestry has emerged as a vital field of science, applied art, and technology. 2. *One* debatable issue in managed reforestation is whether or not the succeeding forest will have the same biodiversity as the original *one*. 3. *One* third of the world's forests are used primarily for production of wood and other forest products. 4. *One* tree can make a million matches — *one* match can burn a million trees. 5. With their small size, bonsai plants would not technically be 'trees', but *one* should not confuse reference to the form of a species with the size or shape of individual specimens. 6. Clearcutting is *one* of many silvicultural treatments that alter the environment for regeneration to optimize harvest. 7. Concepts of "old growth" vary widely and are not always easily applied or reconcilable with *one* another. 8. Occasionally *one* uses leafy, fragrant twigs of silver birch to gently beat *oneself* in a sauna. 9. There may be decided differences in the grain of heartwood and sapwood cut from a large tree, particularly *one* that is mature. 10. There are no vessels ("pores") in coniferous wood such as *one* sees so prominently in oak and ash, for example. 11. If a heavy piece of pine is compared with a light specimen it will be seen at once that the heavier *one* contains a larger proportion of late wood than the other, and is therefore considerably darker. 12. Russia occupies *one* eighth of the global land area and most of non-tropical Eurasia. 13. The conversion of virgin forest to managed forest did not just affect the standing volume; changes were even greater when *one* considers the structure of the forest.

**Exercise 8.** *Translate the sentences with the Gerund. Define the syntactical functions (subject, object, attribute, adverbial modifier, part of the predicate).*

1. *Preserving* biological diversity is naturally one element of sustainable forest management. 2. Forests tend to decrease the amount of moisture in the soil by *intercepting* precipitation, by *retaining* water in the for-

est floor, and by transpiration. 3. *Removing* trees whose growth has been stunted or which are diseased or otherwise of poor quality gives the others more room in which to grow. 4. *Exposing* mineral soil gives planted seedlings a better chance of *thriving* and promotes the natural *sprouting* of, especially, birch as a supplementary species. 5. Gentler soil-preparation methods have been adopted in recent years and deep *ploughing* has been almost completely abandoned. 6. Interest in controlled *burning* is reviving, but the areas on which this method is practised are still small. 7. The guidelines for *tending* young stands have been revised in recent years. 8. Hardwoods also improve the quality of softwoods, especially pine, by *retarding* the growth of branches. 9. Stands of young trees usually need *tending* once or twice during their first fifteen years of life. 10. There is growing interest in *using* biomass obtained when older seedling stands and young forests are thinned as fuel.

**Exercise 9.** *Translate the sentences with the Passive Voice. Try to vary the translation models.*

A) 1. Reforestation is the restocking of existing forests and woodlands, which have been depleted, with native tree stock. 2. Afforestation is the process of restoring and recreating areas of woodlands or forest that once existed but were deforested or otherwise removed or destroyed in the past. 3. Generally conifer stands are regenerated at an age of 60—120 years (depending on growth site). 4. The main tree species and regeneration method used are chosen primarily on the basis of soil type and fertility. 5. Gentler soil-preparation methods have been adopted in recent years and deep ploughing has been almost completely abandoned. 6. The guidelines for tending young stands have been revised in recent years. 7. The frequency of thinning has been reduced to improve the economy of these operations and lessen the damage done to standing trees. 8. In tropical American nations such as Costa Rica and Panama, many thousands of acres of ex-cattle pasture are being planted with economically valuable tropical timber species. 9. Unlike in the US and Canada, where plantations are established for wood pulp and paper, in Costa Rica and Panama and other nations in Central America, plantations are being established to grow timber.

B) 1. Forestry may be defined in principle as the management of forests to insure maximum benefit to mankind. 2. In the event of enough seedlings failing to spring up spontaneously, expensive and labour-intensive efforts to redress the matter must be resorted to. 3. First thinnings ought to be carried out considerably more often than at present. 4. The

products of forest growth may be harvested on a sustainable basis, and even enhanced through silvicultural practices, as long as the forests' inherent biological limits are respected. 5. Reforestation need not be only used for recovery of accidentally destroyed forests. 6. In such circumstances, the cutting of trees can be carefully done to allow easier reforestation. 7. Birch stands can be regenerated earlier if the tree trunks are stout enough. 8. Before the first thinning is done, the lower branches must be pruned from some or all of the trees, to improve access, lessen fire risk, and aid the formation of better timber with fewer knots. 9. Both hunting and fishing need to be taken into consideration since they are naturally connected to forestry's key environmental considerations.

*Exercise 10. Translate the text about forestry and forestry practices into English, sentence by sentence, and then give your opinion of the suggested theory.*

Лесоводством принято называть теорию и практику лесного хозяйства или деятельности, направленной на наиболее выгодное и постоянное использование леса в интересах людей.

Основной принцип лесоводства — это постоянство пользования лесом, которое обеспечивается заботой о лесовозобновлении в процессе рубки и сохранении устойчивости лесов. Под устойчивостью понимается не только противодействие (counteraction) болезням и повреждениям, но и также сохранение почвенного плодородия, биоразнообразия и производительности древостоев.

В последние годы лесоведам всех стран приходится уделять все больше внимания экологической роли леса, что объясняется многими причинами: чрезмерными рубками леса; неправильным упрощенным хозяйством, не обеспечивающим лесовосстановление; ослаблением борьбы с пожарами и болезнями леса; загрязнением атмосферы.

С устойчивостью связано биоразнообразие — видовое, генетическое, экосистемное. Поскольку лесоведение и лесоводство неразрывно связаны между собой, целесообразно дать определения некоторых терминов и понятий лесоводства, таких, например, как рубки главного пользования, проводимые в спелых лесах, рубки ухода за лесом, меры содействия возобновлению леса.

С рубками главного пользования связаны принципиально разные системы хозяйства: сплошнолесосечная, семенно-лесосечная и выборочная. Первая основана на применении сплошных рубок, вторая — постепенных с удалением старого древостоя за несколько приемов и третья, выборочная, которая применяется в разновозрастном лесу и обеспечивает постоянное сохранение леса. Постепенная рубка также

связана с естественным возобновлением. Сплошнолесосечная система включает естественный и искусственный способы лесовозобновления.

Рубки ухода делят на виды по возрасту древостоев: в молодняках до 10 лет их называют осветлениями, от 11 до 20 лет — прочистками, 21 — 40 лет — прореживаниями и на последнем этапе — проходными рубками, которые принято заканчивать за 20 лет до главной рубки. В больных древостоях осуществляют санитарные рубки. В лесопарковых частях зеленых зон проводят ландшафтные рубки.

Способы возобновления делят на естественные (сохранение подраста, оставление семенников, подготовка почвы) и искусственные (посев и посадка).

### *Questions and tasks for discussion*

1. What is forestry? Find the definitions of forestry in the texts under study and, if possible, in reference books and manuals. Give your own definition of forestry.
2. What implications does sustainable forest management have?
3. What is forest regeneration? What types of forest regeneration do we distinguish between?
4. How is natural forest regeneration done? What are the benefits of natural regeneration? What should a forester do if natural regeneration does not succeed?
5. What does site preparation include? Why is it necessary? How is it done?
6. Why is a mixed tree composition recommended in regeneration?
7. What is the purpose of thinning? How many times is it done? What are the resulting densities?
8. Why is plantation not recognized as a regeneration method? What is the aim of plantations in Central America?

### *Comment on the definitions and descriptions dealing with forestry operations*

*Thinning*, a silvicultural technique used in forest management, is a stand manipulation operation designed to modify tree growth. Where trees are managed under a commercial regime, competition is reduced by removing adjacent stems that exhibit less favourable timber quality potential. When left in a natural state trees will 'self-thin' but this process of natural selection is unreliable.

*Ecological thinning* is where the primary aim of forest thinning is to increase growth of selected trees, favouring development of wildlife habitat (such as hollows) rather than focussing on increased timber yields. Ecological thinning can be considered a new approach to landscape restoration for some types forests and woodlands. A thinning in which the trees removed have little or no economic value is called a *pre-commercial thinning*.

## UNIT 5. CLASSIFICATION AND IDENTIFICATION OF TREES

*Plant taxonomy is the science that finds, describes, classifies, identifies, and names plants. What is the practical application of taxonomy in dendrology? Two goals of tree taxonomy are the identification and classification of tree plants.*

*Plant classification is the placing of known plants into groups or categories to show some relationship. Scientific classification follows a system of rules that standardizes the results and groups successive categories into a hierarchy.*

*The texts to follow acquaint us with the main issues of taxonomy, identification and description of trees.*

*Before reading Text 1 study the topical vocabulary. Exercises will follow the text.*

### Topical Vocabulary

**taxonomy** [tæk'sɒnəmi] — таксономия (теория классификации и систематизации сложноорганизованных иерархических сфер);

**dendrology** — дендрология (раздел ботаники, изучающий древесные растения);

**horticulture** ['hɔ:tɪkʌltʃə] — садоводство;

**silviculture** ['sɪlvɪ,kʌltʃə] — лесоводство;

**nomenclature** [nəu'menklətʃə] — номенклатура (совокупность или перечень названий);

**common name** — общепринятое (в отличие от научного) название (растения, животного);

**commemorate** [kə'meməreɪt] — увековечить;

**distinctive feature** — отличительная черта;

**initial description** — первоначальное описание

**generic name** — родовое название;

**specific name** — видовое название;

**binomial** [baɪ'nəʊmɪəl] **system** — биномиальная система (состоящая из двух названий);

**differentiate** (between, from) — различать(ся), проводить различия; отличать (от);

**herbaceous** — травянистый;

**botanical relationship** — ботаническое родство;

**fruit** — плод; фрукты; плоды, результаты;

**artificial classification** — искусственная классификация, систематизация;

**stamen** ['steɪmən] — тычинка;

**common lineage** ['lɪnɪdʒ] — общее происхождение, родословная;

**arrangement** — расположение, классификация, систематизация;

**similarity** — сходство, подобие;

**common origin** — общее происхождение;

**seed-bearing** — семяночный;

**descent** [dɪ'sent] — происхождение;

**phylogenetics** — филогенетика (наука о закономерностях исторического развития разных групп организмов);

**evidence** — доказательство, подтверждение; свидетельство; данные;  
**inherently** — по сути, по своему существу;  
**taxonomist** — специалист по таксономии, систематике.

## TEXT 1. NOMENCLATURE OF PLANTS

The taxonomy of plants deals with the kinds of plants (identification), their nomenclature, and their classification. Dendrology, from the Ancient Greek δένδρον meaning "tree" and λόγος meaning "study", is the science of trees, and more generally the study of woody plants. Woody plants may be trees, shrubs, and lianas.

There is no sharp boundary between plant taxonomy and dendrology. However, woody plants do not only belong to many different plant families, but these families may be made up of both woody and non-woody members. Some families include only a few woody species. This severely limits the usefulness of a strictly dendrological approach. Dendrology tends to focus on economically useful woody plants, their identification and horticultural or silvicultural properties.

### *Nomenclature*

*Common Names.* The chief characteristics of trees usually influence the selection of their common names, although the names of many botanists or their friends have also been commemorated in this way. A few examples may prove of interest.

1. Habitat: swamp white oak, sandbar willow, alpine fir, river birch, mountain hemlock.
2. Some distinctive feature: weeping willow, bigleaf maple, white-bark pine, bitternut hickory, cut-leaf birch, trembling aspen, tulip tree.
3. Locality or region: Pacific yew, Idaho white pine, southern red oak, Ohio buckeye, Virginia pine.
4. Use: canoe birch, sugar maple, tanbark oak, paper mulberry.
5. In commemoration: Nuttall oak, Engelmann spruce, Sargent cypress, Douglas fir.
6. Adaptation of names from other languages (i. e. Indian, Latin, Spanish): chinquapin, arborvitae, and frijolito.

Unfortunately for the beginner, the application of common names is not regulated by any constituted authority.

*Scientific Names.* Because of the great confusion on common names, it became necessary to find some universal system, which could be used not only within the boundaries of a single country, but throughout the world.

Such a system has been developed through the use of Latin names, many of which were first applied when this language was employed by scientists of all countries. This practice has been continued, and even now not only are technical names written in Latin but also the initial descriptions of new species.

Scientific names have been in common use since the middle of the eighteenth century when Linnaeus, the great Swedish botanist, developed the binomial system of nomenclature, which is now used. The scientific name of a tree or other plant consists of three parts, viz.<sup>1</sup>, a generic name, a specific name, and the full or the original published plant description. Thus in the scientific name Quercus imbricaria Michaux *Quercus* is the generic or group name, *imbricaria* is the specific or species name, and *Michaux* is the person who named and described the tree. Generic names always appear first and are invariably capitalized, while specific names begin with small letters. In all but scientific writings<sup>2</sup>, the author's names may be disregarded. But it should be indicated that the factors, which influence the original choice of common names apply as well to scientific names.

### ***Classification***

The classification of plants dates back to ancient Greek civilization when Theophrastus (372—287 B. C.), a student of Aristotle's, and by many considered to be the father of botanical science, described and classified over 400 species. He differentiated between woody and herbaceous forms but failed to indicate any botanical relationships. Probably the first extensive classification of plants was that of Caesalpino (1519—1603), an Italian physician, who arranged and classified a large number according to the nature and structure of their fruits and seeds. While he did not recognize any natural relationships, his work is generally conceded to be superior to anything else developed previously. Linnaeus' chief contributions to taxonomy were in the field of nomenclature, although he, too, developed an artificial classification of plants based on the parts of the flower, particularly the stamens. However, like the others, he also failed to recognize the possibility of a common lineage among plants or groups of plants. It is of the greatest importance to remember that all of these early writers thought of different kinds of plants as separate and distinct from each other, and their arrangement in groups was only for convenience. The idea of evolution had not yet been generally accepted.

The publication of Darwin's "Origin of Species", in 1859, produced a revolution in scientific thinking, and in the field of taxonomy the artificial systems were swept away. Although the features of plants (flowers, fruits,

leaves, etc.) had not changed, the method of approach became entirely different and similarities in anatomy acquired a new meaning, namely, that of relationship or common origin.

It was soon found that the structure of the flower was a suitable basis upon which to classify all seed-bearing plants. In fact, our present classifications are based upon flowers, and it has been demonstrated that plants exhibiting similar floral structure usually show other botanical similarities indicative of a common lineage. Furthermore, plants with flowers of simple structure are usually regarded as primitive or of great antiquity while those with structurally complex flowers are ordinarily conceded to be of much more recent origin. If this were invariably true, the taxonomist should experience little difficulty in arranging trees and other seed-bearing plants in the order of their apparent descent, listing those of greatest age first and those of most recent origin last. However, the phylogenetic positions of several plant families have never been accurately determined because of conflicting evidence. It is often extremely difficult to ascertain if a certain plant (or group of plants) is inherently simple structurally, or if it is simple through extensive evolutionary modification.

It should not be surprising, however, that no one classification is universally accepted. At present, there are two principal systems in common use. England and her possessions employ the Bentham and Hooker system, while the United States and other nations prefer that developed by the German taxonomists, Engler and Prantl. In recent years a system initiated by the late E. C. Bessey, an American botanist, has found much favor with taxonomists.

*Note:*

<sup>1</sup> viz. (*videlicet*) (*namely*) — а именно;

<sup>2</sup> *in all but scientific writings* — во всех публикациях, кроме научных.

## EXERCISES

### *Exercise 1*

*A) There are a number of words with suffix **-(t)ure** in the text: horticulture; silviculture; nomenclature; structure; feature...*

*B) What part of speech do they produce? What other words with this suffix do you know?*

C) Find sentences containing nouns with suffix **-(i)ty** (antiquity, authority, difficulty, locality, property, possibility, similarity, etc.) and translate them into Russian.

**Exercise 2.** Choose the right word to be used in the following descriptions:

1. *Silviculture / horticulture* deals with growing fruit trees. 2. *Dendrology / taxomomy* is the study of woody plants. 3. *Generic / specific* names always appear first and are invariably capitalized. 4. The *digital / binomial* system of nomenclature was developed by Linnaeus, the great Swedish botanist. 5. The selection of the *common / scientific* names is influenced by the chief characteristics of trees. 6. The universal system, which could be used throughout the world has been developed through the use of *Latin / Greek* names. 7. Linnaeus developed an artificial classification of plants based on the parts of *the bark / the flower*. 8. The publication of Darwin's "Origin of Species", in 1859, produced a *revolution / evolution* in scientific thinking. 9. The phylogenetic positions of several plant families have never been accurately determined because of *conflicting / unreliable* evidence. 10. Linnaeus described only five *habitats / species* of oak from eastern North America, based on general leaf form.

**Exercise 3.** Translate the negative sentences from text 1. Comment on the negative components.

1. There is no sharp boundary between plant taxonomy and dendrology. 2. Woody plants do not only belong to many different plant families, but these families may be made up of both woody and non-woody members. 3. Unfortunately for the beginner, the application of common names is not regulated by any constituted authority. 4. Because of the great confusion on common names, it became necessary to find some universal system, which could be used not only within the boundaries of a single country, but throughout the world. 5. This practice has been continued, and even now not only are technical names written in Latin but also the initial descriptions of new species. 6. He differentiated between woody and herbaceous forms but failed to indicate any botanical relationships. 7. While Caesalpino did not recognize any natural relationships, his work is generally conceded to be superior to anything else developed previously. 8. However, like the others, Linnaeus also failed to recognize the possibility of a common lineage among plants or groups of plants. 9. Although the features of plants (flowers, fruits, leaves, etc.) had not changed, the method of approach became entirely different and similarities in anatomy acquired

a new meaning, namely, that of relationship or common origin. 10. However, the phylogenetic positions of several plant families have never been accurately determined because of conflicting evidence. 11. It should not be surprising, however, that no one classification is universally accepted.

## **TEXT 2. IDENTIFICATION OF TREES**

Before reading Text 2 and attempting to understand the descriptions of species of this or that tree, one should become familiar with the variation in form, colour, and size exhibited by the leaves, flowers, fruits, twigs, and bark of woody plants.

a) explain:

- *which of the identification parts are the most diagnostic,*
- *which are the least reliable.*

b) *what differentiation do we make between:*

- buds,
- leaves,
- roots,
- flowers,
- fruits.

### ***Tree Stems and Bark***

Bark is one of the most important features in the identification of large trees, particularly when leaves and twigs are inaccessible, or during the winter months when the former may be lacking. The average timber cruiser relies almost wholly upon bark in tallying species.

In a few species such as beech, red alder, and balsam fir, the roughness of outer bark is seldom seen because the trees usually do not become of sufficient age or size. Deep cork formation commonly shows first at the base of a tree, so that while the surface there may be quite rough, that along the bole is still relatively smooth. Another place where early roughening may be expected is below the branch insertions in such groups of species as the poplars and birches.

The color, together with the shape and prominence of lenticels, is the most important feature of the bark on young stems. On old trunks the configuration, texture, thickness, and color are features to be observed.

### ***Twigs, Buds and Leaf Scars, Leaves***

Twigs offer an excellent means of identifying trees and shrubs throughout the year, except for a short time during the spring when the buds formed the previous season are opening and those for the current season have not yet appeared.

The most conspicuous features of twigs are their buds, leaf scars, stipule scars, and pith, although their color, taste, odor, and the presence or absence of cork, spur shoots, spines thorns, glaucous bloom, or pubescence are also valuable characters for purposes of identification.

Buds are young, undeveloped shoots. If they are leaf-buds only they finally grow out to produce either single leaves or branch stems bearing other leaves. On the other hand, if they are flower-buds, they finally produce the flower or flowers and then their growth ceases. Axillary buds produce branch shoots, or single leaves or flowers.

When a leaf falls from a twig, there remains at the point of attachment a leaf scar. Leaf scars vary in size and shape with different species and hence are usually diagnostic. On the surface of each leaf scar are found one or more minute dots or patches, which show where the now ruptured strands of vascular tissue passed from the twig into the leaf. The size, number, and arrangement of these so-called vascular bundle scars are often helpful in identification.

Leaves are diverse in size and form. Thus we have the comparatively small and simple leaf of the privet, and, in contradistinction to this, the leaf of the banana plant, which, though roughly similar in shape, is from one to three yards long.

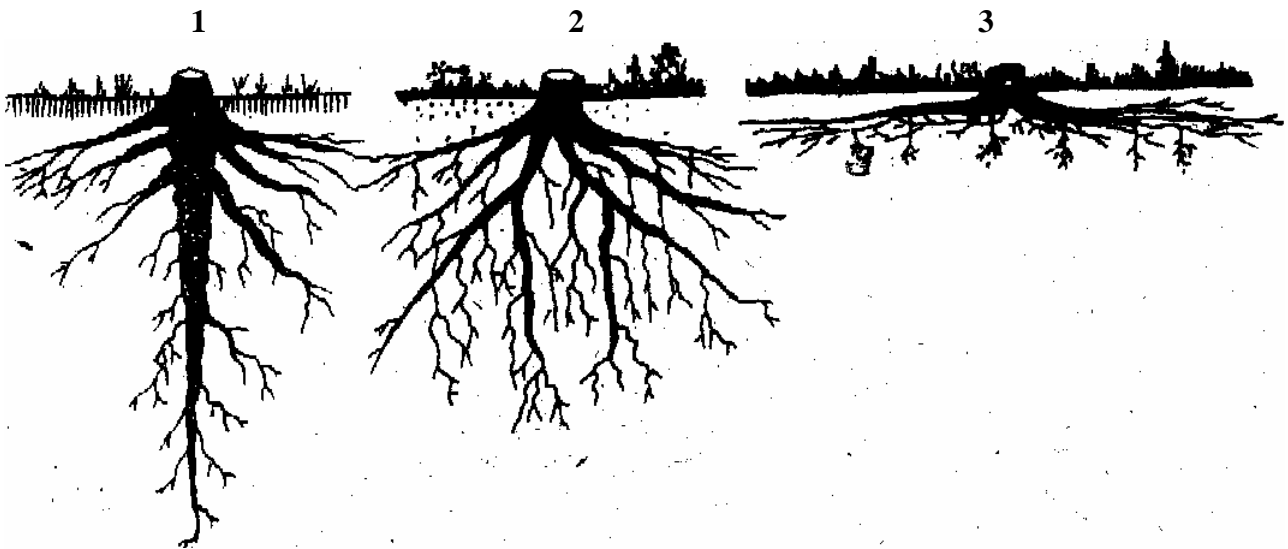
A typical leaf is composed of a leaf-stalk or petiole which usually widens at its base where it joins the stem at the node. The main flattened expansion of the leaf is called the leaf-blade or lamina. In some cases, the leaf-blade is borne directly on to the stem, that is, there is no leaf-stalk, in which case the leaf is said to be sessile. Where there is a leaf-stalk, it may be thick or thin, long or short.

On the leaf-blade thicker lines are visible. These are the veins, and are the channels for conducting water with its dissolved substances into the leaf and for transporting manufactured food substances away from the leaf. The main veins give off branch veins, thus presenting a complete network of veins. The whole arrangement of veins in a leaf is called venation. In some leaves there is one main vein, which branches. The branches give off secondary branches, and so on, thus producing a reticulate or net venation. This is seen in such leaves as elm, oak and all broad-leaved trees.

In many leaves, despite diversity of shape, the whole-leaf-blade is a single structure, as is the case in the elm, oak, maple and pine. Such leaves are simple. In other cases, each leaf is composed of several leaflets arranged in a definite order, for example, horse-chestnut, ash and acacia. Such leaves are compound.

## **Roots**

By virtue of their genetic origin, root systems of trees tend to exhibit three morphological types: taproot, heartroot, and plate or flatroot (see *Fig. 1*). A taproot consists of a nearly vertical main root and many laterals terminated in feeding roots; the feeding roots carry either root hairs or fungusmodified short roots, called mycorrhizae. A taproot system is particularly common to pine and oak species. Its full development is reached in permeable, adequately moist, but well-aerated soils. A heart-root lacks the main root but consists of several primary and secondary laterals, extending into a network of fibrous feeding roots. This root system pattern is produced by maple, beech, and fir. It attains its full development also in permeable, well-aerated soils. A plate or flatroot is composed of anchoring horizontals and numerous fringe roots. It is exhibited by spruce, hemlock, and other trees of saprophytic tendencies, especially when they grow in poorly drained soils.



*Fig. 1. Major types of root systems of forest trees:*  
1 — taproot; 2 — heartroot; 3 — plate-shaped or flatroot

## **Flowers**

*Petal.* Flowers may be considered to be modified branches whose leaves have undergone such change that they have become, or support, the reproductive organs of the plant. Flowers of woody plants are ordinarily in blossom for so short a time that, during the greater part of the year, they are of little value for practical purposes of identification. However, since all natural classifications of seed plants are based upon flower structure (see *Fig. 2*), it is essential to have a basic knowledge of tree flowers.

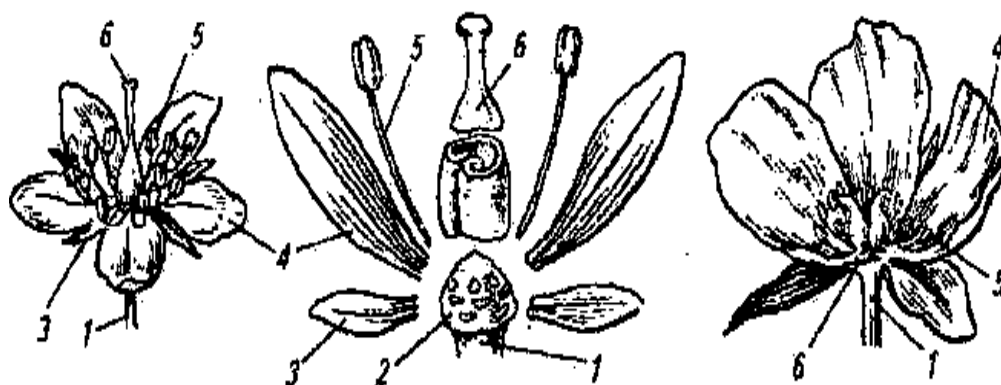


Fig. 2. *Flower Structure:*

1 — peduncle; 2 — receptacle; 3 — sepals; 4 — petals; 5 — stamens; 6 — pistil

*Flower parts.* A flower having a calyx (sepals), a corolla (petals), stamens, and one or more pistils is said to be complete. A perfect flower includes actively functioning organs of both sexes, but the accessory parts (calyx and corolla) may or may not be present. It follows, therefore, that a perfect flower may be either complete or incomplete. A flower lacking either functioning stamens or functioning pistils is imperfect. Imperfect flowers are also known as unisexual flowers, while perfect flowers are called either bisexual or hermaphroditic. An imperfect flower in which the only functioning sex organs present are stamens is called a staminate flower, while that in which the pistil is the only active organ is said to be pistillate. A species in which these separate staminate and pistillate flowers are both borne on the same individual, although frequently on different branches, is termed monoecious; in contrast, when the staminate flowers occur on one tree and the pistillate appear on another it is said to be dioecious. In some instances both perfect and unisexual flowers occur on the same tree. Species exhibiting this condition are termed polygamous.

When both calyx and corolla are wanting\*, a flower is said to be naked. If only the corolla is omitted however, the flower is apetalous. When the corolla is composed of separate petals, the flower is classified as a polypetalous type; but when the petals are partially or wholly fused with one another it is said to be sympetalous.

### *Fruit*

A fruit may be defined as the seed-bearing organ of a plant. Since the fruits of conifers are quite different in structure from those of the angiosperms (broad-leaved trees), each group is considered separately.

*Coniferous fruits* may be either dry or fleshy. In the majority of cases they ripen during the first season, although in several genera, two and occasionally three years are necessary for their maturation.

The principal unit of the cone is the cone scale. The scales are attached to a central woody axis and may be spirally inserted. They may be either thin or thick, flexible or rigid, broader than long (some species of fir), narrow-oblong (some pines), or peltate (shield-shaped) in some "cedars" and cypresses.

The exposed portion of the cone scale in a mature unopened cone is known as the apophysis. In some species the apophysis is smooth, in others it is wrinkled; also it may be grooved or ridged.

Seeds are borne at the base of the cone scales.

*Angiospermous fruit* is generally described as a ripened ovary, although in some fruits various accessory parts such as the receptacle, involucre, calyx and style are also included. These fruits may be classified in a number of ways. If their origin is traceable to a single pistil, they are known as simple fruits, but when two or more pistils on the same receptacle are involved in their formation, they are said to be compound. Both types of fruits may be either dry or fleshy.

*Note:*

\* are wanting — отсутствуют.

### Topical Vocabulary

**twig** — веточка, прут;

**cruise** — таксация (леса) || таксировать, проводить таксацию;

**tally** — подсчитывать, пересчитывать;

**poplar** — тополь;

**lenticel** — чечевичка (поры в коре ветвей);

**bud** — почка; зачаток;

**leaf scar** — листовый рубец;

**stipule** — прилистник;

**pith** — сердцевина;

**spine thorn** — колючка, шип;

**glaucous** — тусклый; покрытый налетом;

**pubescence** — опушение, опушенность;

**leaf-bud** — листовая почка;

**axillary bud** — пазушная почка;

**ruptured strand** — оторванная, разорванная жила;

**vascular tissue** — сосудистая ткань; сосудистая сеть, сплетение;

**vascular bundle** — сосудистый пучок;

**privet** — бирючина;

**leaf-stalk** — стебель листа;

**petiole** — черешок листа;

**node** — узел; нарост; мутовка;

**leaf-blade (lamina)** — пластина листа;

**sessile** — сидячий; бесчерешковый;  
**network of veins** — сеть жилок;  
**venation** — жилкование; венозная сеть;  
**reticulate** — сетчатка; сетчатый, ретикулярный;  
**horse-chestnut** — конский каштан;  
**ash** — ясень;  
**acacia** — акация;  
**taproot** — главный стержневой корень;  
**heartroot** — сердцевидный корень;  
**plateroot / flatroot** — пластинчатый, плоский корень;  
**feeding root** — питающий корень;  
**mycorrhizae** — микориза;  
**fibrous root** — мочковатый корень;  
**fringe root** — бахромчатый корень;  
**saprophytes** — сапрофиты (микроорганизмы, питающиеся органическими веществами отмерших организмов);  
**blossom** — цвет, цветение;  
**calyx** — чашечка (цветка);  
**sepal** — чашелистик;  
**corolla** — венчик цветка;  
**petal** — лепесток;  
**pistil** — пестик;  
**uni(bi-)sexual flower** — однополый (двуполый) цветок;  
**hermaphroditic** — гермафродитный, бисексуальный, двуполый;  
**staminate flower** — тычиночный цветок;  
**pistillate flower** — женский цветок;  
**monoecious** — обоеполый;  
**dioecious** — двудомный;  
**apetalous** — безлепестный;  
**polypetalous** — многолепестный, раздельнолепестный;  
**sympetalous** — спайнолепестный;  
**angiosperms** — покрытосеменные растения;  
**maturation** — созревание; достижение полного развития;  
**cone scale** — чешуйка шишки;  
**cypress** — кипарис;  
**apophysis** — апофиза (видимая часть семенной чешуйки сомкнутой шишки);  
**ripened ovary** — созревшая завязь;  
**receptacle** — цветоложе;  
**involucre** — обертка соцветия.

## EXERCISES

*Exercise 4. Make the words negative. In case you are not sure check the forms in the texts. Model: perfect — imperfect.*

woody; fortunately; complete; opened; petalous; developed; accessible; variably; regard; like (adj.).

**Exercise 5.** *In scientific texts prefixes of Greek origin are often used. Some of them can be found in the texts under study, e. g. **mono-** (греч. ‘один, единый, единственный’), **di-** (греч. ‘два, дважды, двойной’), **poly-** (греч. ‘много, многое’).*

*Compare: **uni-** (лат. ‘один’) и **bi-** (лат. ‘два, двойной’), **multi-** (лат. ‘много’).*

*A) You can easily guess their meaning and translate the examples suggested: unisexual; monoecious; dioecious; polygamo-monoecious; polygamo-dioecious; polygamous; polypetalous;*

*B) Translate the following words with prefixes. Consult the dictionary if necessary:*

-polyatomic; polychromatic; polyglot; polysemantic; polyvalent; polygamy;

-digamy; digraph; dimorphic; diode; diptych; diatomic;

-monoculture; monorail; monogamy; monologue; monotone; monoxide.

**Exercise 6.** *Insert the right word from the list below.*

*axillary buds; binomial system; boundary; dendrology; generic names; herbaceous; in blossom; leaf scar; morphological types; polypetalous; selection; timber cruiser.*

1. Linnaeus developed the ... of nomenclature, which is now used.
2. The average ... relies almost wholly upon bark in tallying species.
3. ... tends to focus on economically useful woody plants, their identification and horticultural or silvicultural properties.
4. ... always appear first and are invariably capitalized.
5. The root systems of trees tend to exhibit three ...: taproot, heart-root, and plate or flatroot.
6. There is no sharp ... between plant taxonomy and dendrology.
7. Flowers of woody plants are ordinarily ... for so short a time and they are of little value for practical purposes of identification.
8. When the corolla is composed of separate petals, the flower is classified as a ... type.
9. ... produce branch shoots, or single leaves or flowers.

10. Theophrastus differentiated between woody and ... forms but failed to indicate any botanical relationships.

11. The chief characteristics of trees usually influence the ... of their common names.

12. When a leaf falls from a twig, there remains at the point of attachment a ... .

*Exercise 7. Supply synonyms for the words taken from the texts.*

*bare; bushes; commemorate; dominating; form; in blossom; leaves; ripening; sleeping; stem.*

1. Douglas-fir is the common name applied to coniferous trees of the genus *Pseudotsuga* in the family Pinaceae, which *honours* David Douglas, the Scottish botanist who first introduced the tree into cultivation in 1826.

2. Larches are among the *dominant* plants in the immense boreal forests of Russia and Canada.

3. Others are *shrubs* less than 10 metres tall with a number of small trunks originating at ground level.

4. Though individually flowers may be small, the effect of an entire tree *in flower* can be striking in several species.

5. Most species require stratification in order to germinate, and some seeds can remain *dormant* in the soil for several years before germinating.

6. Junipers vary in size and *shape* from tall trees, 20—40 m tall, to low spreading shrubs with long trailing branches.

7. The seed *maturation* time varies between species from 6—18 months after pollination.

8. The needles turn yellow and fall in the late autumn, leaving the trees *leafless* through the winter.

9. Because of its beautifully shaped crown and dense lustrous *foliage*, the silver fir is commonly used ornamentally.

10. All firs are trees, reaching heights of 10—80 m tall and *trunk* diameters of 0.5—4 m when mature.

*Exercise 8. Insert who, which, or that into the complex sentences with attributive clauses. Translate the sentences into Russian.*

1. Because of the great confusion on common names, it became necessary to find some universal system, ... could be used throughout the world.

2. Such a system has been developed through the use of Latin names, many of ... were first applied when this language was employed by scien-

tists. 3. Thus in the scientific name Quercus imbricaria Michaux *Quericus* is the generic or group name, *imbricaria* is the specific or species name, and *Michaux* is the person ... named and described the tree. 4. It should be indicated that the factors, ... influence the original choice of common names apply as well to scientific names. 5. The first extensive classification of plants was that of Caesalpino (1519—1603), an Italian physician, who arranged and classified a large number according to the nature and structure of their fruits and seeds. 6. Linnaeus gave every plant species a name ... remained the same no matter what other species were placed in the genus, and thus separated taxonomy from nomenclature. 7. It was soon found that the structure of the flower was a suitable basis upon which to classify all seed-bearing plants. 8. The most productive of the early naturalists was Alexander von Humboldt, ... collected 60,000 plant specimens on a five year voyage to South and Central America from 1799 to 1804. 9. In Europe, classification often emphasizes indicator or diagnostic species ... separate one type from another. 10. Functional classifications, which attempt to categorise all plant species into a very small number of groups, are unlikely to be effective.

*Exercise 9. Translate the complex sentences with adverbial (conditional) clauses.*

1. Buds are young, undeveloped shoots; if they are leaf-buds only they finally grow out to produce either single leaves or branch stems bearing other leaves. 2. On the other hand, if they are flower-buds, they finally produce the flower or flowers and then their growth ceases. 3. If the terminal bud is severed or injured so that it cannot itself develop, then some of the dormant axillary buds develop. 4. If an individual plant is either female or male the species is regarded as dioecious. 5. If perfect flowers, together with unisexual flowers of both sexes, are present on a single individual, the species is polygamo-monoecious. 6. But if the perfect flowers are accompanied by one sex on some individuals and with the opposite sex on others it is polygamo-dioecious. 7. If both calyx and corolla are wanting, a flower is said to be naked. 8. If only the corolla is omitted however, the flower is apetalous. 9. If the flower has no stem but forms in the axil of a leaf, it is called sessile. 10. If the peduncle (стебель, ножка) ends with groups of flowers, each stem that holds a flower is called a pedicel (цветоножка). 11. If the perianth (околоцветник) is bisected through the central axis from any point, symmetrical halves are produced — the flower is called regular or actinomorphic.

**Exercise 10.** Transform the sentences with *if* to make up definitions.

*Model:* If both calyx and corolla are wanting, a flower is said to be *naked*. — The naked flower is the one, which has neither calyx nor corolla.

1. If only the corolla is omitted, the flower is *apetalous*. 2. If the flower has no stem but forms in the axil of a leaf, it is called *sessile*. 2. If the peduncle ends with groups of flowers, each stem that holds a flower is called a pedicel. 3. If an individual plant is either female or male the species is regarded as *dioecious*. 4. If perfect flowers together with unisexual flowers of both sexes are present on a single individual, the species is *polygamo-monoecious*. 5. If the perfect flowers are accompanied by one sex on some individuals and with the opposite sex on others it is *polygamo-dioecious*.

**Exercise 11.** Give definitions to the following biological terms:

bud; leaf-bud; flower-bud; axillary bud; leaf-stalk; leaf-scar; leaf-blade; sessile leaf; venation; reticulate; compound leaf; taproot; heart-root; flatroot; flower.

**Exercise 12.** Translate the text about fires into English, sentence by sentence. Then speak about the damage forest fires make and their and comment on the suggested approach.

Лист — один из основных органов. Состоит из листовой пластинки, черешка, влагалища и прилистников. Форма, размеры, окраска, продолжительность жизни частей листа и их число положены в основу классификации листьев. Листья делятся на простые и сложные: у простого листа одна листовая пластинка; у сложного — две и более.

По форме листовой пластинки листья бывают: продолговатые, или узкоэллиптические, линейные, яйцевидные, округлые, ланцетные, обратнояйцевидные, обратноланцетные, эллиптические, ромбические, лопатчатые. Эти названия даны по соответствию внешнего контура листовой пластинки той или иной геометрической фигуре. При более детальной конкретизации к упомянутым терминам добавляются слова «узко», «широко», «вытянуто» (например, широкояйцевидный, узколанцетный и т. д.).

Существенный морфологический признак листьев — характер расположения жилок. Растения различаются по расположению и прикреплению листьев к стеблю. По этому признаку различают растения с черешковыми, с сидячими листьями и т. д. Расположение листьев на побеге также бывает различным.

### ***Questions and tasks***

1. Why do foresters resort to both dendrology and taxonomy in their work?
2. What information is considered important for the common name?
3. Where are the Latin names of plants used? Why?
4. What does the binominal system include?
5. Who were the first contributors to the plant classification? What did they do?
6. Why is the *Origin of Species* considered revolutionary?
7. Is the structure of the flower of any use for the plant classification?
8. Is it possible to differentiate between trees judging from the bark and stem?

Can you give examples to prove your point?

9. How do twigs help to differentiate between tree species?
10. Describe the structure of the leaf. What is diagnostic in the leaf, do you think?
11. What parts make the flower? Can the flower help to identify the tree species?

### ***Comment on the following information***

*Plant taxonomy* is the science that finds, describes, classifies, identifies, and names plants. It thus is one of the main branches of taxonomy.

Plant taxonomy is closely allied to plant systematics, and there is no sharp boundary between the two. In practice, "plant systematics" is involved with relationships between plants and their evolution, especially at the higher levels, whereas "plant taxonomy" deals with the actual handling of plant specimens.

Plant taxonomy is well known for being turbulent, and traditionally there is no really close agreement on circumscription and placement of taxa.

*Plant identification* is the determination of the identity of an unknown plant by comparison with previously collected specimens or with the aid of books or identification manuals. The process of identification connects the specimen with a published name. Once a plant specimen has been identified, its name and properties are known.

*Plant classification* is the placing of known plants into groups or categories to show some relationship. Scientific classification follows a system of rules that standardizes the results, and groups successive categories into a hierarchy.

## UNIT 6. DESCRIPTION OF TREE SPECIES AND TREES

*In scientific texts we may come across descriptions of trees. These descriptions often vary, but there are principles universally recognized for the presentation of common and rare tree species.*

*A tree is a plant form that occurs in many different orders and families of plants. As we know, trees show a wide variety of growth forms, leaf type and shape, bark characteristics, and differences in reproductive organs. Most species of trees today are flowering plants (Angiosperms) and conifers (Gymnosperms).*

*All these differences, as well as the distribution, are taken into account when describing tree plants.*

*Before reading Text 1 study the topical vocabulary and then do some exercises.*

### Topical Vocabulary

**variable** ['vɛəriəbl] — переменный; изменчивый, непостоянный;

**site** — место, участок;

**distribution** — распространение; распространение;

**shrub** — куст, кустарник;

**prostrate** ['prɒstreɪt] — стелющийся;

**oldgrowth trees** — перестойный лес, перестойные деревья;

**open-grown specimen** — дерево, выросшее на открытом месте;

**clear trunk** — чистый ствол;

**taper** — сужение, конусность;

**under competition** — в условиях конкуренции;

**tolerant** — толерантный, выносливый; терпимый;

**hillside** — горный склон;

**swamp** ['swɒmp] — болото;

**range** — ареал, область распространения;

**bog** — болото, трясина; болотистая местность;

**associate** [ə'səʊʃiət] — сопутствующий вид;

**unhampered** — свободный; нестеснённый; беспрепятственный;

**scattered trees** — отдельно растущие деревья;

**logging** — лесозаготовки;

**bear** ['bɛə] — выносить, выдерживать; терпеть;

**shade** — тень; полумрак;

**adult** — взрослый, зрелый;

**prosper** — благоденствовать, преуспевать, процветать;

**exposure** — выставление, оставление (на солнце, под дождем, на холоде);  
обнажение;

**external conditions** — внешние условия;

**dissimilar** — непохожий, отличный; разнородный, неоднородный;

**seed production** — семенная продуктивность; образование семян;

**germination** — зарождение; прорастание;

**temperature extremes** — максимальные и минимальные температуры;

**storage** — хранение;

**stratifying media** — способ, средство стратификации.

## TEXT 1. PRINCIPLES OF GENERAL DESCRIPTION

*Sizes of Mature Trees.* These are very variable and are often influenced by local conditions of site, or by geographical distribution, especially with boreal species, which may become shrubby or prostrate at the northern limits of their range. Maximum sizes are often from oldgrowth trees, which are no longer standing, and in some instances it is not certain whether actual measurements were made, or whether the size was merely estimated. Maximum heights and diameters as given are usually not from the same tree.

*Form.* Trees when grown in the open tend to develop characteristic shapes, which may be typical of individual species, or groups of species (genera), this is well illustrated in such trees as American elm, white oak, or white pine. In general, open-grown specimens have large crowns, which may reach nearly to the ground and the clear trunk is short, with considerable taper. Under forest competition, the form is very different, the bole is long, more cylindrical, often clear of branches for one half or more of its length, and the crown small. Certain species, especially those which are extremely tolerant, resist crown restriction, but it may be said that most trees develop typical shapes only in the open, such individuals are, of course, usually unfit for lumber because of the short clear length and many side branches which would appear as knots in the finished boards.

*Site.* Although many trees are cosmopolitan in this respect, others are invariably associated with certain combinations of soil and moisture, and it is, for instance, as futile to look for a black ash on a high, excessively dry hillside, as to expect ponderosa pine to inhabit a permanent swamp. Site relationships are frequently very complicated, and the absence of a certain species may not be due to its inability to grow in a given situation, but merely because other forms can compete more advantageously there.

The effect of latitude on site is also pronounced, since trees of the north when found at the southern limit of their range often grow only in bogs, even though farther north they are found on dry ground.

*Associates.* When left unhampered, trees as well as other plants tend to group themselves on the basis of soil and climatic factors, and their ability to compete with their neighbors. In this way fairly definite plant associations come into being, which may be semipermanent or only temporary in nature. Since a large portion of the forest of this country have been devastated, and the new growth springing up is often so different from that which preceded it, lists of associated tree species lose much of their value unless one knows the recent history of the particular forest in question: for example, trembling aspen originally occurred as a scattered tree in the

spruce forests of the northeast, but following logging and fire has now spread in nearly pure stands over wide areas.

**Tolerance.** It has been known for a considerable time that certain species will grow under varying densities of forest cover, while others exist only in the open. For many years this was interpreted as a reaction to light, and hence an intolerant tree was one, which could bear little or no shade. At present it seems best to consider tolerance as the ability of a plant to complete its life history from seedling to adult, under the cover of a dense forest regardless of the specific factors involved. Or, put more simply, a tolerant tree is one, which can exist, if not prosper, under forest competition, when this is removed or lessened, the rate of growth usually shows a marked increase.

Tolerance is influenced by site (soil, exposure, climate, etc.) so that the best comparisons are made only between trees growing together under the same set of external conditions. Little is gained in attempting to compare two species of widely separated ranges, growing on different soils and with dissimilar associates.

**Seed Production and Germination.** These are very variable, the former depending on many factors including temperature extremes, condition of the tree, the presence or absence of competition, and the time elapsed since the last heavy crop was borne. The germination percentages vary exceedingly, being influenced by a large number of factors, such as storage (temperature, moisture, and stratifying media, if any) and conditions, surrounding actual germination.

**Growth.** It is difficult to make general statements of any value, unless they are accompanied by such facts as the age of the tree, density of the stand, and the quality of the site.

## EXERCISES

**Exercise 1.** *In descriptions we have to use many different adjectives. Find in the text adjectives with suffixes -al; -ic; -an; -able; -ent/-ant (and some others).*

<i>-al</i>	<i>-ic</i>	<i>-an</i>	<i>-able</i>	<i>-ent/-ant</i>	<i>others</i>

**Exercise 2.** *There are few suffixes to form adverbs. The most productive is -ly (to form adverbs from adjectives).*

**A)** *Find in the text and give examples of adverbs derived from adjectives.*

Model: especially; merely; excessively; etc.

**B)** *Which of the adjectives you inserted into the table in ex. 1 can acquire suffix -ly?*

**Exercise 3.** *Match the word (numbers 1—9) with its definition (letters A—I).*

1. tolerance	A. place and situation of growth, the environment associated with certain combinations of soil, moisture and other factors
2. germination	B. yielding a fruit part containing an embryo which will develop a new plant if sown
3. size	C. set of external conditions of the site (soil, exposure, climate, etc.) that affect the trees growing together
4. tolerance factors	D. plants which group themselves on the basis of soil and climatic factors, and ability to compete with their neighbours
5. form	E. producing a sprout, starting development or growth from a seed
6. seed production	F. the ability of a plant to resist to effects, to complete its life history from seedling to adult, under the cover of a dense forest
7. site	G. development with increase in size, volume, quality, etc.
8. associates	H. characteristic shape, typical of individual species, or groups of species, which is usually developed when grown in the open
9. growth	I. measurements and dimensions as required by the classification such as height, diameter

**Exercise 4**

**A)** *Make up compound participles, which can be used to describe shape.*

Model 1: heart-shaped

Model 2: heart-like

egg; heart; bone; palm; bell; pear; diamond; umbrella; arrow; spire; needle.

**B)** *See how compound descriptions are used in sentences. Translate the sentence and then try to make up your own descriptions of trees or other plants and their parts.*

1. The seed cones of cedar are *barrel-shaped*, 6—12 cm long and 3—8 cm broad, green maturing grey-brown, and disintegrate at maturity to release the winged seeds.

2. Cranberries differ in having stouter, woodier stems forming taller shrubs, and in the *bell-shaped* flowers.

3. The term "toadstool" was often but not exclusively applied to poisonous mushrooms or to those that have the classic *umbrella-like* form.

4. The leaves are needle-like, 2—5 cm long, slender (under 1 mm wide).







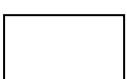

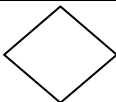

5. The female catkins are not woody and disintegrate at maturity, falling apart to release the seeds, unlike the woody *cone-like* female alder catkins.

6. The fruit of the oak is a nut called an acorn, borne in a *cup-like* structure known as a cupule.

7. The bole and root systems are similar to those of other firs of low altitudes, but the crowns, particularly of old trees, is usually pyramidal or even *spirelike*.

**Exercise 5.** Describe the forms and shapes. Provide the description with a shape-noun (choose one of the three offered) and shape-adjective.

Model: pyramid — pyramidal.

1		a) circle, cylinder, heart b)	6		a) cylinder, heart, rhomb b)
2		a) rhomb, triangle, cube b)	7		a) square, oval, star b)
3		a) triangle, square, star b)	8		a) square, oval, rectangle b)
4		a) square, star, rectangle b)	9		a) oval, circle, cube b)
5		a) oval, circle, cylinder b)	10		a) cube, heart, rhomb, b)

Can you draw a pyramid (triangle, square, star, rectangle, oval, circle, cylinder, heart, rhomb, cube)?

**Exercise 6.** *In English there are many different prepositions. The same preposition can be translated differently in different contexts, because a) the prepositions are polysemantic, and b) there are often differences in combinability of similar nouns in English and Russian.*

*Translate the sentences taken from the text and comment on the use of prepositions **under, for, from, to.***

1. It has been known for a considerable time that certain species will grow *under* varying densities of forest cover, while others exist only in the open. 2. *Under* forest competition, the form is very different, the bole is long, more cylindrical, often clear of branches one half or more of its length, and the crown small. 3. At present it seems best to consider tolerance as the ability of a plant to complete its life history from seedling to adult, *under* the cover of a dense forest regardless of the specific factors involved. 4. Although many trees are cosmopolitan, others are invariably associated with certain combinations of soil and moisture, and it is, *for* instance, as futile to look for a black ash on a high, excessively dry hillside, as to expect ponderosa pine to inhabit a permanent swamp. 5. Individuals grown in the open are usually unfit *for* lumber because of the short clear length and many side branches which would appear as knots in the finished boards. 6. *For* many years tolerance was interpreted as a reaction *to* light, and hence an intolerant tree was one, which could bear little or no shade. 7. Maximum heights and diameters as given are usually not *from* the same tree. 8. Since a large portion of the forest of this country have been devastated, and the new growth springing up is often so different *from* that which preceded it. 9. At present it seems best to consider tolerance as the ability of a plant to complete its life history *from* seedling to adult, under the cover of a dense forest regardless of the specific factors involved. 10. In general, open-grown specimens have large crowns, which may reach nearly *to* the ground and the clear trunk is short, with considerable taper. 11. The absence of a certain species may not be due *to* its inability to grow in a given situation, but merely because other forms can compete more advantageously there. 12. At present it seems best to consider tolerance as the ability of a plant to complete its life history from seedling *to* adult.

## **TEXT 2. PINE**

**Read text 2** and 1) give definitions to the words in italics and 2) find the answers to the following questions:

- *How many species of pines are recognized and where do they grow?*

- What sizes and forms do pines come in?
- Describe the bark (branches, needles) of pines.
- What is a candle?
- How do pines reproduce themselves? Describe the cone of the pine.
- What sites do pines prefer? Can they grow in a different environment?

A pine is a coniferous tree in the genus *Pinus*, in the family *Pinaceae*. They make up the monotypic subfamily *Pinoideae*.

**Distribution.** There are about 115 species of pine. Pines are native to most of the Northern Hemisphere. In Eurasia, they range from the Canary Islands and Scotland east to the Russian Far East, and the Philippines, north to just over 70°N in Norway (Scots Pine) and eastern Siberia (Siberian Dwarf Pine), and south to northernmost Africa, the Himalaya and Southeast Asia.

**Morphology.** Pines are evergreen and resinous trees (rarely shrubs) growing to 3—80 m tall, with the majority of species reaching between 15—45 m tall. The smallest are Siberian Dwarf Pine and Potosi Pinyon, and the tallest, Sugar Pine. Pines are long-lived, typically reaching ages of 100—1,000 years, some even more. The longest-lived is the Great Basin Bristlecone Pine *Pinus longaeva*, one individual of which at 4,839 years (2007) is the oldest living organism in the world.

The bark of most pines is thick and scaly, but some species have thin, flaking bark. The branches are produced in regular "pseudowhorls", actually a very tight spiral but appearing like a ring of branches arising from the same point. Many pines are uninodal, producing just one such whorl of branches each year, from buds at the tip of the year's new shoot, but others are multinodal, producing two or more whorls of branches per year. The new spring shoots are sometimes called "candles"; they are covered in brown or whitish bud scales and point upward at first, then later turn green and spread outward. These "candles" offer foresters a means to evaluate fertility of the soil and vigour of the trees.

Pines have four types of leaves.

*Seed leaves* (cotyledons) on seedlings, borne in a whorl of 4—24.

*Juvenile leaves*, which follow immediately on seedlings and young plants, 2—6 cm long, single, green or often blue-green, and arranged spirally on the shoot. These are produced for six months to five years.

*Scale leaves*, similar to bud scales, small, brown and non-photosynthetic, and arranged spirally like the juvenile leaves.

*Needles*, the adult leaves, which are green (photosynthetic), bundled in clusters of 2—5 needles together, each fascicle produced from a small bud

on a dwarf shoot in the axil of a scale leaf. The needles persist for 1.5—40 years, depending on species.

**Cones.** Pines are mostly monoecious, having the male and female cones on the same tree. The male cones are small, typically 1—5 cm long, and only present for a short period (usually in spring), falling as soon as they have shed their pollen. The female cones take 1.5—3 years (depending on species) to mature after pollination, with actual fertilization delayed one year. At maturity the cones are 3—60 cm long. Each cone has numerous spirally arranged scales, with two seeds on each fertile scale; the scales at the base and tip of the cone are small and sterile, without seeds. The seeds are mostly small and winged, and are anemophilous (wind-dispersed), but some are larger and have only a vestigial wing, and are bird-dispersed (see below). At maturity, the cones usually open to release the seeds, but in some of the bird-dispersed species (e. g. Whitebark Pine), the seeds are only released by the bird breaking the cones open.

**Ecology.** Pines grow well in acid soils, some also on calcareous soils; most require good soil drainage, preferring sandy soils, but a few, e. g. Lodgepole Pine, will tolerate poorly drained wet soils. A few are able to sprout after forest fires, e. g. Canary Island Pine. Some species of pines, e. g. Bishop Pine, need fire to regenerate and their populations slowly decline under fire suppression regimes. Several species are adapted to extreme conditions imposed by elevation and latitude; see e. g. Siberian Dwarf Pine, Mountain Pine, Whitebark Pine and the bristlecone pines. The pinyon pines and a number of others, notably Turkish Pine, are particularly well adapted to growth in hot, dry semi-desert climates.

The seeds are commonly eaten by birds and squirrels. Some birds, notably the Spotted Nutcracker, Clark's Nutcracker and Pinyon Jay, are of importance in distributing pine seeds to new areas where they can grow. Pine needles are sometimes eaten by some Lepidoptera species (see list of Lepidoptera that feed on pines) and also the Symphytan species Pine Sawfly.

**Uses.** Pines are among the most commercially important of tree species, valued for their timber and wood pulp throughout the world. Pine wood is widely used in high-value carpentry items such as furniture, window frames, paneling and floors.

Many pine species make attractive ornamental plantings for parks and larger gardens, with a variety of dwarf cultivars being suitable for smaller spaces.

## Topical Vocabulary

- subfamily** — подсемейство; субсемья, вторичная семья, семья второго поколения;
- native** — местное (растение или животное); естественный;
- range** — простираться; колебаться в известных пределах;
- resinous** ['rezɪnəs] — смолистый;
- long-lived** — долгоживущий; долговременный;
- scaly** ['skeɪli] — чешуйчатый, покрытый чешуей; слоистый;
- flake** — отслаиваться, шелушиться, откалывать(ся);
- pseudowhorl** ['sju:dəu'wɜ:l] — псевдомутовка; псевдовиток;
- uninodal** [ˌju:nɪ'nəʊdəl] — одномутовчатый;
- whorl** ['wɜ:l] — мутовка; виток; изгиб;
- multinodal** [ˌmʌlti'nəʊdəl] — многомутовчатый; многоузловой;
- bud scales** — чешуйки почек;
- fertility** [fɛ:'tɪlɪti] — фертильность, плодовитость;
- cotyledon** [ˌkɒtɪ'li:dən] — котиледон; семядоля;
- juvenile** ['dʒu:vənəɪl] **leaves** — молодые листья;
- scale leaf** — прилистник; почечная чешуйка;
- non-photosynthetic** — нефотосинтезирующий;
- needle** — игла, хвоя (иголка);
- fascicle** ['fæsɪkl] — пучок (совокупность нервных или мышечных волокон);
- dwarf** [dwɔ:f] **shoot** — карликовый, миниатюрный; малорослый побег;
- pollen** — пыльца;
- pollination** — опыление;
- fertilization** — оплодотворение; внесение удобрений;
- sterile** ['steraɪl] — бесплодный; стерильный; неспособный к деторождению;
- anemophilous** [ˌænɪ'mɔːfɪləs] — анемофильный; ветроопыляемый;
- wind-dispersed** — распространяемые ветром; ветроопыляемый;
- vestigial wing** — рудиментарный; остаточный
- soil drainage** — дренаж почвы;
- tolerate** — выносить, терпеть;
- sprout** — пускать ростки, прорасти; побег, росток; отросток;
- fire suppression** — подавление пожаров;
- extreme conditions** — экстремальные условия;
- elevation** — высота (над уровнем моря); поднятие, высокое расположение;
- pinon pine** — сосна съедобная;
- semi-desert** — полупустыня;
- ornamental planting** — декоративные, орнаментальные посадки (насаждения);
- cultivar** ['kʌltɪvə] — культурный сорт (растение).

## EXERCISES

*Exercise 7. Insert into the sentences the right word or word combination in keeping with the information from the text. Translate the sentences into Russian.*

1. Pines are ... to most of the Northern Hemisphere.
2. Pines are ... and ... trees growing to 3—80 m tall, with the majority of species reaching between 15—45 m tall.
3. The branches are produced in regular ... , a very tight spiral appearing like a ring of branches arising from the same point.
4. Many pines are ... , producing just one such whorl of branches each year.
5. ... grow on seedlings and young plants and are produced for six months to five years.
6. Needles are ... leaves, which are green (photosynthetic), bundled in clusters of 2—5 needles, persisting for 1.5—40 years.
7. Pines are mostly ... , having the male and female cones on the same tree..
8. The female cones take 1.5—3 years to mature after ... , with actual fertilization delayed one year.
9. The scales at the base and tip of the cone are small and ... , without seeds.
10. At maturity the cones usually open to release the seeds, but in some of the ... species the seeds are only released by the bird breaking the cones open.
11. Pines grow well in acid soils, some also on calcareous soils; most require good ... , preferring sandy soils.
12. Many pine species make attractive ornamental plantings, with a variety of ... cultivars for small spaces.

*Exercise 8. As we know the same preposition can be translated differently in different contexts. Translate the sentences and comment on the use of preposition with.*

1. Sizes are very variable influenced by local conditions, or by geographical distribution, especially *with* boreal species, which may become shrubby or prostrate at the northern limits of their range. 2. Open-grown specimens have large crowns, which may reach nearly to the ground and the clear trunk is short, *with* considerable taper. 3. Although many trees are cosmopolitan, others are invariably associated *with* certain combinations of soil and moisture. 4. When left unhampered, trees tend to group them-

selves on the basis of soil and climatic factors, and their ability to compete *with* their neighbours. 5. Little is gained in attempting to compare two species of widely separated ranges, growing on different soils and *with* dissimilar associates. 6. Each cone has numerous spirally arranged scales, *with* two seeds on each fertile scale. 7. Seed maturation is usually in a few weeks to six months after flowering, *with* seed dispersal shortly after maturity. 8. The bark of all birches is characteristically marked *with* long horizontal lenticels, and often separates into thin papery plates. 9. Birch sap is consumed as a refreshing beverage; it is watery and pale green in color, *with* a slightly sweet flavor, and is bottled commercially. 10. The flowers (larch) are monœcious, opening *with* or before the leaves and borne on three-flowered clusters. 11. *With* care, the birch bark can be split into very thin sheets that will ignite from even the smallest of sparks. 12. In the taiga zone the temperatures vary from  $-50\text{ }^{\circ}\text{C}$  to  $+30\text{ }^{\circ}\text{C}$  throughout the whole year, *with* eight or more months of temperatures averaging below  $10\text{ }^{\circ}\text{C}$ .

**Exercise 9.** Translate the sentences with compound attributes, which often come in tree descriptions. Pay attention to the first components of compound words. Then give your own examples of compound adjectives and compound participles.

A) 1. Spruces are also popular ornamental trees, admired for their evergreen, symmetrical *narrow-conic* growth habit. 2. Evergreen species in the taiga (spruce, fir, and pine) have a number of adaptations specifically for survival in harsh taiga winters, though larch, the most *cold-tolerant* of all trees, is deciduous. 3. Because spruce is shade-intolerant, it requires an open canopy to be established. 4. The *shade-intolerant* species are able to photosynthesize at high rates and as a result grow quickly. 5. Norway Maple is especially popular as it is *fast-growing* and extremely *cold-resistant*, though it is also an invasive species in some regions. 6. Tree nurseries may specialize in selective breeding in order to produce fast growing *disease-* and *pest-resistant* strains. 7. The cedar needles vary from bright *grass-green* to dark green and to strongly glaucous pale *blue-green*. 8. Silver fir is most abundant on *deep-moist* soil covering slopes of southern and western exposure and grows on a variety of soil types.

B) 1. The bole of *forest-grown* spruce is long and cylindrical, and arises from a shallow, wide spreading root system. 2. Compared with most other plants, trees are *long-lived*, some of them getting to be several thousand years old and growing to up to 115 m (375 ft) high. 3. Taiga soil

tends to be young and nutrient-poor; it lacks the deep, *organically-enriched* profile present in temperate deciduous forests. 4. Birches often form *even-aged* stands on light, *well-drained*, particularly acidic soils. 5. Birch wood is *fine-grained* and pale in colour, often with an attractive satin-like sheen. 6. Taigas also have some *small-leaved* deciduous trees like birch, alder, willow, and aspen; mostly in areas escaping the most extreme winter cold. 7. Aspens are all *medium-sized* deciduous trees reaching 15—25 m tall, exceptionally to 30 m. 8. In pines the late wood is very dense and is *deep-colored*, presenting a very decided contrast to the soft, *straw-colored* early wood. 9. Cedars are trees up to 30—40 m (occasionally 60 m) tall with spicy-resinous scented wood, thick ridged or *square-cracked* bark, and broad, level branches.

**Exercise 10.** Translate the sentences with **both** in different meanings.

1. Silver fir and noble fir are *both* erroneously called "larch" by west coast loggers, and the timber of these two species is exported in quantities under this name. 2. Different types of forests can have very different structures; tropical rainforests are very different from boreal conifer forests, *both* of which differ from temperate deciduous forests. 3. Silvicultural regeneration methods combine *both* the harvest of the timber on the stand and re-establishment of the forest. 4. Of particular interest and importance are questions of the relative roles of climate, soil, topography, and history on vegetation characteristics, including *both* species composition and structure. 5. If a plantation is established on abandoned agricultural land, it can result in an increase in *both* habitat and biodiversity. 6. The resulting regenerated forest can provide *both* ecosystem and resource benefits and has the potential to become a major carbon sink. 7. The 2005 Forest Resource Assessment is the most comprehensive assessment of forests to date, in terms of *both* content and number of contributors. 8. Goals for *both* forest production and forest environment have been established and these two types of goals carry equal weight. 9. *Both* hunting and fishing need to be taken into consideration since they are naturally connected to forestry's key environmental considerations. 10. Dynamism in vegetation is defined primarily as changes in either or *both* of species composition and vegetation structure. 11. The largest trees in total volume are those which are *both* tall and of large diameter, and in particular, which hold a large diameter high up the trunk. 12. The quality of seed, as well as seed production, are both directly and indirectly of importance for the existence of mankind and also for a considerable number of animal organisms.

**Exercise 11.** Translate the sentences with *most* and *mostly* in different meanings.

1. Pines are among the *most* commercially important of tree species, valued for their timber and wood pulp throughout the world. 2. Spruce is one of the *most* important woods for paper manufacture, as it has long wood fibres which bind together to make strong paper. 3. There are approximately 125 species of maple, *most* of which are native to Asia, but several species also occur in Europe, northern Africa, and North America. 4. The bark of *most* pines is thick and scaly, but some species have thin, flaking bark. 5. Birches are generally small to medium-size trees or shrubs, *mostly* of northern temperate climates. 6. The most common tree species appear to have remained the same in *most* countries over the last 15 years. 7. *Most* of the world's forests are publicly owned (84 %), but private ownership is increasing. 8. Several countries, *mostly* in Europe and in the arid zones of Africa and Western Asia, have no primary forests left. 9. A tree is *most* often defined as a woody plant that has secondary branches supported clear of the ground on a single main stem or trunk with clear apical dominance. 10. If a tree grows all its life in the open and the conditions of soil and site remain unchanged, it will make its *most* rapid growth in youth, and gradually decline. 11. The *most* productive coniferous stands have been exploited, while the less productive ones and stands of deciduous species have hardly been used at all. 12. Because the sun is low in the horizon for *most* of the year, it is difficult for plants to generate energy from photosynthesis. 13. When juvenile foliage occurs on mature plants, it is *most* often found on shaded shoots, with adult foliage in full sunlight.

**Exercise 12.** Translate the text about forest trees into English, sentence by sentence. Then speak about the differences of trees grown under forest conditions and in the open and comment on the suggested approach.

Для леса наиболее характерна древесная растительность, однако не всегда присутствие древесных растений свидетельствует о наличии леса. Одиноко растущие сосны, раскинувшиеся среди полей и лугов, не означают соснового леса. Также и березы или липы, посаженные цепочкой вдоль дороги или в саду, еще не образуют березового или липового леса. Эти деревья заметно отличаются от деревьев тех же пород, но выросших в лесу. Дерево, росшее всю жизнь одиноко, имеет широкую раскидистую крону, толстые сучья и ветви, спускающиеся почти до земли, закомелистый ствол, т. е. сильно утолщенный у основания (Fig. 3). Обилие света здесь содействует интенсивному фотосинтезу даже в нижних частях кроны. Одиночные деревья

нередко привлекают внимание внешним красивым обликом, но древесина их оценивается хозяйством, как правило, низко. Дерево же, выросшее в тесном соседстве с другими деревьями, имеет большую высоту, гладкий не суковатый ствол, приближающийся по форме к цилиндру, сучья имеются только в верхней части дерева, крона занимает небольшую часть (*Fig. 3*). Древесина такого дерева расценивается высоко, она идет на постройки, пиловочник, фанеру, целлюлозу и т. д.

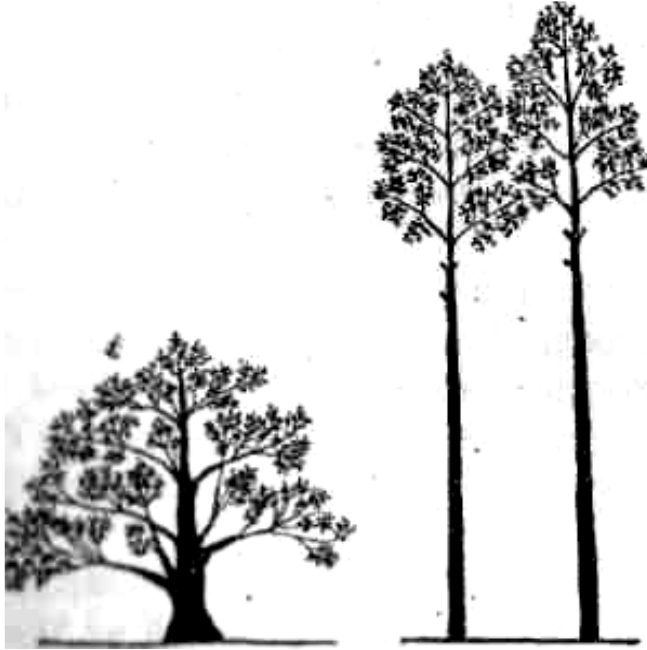


Fig. 3. Trees in different growth conditions

### *Questions and tasks*

1. How are maximum sizes of species determined?
2. How is usually the form and shape of the tree described?
3. What is 'site'? What is the effect of site on the tree like?
4. Do the trees differ if they grow in the open or in competition with neighbours?
5. What is tolerance? What is it influenced by?
6. What does seed production depend on? Give examples of seed production characteristics of the most common species in the Komi Republic.
7. What parts of the world are pines native to? Compare pines with birch. Where does birch grow?
8. How is pine described morphologically? Compare it with birch.
9. Compare the bark of pine and birch.
10. What is characteristic of pine cones? How are pine seeds dispersed?
11. What soils do pines prefer? How do pines differ in native sites and in extreme conditions?
12. Try to present a scientific description of birch (or, perhaps, some other species).

### ***Project “Scientific Description of Tree Species”***

Divide into teams. Jointly within your team arrange a presentation of the information and materials collected in form of presentations. It is recommended to describe the local species. Try to illustrate your points of presentation.

### ***Comment on the following information***

The genie (джин) of genetically modified (GM) plants is already out of the bottle. GM trees that do cross fertilise with each other or with native species could create super-species which would displace slower growing normal plants and at the same time destroy the habitat of many creatures. Trees provide food and shelter to many interdependent organisms including insects, birds, and mammals. Their root systems are often vast and closely interact with soil organisms like bacteria and nematode worms. The presence of transgenes represents a threat to the crops biodiversity. More than two thirds of conventional crops in the US are now contaminated with genetically modified material — dooming organic agriculture and posing a severe future risk to health. The nature of GM products and their long term action are not well understood as these products have not been properly tested before being released into the environment. The genetic modification of plants raises important issues for science and the public about the potential benefits and risks of this technology. The public mood related to GM ranges from caution and doubt to hostility and rejection.

## UNIT 7. FOREST GROWTH CONDITIONS

*No wooded landscape we see today has been forest for all time. Plants have minimum requirements of temperature and moisture and, in ages past, virtually every part of Earth's surface has at some time been either too dry or too cold for plants to survive. However, as soon as climatic conditions change in favour of plant life, a fascinating sequence of changes occurs.*

*Carbon products are stored in the wood of the tree and in forest-floor litter; the water-balance is maintained by rain and snowfall, held in the tree's tissues and in the soil, while a vast store of mineral nutrients derived from the soil is held in the leaves, only to be returned to the soil as the leaves fall and decay in the annual cycle of regeneration.*

*Before reading Text 1 study the topical vocabulary and then do some exercises.*

### Topical Vocabulary

**sufficient** [sə'fiʃənt] — достаточный; обоснованный;

**mineral nutrients** — минеральные питательные вещества;

**wavelength** — длина волны;

**duration** — длительность, продолжительность;

**periodicity** [ˌpɪərɪɒ'dɪsətɪ] — периодичность;

**in full sun** — в солнечном месте;

**root/shoot ratio** — пропорция (соотношение) между корнем и побегом;

**photoperiod** — фотопериод; световой день;

**fluctuation** — колебание, неустойчивость;

**rate** — интенсивность; скорость; степень; норма;

**respiration** — дыхание;

**cell division** — деление клетки;

**elongation** — удлинение; вытяжение;

**enzymatic activity** — ферментативная активность;

**transpiration** [ˌtrænsˈpɪrɪʃn] — выделение жидкости (из организма в виде паров);

**excessive** — избыточный; чрезмерный, неумеренный;

**wilt** — вилт (увядание растений) || вянуть, поникать, увядать;

**forest cover** — лесной покров;

**slope** — уклон; склон;

**aspect** — сторона; аспект, вид;

**calm** — тишина, спокойствие || тихий, безветренный

**obstruction** — препятствие; обструкция;

**deflect** — смещение; деформация; изгиб; искривление, преломление;

**slow down the velocity** — снижать скорость, замедлять;

**wind velocity** — скорость ветра;

**reduction** — редукция; уменьшение, ослабление, снижение;

**actual velocity** — фактическая скорость;

**relative velocity** — относительная (условная) скорость;

**leeward** ['li:wəd] — подветренная сторона; подветренный;

**shelter belt** — лесополоса;

**radiation** — излучение;

**moderate** — смягчать; умерять, сдерживать;

**solar** — солнечный;

**maximum** — (*pl. maxima*) максимум; максимальный показатель;

**minimum** — (*pl. minima*) минимум; минимальный показатель;

**amount** (to) — составлять; достигать.

## TEXT 1. GENERAL CONDITIONS

The general environmental requirements for successful growth of plants are sufficient light, water, oxygen, mineral nutrients and suitable temperatures. In terms of physiological processes the environmental requirements are conditions favorable for the manufacture of sufficient food for growth and maintenance of a satisfactory internal water balance. These apparently simple requirements actually involve a large number of environmental factors and physiological processes.

**Light.** The effects of light on plant growth depend on its intensity, its quality or wavelength, and its duration and periodicity. Variation in any of these characteristics can modify both the quantity and quality of growth. For example, seedlings grown in light of low intensity differ not only in height and dry weight from those grown in full sun but also in root/shoot ratio and leaf and stem structure. The photoperiod affects both vegetative growth and flowering, and wavelength affects other processes in addition to photosynthesis.

**Temperature.** Fluctuations in soil and air temperature influence growth and distribution of trees by altering rates of various important physiological processes such as photosynthesis, respiration, cell division and elongation, enzymatic activity, chlorophyll synthesis and transpiration. Growth usually increases with an increase in temperature until a critically high temperature for a species is reached, and then declines rapidly. The decrease in growth may result from excessive respiration which reduces carbohydrates, from decreased rates of photosynthesis, from excessive transpiration which causes wilting, or from a combination of these.

**Atmospheric Conditions.** The climate of any given place is determined chiefly by its latitude, its elevation and meteorological forces that operate over wide areas and at high as well as low altitudes. But within the broad limits established by these major factors, local modifications of the "microclimate" are effected by topography and forest cover. These effects vary greatly with different combinations of slope, aspect, kind and size of trees, density of stand, and area covered.

**Wind Movement.** The first thing that one notices on entering a forest on a windy day is the relative calm. So great is the difference that one seems to have stepped suddenly into another world. The mechanical obstruction offered by the trees deflects upward a large part of the moving mass of air, and slows down the velocity of that which enters the forest. Dense stands with heavy foliage naturally have the greatest effect. Thus, a forest of deciduous broadleaf trees has more effect on wind velocity in summer than in winter.

The stronger the wind, the greater the reduction of actual velocity, but not of relative velocity.

This influence on wind movement is felt not only inside the forest itself, but for a considerable distance to the leeward. Shelter belts consisting of several rows of trees are often planted to take advantages of this fact, particularly in regions where lack of natural forest cover gives the wind an unbroken sweep over long distances.

**Temperature and Radiation.** Forests exercise a moderating influence on air temperature as well as on wind movement. Here again the extent of the influence is greatest in dense stands with heavy foliage, which have the maximum effect on incoming and outgoing radiation. Protection from solar radiation, which under extreme conditions may be in the forest only 1 percent of what it is in the open, reduces maximum temperatures throughout the year. In the forests of the United States the reduction in monthly maxima may range from about 3 °F in January to 8 °F in July.

Similarly the slowing down of outward radiation from the earth generally raises minimum temperatures throughout the year. The effect of a forest on monthly minima is less than on monthly maxima, both in summer and winter, but may amount to more than 6 °F in the United States.

## EXERCISES

**Exercise 1.** *Some nouns mostly denoting size are derived from adjectives, some others — from other parts of speech (describing some property or quality).*

*Form the nouns:*

1) *with suffix -th (don't forget to make changes in the root vowel), -t,*

2) *with suffix -(i)ty.*

*Translate the nouns into Russian.*

broad

dense

high

humid

wide

to qualify

to intensify  
long  
to weigh  
to grow

to quantify  
deep  
strong  
active

*Give examples of some other words with these suffixes which can be used to describe trees, their growth and development.*

**Exercise 2.** *What do we measure in:*

- metres (km, cm, mm, etc.),
- square metres (km<sup>2</sup>, cm<sup>2</sup>, mm<sup>2</sup>, etc.)
- cubic metres (km<sup>3</sup>, cm<sup>3</sup>, mm<sup>3</sup>, etc.),
- km/hr
- tree/ha
- hours (seconds, minutes, days, etc.),
- years
- degrees (°)
- gram (kg, tonne)

*(age, area, density, speed, length, power, temperature, time, volume, weight)*

**Exercise 3.** *Do you know what is measured in the following units of measurement? Can you compare them with the commonly used units? Consult reference books in case you are not sure.*

inch; pound; mile; stone; pound; gallon; yard; foot; acre; bushel; carat; grain.

**Exercise 4.** *Insert the right word or word combination from the list below. Translate the sentences into Russian.*

***climate; excessive respiration; forest cover; heavy foliage; intensity; leeward; light; monthly maxima; obstruction; photoperiod; wind velocity;***

1. The effects of ... on plant growth depend on its intensity, its quality or wavelength, and its duration and periodicity.

2. Seedlings grown in light of low ... differ not only in height and dry weight from those grown in full sun but also in root/shoot ratio and leaf and stem structure.

3. The ... affects both vegetative growth and flowering, and wavelength affects other processes in addition to photosynthesis.

4. The decrease in growth may result from ... which reduces carbohydrates, from decreased rates of photosynthesis, from excessive transpiration, or from a combination of these.

5. The ... of any given place is determined chiefly by its latitude, its elevation and meteorological forces that operate over wide areas.

6. Within the broad limits established by these factors, local modifications of the "microclimate" are effected by topography and ... .

7. A forest of deciduous broadleaf trees has more effect on ... in summer than in winter.

8. This influence on wind movement is felt not only inside the forest itself, but for a considerable distance to the ... .

9. The extent of the influence is greatest in dense stands with ... , which have the maximum effect on incoming and outgoing radiation.

10. In the forests of the United States the reduction in ... may range from about 3 °F in January to 8 °F in July.

*Exercise 5. Match the words from groups A and B as being similar in meaning (synonyms)*

A) actual; decide; decrease; effect; enter; increase; modify; obstruction; soil; speed; territory; vary; wide.

B) area; barrier; broad; change; come in; determine; differ; influence; ground; growth; real; reduction; velocity;

## **TEXT 2. WATER BALANCE**

*Read text 2 and 1) give definitions to the words in italics and 2) answer the following questions:*

- *Why is humidity higher in the forest?*
- *Is it true that forests increase precipitation? How do they do it?*
- *How much precipitation is lost in the forests? How is it lost?*
- *Why does soil without vegetative cover receive less precipitation?*
- *What does transpiration depend on?*

**Humidity.** In general, the air in the forest is somewhat moister than that in the open in view of the large amount of water transpired by trees. Relative humidity, which varies with temperature as well as with the absolute amount of water vapor in the air, may be as much as 11 per cent higher in the forest. As in the case of temperature, the influence of the forest is much more pronounced on maximum and minimum humidities than on mean humidities.

**Precipitation.** The argument that forests increase rainfall and other forms of precipitation is based chiefly on the fact that they transpire enormous quantities of water. Trees not only use more water in the process of growth than does any other form of vegetation, but may even add more moisture to the atmosphere than is evaporated from an equal area of open water. Many attempts have been made to measure the influence of forests on precipitation, with widely varying results, as there are a lot of complicating factors to obtain strictly comparable measurements.

**Moisture Content.** Forests tend to decrease the amount of moisture in the soil by intercepting precipitation, by retaining water in the forest floor, and by transpiration. They tend to increase the amount by reducing surface *runoff*, by increasing the *permeability* of the soil, and by decreasing evaporation from it.

Much precipitation in a forest never reaches the ground because it is first intercepted by and then evaporated from, the leaves, twigs, branches, and trunks. This loss may run as high as one tenth of an inch per shower. The amount of water that actually reaches the ground may vary from none in light showers to the great bulk of the total precipitation in heavy rains. Interception naturally increases with the density of the stand and of the foliage, and is much greater with deciduous trees in summer than in winter. When the precipitation reaches the ground it is first absorbed by the forest floor. Its absorptive and storage ability is much greater than that of mineral soil. The thicker and the more decomposed the litter and humus of the forest floor, the more water it will hold.

The amount of water that actually gets through to the mineral soil may vary from zero to 100 per cent, depending on the amount of precipitation and on the condition of the forest floor.

On land without vegetative cover, and particularly with heavy soils, the surface layer tends to become hard and impermeable, with marked reduction in the amount of precipitation that sinks into the main body of the soil. In the forest, on the other hand, the litter slows down surface runoff and thus gives more time for the water to be absorbed by the humus, which acts as a huge sponge. More important still, the humus prevents muddying of the underlying mineral soil, which remains porous, and thus absorbs and retains much more water than does exposed soil in the open.

Enormous quantities of water are removed from the soil by *transpiration*. A well-stocked forest of mature trees uses more water than does any other form of vegetation. It may require from 100 to 1,400 pounds of water for every pound of dry matter produced. Transpiration is far greater in summer than in winter, and during the growing season is somewhat greater with broadleaf deciduous trees than with conifers. Its tendency is obviously to reduce the moisture content of soil in the forest as compared to that in the open. On the other hand, the reduction of *evaporation* in the forest tends to maintain the moisture content at a higher level than in the open.

The net effect of these conflicting influences varies widely with the character of the topography, the soil, the climate, and the forest.

## Topical Vocabulary

- moist** — сырой; влажный, мокрый;  
**humidity** — влажность; влага, сырость;  
**humidities** — показатели влажности;  
**water vapor** — водяные пары;  
**mean** — средняя величина, среднее число;  
**precipitation** [prɪ,sɪpɪ'teɪʃn] — выпадение осадков; осадки;  
**transpire** — испаряться;  
**moisture content** — содержание влаги;  
**intercept** — останавливать, задерживать;  
**retain water** — удерживать; сохранять;  
**runoff** — сток (осадков);  
**surface runoff** — поверхностный сток;  
**permeability** [ˌpɛ:miə'biliti] — проницаемость; просачиваемость;  
**impermeable** — непроницаемый; герметический;  
**shower** [ˈʃaʊə] — ливень, ливневый дождь;  
**total** — общий, совокупный, суммарный;  
**total precipitation** — общее количество осадков;  
**density of the stand** — густота, плотность насаждений;  
**absorb** [əb'z(s) ɔ:b] — впитывать; абсорбировать; поглощать;  
**absorptive** — абсорбирующий, впитывающий, всасывающий; гигроскопический;  
**forest floor** — лесная подстилка; богатый органическими веществами слой лесной почвы;  
**litter** — подстилка; сор, мусор;  
**humus** ['hju:məs] — гумус, перегной;  
**vegetative cover** — растительный покров;  
**heavy soil** — тяжёлая почва;  
**sink** — просачиваться; впитываться; оседать;  
**porous** ['pɔ:rəs] — пористый;  
**exposed soil** — минерализованная (обнаженная) почва;  
**stock** — ствол, пень;  
**well-stocked forest** — достаточно густой лес;  
**dry matter** — сухое вещество;  
**net effect** — конечный результат;  
**conflicting** — противоречивый.

## EXERCISES

*Exercise 6. Match the words from groups A and B as being opposite in meaning (antonyms)*

A) absolute; maximum; increase; similar; comparable; permeable; heavy; reduction; mature; dry matter; conifer; complacating;

**B)** relative; minimum; decrease; varying; incomparable; impermeable; light; growth; immature; water; deciduous tree; simple.

**Exercise 7.** Suffix *-less* doesn't change the part of speech but it changes the meaning of the word (means 'without', 'having no...'). Translate the sentences containing adjectives with suffix *-less*.

1. The needles turn yellow and fall in the late autumn, leaving the trees *leafless* through the winter.

2. Common causes of wildfires include lightning, human *carelessness*, arson, volcano eruption, and pyroclastic cloud from active volcano.

3. What is sometimes called commercial clearcutting is used to maximize income *regardless* of silvicultural issues.

4. By autumn, the ground is littered red with the winged fruits, and the following spring, *countless* thousands of seedlings unfold their straplike cotyledons.

5. The greatest peril facing Britain's forests is fire, leaving behind a blackened *worthless* ruin in place of a green hillside of living trees, promising future wealth and beauty. One tree can make a million matches — one match can burn a million trees.

6. *Careless* logging had been performed in these regions by the people of antiquity.

7. It is always wise to treat — preferably by impregnation with an *odourless* wood preservative — any woodwork used in the lining of cold stores.

8. Forests are *priceless*, unique basic resource that Man can renew.

9. Some forest creatures are spectacular, others are hidden somewhere beneath the canopy of *countless* billions of leaves.

10. People used the seemingly *limitless* forest, cutting down millions of trees.

11. *Careless* exploitation of Russian forests could hold back Russia's economic renewal, permanently degrading the local environment and destabilizing the global climate.

12. The Russian forests seemed like an *endless* source of cheap raw material for the West-European forest industry.

**Exercise 8.** Translate the sentences with the adjectives and adverbs in different forms of comparison (positive, comparative and superlative). Pay attention to various comparative constructions.

1. *The stronger* the wind, *the greater* the reduction of actual velocity, but not of relative velocity.

2. Relative humidity, which varies with temperature as well as with the absolute amount of water vapor in the air, may be *as much as* 11 per cent higher in the forest.

3. Interception naturally increases with the density of the stand and of the foliage, and is much *greater* with deciduous trees in summer than in winter.

4. Transpiration is far *greater* in summer than in winter, and during the growing season is greater with broadleaf deciduous trees than with conifers.

5. A forest of deciduous trees has *more* effect on wind velocity in summer than in winter.

6. The effect of a forest on monthly minima is *less* than on monthly maxima, both in summer and winter, but may amount to *more* than 6 °F in the United States.

7. As in the case of temperature, the influence of the forest is much *more pronounced* on maximum and minimum humidities than on mean humidities.

8. In general, the air in the forest is somewhat *moister* than that in the open in view of the large amount of water transpired by trees.

9. Trees not only use *more* water in the process of growth than does any other form of vegetation, but may even add *more* moisture to the atmosphere than is evaporated from an equal area of open water.

10. When the precipitation reaches the ground it is first absorbed by the forest floor. Its absorptive and storage ability is much *greater* than that of mineral soil.

11. *The thicker and the more decomposed* the litter and humus of the forest floor, *the more* water it will hold.

12. A well-stocked forest of mature trees uses *more* water than does any other form of vegetation.

**Exercise 9.** Development and growth imply change. Positive trends are rendered with the help of special verbs and nouns of growth, like increase. Negative trends — decline; decrease; reduce (reduction). Translate the following sentences into Russian.

1. Growth usually *increases* with an increase in temperature until a critically high temperature for a species is reached, and then *declines* rapidly.

2. This tendency is obviously to *reduce* the moisture content of soil in the forest as compared to that in the open.

3. Protection from solar radiation, which under extreme conditions

may be in the forest only 1 percent of what it is in the open, *reduces* maximum temperatures throughout the year.

4. In the forests of the United States the *reduction* in monthly maxima may range from about 3 °F in January to 8 °F in July.

5. Similarly the *slowing down* of outward radiation from the earth generally *raises* minimum temperatures throughout the year.

6. The argument that forests *increase* rainfall and other forms of precipitation is based chiefly on the fact that they transpire enormous quantities of water.

7. Forests tend to *decrease* the amount of moisture in the soil by intercepting precipitation, by retaining water in the forest floor, and by transpiration.

8. They tend to increase the amount by *reducing* surface runoff, by increasing the permeability of the soil, and by *decreasing* evaporation from it.

9. Interception naturally *increases* with the density of the stand and of the foliage, and is much greater with deciduous trees in summer than in winter.

10. On land without vegetative cover, and particularly with heavy soils, the surface layer tends to become hard and impermeable, with marked *reduction* in the amount of precipitation that sinks into the main body of the soil.

11. In the forest, on the other hand, the litter *slows down* surface runoff and thus gives more time for the water to be absorbed by the humus, which acts as a huge sponge.

12. The tendency is obviously to *reduce* the moisture content of soil in the forest as compared to that in the open.

13. On the other hand, the *reduction* of evaporation in the forest tends to maintain the moisture content at a higher level than in the open.

14. The *decrease* in growth may result from excessive respiration which *reduces* carbohydrates, from *decreased* rates of photosynthesis, from excessive transpiration which causes wilting, or from a combination of these.

**Exercise 10.** Translate sentences with the verb to take in different meanings. This verb is often used as a component of set expressions.

1. Cone maturation *takes* one year, with pollination in autumn and the seeds maturing the same time a year later.

2. It *takes* about 40 litres of Sugar Maple sap to make a litre of syrup.

3. Cranberries are harvested in the autumn when the fruit *takes on* its distinctive deep red color.

4. Douglas-firs typically *take* five to seven years before they are mature enough to sell as Christmas trees.

5. From the farm, cranberries *are taken* to receiving stations where they are cleaned, sorted, and stored prior to packaging or processing.

6. Many of the newly passed regulations do not *take into account* the rich diversity of Russia.

7. But it is not only the forest environment with its flora and fauna which *is taken into consideration*.

8. The cultural considerations usually *take* the form of joint programs with various local authorities.

9. Sports such as orienteering, cross-country skiing, as well as berry-and-mushroom picking are other popular activities which *take place* in the forests.

10. French models of wildfires dictate that a fire's front line will *take on* the characteristic shape of a pear.

11. Vegetation with the potential for rapid growth can quickly *take advantage* of the lack of competition.

**Exercise 11.** *Translate the text into English, sentence by sentence. Then speak about the relations of the forest organisms and their growth conditions of the forest and comment on the suggested approach.*

Лес — природное единство, составной частью которого является и среда. Экология леса рассматривает роль среды в жизни леса. Все многообразие экологических факторов, определяющих условия произрастания леса, его жизни и развития, можно свести к нескольким группам. I. Климатические факторы, включая радиационный, тепловой, водный режимы, состав и движение воздуха и т. д. II. Эдафические и орографические факторы (почва, грунт, особенности рельефа, крутизна и экспозиция склонов). III. Биотические факторы (животные, растения, микроорганизмы). IV. Антропогенные факторы. V. Исторические факторы. Экологические факторы оказывают влияние как на лес в целом, так и на его отдельные компоненты.

В природе существует комплексное влияние экологических факторов, проявляемое в различных сочетаниях. Изменение одного фактора влечет за собой изменение другого. Например, изменение высоты над уровнем моря, экспозиции, крутизны склона вызывает изменения климата, почвы и некоторых других факторов. Изменение условий освещения в лесу сопровождается изменением и теплового режима. Одно и то же количество осадков выпадает в северных таежных районах и в некоторых южных степных районах. Однако в пер-

вом случае оно выпадает в условиях преобладания низких температур, повышенной влажности воздуха и почвы, при пониженном испарении влаги, во втором — при обратном сочетании. Отсюда — разные условия и возможности существования леса при одном и том же количестве осадков. В одном случае лесоводу приходится бороться с избытком влаги, с угрозой заболачивания, в другом — изыскивать средства повышения влаги, бороться с засоленностью почв и т. д.

### ***Questions and tasks***

1. What factors contribute to the success of the physiological processes of trees and plants?
2. How do plants differ if they grow in the environments with different photoperiods?
3. What does the increase in temperature affect?
4. How does the growth depend on the latitude and elevation? How can you characterize the forest in your native place in relation with that?
5. What is the role of shelterbelts? Are forests 'shelterbelts'? In what sense?
6. How do temperatures vary in the forest and non-forest environments?
7. How do forests affect the precipitation levels?
8. How does the moisture content vary in the forest and non-forest environments?
9. How do the forest soils manage to retain water?
10. Describe the environmental conditions of the tree growth in our republic.

***For more information about growth conditions study text Community Interactions from the Supplement.***

### ***Comment on the following***

*Climate factors.* Climate factors that affect trees include temperature, precipitation, sunlight, and wind. To differentiate among these factors, scientists collect information from "limiting stands". An example of a limiting stand is the upper elevation treeline: here, trees are expected to be more affected by temperature variation (which is "limited") than precipitation variation (which is in excess). Conversely, lower elevation treelines are expected to be more affected by precipitation changes than temperature variation. This is not a perfect work-around as multiple factors still impact trees even at the "limiting stand", but it helps. In theory, collection of samples from nearby limiting stands of different types (e. g. upper and lower treelines on the same mountain) should allow mathematical solution for multiple climate factors. However, this method is rarely used.

*Non-climate factors.* Non-climate factors include soil, tree age, fire, tree-to-tree competition, genetic differences, logging or other human dis-

turbance, herbivore impact (particularly sheep grazing), pest outbreaks, disease, and CO<sub>2</sub> concentration. For factors which vary randomly over space (tree to tree or stand to stand), the best solution is to collect sufficient data (more samples) to compensate for confounding noise. Tree age is corrected for with various statistical methods: either fitting spline curves to the overall tree record or using similar aged trees for comparison over different periods. Careful examination and site selection helps to limit some confounding effects, for example picking sites undisturbed by modern man.

## UNIT 8. DISTURBANCES AND THREATS

*Forests are facing a range of threats. They can be damaged by fires, airborne pollution, storms, invasive species, pests, diseases, and insects.*

*About 1 % of forests is consumed by fire each year, causing casualties, economic damage, loss of biodiversity and release of carbon to the atmosphere. Every fire is a tragedy for the wildlife killed in the blaze that destroys its habitat and a major commercial disaster for Man.*

*Globally, 3 % of forest area is reported to be affected by insects and diseases. Other forest disturbances include climatic factors such as wind, snow, ice, floods, tropical storms and drought, or impacts of animals such as deer and rodents.*

*Before reading Text 1 study the topical vocabulary and then do some exercises.*

### Topical Vocabulary

**disturbance** [di'stɜ:bəns] — нарушение; вторжение в естественный ход вещей, нарушение порядка;

**disrupt** — разрушать; разрывать; нарушать;

**insect outbreak** — вспышка; внезапное появление насекомых;

**anthropogenic** [æn,θrəpəu'dʒenik] **disturbance** — нарушение, причиняемое человеком;

**forest clearing** — участок леса, расчищенный под пашню, рощище;

**introduction** — интродукция, введение в состав животного или растительного мира;

**upset the balance** — нарушить равновесие;

**restore balance** — восстановить равновесие;

**quarantine** ['kwɔrəntain / 'kwɔrənti:n] **law** — закон о карантине;

**safeguard** — гарантия; защита; охрана || гарантировать; защищать; охранять;

**virulent** ['virulənt] **strain** — вирулентный (опасный) штамм;

**remedy** — средство; лекарство, лечебное средство;

**oxidation** — окисление;

**alteration** — изменение;

**strength** — прочность; интенсивность, мощь;

**suffer fatigue** [fə'ti:g] — страдать от усталости; испытывать усталость;

**repeated stressing** — многократное, частое напряжение (нагрузка);

**derive (from)** — получать; происходить;

**decompose** — гнить, портиться, разлагаться;

**clutter up** — загромождать;

**decay** — гниение, разложение, разрушение;

**dead remains** — мертвые останки;

**saprophyte** ['sæprəfəit] — сапрофиты (микроорганизмы, питающиеся отмершими тканями);

**heart-rot** — ядровая гниль;

**butt-rot** — напенная гниль; комлевая гниль;

**gale** — шторм; буря; ветер от 7 до 10 баллов (с 51 до 100 километров в час);

**preservative** [pri'zɜ:vətiv] — предохраняющее средство; профилактическое средство; консервант.

## **TEXT 1. A SYSTEM IN BALANCE AND THREATS**

No communities of plants and animals are stable. Many factors are constantly disrupting these ecosystems — weather, predation, food supply, and, above all, humans. Conditions are favorable to different species at different times. Ecosystems are constantly changing, and after every change, it is impossible to re-create the ecosystem that existed before.

In ecology, a disturbance is a temporary change in average environmental conditions that causes a pronounced change in an ecosystem. Outside disturbance forces often act quickly and with great effect, sometimes resulting in the removal of large amounts of biomass. Ecological disturbances include fires, flooding, windstorm, insect outbreaks, as well as anthropogenic disturbances such as forest clearing and the introduction of exotic species. Disturbances can have profound immediate effects on ecosystems and can greatly alter the natural community.

Every old-established forest provides a home for vast numbers of animals, birds and insects which live in a delicate state of balance with each other and with their environment. Seed-eaters might, in theory, destroy the forest by devouring all the nuts destined to produce seedling trees, but in practice this rarely happens. Predatory owls, hawks, foxes and pine martens limit the numbers of seed-eating birds, mice and squirrels and allow sufficient seeds to survive to ensure the replacement of old and diseased trees. If the predators become too successful and destroy their prey, they in turn will decline in numbers through shortage of food.

The wildlife population is markedly different in deciduous and coniferous woodlands. Broad-leaf forests support a great variety of life. More than 200 insect species have been found on oak trees alone, including leaf-roller moths, gall-makers, predators and vegetarians. Insect-eating birds like thrushes, blackbirds and warblers abound, sharing their habitat with seed-eating wood-pigeons, pheasant, dormice and squirrels. Coniferous forests have a more restricted fauna comprising species better equipped to deal with their resinous bark and foliage and their tough leaves and seeds.

This delicate balance may, however, be upset by the introduction of a species into a new country where it has no natural enemy. Today, quarantine laws attempt to safeguard each country's woodlands, but without complete success. The bark beetles that carried a virulent strain of Dutch elm disease to Britain in 1970 made the crossing from Canada in consignments of unsawn rock elm used in the boat-building industry. Maps plotting the spread of the disease focused on ports at which the timber was landed.

Poisons are the simplest large-scale means of attack, but these need

repeated application and may also harm innocent species. Biological control offers a better remedy. American Monterey pines, planted in Australia, suffered great damage from *Sirex* wood wasps accidentally imported from Europe. The balance was restored by the introduction of the European ichneumon fly — a natural, and destructive, parasite of the wood wasp.

Timber, naturally durable material, provided by the forest, does not change or lose its nature, as result of age. So long as timber is protected from moisture and insect attack it can remain unchanged for centuries. Many materials become brittle and crumble after a certain number of years due to oxidation and other slow chemical alterations in their composition, but wood retains its strength indefinitely. Nor does it suffer fatigue, as do metals, after repeated stressing.

Under damp conditions, however, and when in contact with the soil all natural materials derived from plants and animals decompose, more or less slowly. It is in fact fortunate that they do so as otherwise forests would become cluttered up with fallen trees, branches and leaves. Decay does not happen as a result of wet conditions alone but is brought about by the fungi and, though to a lesser extent, by bacteria.

Fungi are forms of plant life that do not possess the chlorophyll which enables greens plants to make organic materials from the carbon dioxide in the air. Consequently they must obtain their nutrients from living on other plants, on animals, or on their dead remains. The fungi that attack living plants are called “parasites” and those that grow only on dead remains are known as “saprophytes”. Some fungi grow in the sapwood and block the vessels that carry the sap to the leaves thus causing the tree to die of desiccation. Others grow deeper in the trunk causing the disease known as “heart-rot”, while “butt-rot” is caused by a fungus entering the tree at its base and may eventually result in the tree-falling in a gale. It is however the saprophytes with which the timber user is most concerned. These fungi live on fallen logs and branches and attack timber in storage and also wooden structures in service if these are not protected by preservative or paint.

## EXERCISES

*Exercise 1. Write the following word groups as one word, hyphenated word or two separate words. Check spelling of the following separate and compound words in the text under study. Comment on the examples with two possible choices.*

black bird; boat building; butt rot; carbon dioxide; chloro phyll; eco system; food supply; gall maker; heart rot; large scale; leaf roller; old established; pine marten; safe guard; sap wood; seed eaters; seedling trees; tree falling; wind storm; wood land; wood pigeon; wood wasp.

**Exercise 2.** *Translate the word combinations with attributive Past or Present Participles, taken from the text.*

*Find those word groups in the suggested sentences in the text under study and check your translation in a wider context.*

boat-building industry; diseased trees; fallen logs; fallen trees, branches and leaves; insect-eating birds; living plants; old-established forest; pronounced change; repeated application; repeated stressing; seed-eating birds, seed-eating wood-pigeons; unsawn rock elm; wooden structures.

**Exercise 3.** *Choose the right word to be used in the following sentences:*

1. Ecosystems are constantly changing, and after every change, it is *possible / impossible* to re-create the ecosystem that existed before. 2. In ecology, a disturbance is a *temporary / permanent* change in average environmental conditions that causes a pronounced change in an ecosystem. 3. Every *newly established / old-established* forest provides a home for vast numbers of animals, birds and insects. 4. Seed-eaters might, in theory, destroy the forest by devouring all the nuts, but in practice this *often / rarely* happens. 5. *Coniferous / deciduous* forests have a more restricted fauna comprising species better equipped to deal with their resinous bark. 6. The *delicate / stable* balance may be upset by the introduction of a species into a new country where it has no natural enemy. 7. American Monterey pines, planted in Australia, suffered great damage from *Sirex* wood wasps *intentionally / accidentally* imported from Europe. 8. Timber, naturally *durable / fragile* material, provided by the forest, does not change or lose its nature, as result of age. 9. Under damp conditions and when in contact with the soil all *artificial / natural* materials decompose more or less slowly. 10. It is however the *parasites / saprophytes* with which the timber user is most concerned. These fungi live on fallen logs and branches and attack timber in storage and also wooden structures in service if these are not protected by preservative or paint.

**Exercise 4.** *Match the word (numbers 1—12) with its definition or explanation (letters A—L).*

1. disturbance	A. a bird or other animal that feeds on tree or other plant seeds
2. quarantine law	B. the fungi that grow only on dead remains
3. remedy	C. substance added to food or material to keep it from spoiling
4. preservative	D. the disease when the fungi grow deep in the heartwood of the tree trunk
5. parasites	E. the disease of the wood with a fungus entering the tree at its base
6. saprophyte	F. rotting, decomposition, deterioration of matter
7. heart-rot	G. an insect whose eggs cause a gall (tumour) on plant tissue or tree stem
8. butt-rot	H. a temporary change in average environmental conditions that causes a pronounced change in an ecosystem
9. seed-eater	I. forms of plant life that do not possess the chlorophyll and live on other plants, on animals, or on their dead remains
10. gall-maker	J. rules for isolation or restriction on travel or transportation imposed to keep diseases, insect pests, etc. from spreading
11. decay	K. the fungi that attack living plants
12. fungi	L. something that corrects or counteracts the evil or wrong

## TEXT 2. FOREST FIRES

Read text 2 and 1) give definitions to the words in italics and 2) find the answers to the following questions:

- *Are forest fires only destructive?*
- *What causes forest fires?*
- *How do uncontrolled forest fires differ?*
- *How do forest fires affect wildlife? Give positive and negative examples.*
- *What is the key factor in fire fighting? How is the monitoring done?*

*Fire* is one of natural disturbances. Periodic fires caused by lightning have shaped and altered forests for millions of years. A *wildfire*, also known as a wildland fire, forest fire, brush fire, vegetation fire, grass fire, peat fire, or hill fire, is an uncontrolled fire often occurring in wildland areas, but which can also consume houses or agricultural resources. Common causes include lightning, human carelessness, arson, volcano eruption, and pyroclastic cloud from active volcano.

Wildfires are common in many places around the world. Fires are particularly prevalent in summer when fallen branches, leaves, and other material can dry out and become highly flammable. It is also suggested that global warming has been increasing the intensity and frequency of droughts in many areas, creating more intense and frequent wildfires. Wildfires tend to be most common and severe during years of drought and occur on days of strong winds.

Forest fires move in varying and often unpredictable ways. *Ground fires* creep through the duff, and fires may smolder below the surface for long periods of time. *Surface fires* are another form of forest fire, and move along at up to 1.3 meters in height. *Crown fires* occur higher in the trees (in the upper branches known as the "crown" of a tree), and can be of several different varieties. These include "*dependent crown fires*", which use convection to pre-heat the crown, and most dangerous of all, independent crown fires which leap from tree to tree. Often the battle is won only when heavy rain falls or the fire reaches a natural obstacle such as a river or mountain range.

Recently there have been made serious efforts at *fire suppression*. The relationships between forests, fire, insects, disease, and climate are just beginning to be understood. The huge fires in Yellowstone National Park in 1988 caused many people to wonder whether a more natural approach to fire might be better than complete suppression. There is no doubt that fire destroys trees, which humans consider a waste. But the hidden benefits of natural fires might be greater than were previously thought. Most forest ecologists agree that controlled fires are essential to restoring forest health and biodiversity.

Fires affect forests in various ways. Most animals can successfully evade fires, and many thrive afterwards on abundant new growth on the forest floor. New conditions support a wider variety of plants, often rich in nutrients compared to pre-disturbance vegetation. The plants in turn support a variety of wildlife, temporarily increasing biological diversity in the forest.

In general a disturbance changes forests significantly. Afterwards, the forest floor is often littered with dead material. This decaying matter and abundant sunlight promote an abundance of new growth. In the case of forest fires a portion of the nutrients previously held in plant biomass is returned quickly to the soil as biomass burns. Many plants and animals benefit from the conditions created by disturbances. Habitats are most often destroyed, as well as the food source which means that even if the animals escape the flames, they have to find new territory. Other animals which live in the surrounding forest come to feed on the new seedlings and young plants growing in a recently burned area.

Fast and effective detection is a key factor in *wildfire fighting*. Recently, there have been significant efforts to create automatic solutions for early wildfire detection. An integrated approach is best, based on a practical combination of different detection systems depending on wildfire risk and the size of the area.

A careful GIS data analysis will suggest how to divide the area in sub-categories based on different risk level and human presence (which imply a higher wildfire risk and a need for earlier intervention). A small high risk area (thick vegetation, strong human presence or close to critical urban area) could be monitored using a local sensor network. Although it is a relatively new approach, it seems to be the only solution able to penetrate thick vegetation and guarantee early detection without false alarms, as well as detecting crawling wildfires. The main limitation of this technology is its high cost which at this time limit its application to small areas.

A larger medium risk area could be monitored by infrared scanning towers. Satellite and aero monitoring can provide a wider view and may be sufficient to monitor very large and low risk areas.

### Topical Vocabulary

**lightning** ['laɪtnɪŋ] — молния;

**wildfire** ['waɪldfaɪə] — лесной пожар;

**peat fire** — подземный (торфяной) пожар;

**(un)controlled fire** — (не)управляемый пожар;

**human carelessness** — небрежность, халатность человека;

**arson** — поджог;

**volcano** [vɒl'keɪnə] **eruption** — извержение вулкана;

**flammable** ['flæməbl] (= inflammable) — легко воспламеняющийся, огнеопасный; горючий;

**ground fires** — низовой пожар;

**creep** — ползти; стлаться;

**duff** — грубый (сырой) гумус лесной подстилки;

**smolder** ['smɔʊldə] (= smoulder) — тлеть;

**surface fire** — наземный пожар;

**crown fire** — верховой пожар;

**fire suppression** — подавление пожара;

**evade fire** — избегать; уклоняться от пожара;

**detection** — обнаружение, выявление;

**wildfire fighting** — битва, борьба;

**GIS data analysis** — анализ данных ГИС;

**crawl** — ползать, ползти;

**disrupt** — разрушать; разрывать (узы); нарушать;

**infrared scanning tower** — вышка инфракрасного сканирования;

**satellite** ['sætəlaɪt] **monitoring** — спутниковый мониторинг;

**aero monitoring** — аэромониторинг.

## EXERCISES

*Exercise 5. Provide verbal and nominal word-groups. Translate the resulting word combinations into Russian*

A) Give all possible verbs which combine with noun **fire**

Model: to cause fire; to extinguish fire ...

B) Give all possible attributes to describe **fires**.

Model: forest fire; crawling fire ...

*Exercise 6. Make sure you know the meaning of prefixes **sub-**, **over-**, **pre-**, **inter-**, **under-**, **super-** and some others. Translate the suggested sentences into Russian.*

1. The genus is *subdivided* by its morphology into a number of sections and *subsections*. 2. A careful GIS data analysis will suggest how to divide the area in *sub-categories* based on different risk level and human presence. 3. Everything from the direct and obvious effects of *over-cutting* to the more subtle effects of climate change are threatening to destroy the last of the remaining natural forests. 4. Much of the human-caused forest destruction stems from *overpopulation*. 5. Dependent crown fires use convection to *pre-heat* the crown. 6. The futures of people and forests are still *interconnected*. 7. New conditions support a wider variety of plants, often rich in nutrients compared to *pre-disturbance* vegetation. 8. The controlled burn clears much of the *undergrowth* through forest and woodland areas. 9. A new material called "gel" (made from *super-absorbent* polymer) is used in California, USA for fighting forest fire. 10. All wild land firefighters carry a fire shelter, but it provides limited protection from radiant and convective heat, as well as *superheated* air. 11. Succession often leads to conditions that will once again *predispose* an ecosystem to disturbance. 12. Forest fires move in varying and often unpredictable ways. Ground fires creep through the duff, and fires may smolder below the surface for long periods of time. 13. Constant vigilance by fire wardens using watch-towers and patrolling aircraft is essential if *outbreaks* are to be *discovered* promptly and tackled while still small. 14. Ecosystems are constantly changing, and after every change, it is *impossible* to *re-create* the ecosystem that existed before.

*Exercise 7. Translate the sentences with pairs of suffixes which either form an adjective or a noun (important — importance)*

1. It is suggested that global warming has been increasing the *intensity* and *frequency* of droughts in many areas, creating more *intense* and *frequent* wildfires. 2. Douglas-firs, having *dense* crowns, severely limit the amount of sunlight reaching the forest floor. 3. In rocky, mountainous terrain areas of high and low tree *density* alternate depending on the soil and climatic variables. 4. Spruce and fir forests have a greater *biodiversity* than most other forests because of their multiple layers of canopy and *dense* understories. 5. The heterogeneous, *diverse* stand structure leads to an assortment of fire types which usually leave patches of unburned trees. 6. Evaporation is low in taiga forests for most of the year, precipitation exceeds evaporation and is sufficient for the *dense* vegetation growth. 7. This decaying matter and *abundant* sunlight promote an *abundance* of new growth. 8. Biological *diversity* is *dependent* on natural *disturbance*. 9. Many shade-*intolerant* plant species rely on disturbances for successful establishment and to limit competition. 10. Fire, in this case, is *important* not only to the species directly affected but also to many other organisms whose survival depends on those key plants. 11. Russia's vast forests are a natural resource of global importance, both ecologically and economically. 12. The late wood of all species is *denser* than that formed early in the season, hence the greater the proportion of late wood the greater the *density* and strength.

**Exercise 8.** Translate the pairs of sentences with the words in italics in different functions, as a noun or verb (conversion).

1. Forests can be *damaged* by fire, agricultural and urban expansion, and other disturbances. // American Monterey pines, planted in Australia, suffered great *damage* from Sirex wood wasps accidentally imported from Europe.

2. So long as timber is protected from moisture and insect *attack* it can remain unchanged for centuries. // The fungi live on fallen logs and branches and *attack* timber in storage and also wooden structures in service if these are not protected by preservative or paint.

3. Periodic fires *caused* by lightning have shaped and altered forests for millions of years. // Common *causes* include lightning, human carelessness, arson, volcano eruption, and pyroclastic cloud from active volcano.

4. The hidden *benefits* of natural fires might be greater than were previously thought. // Many plants and animals *benefit* from the conditions created by disturbances.

5. Spruce and fir forests are greatly *impacted* by slight fluctuations in

climate. // Other forest disturbances include climatic factors such as wind, snow, ice, floods, tropical storms and drought, or *impacts* of animals such as deer and rodents.

6. The forest floor is often *littered* with dead material. // Fuel is readily available in the form of standing timber, bark, branch-wood, fallen branches and leaf-*litter* on the forest floor.

7. Disturbance *forces* often act quickly and with great effect, sometimes resulting in the removal of large amounts of biomass. // The transition to a market economy *has forced* forest producers to be much more efficient economically.

8. Mounds (ХОЛМЫ) are *caused* by decaying fallen trees, and pits (ЯМЫ) by the roots pulled out of the ground when trees fall due to natural *causes*.

**Exercise 9.** Translate the sentences with the *for + infinitive* construction in italics in different functions. Start with stating the function of the *for-phrase* and translate the sentence accordingly, using subordinate clauses in most cases.

1. The conventional practice has been *for forests to be measured* in terms of economic or physical parameters, e. g. area and increment rate. 2. Aircraft "bomb" fiercely burning hot-spots with retardant chemicals, which cling to the foliage and branches — slowing the rate of burning long enough *for teams of fire-fighters to arrive* and tackle the blaze on the ground. 3. Trees are cleared not only for wood and other products, but so that the land they once grew on can be turned into pastures *for cattle and agricultural fields to feed* growing numbers of people. 4. Small, frequent fires in certain areas make it easier for pines to survive where oaks would otherwise grow. 5. It is typical *for large and valuable specimens from the overstory to be removed* thus creating a gap in the canopy simulating the death of an old-growth tree. 6. In a situation where a vast majority of trees are valuable to harvest, it is easier *for loggers* and economically sound *to remove* trees in an open clearcut, as opposed to moving equipment around standing trees. 7. It is quite common *for firefighters to simply observe a fire burn* towards control lines through forest rather than attempt to put it out more quickly. 8. Virtually every part of Earth's surface has at some time been either too dry or too cold *for plants to survive*. 9. The time it takes *for fir and spruce to regenerate* varies greatly, but it takes a number of years if no roots or snags remain. 10. It may be much more difficult *for fir and spruce to be established* on a slope, because erosion is greatly increased by fire, making it harder *for the seeds to take root*. 11. Individual

plant species vary their resistance to fire injury in predictable ways, and these resistances make it possible *for the biodiversity to greatly increase* during recolonization after a fire.

**Exercise 10.** Translate the sentences with the Subjective-with-the-Infinitive construction. Start the translation with the predicate.

1. Globally, 3 % of forest area **is reported to be affected** by insects and diseases. 2. Although sensor monitoring is a relatively new approach, *it seems to be* the only solution able to penetrate thick vegetation and guarantee early detection without false alarms, as well as detecting crawling wildfires. 3. Cedar wood and cedar oil **is known to be** a natural repellent to moths, hence chests were made of cedar when available. 4. Recent systematic studies **appear to confirm** the high tendency of Quercus species (oak) to hybridize as a result of a combination of factors. 5. Firs, very popular Christmas trees, **are generally considered to be** the best trees for this purpose, with aromatic foliage that does not shed many needles on drying out. 6. Birch sap is consumed as a refreshing beverage, and **is believed to have** tonic qualities. 7. The cross that Christ was crucified on **is sometimes said to have been** aspen wood. 8. Overall, the world's forest ecosystems **are estimated to store** more carbon than the entire atmosphere. 9. The most common tree species **appear to have remained** the same in most countries over the last 15 years. 10. Trees **have also been found to play** an important role in producing oxygen and reducing carbon dioxide in the atmosphere, as well as moderating ground temperatures.

**Exercise 11.** Translate the text about fires into English, sentence by sentence. Then speak about the damage forest fires make and their benefits and comment on the suggested approach.

Огонь играет значительную роль в жизни леса как экологический фактор. Огонь — разрушитель и созидатель леса. Лесные пожары изменяют окружающую среду. Они происходят преимущественно по вине человека.

Во многих частях нашей планеты формирование природных лесов связано с влиянием пожаров. Уничтожая моховой и травяной покровы, толстую подстилку и гумус, огонь создает благоприятные условия для возобновления леса — прорастания семян, появления и формирования самосева; особенно сосны, лиственницы. В то же время уничтожая молодняк, пожар нередко способствует появлению малценных пород и приводит к ухудшению условий среды для возобновления хозяйственных пород.

Лесные пожары обуславливают процессы смены состава лесов, влияют на состав древостоев, на их возрастную структуру, видоизменяют типы леса. Пожары существенно изменяют численность и состав фауны — зверей, птиц, насекомых.

Они обуславливают жизнедеятельность почвенных микроорганизмов, стимулируя или подавляя ее. Огонь влияет на санитарное состояние леса. Нанося травмы деревьям, ослабляя их, он способствует образованию ветровала и бурелома, нападению и размножению вредных насекомых и некоторым заболеваниям деревьев. С другой стороны огонь уничтожает источники инфекции, носителей ряда грибных и других заболеваний, а также и вредных насекомых. Вызывая отмирание в первую очередь отставших в росте деревьев и ускоряя этим процесс изреживания в лесу, огонь может способствовать более интенсивному приросту сохранившихся крупномерных деревьев. Воздействуя на все компоненты леса, пожары вносят коренные изменения в лесные экосистемы.

Лесоводы используют положительную роль огня в практике лесного хозяйства (при очистке лесосек, при подготовке почвы для возобновления леса и др.). Огонь — величайшее благо, когда он находится в умелых руках, но он становится страшнейшим врагом, вырвавшись из повиновения. Лесные пожары — грозное глобальное явление. На земном шаре они ежегодно охватывают площадь до 10—15 млн га и выше, а в отдельные годы эта цифра более чем удваивается. Проблема борьбы с лесными пожарами — одна из важнейших в лесном хозяйстве.

### *Questions and tasks*

1. Why aren't communities of plants stable?
2. What is disturbance? What kind of disturbances do you know? How are they caused?
3. What living organisms create the stability and balance?
4. Which forests are characterized by a greater variety of species? Explain why.
5. How can the introduction of a new species affect the forest environment? What is the best remedy? Is poison always a good solution?
6. What is timber affected by? What makes timber different from other materials?
7. What is fungus? What types of fungi are there? In what do they differ?
8. Is there a remedy against fungi?
9. What is fire caused by? Which cause is the most common?
10. How are different types of fires distinguished?
11. What are the different attitudes to fire suppression?
12. How does fire affect animals? How can animals and plants benefit from fire?
13. What methods of fire detection do you know? Which would you prefer? Why?

*For more information about threats and disturbances study texts Threats and Physiology of Wood Destroying Fungi from the Supplement.*

***Project “Threats and Disturbances”***

Divide into teams of 4 or 5 students. Choose any aspect of the problem of the forest disturbances. Jointly arrange a presentation of the materials collected in form of PowerPoint demonstration. Try to illustrate your points of presentation.

## SUPPLEMENTARY TEXTS

### *THE TREE*

A tree is a woody plant with a single stem more or less branched and taking on what is commonly known as the tree form.

The most evident parts of a tree are roots, stem, or trunk, branches, buds, leaves, flowers, fruit, and seed.

The stem, branches, and roots are made up of inner bark, outer bark, sapwood, and heartwood. The outer bark, sapwood and heart-wood are made up of concentric circles termed annual rings. During each period of growth two new rings are formed — one on the outside of the sapwood and another on the inside of the outer bark, and as we seldom have more than one season of growth each year but one ring is formed on the wood in a year; so that by counting the rings of wood in the stem we can determine very closely the age of trees. In very rare cases we have two periods of growth and two rings of wood in one year, as in 1894, when the draught of midsummer ripened up the wood of the trees by the first of August and the rains of autumn started a new growth and caused some trees and shrubs to flower in October, but such occurrences are very uncommon and the extra rings formed are readily detected by their being smaller than adjoining rings and less distinctly defined. The age of trees could be told by the rings of the outer bark nearly as well as by those of the wood were it not for the fact that the outer layers of bark fall off as the tree grows older.

Wood once hardened never changes, and the branches are practically always at the same height from the ground. They might be raised a little by the thickening of the main roots. In some experiments the bark of rapidly growing branches was peeled back in the spring for a few inches, the wood covered with tin-foil and the bark replaced.

At the end of the season there was found a ring of wood outside of the tin-foil, thus showing where the annual growth of the tree was made.

*The bark* covers the whole exterior surface of the trunk, branches, and roots and serves as a protection. It is made up of two parts, the outer or corky layer which is dead bark and the inner or live bark. These vary much in appearance and thickness on different kinds of trees. For instance, on the White Pine it is very dark brown and often an inch or more in thickness and quite brittle.

*The sapwood* is the portion of the wood next to the bark. It varies much in thickness in different species and in trees of the same species, the most rapidly grown trees contain the largest amount. It is the most active

portion of the wood in the growing tree, and contains considerable plant-food and more water than the heartwood.

*The heartwood* is the wood in the centre of the trunk and is generally distinguished from the sapwood. It is also harder and more valuable for fuel, shrinks less in drying, and is more durable in contact with the soil than the sapwood. There is very little movement of the sap in the heartwood.

*The roots* furnish water and nourishment that the plant receives from the soil, but only the young roots have the power of taking up the soil water; the elder roots are most useful in holding the tree in place. It is common to classify roots into surface roots and tap-roots, depending on the shape and the depth they go in the ground. Some trees have nearly all surface roots, as the Birch and Spruce, others have nearly all tap-roots, which often go to a great depth on dry land, as these of the Bur Oak, Black Walnut, and Butternut. Most of our trees have a combination of the two kinds, as the Maple, Hackberry, and Ash. Seeding trees of most kinds have a decided tap-root when young, but in many species it ceases to grow downward when a few years old. This, is true of the Red and Scarlet Oaks which often have a tap-root extending four feet in depth before the tree has attained a corresponding height above ground, but after about five large lateral roots develop and the growth of the tap-root nearly ceases.

Root-growth is relatively less to the extent of ground occupied in moist and fertile soil than in a dry and poor soil, but the roots are proportionately more branched. In wet seasons the root development is less for a given plant than in dry seasons, because the roots may get their needed food and water from small area. Nursery trees grown on moist rich land have a more compact root system than those grown on poor land.

*Buds* are placed regularly on the young branches and are said to be either alternative or opposite. When they occur on the stump or on roots they are not arranged in any regular order. There are two kinds of buds—flower-buds, which develop into flowers and fruit; and leaf-buds, which develop into leaves and branches. These can generally be distinguished from each other by their shape and size and by cutting through them and noting their construction. Flower-buds are generally more liable to injury from climatic changes than leaf-buds.

*The leaves* of our trees vary much in size and shape. They are simple when composed of but one piece, as the leaves of the Oak Maple, and Birch, and compound when composed of more than one piece, as the leaves of the Locust, Ash, and Black Walnut. Leaves are made up of a framework filled in with cellular tissue and covered with a thin skin. This

skin has very many small pores called stomata, through which the plant takes in carbon dioxide "from the air and gives off oxygen and water.

All our trees shed at least a part of their leaves each year. All the broad-leaved trees and the Tamarack shed their entire foliage yearly, while our so-called evergreen trees lose a part of their leaves each year. The length of time leaves remain on this latter class of trees varies from two or three years, in the case of White Pine growing in very severe locations, to perhaps eight years, in the case of Red Cedar favorably located. The time that leaves remain on the branches of evergreens depends to some extent on the location and age of the individual tree.

*Flowers* are parts of the plant especially modified for the reproduction of the plant by seed. Both sexual organs may be located together in the same flower, as those of the Basswood, Mountain Ash, and Cherry; or in separate flowers on the same plant as those of the Birch, Oak, and Black Walnut; or they may be separate or entirely different plants, as in the Willow, Poplar, Box-elder, and Ash.

*The Fruit*, botanically defined, is the seed-containing area, derived from a single flower. As used in nursery practice the term is generally applied to seeds having a fleshy covering or an adjoining fleshy part.

*The Seed*, botanically defined, is the ripened ovule, but as the term is used in nursery practice it often includes the ovary and other parts that may be attached to it. What is commonly called the seed of Maple, Ash, Elm, Walnut, and Basswood is really the fruit.

*Distribution of Seeds.* The seeds of plants are distributed in various ways, the most common of which are (1) by means of floats or wings which buoy the seeds up in the air or water, and (2) by animals. The seeds of Ash, Box-elder, Elm, Maple, Pine, and Spruce have wings which allow them to be blown great distances by the wind, especially when they break loose from the upper branches of high trees during severe winds. The seeds of the Honey Locust are not shed from the pod until after it has fallen, and as the pod is ten inches or more long and spirally twisted it may be blown long distances on level ground or snow crust. The seeds of the poplars and willows have a cottony float attachment which buoys them up in the air. In the case of the Basswood, the parachute-like bract attached to the seed-cluster aids in spreading the seeds by carrying them through the air along the snow crust. The seeds of Mountain Ash, Wild Black Cherry, Hawthorn, and others are largely distributed by wild animals which eat the fruit and allow the seeds to pass through the alimentary canal uninjured or carry off the fruit and spit out the seeds. Many seeds or seed-vessels have bur-like or sticky coats by which they adhere to animals and are thus car-

ried considerable distances. Very often bodies of water aid in the distribution of seeds, since all that are spread by the agency of the wind and most of those that have fleshy coverings will float on the surface of the water and may in this way be scattered.

*Shapes of Trees.* Different species of trees naturally develop different shapes. Some, like Spruces, have a decided tendency to form a strong stem and to take on a conical form in preference to the development of a crown or head; while others, like the Basswood, Oaks, Maples, and Box-elder, develop their crown in preference to their stem. The actual shape of trees depends on the space they have to grow in, on the soil, situation, and on the age of the trees. Where trees have plenty of room to grow, and their natural development is not interfered with, their individual characteristics are most apparent.

*Cambium Layer.* A visual examination of the end section of a softwood log, such as Douglas fir, will reveal a series of light and dark colored bands or rings of wood with the pith as the common centre. The light-colored rings are known as Springwood and the dark ones as Summerwood. One band of each, together, constitutes one season's growth of the tree in diameter and is called an annual ring.

In temperate regions, the cambium layer cuts off new sapwood cells very rapidly in the spring months when the tree is making a quick upsurge of growth demanding and drawing large quantities of moisture from the soil.

These springwood cells are well adapted to the upward passage of sap because they are formed with thin walls and large central cavities. In the summer and autumn, tree growth slows up and less moisture is needed. Consequently, we find the cells cut off by the cambium during that part of the growing season have thicker cell walls and smaller central cavities. Summerwood, therefore, is more adapted to giving strength and hardness to the wood than for passing moisture. In fact, the strength of wood, to a great extent, depends on the amount of summerwood present in the annual rings compared to the springwood. During the normal winter the cambium lies dormant and growth ceases. The following spring, thin-walled springwood cells are again cut off by the cambium followed by the summerwood cells, and so on throughout the life of the tree.

The cells cut off by the cambium layer are very tiny, numbering many thousands to the cubic inch. Seen under the microscope, they are much longer than wide, hollow with thin or thick walls as explained above and have tapering closed ends. The passage of moisture from cell is made pos-

sible by the presence of tiny openings in the cell walls, called pits.

Most of these tiny cells are positioned in fairly straight rows with their long axis parallel to the length of the trunk or branch. About seven to ten per cent of the total volume of the wood is made up of cells placed in narrow bands which run radially in the tree, i. e., in a direction from pith to bark. These bands of cells, called wood rays, serve the tree in storing and distributing food materials horizontally. They are of interest to lumbermen because of the important part they play in the shrinking and swelling of lumber which undergoes changes in moisture content.

Wood, as a construction material, has several advantages over other building materials, mostly due to its characteristic cellular structure. For example, it is comparatively light in weight, combined with great strength: the cell walls give in, allowing nails and screws to be driven in, and the displaced fibres tend to recover thus giving great nail holding power, the porous surface takes and holds stains and paints and also makes strong glued joints; it is easily worked into shapes and smooth surfaces, insulation value is high because of the many dead-air spaces in the cell cavities if irregularities are present they are usually on the surface, making it easier to grade and reject poor pieces; the salvage value of wood is high, in many cases being perfectly sound and suitable for re-use after 30 years or more.

## ***THE EARTH'S BIOSPHERE***

Biosphere is the thin layer of life that covers the Earth. Biosphere is the earth's relatively thin zone of air, soil, and water that is capable of supporting life, ranging from about 10 km into the atmosphere to the deepest ocean floor. Life in this zone depends on the sun's energy and on the circulation of heat and essential nutrients. The biosphere remained sufficiently stable for hundreds of millions of years to keep going the evolution of today's life forms. Major divisions of the biosphere into regions of different growth patterns are called plant formations, or biomes.

### ***Biomes or Plant Formations***

The broad units of vegetation are called *plant formations* (фитоценоз, растительное сообщество) by European ecologists and *biomes* by North American ecologists. The major difference between the two terms is that biomes include associated animal life. Major biomes, however, go by the name of the dominant forms of plant life. Biome is a large ecosystem characterized by similar vegetation, animals, and climate. Biome's abiotic (non-living) factors, such as light intensity, wind, soil quality, amount of

rainfall, temperature, and nutrients, determine what plants and animals inhabit the zone.

There are various terrestrial and two aquatic (freshwater and saltwater) biomes. While scientists do not agree on the number of land-based biomes, the six most widely accepted biomes are:

- 1) tundra;
- 2) taiga;
- 3) grassland;
- 4) deciduous forest;
- 5) desert;
- 6) tropical rain forest.

Influenced by latitude, elevation, and associated moisture and temperature regimes, terrestrial biomes vary geographically from the Tropics to the Arctic and include various types of forest, grassland, shrub land, and desert. These biomes also include their associated freshwater communities: streams, lakes, ponds, and wetlands. Marine environments, also considered biomes by some ecologists, comprise the open ocean, littoral (shallow water) regions, benthic (bottom) regions, rocky shores, sandy shores, estuaries, and associated tidal marshes.

### ***Ecosystems***

A more useful way of looking at the terrestrial and aquatic landscapes is to view them as ecosystems, a word coined in 1935 by the British plant ecologist Sir Arthur George Tansley to stress the concept of each locale or habitat as an integrated whole. A system is a collection of interdependent parts that function as a unit and involve inputs and outputs. The major parts of an ecosystem; are the producers (green plants), the consumers (herbivores and carnivores), the decomposers (fungi and bacteria), and the non-living, or abiotic, component, consisting of dead organic matter and nutrients in the soil and water. Inputs into the ecosystem are solar energy, water, oxygen, carbon dioxide, nitrogen, and other elements and compounds. Outputs from the ecosystem include heat of respiration, water, oxygen, carbon dioxide, and nutrient, losses. The major driving force is solar energy.

### ***Energy and Nutrients***

Ecosystems function with energy flowing in one direction from the sun, and through nutrients, which are continuously recycled. Light energy is used by plants, which, by the process of photosynthesis, convert it to chemical energy in the form of carbohydrates and other carbon compounds. This energy is then transferred through the ecosystem by a series of steps that involve eating and being eaten or what is called a food web.

Each step in the transfer of energy involves several trophic (trophism — питание), or feeding, levels: plants, herbivores (plant eaters), two or three levels of carnivores (meat eaters), and decomposers (редуценты — организмы, минерализующие органические вещества, напр. бактерии, грибы; сапрофиты). Only a fraction of the energy fixed by plants follows this pathway, known as the grazing food web. Plant and animal matter not used in the grazing food chain, such as fallen leaves, twigs, roots, tree trunks, and the dead bodies of animals, support the decomposer food web. Bacteria, fungi, and animals that feed on dead material become the energy source for higher trophic levels that tie into the grazing food web. In this way nature makes maximum use of energy originally fixed by plants.

The number of trophic levels is limited in both types of food web, because at each transfer a great deal of energy is lost (such as heat of respiration) and is no longer usable or transferable to the next trophic level. Thus, each trophic level contains less energy than the trophic level supporting it. For this reason, there are more deer or caribou (which are herbivores) than wolves (carnivores).

Energy flow fuels the biogeochemical cycles, or nutrient cycles. The cycling of nutrients begins with their release from organic matter by weathering and decomposition in a form that can be picked up by plants. Plants incorporate nutrients available in soil and water and store them in their tissues. The nutrients are transferred from one trophic level to another through the food web. Because most plants and animals go uneaten, nutrients contained in their tissues, after passing through the decomposer food web, are ultimately released by bacterial and fungal decomposition, a process that reduces complex organic compounds into simple inorganic compounds available for re-use by plants.

### ***Imbalances***

Within an ecosystem nutrients are cycles internally. But there are leakages or outputs, and these must be balanced by inputs, or the ecosystem will fail to function. Nutrient inputs to the system come from weathering the rocks, from windblown dust and from precipitation, which can carry material great distances. Varying quantities of nutrients are carried from terrestrial ecosystems by the movement of water and deposited in aquatic ecosystems and associated lowlands. Erosion and the harvesting of timber and crops remove considerable quantities of nutrients that must be replaced. The failure to do so results in an impoverishment of the ecosystem. This is why agricultural lands must be fertilized.

If inputs of any nutrient greatly exceed outputs, the nutrient cycle in the ecosystem becomes stressed or overloaded, resulting in pollution. Pollution can be considered an input of nutrients exceeding the capability of

the ecosystem to process them. Nutrients from agricultural lands, along with sewage and industrial wastes accumulated from urban areas, all drain into streams, rivers, lakes, and estuaries. These pollutants destroy plants and animals that cannot tolerate them or the changed environmental conditions caused by them; at the same time they favour a few organisms more tolerant to changed conditions. Thus, precipitation filled with sulphur dioxide and oxides of nitrogen from industrial areas converts to weak sulphuric and nitric acids, known as acid rain, and falls on large areas of terrestrial and aquatic ecosystems. This upsets acid-base relations in some ecosystems, killing fish and aquatic invertebrates, and increasing soil acidity, which reduces forest growth in northern and other ecosystems that lack limestone to neutralize the acid.

### ***Populations and Communities***

The functional units of an ecosystem are the populations of organisms through which energy and nutrients move. A population is a group of interbreeding organisms of the same kind (a species) living in the same place at the same time. Groups of populations within an ecosystem interact in various ways. These interdependent populations of plants and animals make up the community сообщество, which encompasses the biotic portion of the ecosystem.

### ***Diversity***

The community has certain attributes, among them dominance and species diversity. Dominance results when one or several-species control the environmental conditions that influence associated species. In a forest, for example, the dominant species may be one or more species of tree, such as oak or spruce; in a marine community the dominant organisms are frequently animals such as mussels or oysters. Dominance can influence diversity of species in a community because diversity involves not only the number of species in a community, but also how numbers of individual species are apportioned.

The physical nature of a community is evidenced by layering, or stratification. In terrestrial communities, stratification is influenced by the growth form of the plants. Simple communities such as grasslands, with little vertical stratification, usually consist of two layers, the ground layer and the herbaceous layer. A forest has up to six layers: ground, herbaceous, low shrub, low tree and high shrub, lower canopy, and upper canopy. These strata influence the physical environment and diversity of habitats for wildlife. Vertical stratification of life in aquatic communities, by contrast, is influenced mostly by physical conditions: depth, light, temperature, pressure, salinity, oxygen, and carbon dioxide.

### ***Habitat and Niche***

The community provides the habitat (естественная среда обитания) — the place where particular plants or animals live. Within the habitat, organisms occupy different niches. A niche is the functional role of a species in a community — that is, its occupation, or how it «earns its living». The more a community is stratified, the more finely the habitat is divided into additional niches.

### ***Population Growth Rates***

Populations have a birth rate (the number of young produced per unit of population per unit of time), a death rate (the number of deaths per unit of time), and a growth rate. The major agent of population growth is births, and the major agent of population loss is deaths. When births exceed deaths, a population increases; and when deaths exceed additions to a population, it decreases. When births equal deaths in a given population, its size remains the same, and it is said to have zero population growth.

When introduced into a favourable environment with an abundance of resources, a small population may undergo geometric, or exponential growth, in the manner of compound interest. Many populations experience exponential growth in the early stages of colonizing a habitat because they take over an underexploited niche or drive other populations out of a profitable one. Those populations that continue to grow exponentially, however, eventually reach the upper limits of the resources; they then decline sharply because of some catastrophic event such as starvation, disease, or competition from other species. In a general way, populations of plants and animals that characteristically experience cycles of exponential growth are species that produce numerous young, provide little in the way of parental care, or produce an abundance of seeds having little food reserves. These species, usually shortlived, disperse rapidly and are able to colonize harsh or disturbed environments. Such organisms are often called opportunistic species.

Other populations tend to grow exponentially at first, and then logistically — that is, their growth slows as the population increases, then levels off as the limits of their environment or carrying capacity are reached. Through various regulatory mechanisms, such populations maintain something of an equilibrium between their numbers and available resources. Animals exhibiting such population growth tend to produce fewer young but do provide them with parental care; the plants produce large seeds with considerable food reserves. These organisms are long-lived, have low dispersal rates, and are poor colonizers of disturbed habitats. They tend to respond to changes in population density (the number of organisms per unit

of area) through changes in birth and death rates rather than through dispersal. As the population approaches the limit of resources, birth rates decline, and mortality of young and adults increases.

## **COMMUNITY INTERACTIONS**

Major influences on population growth involve various population interactions that tie the community together. These include competition, both within a species and among species; predation, including parasitism; and co-evolution, or adaptation.

### ***Competition***

When a shared resource is in short supply, organisms compete, and those that are more successful survive. Within some plant and animal populations, all individuals may share the resources in such a way that none obtains sufficient quantities to survive as adults or to reproduce. Among other plant and animal populations, dominant individuals claim access to the scarce resources and others are excluded. Individual plants tend to claim and hold on to a site until they lose vigour or die. These prevent other individuals from surviving by controlling light, moisture, and nutrients in their immediate areas.

Many animals have a highly developed social organization through which resources such as space, food, and mates are apportioned among dominant members of the population. Such competitive interactions may involve social dominance, in which the dominant individuals exclude subdominant individuals from the resource; or they may involve territoriality, in which the dominant individuals divide space into exclusive areas, which they defend. Subdominant or excluded individuals are forced to live in poorer habitats, do without the resource, or leave the area. Many of these animals succumb to starvation, exposure, and predation.

Competition among members of different species results in the division of resources in a community. Certain plants, for example, have roots that grow to different depths in the soil. Some have shallow roots that permit them to use moisture and nutrients near the surface. Others growing in the same place have deep roots that are able to exploit moisture and nutrients not available to shallow-rooted plants.

### ***Predation***

One of the fundamental interactions is predation, or the consumption of one living organism, plant or animal, by another. While it serves to move energy and nutrients through the ecosystem, predation may also regulate population and promote natural selection by weeding the unfit

from a population. Thus, a rabbit is a predator on grass, just as the fox is a predator on the rabbit. Predation on plants involves defoliation by grazers and the consumption of seeds and fruits. The abundance of plant predators, or herbivores, directly influences the growth and survival of the carnivores. Thus, predator-prey interactions at one feeding level influence the predator-prey relations at the next feeding level. In some communities, predators may so reduce populations of prey species that a number of competing species can co-exist in the same area because none is abundant enough to control the resource. When predators are reduced or removed, however, the dominant species tend to crowd out other competitors, thereby reducing species diversity.

### ***Parasitism***

Closely related to predation is parasitism, wherein two organisms live together, one drawing its nourishment at the expense of the other. Parasites, which are smaller than their hosts, include many viruses and bacteria. Because of this dependency relationship, parasites normally do not kill their hosts the way predators do. As a result, hosts and parasites generally co-evolve a mutual tolerance, although parasites may regulate some host populations, lower their reproductive success, and modify behaviour.

### ***Co-Evolution***

Co-evolution is the joint evolution of two unrelated species that have a close ecological relationship — that is, the evolution of one species depends in part on the evolution of the other. Co-evolution is also involved in predator-prey relations. Over time, as predators evolve more efficient ways of capturing or consuming prey, the prey evolves ways to escape predation. Plants have acquired such defensive mechanisms as thorns, spines, hard seed-coats, and poisonous or ill-tasting sap that deter would-be consumers. Some herbivores are able to breach these defences and attack the plant. Certain insects, such as the monarch butterfly, can incorporate poisonous substances found in food plants into their own tissues and use them as a defence against their own predators. Other related, similar organisms such as the viceroy butterfly may acquire through natural selection a colour pattern or shape that mimics the inedible species. Because they look like the distasteful model, mimics thus avoid predation. Other animals avoid predators by assuming an appearance that blends them into the background or makes them appear part of the surroundings. The chameleon is a well-known example of this interaction. Some animals possessing unbearable odours or poisons as a defence also have warning colorations, usually bright colours or patterns, that act as further warning signals to potential predators.

Another co-evolutionary relationship is mutualism, in which two or more species depend on one another and cannot live outside such an association. An example of mutualism is mycorrhizae, an obligatory relationship between fungi and certain plant roots. In one group, called ectomycorrhizae, the fungi form a cap or mantle about the rootlets. The fungal hyphae (threads) (гифы) invade the rootlet (корешок) and grow between the cell walls as well as extending outward into the soil from the rootlet. The fungi, which include several common woodland mushrooms, depend on the tree for their energy source. In return the fungi aid the tree in obtaining nutrients from the soil and protect the rootlets of the tree from certain diseases. Without the mycorrhizae (грибница) some groups of trees, such as conifers and oaks, cannot survive and grow. Conversely, the fungi cannot exist without the trees.

### *Succession and Climax Communities*

Ecosystems are dynamic, in that the populations constituting them do not remain the same. This is reflected in the gradual changes of the vegetational community over time, known as succession. It begins with the colonization of a disturbed area, such as an abandoned crop field or a newly exposed lava flow, by species able to reach and to tolerate the environmental conditions present. Mostly these are opportunistic species that hold on to the site for a variable length of time. Being short-lived and poor competitors, they are eventually replaced by more competitive, longer-lived species such as shrubs, and then trees. In aquatic habitats, successional changes of this kind result largely from changes in the physical environment, such as the build-up of silt at the bottom of a pond. As the pond becomes more shallow, it encourages the invasion of floating plants such as pond lilies and emergent plants such as reed mace. The pace at which succession proceeds depends on the competitive abilities of the species involved; tolerance to the environmental conditions brought about by changes in vegetation; the interaction with animals, particularly the grazing herbivores; and fire. Eventually the ecosystem arrives at a point called the climax, where further changes take place very slowly, and the site is dominated by long-lived, highly competitive species. As succession proceeds, however, the community becomes more stratified, enabling more species of animals to occupy the area. In time, animals characteristic of later stages of succession replace those found in earlier stages.

## **CONIFERS**

Conifers, or softwood trees, form a distinct group, which has become very important in the world's economy, because they grow fast on poor soils even under harsh climates, and yield timbers that are very suitable for industry. They are now being planted on a growing scale in most countries as a source of wealth.

Distinctive characters of the conifers include:

- a) narrow, needle-like or scale-like leaves;
- b) foliage usually evergreen (the only common exception being the larches);
- c) scaly buds;
- d) regular almost geometrical, branching habit;
- e) resinous fragrance of foliage, buds, bark and timber;
- f) male and female flowers always borne separately, though usually on the same tree;
- g) flowers always wind-pollinated, and therefore catlike, lacking showy petals or nectar,
- h) fruit in the form of a woody cone (rarely, as in yew and juniper, a flesh berry).

Most conifers flower in spring, their cones may ripen during the following autumn, the following spring, or in some species eighteen months after pollination.

In natural forests conifers grow readily from seed, unaided by man. In cultivation they are raised in nurseries nearly always from a seed, since most kinds are very hard to grow from cutting.

The timber of conifers is always called softwood, though in a few species it is quite hard. On the whole, however, it is softer and easier to work than the hardwood yielded by broadleaved trees. Today the great bulk of timber used in house building, fencing, packing cases and boxes of all kinds, and as railway sleepers, telegraph poles, or pitprops, is softwood.

For paper making, which uses about half of the output of wood in the main timber-growing countries, softwood is more suitable than hardwood because, amongst other features, its fibres are substantially longer. Softwood is very suitable for the manufacture of most kinds of artificial board, an expanding industry that gives us wood chipboard, hardboard, and insulation board.

At the present time about nine-tenths of all the timber used in Britain, whether in the unaltered state or made up into paper or manufactured board, comes from coniferous trees.

## **BROADLEAVES**

The broadleaves, or hardwood trees, are the leading feature in the British landscape of woods and hedgerows. In the past they were the country's main source of building material, fencing and fuel. Today, when there are other sources of heat and power, and steel and concrete play so large a part in building, the hardwood timbers of these attractive trees are less important to the British economy. But there is still a very substantial trade in good sound oak, beech, ash, sycamore and elm, for the better classes of furniture making and the joinery, while poplar is used in matches, and willow for cricket bats.

To a growing extent, the country's needs of timber in bulk are nowadays met by the conifers, or softwood trees.

Most forest planting today is done, inevitably, with these conifers. But the landscape, shade and shelter values of the broadleaves are so great that they are always likely to play the larger part in hedgerows, as street trees. Most of them are natives, and these are firmly established in old natural or semi-natural woodlands throughout the British Isles.

Our broadleaved trees form part of the vast natural broadleaved forest of Northern Europe. The key feature of all these woods and trees is, as the name implies, the broad leaf, which is shed each autumn as the colder weather approaches. Every leaf holds in its tissue a remarkable substance called chlorophyll, which gives it its green colour. In sunlight and in the presence of sufficient moisture and mineral salts, this chlorophyll 'fixes' some of the carbon dioxide gas that is always present in the air. Once fixed, the carbon dioxide is transformed by intricate chemical processes into sugars, and eventually into all the other complex materials that make up the tree's substance — wood, roots, flowers and seeds as well as the leaves themselves.

## **BIOLOGY OF SEED SETTING IN CONIFERS**

The quality of seed, as well as seed production, are both directly and indirectly of importance for the existence of mankind and also of a considerable number of animal organisms. With regard to agricultural and garden plants the question of seed from the food production point of view, becomes of vital interest on a global scale. The quality and quantity of seed production on forest trees is an important link in the same chain of interests. For many people the forest, its raw products and the manufacture of its industrial products means employment, security and a higher standard of living.

Apart from price levels, extent of forest area and management of forestry, the value of the forest land will depend upon our ability to bring into being in different parts of our country new forests of the best possible utility or cultivation value, suitable density and composition of species.

The knowledge, gained through seed research and reforestation studies, of the differing qualitative properties of the natural seed within certain extreme climatic regions, for instance, in Northern Europe, has helped to increase understanding in Scandinavia of the genetic and physiologic quality of forest-tree seed.

### *Flowering and Seed Setting in Conifers*

Afforestation is intimately bound up with the seed question from both the qualitative and quantitative points of view, and this irrespective of whether it is a matter of natural or artificial regeneration (through sowing or planting). The quality of the seed is in its turn dependent upon the genetic constitution of the seed, and upon the modifying effect of the milieu upon seed formation and seed maturity. The forced production of seed is of current importance for tree species with a small seed production (e. g. *Picea abies* and *Pinus silvestris*) and especially in regions with a severe climate, where seed production is low and the physiological quality of the seed in most cases poor. In extreme highland country in Central Europe and in highland areas (as a rule more than 300 m. above sea level) e. g. in northern Europe the temperature during the vegetative period is often a striking minimum factor for seed maturity, seed production and for growth, conditions of reproduction and tree limit.

Other external factors seem more or less to affect the setting and development of the flower buds, the flowering, seed formation and seed maturity etc., such as the light conditions, rainfall, wind and nutrition, the age of the tree, the density and the height above sea level. Except for the disseminating of the pollen, however, the importance of the wind for the flowering, seed maturity and reproduction should for northern Europe probably be restricted to extreme and exposed altitudes. Especially at low temperatures the wind strengthens the effect of temperature markedly. Of the external factors, which in the above mentioned biological connections have been made the object of observations and studies, the temperature probably with every justification has been generally considered the most important. The effect of climate upon flowering, seed formation and seed maturation is generally divided between:

- 1) year for bud setting;
- 2) flowering year;
- 3) year for seed maturation.

For Norway spruce and other tree species of importance for our forestry, with the exception of pine, the flowering year and the year for seed maturation coincide.

### ***Seed Production of Forest Trees***

The capacity of a tree for seed bearing and the factors which influence it: — The biology of reproduction by trees is still imperfectly understood, but certain more obvious controls may be distinguished, such as the following:

1. Age. A minimum degree of maturity is essential. The minimum age for seed-bearing varies enormously with different species, and within the same species depending upon vigor and growing space.

The minimum age at which viable seed may be produced is of great importance in silviculture. Trees which reproduce exclusively or chiefly by seed must be produced in ample quantity if natural reproduction is to be expected. The statement is frequently made that trees need not be grown to large sizes in the future, since boards can be fabricated from pulp made from small sizes, and plastics and other chemical products will replace lumber. Such assumptions frequently overlook the biological requirements of the trees as well as the other indirect benefits to mankind from older trees. However, much may be done to induce early seed-bearing of many rapidly growing species. Early seed-bearing is also of utmost importance in tree breeding experiments.

The maximum age should also be considered; this may at times effect the natural reproduction of very overmature stands. Maturity, not age or size, is the important factor.

2. Vigor. A number of conditions and factors may be included in this general term, such as size of crown, assimilative area in proportion to volume of wood in the bole and branches, exposure to sun, moisture relations, external injuries, damage by insects and fungi and the like. It is difficult to separate these and point to anyone as a controlling factor in seed production. In so-called "crop years" even trees in poor thrift may bear seed, in "off years" only those most favorably situated or blessed with ample reserves.

3. Environmental Conditions. Many climatic and soil factors influence seed bearing, but most demonstrations have been made with other plants than forest trees. It is considered that since the ash constituents of seed are large, soils low in K and other elements produce poor seed crops. Infertile soils low in N are unfavorable for the same reason.

4. Adaptability to site: Origin of seed. Exotics and trees raised from seed collected in a place differing greatly in climate from that of the grow-

ing site may exhibit their poor adaptation to their new home by relatively poor seed production in quality and quantity. Ability to reproduce and perpetuate itself is a fairly good criterion of adaptation of a species. A large percentage of empty seed, imperfectly developed seed, slow germination, and incomplete fertilization indicate a certain lack of conformity with the environment. Trees growing near the limit of their range, where they are advancing or losing ground, also exhibit these tendencies in their seed production.

5. Differences between species in seed production. It is a commonplace that some species not only bear frequently, but profusely, with huge crops on every tree, while others bear rarely and sparingly. These inherent capacities for seed production may largely determine the so-called "aggressiveness" of trees in colonizing new ground; such areas are invariably active seed-bearers. One cannot fail noting that such trees (birches, poplars, cherries, pines, etc.) are usually exposed to full light, and have ample growing space. The more shade-enduring trees (beeches, maples, firs, spruces, hemlocks) are normally less abundant seeders. These tendencies, of course, are frequently reversed by environment.

The quantities of seed produced by different trees vary so widely both within the same, and between different species that most data mean little. If individuals of different species of the same age and size could be grown side by side, their production would still be scarcely comparable because of the varying age at which each attains maximum bearing. Furthermore, great differences in productivity between individuals of the same species, comparable age and growing conditions have been demonstrated.

## ***LIFE HISTORIES OF TREE SEEDS***

Reproduction of the tree is by no means complete with the development of the new plant in the form of a ripened seed. The adjustments of the various types of seeds to the environments in which the trees grow, and the fate of the seed between the time of dispersal from the mother tree and its germination and establishment as a growing tree are subjects, which merit mention here.

The simplest life histories are found in spring-ripening seeds such as aspen, willow and silver maple. Immediately the seeds come to rest, they may begin to germinate, since they are not dormant, and depend for successful establishment on gaining a foothold before the rank vegetation of summer causes too much competition. Species in this group require for the

most part bare soil and a moist seed bed. They have no need of large food reserves, or capacity to remain dormant — although red maple and elm may become dormant upon drying and lie over until the next year, thus escaping an unfavorable period. Spring-ripening seeds and those holding seed in the cone until spring are relatively little sought after by birds and animals, since other food is plentiful in spring.

Among the seeds which ripen in the fall, some exhibit more or less pronounced dormancy, which protects them from fall germination and freezing; others as in *Pinus banksiana* are retained indefinitely in the cone, and shed only with the hot spring sun, or when the heat of a forest fire opens the cones after many years. Where spring droughts are frequent and winters mild, some species, as longleaf pine (*P. palustris*) and many of the oaks (*Quercus*), germinate in the fall, and extend their radicles during the winter so that the seedlings have a firm foothold when the dry season arrives.

Many seeds ripening in late summer and fall are incapable of immediate germination even when they fall on a moist, warm seedbed until they have undergone a period of after-ripening, just as buds of trees, formed in the late summer, do not open in the fall, although the weather may be favorable, but require exposure to the cold of winter before attaining a condition of readiness to unfold. In both cases the dormancy is of great benefit, protecting the new growth from certain freezing. Fall-ripening seeds may also be held on the tree until danger of fall-sprouting is past; then winter cold prepares the dormant embryo for prompt spring germination. Few if any species with permeable seed coats lie thus more than one winter. Some species of ash like *Fraxinus excelsior* and *F. nigra* have an immature embryo when shed from the tree. The embryo elongates during the fall and after-ripening proceeds during the winter. Large-seeded species, such as oaks and walnuts, which are injured by drying find ideal conditions for after-ripening, protection from drought and frost when buried (and forgotten) by squirrels.

Vivipary, rare in tree seeds, is exemplified in the mangrove. Here the embryo germinates while in the ovary on the parent tree. The seedling may reach a foot or more in height before dropping from the tree.

Fleshy fruits, a favorite food of some birds, are often associated with hard seeds, fortified by a dense or bony seedcoat. This bony layer is frequently a part of the pericarp, e. g. *Cornus*, *Crataegus*, *Prunus*. These seeds are apt to be eaten by birds and pass through the alimentary tract of the bird not only unharmed, but actually rendered permeable and ready for germination by the acids in the digestive fluids. Seedlings of *Juniperus* and

Prunus are abundant along fence rows frequented by birds, but often scarce in the vicinity of the parent trees. The impermeable covering may also serve to protect these seeds from the acids and alcohols present in decaying fruits. Not infrequently these seeds require prolonged after-ripening as well. In nature these drupes with stony endocarps are eroded by fungi and broken by frost action so that germination of the seed occurs the second spring following ripening. They often lie several years longer, when heat and moisture are insufficient. After-ripening at low temperatures is required most commonly in seeds from northern and cold regions. Dormancy is a valuable aid in preventing too early germination, or germination in the fruit. Seedcoats impermeable to water or oxygen favor perpetuation of some species, by aiding longevity, and when combined with a dormant embryo insure germination at a favorable season.

### ***THE TESTING OF GERMINATION***

The Purpose of Germination Tests: — Like other estimates of large numbers of objects, seed tests must be made by sampling, examining a small percentage of the material, since in germination tests especially, the seeds tested are usually not saved for use in producing plants. The purpose of germination tests must be to determine the proportion of the seeds in a given lot which are capable of germinating.

Since it is the capacity for germination which must be investigated, all other variable factors should be eliminated as far as possible. The statement is frequently made that the conditions for germination tests should approximate those to which the seeds will be exposed in the nursery or field; then a truer picture of results to be attained in practice may be gained, it is claimed. While this might at first appear a plausible argument, it is unfortunately very difficult to make such tests, and the variable weather and soil conditions make them extremely uncertain. Seed of excellent quality may fail to germinate completely under unfavorable field conditions. Such tests are also very time-consuming and require elaborate greenhouses for testing during the winter. Where empirical data on the relation between laboratory tests and field results are lacking, field tests are highly desirable. These will be discussed under "plant per cent". Severe tests of germination under controlled conditions (sprouting power, etc.) are also possible. The only true basis for germination tests, which combines uniformity of results and completion of tests in the shortest time, is the determination of the percentage of seed which germinates under optimal conditions for the species in a given time.

Treatments preparatory to germination tests: — Many seeds fail to respond promptly when placed in an environment favorable to germination, unless they have first experienced a period of conditioning, preparing the seed by chemical changes, embryo maturity, or by influences which render the seed coat permeable to water and oxygen. Only when a "readiness to germinate" has been attained by appropriate pre-treatment it is worth while to conduct germination tests. It is true that there is more or less delay in germination in all species, and that some absorb water more promptly than others; some after-ripening takes place in the germinator. The stimulus of spring imparted by the warmth and moisture of the germination medium affects some seeds sooner than others. Dormancy is relative, but pre-treatment, when used, should be standardized for each species, if different tests are to be comparable.

Soaking: — The simplest way of hastening moisture absorption is by immersing the seeds in water. The efficacy of this treatment will vary with each species. Soaking, especially prolonged soaking, has often been found injurious. If employed at all, soaking should be of short duration, — and the time accurately measured and standardized. Requiring as it does another manipulation, complicating seed-testing, it is not recommended except in special cases. Satisfactory results can usually be obtained without recourse to soaking and some lots of seed may be especially sensitive to and damaged by such treatment. However, some seeds may be "conditioned" to tolerate submergence by placing on moist blocks of porous fired clay.

Stratification: — Species which regularly possess dormant embryos, requiring afterripening, should be stratified under standard conditions before a germination test is attempted. Since stratification usually denotes mixing with peat or sand and the separation of the seed from this material is often time-consuming, the author has suggested setting up the seed on a portable germinator which can be placed in a cold chamber for the appropriate stratification period and then moving to a temperature favorable for germination.

Disinfection: — The need for seed treatment before germination tests to reduce fungous attack varies greatly with the species age of seed and length of test. If the germinator is kept scrupulously clean, seeds are washed and substrata (filter papers et al.) changed frequently there is normally little necessity for special disinfectants. Old or slowly-germinating seeds, species which are especially heavily infected with or sensitive to moulds may be treated with one of the organic mercury dusts or sodium hypo-chlorite before being placed to germinate. The use of disinfectants is

further undesirable in that they often affect germination results by introducing another variable. It is difficult to repeat tests under exactly identical conditions. Boiling all glassware and germinator pads is the best precaution.

## **NURSERY**

**Nursery.** This term is applied to a plot of land used for raising plants that are intended for planting elsewhere for their land growth.

*Soil and Cultivation.* The best soil for a general nursery is a deep, rich reasonably level, retentive upland. It is customary to grow most of the nursery crops in rows, so that they may be readily cultivated. The land should be ploughed deeply when the crop is planted and the surface soil kept loose and fine during all the early part of the growing season, or until about the middle of July. If the land that has to be used for a nursery is rather shallow, it should be gradually deepened by ploughing from year to year, and if inclined to dry out the addition of large quantities of organic matter, together with constant cultivation, will do much to remedy these defects.

The cultivation of a nursery or young forest plantation, provided the latter is planted in rows, should be much the same as for garden crops and consists in keeping the land stirred to the depth of three inches, thus giving a dust blanket, which will protect from drought.

### ***Grades of Nursery Stock***

Nursery stock of different kinds has come to be known by such convenient names as seedlings, transplants, street trees, forestpulled seedlings, etc.

*Seedlings* are young plants, grown from seed, that have never been transplanted, and are generally designated by their size or age. They form the cheapest class of nursery stock, and are used largely for starting wind-breaks.

*Transplants* are seedlings that have been at least once transplanted, and are designated by their size and the number of times they have been moved. They are higher in price than seedlings, but with some kinds of trees they are much more likely to grow, and may be well worth the extra price. Evergreens, especially Pines, will seldom do well unless once transplanted before being set in a permanent place.

*Street trees* include the trees of large size which are used for street, shade, and ornamental purposes. To be of the best quality they should have

been transplanted two or more times and have received some attention in the way of pruning so as to give them a good form. Such trees vary much in quality and price, but the best are necessarily rather expensive.

*Forest-pulled Deciduous Trees* of small size can often be obtained at a very low price, and may be as desirable as those that are nursery grown.

*Forest-pulled Evergreen Seedlings of Small Size* may also be desirable, but too often they have poor roots, or have been so injured by poor handling that they are worthless. They should have their roots carefully protected at all times.

*Forest-pulled Shade Trees* sometimes grow very well, but they are always inferior to good nursery-grown trees. They are generally improved by having their roots shortened two years before they are to be removed, and when so treated grow very well.

## **TRANSPLANTING**

*Transplanting is Simply the Removal of the Plant.* It may be to some permanent place, as a park, lawn, or street, or it may be done for the purpose of improving the root system and to give the tree more room to grow. By shortening the long roots the root system is made more compact and better able to withstand subsequent removal. This may be done by transplanting, or by cutting around the tree with a spade or tree-digger. It is especially desirable to do this to trees that are not easily moved on account to their long branching roots, such as the Birch, or to those that have tap-roots, like the Oak and Walnut. It is on account of their having had their roots shortened so that the root system is compact and can all be moved with the tree that nursery grown trees are generally superior to others.

*In Transplanting* it is important to take up a sufficient amount of roots to support the plant, and as a rule the more roots the better the conditions for growth. Very long roots should be shortened unless the tree is removed to a permanent place, in which case all the good roots should be left on the tree. All bruised or broken roots should be cut off in either case and the top of the tree shortened to correspond. In transplanting trees, they should be set at least one or two inches lower in the soil than they formerly stood, and the roots should be spread out in the holes without crowding. It is customary to plant many kinds of small trees in furrows made with a plough.

*Very Large Trees* (those over six inches in diameter) are sometimes successfully planted in winter by taking them up with a ball of earth. This is done by digging a trench around the tree, late in the autumn, deep

enough to cut most of the roots, but far enough away from the tree to leave a large ball of earth. The trench is then filled in with a mulch of some kind, and when the ground is frozen the tree is moved, with the ball of earth attached, to the hole which has been previously prepared and kept free from frost.

*After Trees Have Been Moved*, or had their roots shortened in some other way, they should generally not be transplanted again for at least one or two years, during which time they will have overcome the injuries done to their root system. The time which should thus elapse will vary with the kind of tree, and also with the amount of injury done. Where the injury is severe a much longer time will be required for recovery than where it is slight.

*Time to Transplant.* Planting of trees should always be done when they are dormant, or just as they start into growth in the spring, which is generally from the middle to last of April. If for any reason it is desirable to risk the moving of trees late in the spring, after the leaves started, they should be cut back severely, all the leaves removed, and great pains be taken to secure all the roots and to prevent their drying out. Very hardy deciduous trees, as the Elm, Cottonwood, Boxelder and Ash, can often be successfully moved in the fall if the ground is moist at the time of removal, but great care must be taken to work the soil in very compactly between the roots, so that there will be no large air-spaces among them. If the trees are large, it is a good plan to stake them, so they cannot be blown about by the wind.

*Transplanting Evergreens.* When seedling cone-bearing Evergreens are two years old they should be transplanted and this should be done about once in three years afterwards, until they are moved to their permanent places. As Evergreens are very sensitive to being moved, this requires more care with most deciduous trees. The most important point is to not allow the roots to have even the appearance of being dry. In handling small Evergreens in the field it is often a good plan to keep them in a pail containing enough water to cover their roots or keep them in wet moss. They may be transplanted in the spring, as soon as the ground works easily and the roots have white tips, and they may be safely transplanted even up to the time that the new growth shows three inches, but at this late date more care must be taken in doing the work than when it is done earlier. Evergreens can sometimes be moved successfully in August, or even in the autumn, if they are to be carried only a short distance and the conditions of the weather and land are favorable; but this is not a time for general planting, and it is seldom advisable to do it at this season.

*Heeling-in.* This term is applied to the temporary covering of the roots of trees with earth to keep them from drying out after they are to be kept only a few days, comparatively little care is needed in covering; but if they are to be kept for several weeks or over winter, especially if the weather is dry, great care must be taken to work the fine soil in among the roots and to pack it solid. A good way of doing this is as follows: Select a dry, mellow piece of ground and dig a trench just large enough to take in the roots of the trees when laid close together in a single row. Place the trees or seedlings in this trench in an upright position, a few at a time, and cover the roots firmly and deeply with soil taken from close in front of the first trench, thus making a trench for the next row. If trees that are of questionable hardiness are to remain heeled-in all winter, it is a good plan to bend the tops down and cover with earth. This is only necessary for winter protection. The neglect to properly heel-in nursery stock as soon as it is received is undoubtedly a frequent cause of failure. This is especially so in the case of seedlings which are generally wintered in bundles, as they are liable to dry out in winter. The bundles must be opened if large, and in any case the soil should be packed in around them very solid by the feet or otherwise.

## **FLOWER**

A flower, also known as a bloom or blossom, is the reproductive structure found in flowering plants. The biological function of a flower is to mediate the union of male sperm with female ovum in order to produce seeds. The process begins with pollination, is followed by fertilization, leading to the formation and dispersal of the seeds.

In addition to serving as the reproductive organs of flowering plants, flowers have long been admired and used by humans, mainly to beautify their environment but also as a source of food.

### ***Flower specialization and pollination***

Each flower has a specific design which best encourages the transfer of its pollen. Cleistogamous flowers are self pollinated, after which, they may or may not open. Many Viola and some Salvia species are known to have these types of flowers.

Entomophilous flowers attract and use insects, bats, birds or other animals to transfer pollen from one flower to the next. Flowers commonly have glands called nectaries on their various parts that attract these animals. Some flowers have patterns, called nectar guides, that show pollina-

tors where to look for nectar. Flowers also attract pollinators by scent and color. Still other flowers use mimicry to attract pollinators. Some species of orchids, for example, produce flowers resembling female bees in color, shape, and scent. Flowers are also specialized in shape and have an arrangement of the stamens that ensures that pollen grains are transferred to the bodies of the pollinator when it lands in search of its attractant (such as nectar, pollen, or a mate). In pursuing this attractant from many flowers of the same species, the pollinator transfers pollen to the stigmas—arranged with equally pointed precision—of all of the flowers it visits.

Anemophilous flowers use the wind to move pollen from one flower to the next, examples include the grasses, Birch trees, Ragweed and Maples. They have no need to attract pollinators and therefore tend not to be "showy" flowers. Male and female reproductive organs are generally found in separate flowers, the male flowers having a number of long filaments terminating in exposed stamens, and the female flowers having long, feather-like stigmas. Whereas the pollen of entomophilous flowers tends to be large-grained, sticky, and rich in protein (another "reward" for pollinators), anemophilous flower pollen is usually small-grained, very light, and of little nutritional value to insects.

### ***Morphology***

Flowering plants are heterosporangiate, producing two types of reproductive spores. The pollen (male spores) and ovules (female spores) are produced in different organs, but the typical flower is a bisporangiate strobilus in that it contains both organs.

A flower is regarded as a modified stem with shortened internodes and bearing, at its nodes, structures that may be highly modified leaves. In essence, a flower structure forms on a modified shoot or axis with an apical meristem that does not grow continuously (growth is determinate). Flowers may be attached to the plant in a few ways. If the flower has no stem but forms in the axil of a leaf, it is called sessile. When one flower is produced, the stem holding the flower is called a peduncle. If the peduncle ends with groups of flowers, each stem that holds a flower is called a pedicel. The flowering stem forms a terminal end which is called the torus or receptacle. The parts of a flower are arranged in whorls on the torus. The four main parts or whorls (starting from the base of the flower or lowest node and working upwards) are as follows:

An example of a perfect flower, this *Crateva religiosa* flower has both stamens (outer ring) and a pistil (center).

Calyx: the outer whorl of sepals; typically these are green, but are petal-like in some species.

Corolla: the whorl of petals, which are usually thin, soft and colored to attract insects that help the process of pollination.

Androecium (from Greek andros oikia: man's house): one or two whorls of stamens, each a filament topped by an anther where pollen is produced. Pollen contains the male gametes.

Gynoecium (from Greek gynaikos oikia: woman's house): one or more pistils. The female reproductive organ is the carpel: this contains an ovary with ovules (which contain female gametes). A pistil may consist of a number of carpels merged together, in which case there is only one pistil to each flower, or of a single individual carpel (the flower is then called apocarpous). The sticky tip of the pistil, the stigma, is the receptor of pollen. The supportive stalk, the style becomes the pathway for pollen tubes to grow from pollen grains adhering to the stigma, to the ovules, carrying the reproductive material.

Although the floral structure described above is considered the "typical" structural plan, plant species show a wide variety of modifications from this plan. These modifications have significance in the evolution of flowering plants and are used extensively by botanists to establish relationships among plant species. For example, the two subclasses of flowering plants may be distinguished by the number of floral organs in each whorl: dicotyledons typically having 4 or 5 organs (or a multiple of 4 or 5) in each whorl and monocotyledons having three or some multiple of three. The number of carpels in a compound pistil may be only two, or otherwise not related to the above generalization for monocots and dicots.

In the majority of species individual flowers have both pistils and stamens as described above. These flowers are described by botanists as being perfect, bisexual, or hermaphrodite. However, in some species of plants the flowers are imperfect or unisexual: having only either male (stamens) or female (pistil) parts. In the latter case, if an individual plant is either female or male the species is regarded as dioecious. However, where unisexual male and female flowers appear on the same plant, the species is considered monoecious.

Additional discussions on floral modifications from the basic plan are presented in the articles on each of the basic parts of the flower. In those species that have more than one flower on an axis — so-called composite flowers — the collection of flowers is termed an inflorescence; this term can also refer to the specific arrangements of flowers on a stem. In this regard, care must be exercised in considering what a "flower" is. In botanical terminology, a single daisy or sunflower for example, is not a flower but a flower head — an inflorescence composed of numerous tiny flowers

(sometimes called florets). Each of these flowers may be anatomically as described above. Many flowers have a symmetry, if the perianth is bisected through the central axis from any point, symmetrical halves are produced — the flower is called regular or actinomorphic, e. g. rose or trillium. When flowers are bisected and produce only one line that produces symmetrical halves the flower is said to be irregular or zygomorphic, e. g. snapdragon or most orchids.

### ***Pollination***

The primary purpose of a flower is reproduction. Flowers are the reproductive organs and mediate the joining of the sperm contained within pollen to the ovules, normally from one plant to another but many plants also can pollinate their own flowers. The fertilized ovules produce seeds that are the next generation. Sexual reproduction produces genetically unique offspring, allowing for adaptation. Flowers have specific designs which encourage the transfer of pollen from one plant to another of the same species. Many plants are dependent upon external factors to move pollen between flowers, including the wind and animals, especially insects. Even large animals such as birds, bats, and pygmy possums can be employed. The period of time during which this process can take place (the flower is fully expanded and functional) is called anthesis.

### ***Fertilization and dispersal***

Some flowers with both stamens and a pistil are capable of self-fertilization, which does increase the chance of producing seeds but limits genetic variation. The extreme case of self-fertilization occurs in flowers that always self-fertilize, such as many dandelions. Conversely, many species of plants have ways of preventing self-fertilization. Unisexual male and female flowers on the same plant may not appear or mature at the same time, or pollen from the same plant may be incapable of fertilizing its ovules. The latter flower types, which have chemical barriers to their own pollen, are referred to as self-sterile or self-incompatible.

## ***LEAF***

In botany, a leaf is an above-ground plant organ specialized for photosynthesis. For this purpose, a leaf is typically flat (laminar) and thin, to expose the cells containing chloroplast (chlorenchyma tissue, a type of parenchyma) to light over a broad area, and to allow light to penetrate fully into the tissues. Leaves are also the sites in most plants where transpiration and guttation take place. Leaves can store food and water, and are modified in some plants for other purposes. The comparable structures of ferns

are correctly referred to as fronds. Furthermore, leaves are prominent in the human diet as leaf vegetables.

### ***Leaf anatomy***

A structurally complete leaf of an angiosperm consists of a petiole (leaf stem), a lamina (leaf blade), and stipules (small processes located to either side of the base of the petiole). The petiole attaches to the stem at a point called the "leaf axil". Not every species produces leaves with all of the aforementioned structural components. In some species, paired stipules are not obvious or are absent altogether. A petiole may be absent, or the blade may not be laminar (flattened). The tremendous variety shown in leaf structure (anatomy) from species to species is presented in detail below under Leaf morphology. After a period of time (i. e. seasonally, during the autumn), deciduous trees shed their leaves. These leaves then decompose into the soil.

A leaf is considered a plant organ and typically consists of the following tissues:

- An epidermis that covers the upper and lower surfaces
- An interior chlorenchyma called the mesophyll
- An arrangement of veins (the vascular tissue).

### ***Epidermis***

The epidermis is the outer multi-layered group of cells covering the leaf. It forms the boundary separating the plant's inner cells from the external world. The epidermis serves several functions: protection against water loss, regulation of gas exchange, secretion of metabolic compounds, and (in some species) absorption of water. Most leaves show dorsoventral anatomy: the upper (adaxial) and lower (abaxial) surfaces have somewhat different construction and may serve different functions.

The epidermis is usually transparent (epidermal cells lack chloroplasts) and coated on the outer side with a waxy cuticle that prevents water loss. The cuticle is in some cases thinner on the lower epidermis than on the upper epidermis, and is thicker on leaves from dry climates as compared with those from wet climates.

The epidermis tissue includes several differentiated cell types: epidermal cells, guard cells, subsidiary cells, and epidermal hairs (trichomes). The epidermal cells are the most numerous, largest, and least specialized. These are typically more elongated in the leaves of monocots than in those of dicots.

The epidermis is covered with pores called stomata, part of a stoma complex consisting of a pore surrounded on each side by chloroplast-containing guard cells, and two to four subsidiary cells that lack chloro-

plasts. The stoma complex regulates the exchange of gases and water vapor between the outside air and the interior of the leaf. Typically, the stomata are more numerous over the abaxial (lower) epidermis than the adaxial (upper) epidermis.

### ***Mesophyll***

Most of the interior of the leaf between the upper and lower layers of epidermis is a parenchyma (ground tissue) or chlorenchyma tissue called the mesophyll (Greek for "middle leaf"). This assimilation tissue is the primary location of photosynthesis in the plant. The products of photosynthesis are called "assimilates".

Leaves are normally green in color, which comes from chlorophyll found in plastids in the chlorenchyma cells. Plants that lack chlorophyll cannot photosynthesize.

Leaves in temperate, boreal, and seasonally dry zones may be seasonally deciduous (falling off or dying for the inclement season). This mechanism to shed leaves is called abscission. After the leaf is shed, a leaf scar develops on the twig. In cold autumns they sometimes change color, and turn yellow, bright orange or red as various accessory pigments (carotenoids and xanthophylls) are revealed when the tree responds to cold and reduced sunlight by curtailing chlorophyll production. Red anthocyanin pigments are now thought to be produced in the leaf as it dies.

### ***Veins***

The veins are the vascular tissue of the leaf and are located in the spongy layer of the mesophyll. They are typical examples of pattern formation through ramification. The pattern of the veins is called venation.

The veins are made up of:

- xylem, tubes that brings water and minerals from the roots into the leaf;

- phloem, tubes that usually moves sap, with dissolved sucrose, produced by photosynthesis in the leaf, out of the leaf.

The xylem typically lies over the phloem. Both are embedded in a dense parenchyma tissue, called "pith", with usually some structural collenchyma tissue present.

### ***Leaf morphology***

External leaf characteristics (such as shape, margin, hairs, etc.) are important for identifying plant species, and botanists have developed a rich terminology for describing leaf characteristics. These structures are a part of what makes leaves determinant, they grow and achieve a specific pattern and shape, then stop. Other plant parts like stems or roots are non-

determinant, and will usually continue to grow as long as they have the resources to do so.

Classification of leaves can occur through many different designative schema, and the type of leaf is usually characteristic of a species, although some species produce more than one type of leaf. The longest type of leaf is a leaf from palm trees, measuring at nine feet long.

### ***Venation (arrangement of the veins)***

There are two subtypes of venation, namely, craspedodromous, where the major veins stretch up to the margin of the leaf, and camptodromous, when major veins extend close to the margin, but bend before they intersect with the margin.

Feather-veined, reticulate — the veins arise pinnately from a single mid-vein and subdivide into veinlets. These, in turn, form a complicated network. This type of venation is typical for (but by no means limited to) dicotyledons.

Pinnate-netted, penniribbed, penninerved, penniveined; the leaf has usually one main vein (called the mid-vein), with veinlets, smaller veins branching off laterally, usually somewhat parallel to each other; e. g. *Malus* (apples).

Three main veins branch at the base of the lamina and run essentially parallel subsequently, as in *Ceanothus*. A similar pattern (with 3—7 veins) is especially conspicuous in *Melastomataceae*.

Palmate-netted, palmate-veined, fan-veined; several main veins diverge from near the leaf base where the petiole attaches, and radiate toward the edge of the leaf; e. g. most *Acer* (maples).

Parallel-veined, parallel-ribbed, parallel-nerved, penniparallel — veins run parallel for the length of the leaf, from the base to the apex. Commisural veins (small veins) connect the major parallel veins. Typical for most monocotyledons, such as grasses.

Dichotomous — There are no dominant bundles, with the veins forking regularly by pairs; found in *Ginkgo* and some pteridophytes.

Note that although it is the more complex pattern, branching veins appear to be plesiomorphic and in some form were present in ancient seed plants as long as 250 million years ago. A pseudo-reticulate venation that is actually a highly modified penniparallel one is an autapomorphy of some *Melanthiaceae* which are monocots, e. g. *Paris quadrifolia* (True-lover's Knot).

### ***Margins (edge)***

The leaf margin is characteristic for a genus and aids in determining the species:

entire: even; with a smooth margin; without tothing;  
ciliate: fringed with hairs;  
crenate: wavy-toothed; dentate with rounded teeth, such as *Fagus* (beech);  
dentate: toothed, such as *Castanea* (chestnut);  
coarse-toothed: with large teeth;  
glandular toothed: with teeth that bear glands;  
denticulate: finely toothed;  
doubly toothed: each tooth bearing smaller teeth, such as *Ulmus* (elm);  
lobate: indented, with the indentations not reaching to the center, such as many *Quercus* (oaks);  
palmately lobed: indented with the indentations reaching to the center, such as *Humulus* (hop);  
serrate: saw-toothed with asymmetrical teeth pointing forward, such as *Urtica* (nettle);  
serrulate: finely serrate;  
sinuate: with deep, wave-like indentations; coarsely crenate, such as many *Rumex* (docks);  
spiny: with stiff, sharp points, such as some *Ilex* (hollies) and *Cirsium* (thistles).

## **THREATS**

By now, it is a well-known fact that forests everywhere are facing a range of threats. The forests that remain today cover a fraction of the area that was forested even a few hundred years ago. And the speed of destruction is only increasing. Everything from the direct and obvious effects of over-cutting to the more subtle effects of climate change are threatening to destroy the last of the remaining natural forests.

Threatened forests are more than just threatened trees. When the trees disappear, so does everything that depends on them, from fungi and microorganisms to tigers and bald eagles. Each species has its own particular requirements for habitat, and therefore preserving only certain forest ecosystems, which in many cases aren't prime sources of timber, does not protect the habitat of all forest species.

When a forest is cleared and new trees are planted, the diversity of animals is not brought back. A plantation of one or a few kinds of trees does not support as many life forms as a natural forest. These plantations

will not produce as much high-quality timber. The trees in natural forests have been growing for hundreds and even thousands of years. Planted trees are cut as soon as eighty years after they are planted.

Planting trees and logging, then planting and logging again in continuing cycles can degrade soil and water. Water often washes soil away on cleared slopes, making the area unsuitable for new trees, and destroying riparian zones below. Plantations are also much more susceptible to pests and diseases. Pest controls and fertilizers are often used on plantations, which may have other unfavorable effects on soil and water.

Much of the human-caused forest destruction stems from overpopulation. In many places, there are too many people trying to make a living from too few forest resources. Trees are cleared not only for wood and other products, but so that the land they once grew on can be turned into pastures for cattle and agricultural fields to feed growing numbers of people. As cities expand, forests are cleared to make room for housing developments, shopping malls, golf courses, and other structures that require large amounts of land.

Other threats to the health of forests are more indirect. In certain areas, including much of Europe and the eastern United States and Canada, forests are declining because of air pollution. This pollution is from the fossil fuels burned in vehicles — cars, trucks, buses — and from industry. Carbon dioxide (CO<sub>2</sub>), a gas which contributes to "global warming", is a well known emission from these sources, but vehicles and industry also produce sulphur dioxide and nitrous oxide gases, which create acid rain. Acid deposits can kill trees directly by leaching nutrients from them, resulting in the death of leaves and needles. The most damage, however, is caused when acid gets into the soil and releases poisonous heavy metals, which are naturally present but usually inaccessible. At the same time as the acid rain releases these poisons, it also dissolves and washes away vital nutrients in the soil.

People have been destroying forests for hundreds of years, but the rate of destruction has been increasing so rapidly that some forests won't last much longer. Some areas, such as the American Southeast, that were cut a century ago are now recovering gradually. However, much of the choice timber is now gone and these "new" Southeast forests, which are only beginning to re-grow, are once again being cut. More remote areas are also being logged heavily, often to supply the growing market for wood-chip products. Coastal temperate forests in Chile, which are home to over 700 species of plants are being cut for this reason. Remote forests in Russia are also being cut, mostly for raw logs. About one fifth of the world's

forests are found in Russia. In some cases, these logs are not allowed to be shipped to North America because of fears that species of insect pests might also be unknowingly imported.

For thousands of years, humans have played an ever increasing role in global deforestation. Throughout history, one empire after another stripped forests to build their ships and dwellings, and for fuel. Once devastated, those forests didn't recover for a thousand years or more, and some never did like parts of the Mediterranean, the Middle East, and Great Britain.

Global deforestation has accelerated dramatically in recent decades. The tropical forests of South America and Southeast Asia are being cut and burned at an alarming rate for large and small agricultural uses, from huge palm oil plantations to slash and burn subsistence farming. Fires set for these purposes often rage out of control.

Any reduction in the forest is a problem for its ecosystem. Deforestation occurs when the forests are turned into farms to feed people or converted into cash crops or used for raising livestock. Also, logging trees for commercial use or for firewood leads to the destruction of the forests and to their use as land for agriculture.

Deforestation isn't just about a loss of trees. It also has a large impact on the environment. Many living creatures depend on the trees, so when the trees disappear, the animals die off as well (decreased biodiversity). Potentially valuable medicines and materials are lost, as well as clean water and air. Indigenous peoples suffer, and eventually national economies suffer too. The futures of people and forests are still interconnected.

Trees also store water and then release it into the atmosphere (this process is called transpiration). This water cycle is an important part of the ecosystem because many plants and animals depend on the water that the trees help to store. When the trees are cut down, there is nothing to hold the water, leading to a drier climate. Also, the loss of trees causes erosion because there are no roots holding the soil together. The dirt then washes away into lakes and rivers, degrading aquatic habitats.

Deforestation leads to the increase of carbon dioxide in the air because living trees store CO<sub>2</sub> in their fibers, but when they are cut down, the carbon is released back into the atmosphere. CO<sub>2</sub> is a major greenhouse gas, so cutting down trees contributes to the danger of climate change.

No communities of plants and animals are stable. Many factors are constantly disrupting these ecosystems — weather, predation, food supply, and, above all, humans. Conditions are favorable to different species at different times. Ecosystems are constantly changing, and after every change, it is impossible to re-create the ecosystem that existed before. That is one

of the problems humans face when trying to "manage" forests. As hard as they might try, people can't mold the forest into something that has been, or keep the forest at the state it is now.

Disturbances to forest ecosystems happen all the time; some create short-term havoc, others take several years to begin showing their effects. Some disturbance is necessary to create the diversity of habitats. For example, small, frequent fires in certain areas make it easier for pines to survive where oaks would otherwise grow. When fires happen regularly, species adapt, and some trees even depend on fire to release their seeds.

Weather can change forests in less dramatic ways as well. Temporary cold spells and droughts can seriously affect certain species, though don't usually change the entire composition of the forest. Other disturbances, such as pests, may also be confined to one or two types of trees, creating small gaps in the forest. Diseases can also be responsible for far more serious changes in forests. The effect of any given disturbance depends on its frequency, predictability, and magnitude.

Fire is one of the natural disturbances that forests have evolved to deal with over time. Periodic fires caused by lightning have shaped and altered forests for millions of years. For example, the heat generated in fires actually enables Lodgepole pinecones to release their seeds. In this century, humans have made serious efforts at fire suppression.

The relationships between forests, fire, insects, disease, and climate are only recently beginning to be understood. The huge fires in Yellowstone National Park in 1988 caused many people to wonder whether a more natural approach to fire might be better than complete suppression. There is no doubt that fire destroys trees, which humans consider a waste. But the hidden benefits of natural fires might be greater than were previously thought. Forest fires move in varying and often unpredictable ways. Ground fires creep through the duff, and fires may smolder below the surface for long periods of time. Surface fires are another form of forest fire, and move along at up to 1.3 meters in height. Crown fires occur higher in the trees (in the upper branches known as the "crown" of a tree), and can be of several different varieties. These include "dependent crown fires", which use convection to pre-heat the crown, and most dangerous of all, independent crown fires which leap from tree to tree.

Fires affect forests in various ways. In intense fires, nitrogen, calcium, phosphorus, and potassium can be vaporized; and soil microorganisms can be killed up to 3 inches under the soil, but recover quickly. Mycorrhizal fungi growing on tree roots can also be killed by fire. Recovery of trees takes longer than other organisms. A year after the Yellowstone fires of

1988, grass and inch-tall lodgepole pine seedlings were spotted emerging from the soil. Certain plants have adaptations which help them recover more quickly after a fire. Chaparral shrubs benefit from their large root systems, as their taproot can grow to 3.5 feet in length after only three months. Other plants sprout from roots instead of seeds, giving them an advantage.

Animals can be severely affected by fires. Their habitats are most often destroyed, including their food source which means that even if they escape the flames, they have to find new territory. Many animals do escape from fires, and move to another area. Other animals which live in the surrounding forest come to feed on the new seedlings and young plants growing in a recently burned area.

### ***PHYSIOLOGY OF WOOD-DESTROYING FUNGI***

The most favourable condition for the growth of fungi in wood seems to be when the cell walls in addition to being fully imbibed are covered with a film of liquid water in which free diffusion of the enzymes and the products of their action can take place, but where some air spaces remain in the cavities through which diffusion of gases can take place; in practice this usually means a moisture content of 30 to 40 per cent. The less dense the wood the higher is the optimum moisture content for growth of any particular fungus. If the wood is in the form of sawdust the fungi can tolerate — in fact demand — a very much higher moisture content, one of the order of 200 per cent of its dry weight.

Some fungi can survive prolonged periods of desiccation and can remain alive, though in a dormant condition, for many years in air-dry wood. The fungi that occur on fences and exposed woodwork are much more resistant than those that cause dry rot in buildings. In some tests still in progress at the Laboratory we have found that *Lenzites trabea* is still able to revive and grow vigorously after ten years in wood kept at 12 per cent moisture content at 77 °F, whereas the mycelium of *Merulius lacrymans* in wood died after six months' storage under the same conditions. In practice one cannot assume that even prolonged storage under dry conditions can free wood from latent infection which may revive if the wood is rewetted. For this reason it is vitally important that timber used in boat building and for the construction of vats should be completely free from even traces of infection by wood-rotting fungi when it is used.

### *Temperature Relations*

In common with other plants fungi grow more quickly in warm weather than in cold. Though the optimum temperature varies considerably between one species and another, it generally lies between 75 and 85 °F, and speaking very roughly the rate of growth is twice as fast at 60° and four times as fast at 80° as it is at 40 °F. The practical implications of this are obvious — while it may, for example, be safe to leave beech logs lying on the ground in the woods for months during the winter, it may be unwise to leave them for as many weeks in summer. Far more rapid extraction of logs of perishable species is necessary under tropical conditions than during the winter in the temperate zone if sound timber free from decay is to be obtained. Fungi can make little or no growth at temperatures around freezing point and there is of course no risk of any deterioration below freezing point.

Though growth may be slow at temperatures between 32 and 40 °F, we not infrequently find quite extensive decay in the wooden linings of cold stores used for storage of fruit, where condensation on the walls may wet the wood. It is always wise to treat — preferably by impregnation with an odourless wood preservative — any woodwork used in the lining of cold stores.

Few wood-rotting fungi can grow at temperatures exceeding 100 °F, but many of them can survive quite long periods of exposure to temperatures considerably higher than this. In order to ensure that the most resistant fungi are killed it is necessary to bring the wood up to a temperature of 150 °F, throughout its thickness and to hold it at this temperature for at least 75 minutes. Any time required for heating of the wood throughout its thickness must of course be added to this period. It is much easier to kill fungi by heat when the moisture content of the wood and the atmospheric humidity around it are high. Heat sterilization of infected timber should therefore be carried out in a saturated atmosphere.

The effectiveness of heat in killing deep-seated latent infection in large-sized timber may be of practical significance in the creosoting of Douglas fir in large dimensions, into which creosote cannot penetrate deeply. Some Douglas fir cut from large over-mature trees contains traces of incipient decay and if the fungi responsible are not killed by heat during the pressure treatment they may continue to develop and cause internal decay in service after moisture has penetrated throughout the timber. Certain fungi such as *Merulius lacrymans*, are much more sensitive to heat and wood infected by them can be sterilized by exposure to temperatures of 110 to 120 °F. Though the fruiting bodies of wood-rotting fungi may be shrivelled by frost, their mycelium is usually very resistant to low temperatures and it is evident that native species of fungi are never likely to be in-

jured by exposure to naturally occurring cold conditions in Europe.

### ***Influence of Radiation on Growth***

Generally speaking, light tends to check the growth of fungi and prolonged exposure to sunlight may even kill the vegetative mycelium of many species. Light has an important influence on the formation and development of the fruit bodies of the higher fungi; few species are able to form normal fruit bodies in total darkness and one finds many queer abortive growths on pit props in mines. Agarics tend to form long, branching stalks with little or no cap. Polypores often form only flat poroid growths which may be difficult to recognize. Even short exposure to light of no intensity may initiate fruiting in some species. Prolonged exposure to ultra-violet radiation is fatal to exposed mycelium, but penetration of these rays into wood is slight and exposure to ultra-violet is not therefore an effective method for sterilizing samples of wood for culture experiments.

Fungi appear to be insensitive to X-rays and can survive exposure to radiation of moderate intensity without suffering any noticeable damage. Dielectric heating by means of a high frequency current is now used extensively for setting of glue in joints and it has often been suggested as an effective means for sterilizing timber and walls infected with the dry rot fungus. Under laboratory conditions the intense and localized heating that can be obtained so quickly has proved most effective for sterilizing timber infected with insects or fungi, but there are many practical difficulties to be overcome before this method can successfully be employed for the treatment of large-sized timbers in ships or thick walls in actual buildings.

### ***Metabolic Products of Wood-Rotting Fungi***

Fungi are continually building up products at the same time as their enzymes are decomposing the cellulose and other substances in the wood in which they are growing. Some of these so-called metabolic products remain inside the hyphae of the fungus, others are secreted into the surrounding medium. It is this second group of substances that are of particular interest to the student of wood preservation for they can affect the performance of wood preservatives with which they come into contact. Organic acids are probably the commonest products of the metabolism of wood-rotting fungi. It is well-known that fungi vary greatly in their susceptibility to different fungicides.

The preservation of wood against fungal decay usually involves protecting it against a wide range of possible enemies — unlike the protection of a plant against a specific parasite when one deliberately chooses a chemical that is known from laboratory tests to be particularly deadly to the parasite concerned. While we generally have to give blanket protection against any fungus that may come along, there are cases where we can use

our knowledge of the resistance or susceptibility of particular fungi to practical advantage. We would not, for instance, use copper sulphate for preservation of pit props in mines where *Poria* spp. are known to be prevalent, or attempt to treat an outbreak of *Lentinus lepideus* with brush-applied applications of creosote. This problem of choosing the preservative in relation to the type of destructive organism involved assumes greater importance if we attempt to protect timber against the fungi that bring about so-called "soft rot".

### ***Physiology of Fungi that Cause "Soft Rot"***

We have coined the term "soft rot" to describe the decomposition of wood by cellulose-destroying micro-fungi which is characterized under the microscope by the longitudinal penetration of the secondary cell walls by the fungal hyphae. This type of breakdown is generally found on the surface of timber exposed to persistently damp conditions and is much more common in hardwoods than in softwoods, at least at normal temperatures. It assumed economic importance only in special instances where for some reason the attack by normal wood-rotting Basidiomycetes is inhibited, as in the louvres of water-cooling towers. Generally speaking, the attack is confined to the surface layers of the wood and one may reasonably compare the method of attack to the damage done by the gribble — which results, in a wasting away of the surface layers. It will obviously be of greater significance where the softened surface is eroded away, e. g. by falling water, or when it occurs on very thin material such as plywood. For this reason we shall find that it will be more difficult by treatment with conventional wood preservatives to protect ply-wood that is in contact with the ground than solid timber, in which slight surface softening has no practical significance.

In preliminary studies on the physiology of the moulds that cause soft rot we have established that they grow very much more readily on hardwoods than on coniferous woods and that their ability to attack wood is greatly stimulated by the addition of nitrogen and phosphates. Temperature seems to have an even greater effect on the rate of decay by these moulds than it has on the wood-rotting Basidiomycetes. In the limited number of tests that we have been able to make it appears that some of the cellulose-destroying moulds are more resistant than most of the Basidiomycetes to many of the chemicals used in wood preservation, and that in situations where this type of attack is important it may be necessary to modify the treatment given or again, as in the case of the gribble, to combine chemical treatment with some form of physical protection such as a paint or synthetic resin finish afford.

# VOCABULARY

## A

**abandon** [ə'bændən] — покидать, оставлять; отказываться (от чего-л.), прекращать;

**absorb** [əb'z(s)ɔ:b] — впитывать; абсорбировать; поглощать;

**absorptive** — абсорбирующий, впитывающий, всасывающий; гигроскопический;

**abundant** [ə'blndənt] — обильный, богатый; имеющийся в изобилии, изобилующий;

**acacia** [ə'keiʃə] — акация;

**accept** [ək'sept] — допускать, признавать; принимать;

**accessory** [ək'sesəri] part — вспомогательный, добавочный, дополнительный;

**accidental** [,æksɪ'dentəl] — случайный; несущественный;

**accidentally** [,æksi'dentəli] — случайно, нечаянно; непредумышленно;

**accurately** ['ækjərətli] — точно; безошибочно; аккуратно;

**acid** ['æsid] — кислота;

**acid soils** — кислые почвы;

**acidic** — кислый, кислотный;

**acquire** [ə'kwaɪə] — получать, приобретать; овладевать;

**acre** ['eɪkə] — акр;

**activate** — активировать, активизировать;

**active growth region** — область активного роста;

**actual velocity** — фактическая скорость;

**adapt** — приспособляться;

**adult** ['ædʌlt / ə'dʌlt] — взрослый, зрелый;

**advantageous** [,ædvən'teɪdʒəs] — благоприятный; выгодный; полезный;

**aerate** [ɛə'reɪt] — аэрировать; проветривать, вентилировать;

**aero monitoring** — аэромониторинг;

**affect** [ə'fekt] — подвергать физическому воздействию; наносить ущерб, вред;

**afforestation** [æ,fɔ:ri'steɪʃən] — облесение; посадка леса, лесоразведение;

**airborne pollution** — загрязнение, переносимое по воздуху;

**alder** ['ɔ:ldə] — ольха;

**alter** ['ɔ:lter] — менять, изменять; переделывать;

**alteration** — изменение;

**altitude** ['æltɪtju:d] — высота; высота над уровнем моря;

**amino acids** — аминокислоты;

**amount (to)** — составлять; достигать;

**amphibian** [æm'fɪbiən] — амфибия; земноводное животное;

**anchor** ['æŋkə] — закреплять, прикреплять; фиксировать;

**anemophilous** [,æni'mɔ:filəs] — анемофильный; ветроопыляемый;

**angiospermous** [,ændʒiə'spɛ:məs] fruit — покрытосеменной плод;

**angiosperms** [,ændʒiə'spɛ:mz] — покрытосеменные растения; лиственные (листопадные) деревья;

**annual** ['ænjuəl] ring — годовое кольцо;  
**anthropogenic** [æn,θrəpəu'dʒenik] — антропогенный, созданный человеком;  
обусловленный влиянием человека;  
**anthropogenic disturbance** — нарушение, причиняемое человеком;  
**anti-cancer agent** — противораковый препарат;  
**antiquity** [æn'tikwiti] — античность; древность; старина;  
**apetalous** [ei'petələs] — апетальный, безлепестный;  
**apophysis** [ə'pɒfəsis] — апофиза (видимая часть семенной чешуйки сомкнутой шишки);  
**apparently** [ə'pærəntli] — явно, очевидно; практически;  
**applied art** — прикладное искусство;  
**appreciate** [ə'pri:ʃieit] — понимать, ценить по достоинству;  
**appreciation** — признательность, оценка, понимание;  
**approximately** [ə'prɒksimətli] — около, приблизительно;  
**arid** ['ærid] — сухой, засушливый; безводный; аридный;  
**arranged spirally** — расположенные спиралеобразно;  
**arrangement** [ə'reindʒmənt] — расположение, размещение; устройство;  
мероприятия, меры;  
**arson** — поджог;  
**artificial classification** — искусственная классификация, систематизация;  
**artificially** [,ɑ:tɪ'fi:ʃəli] — искусственно;  
**ascertain** [,æ sə'tein] — убеждаться, удостоверяться;  
**ash** — ясень;  
**aspect** — сторона; аспект, вид;  
**aspen** — осина;  
**assessment** [ə'sesmənt] — оценка; определение ценности;  
**associate** [ə'səʊʃiət] — сопутствующий вид;  
**attachment** — прикрепление; присоединение;  
**attain** — достигать, добираться;  
**authority** — авторитетный орган; органы власти;  
**available** — доступный; имеющийся в распоряжении, наличии;  
**aware / unaware** — знающий, осведомленный / несведущий;  
**axil** — пазуха листа;  
**axillary** [æk'siləri] bud — пазушная почка;  
**axis** ['æksil] — ось;

## **B**

**balsam fir** — пихта бальзамическая;  
**bark** — кора;  
**bark beetle** — короед;  
**barren** ['bærən] **soil** — бесплодная, тощая земля;  
**base** — основание;  
**bast** [bæst] — лыко;

**bear** [bɛə] — *v.* выносить, выдерживать; терпеть;  
**bear** [bɛə] — медведь;  
**beetle** — жук;  
**beneath** — внизу; ниже, под;  
**benefit** ['benɪfɪt] — выгода; польза; прибыль; преимущество;  
**bind** ['baɪnd] — связывать  
**binding material** — связующий материал;  
**binomial** [baɪ'nəʊmɪəl] **system** — биномиальная система (состоящая из двух названий);  
**biomass** ['baɪəʊ,mæs] — биомасса; энергетическое сырьё;  
**biome** ['baɪəʊm] — биом (совокупность видов растений и животных);  
**bisexual** — двуполой;  
**blackbird** — черный дрозд;  
**black-throated green warbler** — зелёный лесной певун (*Dendroica virens*);  
**blaze** — яркий огонь, пламя;  
**blossom** ['blɒsəm] — цвет, цветение;  
**board** — доска, пиломатериал;  
**bog** — болото, трясина; болотистая местность;  
**bole** — толстый ствол; кряж;  
**boreal** ['bɔːriəl] **forest** — бореальный (северный) лес;  
**botanical relationship** — ботаническое родство;  
**branch stem** — боковой ствол;  
**branch stub** — обрубленный конец ветки;  
**branch vein** — ответвление жилки, прожилка;  
**break down** — разрушать(ся); прекращать работу (о механизмах);  
**breast** — грудь; молочная железа;  
**breathe out** — выдыхать;  
**bring back** — приносить обратно; возвратить; восстановить;  
**bristlecone pine** — сосна остистая;  
**brittle** — ломкий, хрупкий;  
**broadleaf forest** — широколиственный лес;  
**buckeye** — конский каштан;  
**bud** — почка; зачаток;  
**bud scales** — чешуйки почек;  
**build up** — накапливать(ся);  
**bundled** — связанные в узел; собранные в пучок;  
**bury** ['beri] — зарывать(ся) в землю;  
**buttress** ['bʌtrɪs] — подпирать, поддерживать; усиливать, укреплять;  
**buttressed tree** — дерево, поддерживаемое (подпорами);  
**butt-rot** — напенная гниль; комлевая гниль;  
**buzzard** ['bʌzəd] — канюк;  
**by virtue** — благодаря чему-л.; в силу чего-л., на основании чего-л.;

## С

- calcareous** [kæl'keəriəs] — известковый;
- calm** — тишина, спокойствие || тихий, безветренный;
- calyx** ['keiliks] — чашечка (цветка);
- cambial** ['kæmbiəl] cells — клетки камбия;
- cambium** ['kæmbiəm] — камбий (образовательная ткань между древесиной и лубом);
- candle** — свеча;
- canopy** ['kæpəri] — полог, навес;
- canopy coverage** — укрытие из полога (навеса);
- capitalize** — писать с заглавной буквы;
- carbohydrate** [,kɑ:bə'haidreit] — углевод;
- carbon dioxide** — диоксид углерода, углекислый газ;
- carbon sink** — приёмник углерода; колодец, поглощающий углерод;
- carbon storage** — хранение; накопление углерода;
- caribou** — карибу; канадский олень;
- carnivore** ['kɑ:nivɔ:] — плотоядное (хищное) животное;
- carnivorous** [kɑ:'nivərəs] — плотоядный;
- carpentry** — плотничные работы; плотничное дело;
- carrion-feeding** — падальщик;
- casualty** ['kæzjuəlti] — пострадавший от несчастного случая, раненый или убитый;
- cattle pasture** ['pɑ:stfə] — выгон, пастбище;
- cause** — послужить причиной для чего-л.; мотивировать, вызывать;
- cause flooding** — вызывать наводнение, потоп;
- cease** — приостанавливать, прекращать, останавливать;
- cell** — клетка;
- cell contents** ['kɒntənts] — содержимое клетки;
- cell division** — деление клетки;
- cellobiose** [,seləu'baɪəus] — целлобиоза;
- cellulose** ['seljʊləus] (= pulp) — целлюлоза; клетчатка;
- chemical reaction** — химическая реакция;
- chlorophyll** ['klɔrəfil] — хлорофилл;
- chloroplast** ['klɔrəu,plæst] — хлоропласт (зеленые пластиды растительной клетки);
- cleaning** — очистка, осветление; рубки осветления;
- clear trunk** — чистый ствол;
- clear wood** — бездефектная древесина;
- clear-cut** — и. проводить сплошную рубку леса;
- clear-cut** — сплошная рубка; лес, вырубемый сплошной рубкой;
- clear-cut stand** — лес сплошной рубки;
- clearing saw** — пила для рубок ухода;
- closely-spaced** — с небольшим просветом;
- cluster** — пучок, гроздь; куст;

**clutter up** — загромождать;  
**cold-tolerant** — хладостойкий, морозоустойчивый;  
**colonize** — переселять(ся);  
**colour wood** — окрашивать древесину;  
**combine** — сочетать(ся);  
**come to mind** — приходить на ум;  
**command prices** — управлять ценами;  
**commemorate** [kə'meməreit] — увековечить;  
**common lineage** ['li:niidz] — общее происхождение, родословная;  
**common name** — общепринятое (в отличие от научного) название (растения, животного);  
**common origin** — общее происхождение;  
**complementary** — дополнительный, дополняющий; комплиментарный;  
**complete** — и. кончать, обозначать конец (чего-л.), выполнять;  
**complete** — полный;  
**complex** ['kɒmpleks] — смешанный, многосоставный; сложный;  
**complicating factors** — факторы, вызывающие осложнение;  
**compound** — составной; сложный; смешанный;  
**comprehensive** [kəm'pri'hensiv] — всесторонний, полный, всеобъемлющий;  
**concede** — проигрывать; пропускать; признавать;  
**conceptually** — концептуально, мысленно, на понятийном уровне;  
**condition** — обуславливать, определять; приводить в нужное состояние;  
**conduct water along** — проводить воду;  
**conduction of sap** — проводимость сока;  
**cone scale** — чешуйка шишки;  
**configuration** — конфигурация, форма;  
**conflict** [kən'flikt] — вступать в противоречие, противоречить;  
**conflicting** — противоречивый;  
**confusion** — беспорядок; неразбериха, путаница;  
**conifer** ['kɒnifə] (= softwood tree) — хвойное дерево;  
**conquer** ['kɒŋkə] — завоевывать, покорять; подавлять;  
**consequence** ['kɒnsikwəns] — результат, следствие;  
**consignment** [kən'sainmənt] — партия отправленного/прибывшего товара, груз;  
**conspicuous** [kən'spɪkjʊəs] — видный, заметный, бросающийся в глаза;  
**consume** — уничтожать; поглощать; истреблять;  
**continuous growth** — непрерывный рост;  
**continuous movement** — непрерывное, постоянное движение;  
**contribution** — вклад;  
**(un)controlled fire** — (не)управляемый пожар;  
**controversial** [kɒntrə've:ʃəl] — спорный, сомнительный; дискуссионный;  
**convection** — конвекция (теплообмен в жидкостях и газах);  
**convert** — преобразовывать; превращать;

**cope (with)** — справиться; выдержать;  
**core** — сердцевина, ядро;  
**corolla** [kə'ɒlə] — венчик цветка;  
**cosmopolitan** — космополит; космополитический;  
**cotyledon** [ˌkɒtɪ'liːdn] — котиледон; семядоля;  
**countless** — бесчисленный, бессчетный;  
**coverage** ['kʌv(ə)rɪdʒ] — покрытие; укрытие; охват, зона действия;  
**crawl** — ползать, ползти;  
**crawling wildfire** — стелющийся пожар;  
**creature** — создание, творение; животное, тварь;  
**creep** — ползти; стлаться;  
**cross section** — поперечное сечение;  
**crossbill** — клёст;  
**crown** ['kraʊn] **fire** — верховой пожар;  
**crown of the tree** — крона дерева;  
**crucial** — ключевой, наиболее значительный, решающий;  
**cruise** [kruːz] — таксация (леса) || таксировать, проводить таксацию;  
**crumble** — крошить(ся); осыпаться(ся);  
**cultivar** ['kʌltɪvə] — культурный сорт (растение);  
**cut down** — рубить (деревья);  
**cut regeneration costs** — сократить расходы (затраты, издержки)  
лесовосстановления;  
**cypress** ['saɪprəs] — кипарис;

## D

**damage** — вред; повреждение, ущерб || повреждать, портить;  
**date back (to)** — относить к определенному времени; вести начало (от),  
восходить (к);  
**dead remains** — мертвые останки;  
**debatable** — дискуссионный; являющийся предметом спора; сомнительный;  
**debatable issue** — дискуссионный; спорный вопрос;  
**decay** — гниение, разложение, разрушение;  
**deciduous** [dɪ'sɪdʒjuəs] — лиственный, листопадный;  
**decline** — падение, спад, упадок || спадать, уменьшаться;  
**decompose** — гнить, портиться, разлагаться;  
**decrease** — снижение, уменьшение; спад || снижаться, уменьшаться, ослабевать;  
**deer** — олень; лань;  
**deflect** — смещение; деформация; изгиб; искривление, преломление;  
**deforest** [dɪ'fɔːrɪst] — вырубать лес; обезлесить (местность);  
**delay** — задерживать, замедлять; препятствовать;  
**delicate** — хрупкий, тонкий;  
**dendrology** — дендрология (раздел ботаники, изучающий древесные растения);

**density** — плотность, концентрация, густота;  
**density of the stand** — густота, плотность насаждений;  
**depend (on)** — зависеть, находиться в зависимости (от);  
**deplete** [di'pli:t] — уменьшать; обеднять; истощать;  
**derive (from)** — получать (из); происходить (от);  
**descent** [di'sent] — происхождение;  
**desiccation** [desi'keiʃn] — высыхание; высушивание; обезвоживание;  
**destine** ['destin] — предназначать; предопределять;  
**destroy** [di'stɔɪ] — уничтожать, искоренять, ликвидировать;  
**detach** — отделять(ся); разъединять;  
**detection** — обнаружение, выявление;  
**determine** — определять, устанавливать; выявлять;  
**detritus** [di'traitəs] — детрит (продукт распада тканей);  
**devastate** ['devəsteit] — истощать, опустошать, разорять;  
**devoure** [di'vauə] — есть (жадно), пожирать; уничтожать;  
**dextrose** ['dekstrəuz] (= dextroglucose) — декстроза, Д-глюкоза;  
**diagnostic** [daiə'gnɒstik] — диагностический; выявляемый (обнаружимый);  
**differentiate** [,di'ferenʃieit] (**between, from**) — различать(ся), проводить различия (между);  
**digger** — землеройное орудие; культурный плужный корпус;  
**dioecious** [dai'i:ʃəs] — двудомный;  
**dirt** — земля, почва, грунт; грязь;  
**disaster** — беда, бедствие, несчастье;  
**disastrous** [di'za:stɹəs] — бедственный, гибельный, пагубный;  
**disastrous consequence** ['kɒnsɪkwəns] — гибельный, пагубный результат (последствие);  
**disease** [di'zi:z] — болезнь, заболевание;  
**disperse** [di'spɛ:s] — разбрасывать, раскидывать, рассеивать, рассыпать;  
**disregard** — пренебрегать, игнорировать; не обращать внимания;  
**disrupt** — разрушать; разрывать (узы); нарушать;  
**dissimilar** [di'similə] — непохожий, отличный; разнородный, неоднородный;  
**dissolve** — растворять; разжижать;  
**dissolved substance** — растворённое вещество;  
**distinct** — отличный; особый, индивидуальный;  
**distinction** — различие, распознавание; разграничение;  
**distinctive feature** — отличительная черта;  
**distribution** — распространение; распределение;  
**disturb** [di'stɜ:b] — нарушать; повреждать;  
**disturbance** [di'stɜ:bəns] — нарушение; вторжение в естественный ход вещей, нарушение порядка;  
**disturbed** [di'stɜ:bd] — нарушенный, возмущённый;  
**diverse** [dai've:s] — многообразный, различный, разнообразный;

**divide** — отделять(ся), разъединять(ся), нарушать целостность;  
**dominant species** — господствующий; основной, преобладающий вид (порода);  
**dormant** ['dɔ:mənt] — дремлющий; спящий; находящийся в состоянии покоя  
(о растении);  
**dormouse** ['dɔ:maʊs] (*pl.* dormice) — соня (*зоол.*);  
**dot** — точка, пятнышко;  
**Douglas-fir** — лжетсуга тиссолистная;  
**downward-drooping** — ниспускающийся, нисходящий;  
**drain** — дренаж, дренирование || дренировать;  
**drip** — капать, падать каплями;  
**drought** [draʊt] — засуха;  
**dry matter** — сухое вещество;  
**duff** — грубый (сырой) гумус лесной подстилки;  
**durable** — стойкий, прочный, надежный;  
**duration** [dʒuə'reɪʃn] — длительность, продолжительность;  
**dwarf** [dwɔ:f] **shoot** — карликовый, миниатюрный; малорослый побег;

## E

**eagle** — орел;  
**ecological thinning** — экологические рубки ухода;  
**elapse** — проходить, истекать (о времени);  
**elevation** [,eli'veɪʃn] — высота (над уровнем моря); поднятие, высокое расположение;  
**elm** — вяз, ильм;  
**elongation** [,i:lɒŋ'geɪʃn] — удлинение; вытяжение;  
**embryo** ['embriəʊ] — зародыш, эмбрион;  
**emerge** [i'mɛ:dʒ] — появляться, возникать; выступать;  
**endangered species** — исчезающий, вымирающий биологический вид; вид,  
находящийся под угрозой исчезновения;  
**enhance** [in'hɑ:ns] — усиливать; увеличивать; повышать; обогащать;  
**enrichment planting** — обогатительные посадки;  
**enrichment** — расширение; увеличение; обогащение;  
**ensure** [in'ʃʊə / in'ʃɔ:] — гарантировать, обеспечивать; застраховать, удостоверить;  
**entirely different** — совершенно иной;  
**enzymatic activity** — ферментативная активность;  
**enzyme** ['enzaim] — энзим (фермент);  
**epidermis** [,epi'dɛ:mɪs] — эпидермис, кожа (наружная покровная ткань листа);  
**escape** — избегать;  
**essential** [i'senʃəl] — важнейший; необходимый; основной;  
**establish plantations** — основывать, создавать лесопосадки;  
**estimate** — оценивать; приблизительно подсчитывать, прикидывать;  
**eucalyptus** [,ju:kə'liptəs] — эвкалипт;  
**evade fire** — избегать; уклоняться от пожара;  
**evaporation** [i,væpə'reɪʃn] — испарение;

**even age** — равный, одинаковый возраст;  
**evergreen** — вечнозеленый;  
**evidence** — доказательство, подтверждение; свидетельство; данные;  
**evolution** — эволюция, развитие;  
**evolve** — эволюционировать, развиваться;  
**ex-cattle pasture** ['rɑ:st.fə] — бывшее пастбище для скота;  
**excessive** [ik'sesiv] — избыточный; чрезмерный, неумеренный;  
**exhale** [eks'heil] — выдыхать; производить выдох;  
**exhibit** — проявлять, показывать; выказывать, выражать;  
**expose** — обнажать, выставять;  
**expose (to)** — подвергать действию (радиации, солнца и т. п.); оставлять незащищенным;  
**exposed soil** — минерализованная (обнаженная) почва;  
**exposure** [eks'rəʊzə] — выставление, оставление (на солнце, под дождем, на холоде); обнажение;  
**external conditions** — внешние условия;  
**extinction** — уничтожение;  
**extreme conditions** — экстремальные условия;

## F

**fail (in)** — потерпеть неудачу; не иметь успеха; не удаваться;  
**fall apart** — разваливаться; расходиться;  
**false alarm** — ложная тревога;  
**farther-spaced** — с бóльшим просветом;  
**fascicle** ['fæsɪkl] — пучок (совокупность нервных или мышечных волокон);  
**fat** — жир;  
**fatten** — откармливать (на убой);  
**favorable** — благоприятный; подходящий;  
**feed (on)** — питаться (чем-л.), кормиться;  
**feeding root** — питающий корень;  
**fern** — папоротник;  
**fertility** [fɛ:'tɪlɪtɪ] — фертильность, плодovitость;  
**fertilization** [,fɛ:tlai'zeɪʃn] — оплодотворение; внесение удобрений;  
**feverishly** — лихорадочно; возбуждённо, взволнованно;  
**fibrous** ['faɪbrəs] **root** — мочковатый корень;  
**final tending operation** — последняя рубка ухода;  
**final treatment** — последняя обработка; окончательные рубки ухода;  
**fir** — пихта;  
**fire suppression** — подавление пожаров;  
**flake** — отслаиваться, шелушиться, откалывать(ся);  
**flammable** ['flæməbl] (= inflammable) — легковоспламеняющийся, огнеопасный; горячий;  
**flatroot** — плоский корень;

**flea** — блоха;  
**fleshy** — мясистый, сочный;  
**flexible** — гибкий; мягкий;  
**flood** ['flʌd] — наводнение, потоп; половодье; || заливать, затоплять;  
**flooding** — наводнение, потоп; половодье; разлив;  
**flower-bud** — цветочная почка; бутон;  
**fluctuation** [,flʌktju:'eiʃn] — колебание, неустойчивость;  
**foliage** ['fəʊliɪdʒ] — листва;  
**food storage** — запас питательных веществ;  
**for many purposes** — для многих целей;  
**forest clearing** — участок леса, расчищенный под пашню, росчисть;  
**forest cover** — лесной покров;  
**forest ecology** — экология леса;  
**forest fires** — лесные пожары;  
**forest floor** — лесная подстилка; богатый органическими веществами слой лесной почвы;  
**forest growth** — рост, прирост леса;  
**forest regeneration** — лесовозобновление, лесовосстановление;  
**forested biome** — лесной биом (совокупность видов растений и животных);  
**forestry** — лесное хозяйство, лесоводство; научное управление лесами;  
**fossil fuel(s)** — ископаемое топливо;  
**fragile** ['frædʒaɪl] **network** — хрупкая (тонкая) взаимосвязь, организация;  
**fresh-water fish** — пресноводная рыба;  
**fringe** [frɪndʒ] **root** — бахромчатый корень;  
**fruit** — плод; фрукты; плоды, результаты;  
**fungus** [fʌŋɡəs] (*pl.* fungi) — гриб; грибок; плесень;  
**futile** ['fju:taɪl] — бесполезный, напрасный, тщетный;

## G

**gain weight** — набрать вес; увеличиваться в весе;  
**gale** — шторм; буря; ветер от 7 до 10 баллов (с 51 до 100 километров в час);  
**gall-makers** — галлообразователи (насекомые);  
**garbage** ['gɑ:bidʒ] — мусор; бытовые отходы;  
**generic name** — родовое название;  
**generous** ['dʒenərəs] — щедрый; обильный, изобильный, богатый;  
**genetic material** — генетический; наследственный материал;  
**genus** ['dʒi:nəs] (*pl.* genera) — род;  
**germinate** — давать почки или ростки; вызывать к жизни, порождать;  
**germinating embryo** — прорастающий зародыш;  
**germination** [dʒɛ:'mineɪʃn] — зарождение; развитие; прорастание;  
**girth** [gɜ:θ] — окружность ствола; обхват;  
**GIS (Geographic Information System) data analysis** — анализ данных ГИС;

**give origin to** — положить начало; стать первопричиной (чего-л.);  
**glaucous** ['glɔ:kəs] — тусклый; покрытый налетом;  
**greenhouse effect** — парниковый эффект;  
**grizzly bear** — медведь гризли;  
**grooved** — бороздчатый; имеющий желобок, углубление;  
**ground fire** — низовой пожар;  
**grouse** [graʊs] — куропатка;  
**growing conditions** — условия произрастания, роста;  
**growth hormone** ['hɔ:məʊn] — гормон роста;  
**gymnosperms** ['dʒɪmnəsprɛ:m] — голосеменные растения;

## Н

**habitat** ['hæbitæt] — место, ареал, среда обитания (организмов);  
**habitat for wildlife** — место обитания живой природы  
**habitats (for organisms)** — естественная среда обитания (организмов);  
**hair cell** — волосовидная клетка;  
**hardening** — закалка; закаливание;  
**hardwood** (= deciduous) **tree** — лиственное дерево;  
**harsh climate** — суровый (о климате);  
**harvest** — лесозаготовка || заготавливать древесину;  
**harvest methods** — методы лесозаготовки;  
**harvesting** — лесозаготовки;  
**hasten** — ускорять; торопить, поторапливать; подгонять;  
**have impact** ['ɪmpækt] — оказывать воздействие, влияние; иметь эффект;  
**hawk** [hɔ:k] — ястреб; сокол;  
**headwaters** ['hedwɔ:təs] — главный водосбор;  
**heartroot** — сердцевидный корень;  
**heart-rot** — ядровая гниль;  
**heartwood** ['hɑ:twʊd] — сердцевина, ядро; ядровая древесина;  
**heavy soil** — тяжёлая почва;  
**hemisphere** ['hemɪsfɪə] — полушарие;  
**hemlock** — тсуга (американское хвойное дерево); болиголов;  
**herb** [hɛ:b] — трава, травянистое растение;  
**herbaceous** [hɛ:'beɪʃəs] — травянистый;  
**herbaceous** [hɛ:'beɪʃəs] **plants** — травянистые растения;  
**herbicide** ['hɛ:bɪsaɪd] — гербицид;  
**herbivorous** [hɛ:'bɪvərəs] **mammals** — травоядные млекопитающие;  
**hermaphroditic** [hɛ:,mæfrə'dɪtɪk] — гермафродитный, бисексуальный, двуполоый;  
**hibernation** [haɪbə'neɪʃn] — спячка;  
**hickory** ['hɪkəri] — кария, гикори (род североамериканского орешника);  
**hidden** — спрятанный; скрытый;  
**high cost** — высокая стоимость;

**high salt concentration** — высокая концентрация солей;  
**hillside** — горный склон;  
**hinder** — затруднять, мешать, препятствовать;  
**horse-chestnut** — конский каштан;  
**horticulture** ['hɔ:tɪklʌltʃə] — садоводство;  
**human carelessness** ['kɛələsnəs] — небрежность, халатность человека;  
**human-assisted** — с участием человека;  
**humans** — люди; человечество;  
**humid** ['hju:mɪd] — влажный;  
**humidities** — показатели влажности;  
**humidity** — сырость, влажность; влага, мокрота;  
**humus** ['hju:məs] — гумус, перегной;  
**hydrologic flow modulator** — модулятор гидрологических (водных) потоков;

## I

**ice cap** — ледниковый покров;  
**ichneumon** [ɪk'nju:mən] — фараонова мышь, мангуста; ихневмон (энтомофаг);  
**ignore** — игнорировать, пренебрегать, не придавать значения;  
**impact** ['ɪmpækt] — воздействие, влияние; эффект;  
**impair** [ɪm'peɪə] — ухудшать(ся), портить(ся); причинять ущерб;  
**impermeable** [ɪm'pɛ:miəbl̩] — непроницаемый; герметический;  
**impose** — налагать (ограничения); устанавливать;  
**in contradistinction (to)** — в отличие (от);  
**in full sun** — в солнечном месте; в полностью освещенном месте;  
**in particular place** — именно в этом месте;  
**in perpetuity** [ˌpɛ:prɪ'tju:ɪtɪ] — постоянно; пожизненно; на неограниченный срок;  
**inaccessible** — недоступный, недостижимый;  
**incentive** [ɪn'sentɪv] — побуждение, стимул;  
**incoming** — входящий, поступающий;  
**incomplete** — неполный, недостаточный;  
**indicate** — показывать, указывать;  
**indicative** — указывающий, свидетельствующий;  
**infrared scanning tower** — вышка инфракрасного сканирования;  
**inhabit** — населять, обитать; проживать;  
**inherent** [ɪn'herənt] — неотъемлемый, присущий, свойственный;  
**inherently** [ɪn'herəntli] — по сути, по своему существу, в действительности;  
**initial description** — первоначальное описание;  
**initiate** — начать, приступать, положить начало; побуждать, стимулировать;  
**inland** — внутренняя часть страны; территория, удаленная от моря или границы;  
**inner bark (phloem)** — внутренний слой коры;  
**innermost sapwood** — самый глубокий слой заболони;  
**insect** — насекомое;

**insect outbreak** — вспышка; внезапное появление;  
**insertion** — вставка; вкладка;  
**insoluble** — нерастворимый;  
**insulator** — изолятор; изоляционный материал;  
**intact** [in'tækt] — нетронутый; невредимый; целый;  
**integrate** — объединять (в одно целое); интегрировать;  
**integrity** [in'tegriti] — целостность; непрерывность;  
**interact** [intə'rækt] — взаимодействовать, влиять друг на друга;  
**intercept** [,intə'sept] — останавливать, задерживать; преградить путь, помешать;  
**interconnected communities** — взаимосвязанные сообщества;  
**intervention** — вмешательство;  
**intricate** ['intrikət] — запутанный, сложный, замысловатый;  
**introduction** — интродукция, введение в состав животного или растительного мира;  
**invasive** [in'veisiv] — инвазивный;  
**invigorate** [in'vigəreit] — давать силы, укреплять; вселять энергию;  
**invisible** — невидимый, незримый;  
**involucre** ['invəlu:kə] — обертка соцветия;  
**involve** — втягивать, вовлекать; вызывать, приводить (к чему-л.); запутывать;  
**isotherm** ['aisəuθe:m] — изотерма (линия равной температуры);

## J

**juniper** ['dzu:nipə] — можжевельник;  
**juvenile** ['dzu:vənail] **leaves** — молодые листья;

## K

**knot-free lumber** — пиломатериалы без сучков;

## L

**lack** — испытывать недостаток, нуждаться; отсутствовать;  
**lamina** ['læminə] — пластина листа; тонкая пластинка;  
**landowner** ['lændəunə] — землевладелец;  
**larch** — лиственница;  
**late** — недавний, последний; покойный, недавно умерший;  
**lateral** — латеральный, боковой;  
**latitude** ['lætɪtju:d] — широта (географическая);  
**laurel** ['lɔ:rəl] — лавр благородный;  
**leach soil** — выщелачивать почву;  
**leaf longevity** [lɔ:n'dʒeviti] — долговечность листа;  
**leaf scar** — листовой рубец;  
**leaf-blade (lamina)** — пластина листа;  
**leaf-bud** — листовая почка;

**leaflet** — листочек, листик; молодой лист;  
**leaf-roller moth** — листовертка;  
**leaf-stalk** — стебель листа;  
**leap** — прыгать, скакать; перепрыгивать, перескакивать;  
**leeward** ['li:wəd] — подветренная сторона; подветренный;  
**lenticel** ['lentisəl] — чечевичка (поры в коре ветвей);  
**lessen** — уменьшать(ся), сокращать(ся); преуменьшать; недооценивать, умалять;  
**lichen** ['laikən] — лишайник;  
**lightning** ['laitniŋ] — молния;  
**lignin** — лигнин;  
**likewise** — подобно, подобным образом; так же;  
**limit** — предел; граница; порог || устанавливать предел; ограничивать;  
**limitation** — недостаток; ограничение;  
**locate** — определять местонахождение; располагать в определенном месте;  
**logging** — лесозаготовки; трелёвка, вывозка леса;  
**long-lived** — долгоживущий; долговременный;  
**loss** — потеря; убыток, ущерб;  
**lot** — участок (земли);  
**low salt concentration** — низкая концентрация солей;  
**lung** — *анат.* легкое;  
**lynx** — рысь;

## М

**mahogany** [mə'hɔɡəni] — красное дерево;  
**maintain** [main'tain] — поддерживать, сохранять;  
**maintain forests** — поддерживать, содержать (в хорошем состоянии);  
**majority** — большинство;  
**mammal** ['mæməl] — млекопитающее;  
**managed reforestation** — регулируемое, управляемое лесовозобновление;  
**manually** — вручную;  
**maple** — клен;  
**marked** — явный, заметный;  
**marshy** — болотный; болотистый, топкий;  
**marten** — куница;  
**maturation** [ˌmætʃu:'reɪʃn] — созревание; достижение полного развития;  
**mature** [mə'tʃuə] — созревать; созревший, зрелый;  
**maturity** [mə'tʃuəriti] — созревание; зрелость;  
**maximum** (*p/l.* maxima) — максимум; максимальный показатель;  
**mean** — средняя величина, среднее число;  
**measure** ['meɪzə] — мера;  
**mechanical obstruction** — механическое препятствие; непроходимость;  
закупорка, блокада;

**meet the goal** — удовлетворять, отвечать, соответствовать цели;  
**merge** ['mɛ:dʒ] — сливать(ся), соединять(ся) (into, with);  
**mesophyll** ['mesəu,fil] — мезофилл (фотосинтезирующая паренхима);  
**microscopic realm** [relm] — микроскопическое царство;  
**mineral nutrients** — минеральные питательные вещества;  
**mineral salts** — минеральные соли;  
**minute** [mai'nju:t] — мелкий, мельчайший;  
**mistreatment** — неправильный уход; плохое обращение;  
**mitigate** ['mitigeit] — смягчать, уменьшать; облегчать;  
**mixed temperate forest** — смешанный лес умеренного климата;  
**moderate** — смягчать; умерять, сдерживать;  
**modify** — видоизменять, трансформировать, модифицировать;  
**moist** — сырой; влажный, мокрый;  
**moisture** — влага; вода;  
**moisture content** — влагосодержание, влажность, содержание влаги;  
**monkey** — обезьяна;  
**monoculture** ['mɒnəu,kltʃə] — монокультура;  
**monoculture forest** — монокультурный лес;  
**monoecious** [mɒ'ni:ʃəs] — обоеполый;  
**monotypic** — монотипный (о роде); не имеющий подвидов (о виде);  
**moss** — мох; плаун; лишайник;  
**mound** — насыпь; вал || сооружать насыпь или вал;  
**mouse** (pl. mice) — мышь;  
**muddy** — грязный, запачканный; мутный;  
**mulberry** — шелковица, тутовое дерево;  
**multinodal** [,mʌlti'nəudəl] — многомутовчатый; многоузловой;  
**mycorrhizae** [mai'kɔrɪzə] — микориза;

## N

**naked** — голый, нагой; обнаженный;  
**narrow-oblong** — удлиненно-продолговатый;  
**native** — местное (растение или животное); естественный; родной, исконно присущий;  
**native tree stock** — фонд местных деревьев;  
**natural fire** — естественный пожар;  
**natural regeneration** — естественное восстановление; естественное лесовозобновление, самосев;  
**natural seeding** — естественный посев, самосев;  
**needle** — игла, хвоя (иголка);  
**needle-leaved** — хвойный;  
**negative impact** — воздействие, влияние; эффект;  
**net effect** — конечный результат;

**net venation** — сетчатое жилкование, расположение жилок (на листе);  
**network of veins** — сеть жилок;  
**newly born** — новорожденный;  
**node** — узел; нарост; мутовка;  
**nomenclature** [nəu'menklətʃə] — номенклатура (совокупность или перечень названий);  
**non-photosynthetic** — нефотосинтезирующий;  
**northern hemisphere** ['hɛmɪsfɪə] — северное полушарие;  
**northernmost** ['nɔːðəntməʊst] — самый северный;  
**nutrient** ['njuːtriənt] — питательное вещество, питательный элемент; питательный;  
**nutrient** ['njuːtriənt] sap — питательный сок;  
**nutrient-poor** — бедный (питательными веществами);

## О

**oak** — дуб;  
**obstacle** ['ɒbstəkl] — помеха, преграда, препятствие; затруднение;  
**obstruction** [əb'strʌkʃn] — препятствие; обструкция;  
**obtain** [əb'teɪn] — получать; добывать; приобретать;  
**occur** [ə'kɜː] — происходить, случаться, иметь место;  
**odor** — запах;  
**old growth** — спелое (лесо)насаждение;  
**old-established forest** — давнишний, давно установленный, старый лес;  
**oldgrowth trees** — перестойный лес, перестойные деревья;  
**omit** — пропускать, упускать; не включать;  
**omnivore** ['ɒmnɪ,vɔː] — всеядное животное;  
**open-grown specimen** — деревья, выросшие на открытом месте;  
**organically-enriched** — обогащенный органикой;  
**original forest** — начальный, первоначальный, исходный лес;  
**ornamental planting** — декоративные, орнаментальные посадки (насаждения);  
**osmosis** [ɔz'məʊsɪs] — осмос;  
**outer layer** — внешний, наружный слой;  
**outgoing** — выходящий; исходящий;  
**ovarian** [əu'veəriən] — овариальный, яичниковый;  
**ovary** ['əʊvəri] — завязь; яичник;  
**owl** [aʊl] — сова; сыч; филин;  
**oxidation** [ˌɒksɪ'deɪʃn] — окисление;

## Р

**painstakingly** — старательно, усердно, кропотливо, скрупулезно, тщательно;  
**paneling** — панель (обшивки); филёнка || обшивать панелями;  
**pasture** ['pɑːstʃə] — пастбище, выгон;  
**patch** — пятно, участок, небольшой участок земли;

**pattern** — образец, модель; система, структура;  
**peat fire** — подземный (торфяной) пожар;  
**pedicel** ['pedisel] — цветоножка;  
**peduncle** — стебель, ножка;  
**peltate** — щитовидный;  
**penetrate** — проникать (внутри);  
**perfect flower** — настоящий, идеальный; совершенный, безупречный;  
**perianth** ['periænθ] — околоцветник;  
**periodicity** [,piəriə'disəti] — периодичность;  
**permanent** — перманентный постоянный;  
**permeability** [,pɛ:miə'biliti] — проницаемость; просачиваемость;  
**permeable** ['pɛ:miəbl] — проницаемый, проходимый;  
**persist** — сохраняться; продолжать существование; упорствовать;  
**perspective** [pɛ'spektiv] — ракурс, проекция; перспектива;  
**pest** — вредитель, паразит;  
**petal** — лепесток;  
**petiole** ['petiəul] — черешок листа;  
**pheasant** ['fezənt] — фазан;  
**phloem** ['fləuəm] **cells** — клетки флоэмы;  
**photoperiod** [,fəutəu'piəriəd] — фотопериод; световой день;  
**photosynthesis** [,fəutə'sinθəsis] — фотосинтез;  
**phylogenetics** — филогенетика (наука о закономерностях исторического развития разных групп организмов);  
**physiognomy** [,fizi'ɒnəmi] — учение о живом, о природе;  
**pine** — сосна;  
**pinon pine** — сосна съедобная; сосна однохвойная (*Pinus monophylla*);  
**pistil** — пестик;  
**pistillate** ['pistileit] **flower** — женский цветок;  
**pith** — сердцевина;  
**plant detritus** [di'traitəs] — детрит (кашицеобразный продукт распада тканей);  
**plantation** [plæn'teɪʃn] — плантация, лесопосадка;  
**plantation density** — плотность насаждений;  
**plateroot / flatroot** — пластинчатый, плоский корень;  
**plot** — наносить (на карту);  
**plough** [plau] — вспахивать, пахать;  
**poison** — яд || отравлять;  
**pollen** ['pɒlən] — пыльца;  
**pollination** [,pɒlə'neiʃn] — опыление;  
**polygamous** [pɒ'ligəməs] — полигамный;  
**polypetalous** [,pɒli'petələs] — многолепестный, раздельнолепестный;  
**Ponderosa pine** — сосна желтая;  
**poplar** — тополь;

**porous** ['pɔːrəs] — пористый;  
**pour down** — лить(ся);  
**precede** — предшествовать;  
**precipitation** [priˌsɪpi'teɪʃn] — выпадение осадков; осадки;  
**predation** — грабительство, хищничество;  
**predatory** — хищный;  
**predictable** — предсказуемый;  
**predominantly** — особенно, преимущественно;  
**prescribed** — заданный, установленный;  
**prescribed burning** — заданное; предписанное выжигание, сжигание;  
**preservative** [pri'zɛ:vətɪv] — предохраняющее средство; профилактическое средство; консервант;  
**preserve** — беречь, оберегать, охранять;  
**prevail** — преобладать, господствовать, превалировать; доминировать;  
**prevalent** ['prevelənt] — распространенный; преобладающий; превалирующий;  
**prevent** [pri'vent] — предохранять, предотвращать, предупреждать, не допускать;  
**previous** ['pri:vɪəs] stand — предыдущий; предшествующий древостой;  
**prey** — добыча;  
**prey (on)** — ловить, охотиться (на);  
**primary forests** — первобытные (девственные) леса;  
**primitive** — примитивный, простой, несложный;  
**privet** ['prɪvɪt] — бирючина;  
**profile** ['prəʊfaɪl] — вертикальный разрез; сечение;  
**profound** [prə'faʊnd] — сильный, глубокий;  
**progeny** ['prɒdʒəni] — потомство;  
**prominence** — выступ; выпуклость; видное положение;  
**promptly** ['prɒmtli] — быстро, без промедления; сразу;  
**pronounced** — заметный, явный;  
**pronounced change** — заметное изменение;  
**proper** — правильный, должный; надлежащий; подходящий;  
**property** — свойство, качество; отличительная черта, особенность;  
**prosper** ['prɒsɪərə] — процветать; благоприятствовать, подходить;  
**prostrate** ['prɒstreɪt] — стелющийся;  
**protein** ['prəʊtiːn] — протеин, белок;  
**pruning** — обрезание ветвей, удаление сучьев;  
**pseudowhorl** ['sjuːdəu'wɔːl] — псевдомутовка; псевдовиток;  
**pubescence** [pjuː'besəns] — опушение, опушенность;

## Q

**quarantine** ['kwɔːrəntaɪn / 'kwɔːrəntiːn] **law** — закон о карантине;

## R

**raccoon** [rə'ku:n] — енот;

**radiation** [,reidi'eɪʃn] — излучение;

**rainfall** — количество осадков;

**range** [reɪndʒ] — ареал, область распространения || простираться; колебаться  
в известных пределах;

**raptor** — хищник;

**rate** — интенсивность; скорость; степень; норма;

**raven** — ворон;

**receptacle** [ri'septəkl] — ложе; цветоложе, ложе соцветия; цветоножка;

**recognize** — признавать; узнавать; распознавать;

**recovery** [ri'kʌvəri] — регенерация, восстановление;

**recreation** — восстановление, возобновление (природных ресурсов);  
рекреация, отдых; восстановление здоровья, душевных  
и физических сил; выздоровление;

**recycle** [ri'saɪkl] — использовать повторно, перерабатывать; рециркуляция;

**red alder** — ольха;

**Red Data Books** — Красная книга;

**redress** — исправлять, поправлять; восстанавливать (равновесие); устранять  
(несоответствие, расхождение);

**reduce** — уменьшать, ослаблять, снижать;

**reduction** [ri'dʌkʃn] — редукция; уменьшение, ослабление, снижение;

**re-establish** — исправлять, поправлять; восстанавливать(ся);

**re-establishment of forest** — восстановление прежнего леса;

**reforestation** [,ri:fɔrə'steɪʃən] — лесовосстановление; насаждение лесов,  
восстановление лесных массивов;

**regardless (of)** — безотносительно к чему-л., невзирая (на);

**regeneration** — регенерация, восстановление;

**relative** — относительный; сравнительный; релятивный;

**relative velocity** — относительная (условная) скорость;

**release** — сбрасывание, выброс || выпускать; освобождать; избавлять;

**remedy** — средство; лекарство, лечебное средство;

**removal** — устранение; ликвидация; удаление;

**remove** [ri'mu:v] — удалять, устранять; передвигать, перемещать;

**repeated stressing** — многократное, частое напряжение (нагрузка);

**replant** [,ri:'plɑ:nt] — реплантировать, пересаживать (растение); снова  
засаживать (растениями);

**replicate** — дублировать; тиражировать;

**reproductive** — репродуктивный; генеративный, воспроизводительный;

**reptile** — пресмыкающееся, рептилия;

**require** — нуждаться (в чем-л.); требовать (чего-л.);

**residual** [rɪ'zɪdʒuəl] — остаточный;

**residual stand** [rɪ'zɪdʒuəl] — остаточный древостой;  
**resilience** [rɪ'zɪliəns] — упругость; способность восстанавливать здоровое физическое состояние;  
**resilient** [rɪ'zɪliənt] — упругий; способный восстанавливать здоровое физическое состояние;  
**resin** — смола;  
**resinous** ['rezɪnəs] — смолистый;  
**resinous bark** — смолистая кора;  
**resist** — сопротивляться, оказывать сопротивление; противостоять;  
**resistant to freezing** — морозоустойчивый;  
**respect** — уважение; признание; почтение;  
**respiration** [,respə'reɪʃn] — дыхание;  
**restocking (of forest)** [,ri:'stɔ:kɪŋ] — возобновление запасов; лесовозобновление, лесовосстановление;  
**restore balance** — восстановить равновесие;  
**restoring** — восстановление;  
**restriction** — ограничение;  
**resulting forest** — полученный лес;  
**retain capacity** — сохранять способность;  
**retain water** — удерживать; сохранять воду;  
**retard** — замедлять; задерживать;  
**reticulate** [ri'tɪkjələt] — сетчатка; сетчатый, ретикулярный;  
**revise** — проверять; исправлять; пересматривать;  
**ridged** ['rɪdʒd] — гребенчатый; заострённый, остроконечный;  
**rigid** ['rɪdʒɪd] — неподвижный; жесткий;  
**ripen** — созревать; вызревать; дозревать;  
**ripened ovary** ['əʊvəri] — созревшая завязь;  
**rock outcrop** — выход (пласта или залежи) на поверхность, обнажение пород;  
**rodent** ['rəʊdənt] — грызун;  
**root** — корень;  
**root hair** — корневой волосок;  
**root/shoot ratio** — пропорция (соотношение) между корнем и побегом;  
**rot** — гниль; гнить;  
**rotation** — ротация, чередование;  
**rough** [rʌf] — грубый; жесткий; неровный;  
**rough-legged buzzard** — зимняк, мохноногий канюк (*Buteo lagopus*);  
**rowan** ['rəʊən] — рябина;  
**runoff** — сток (осадков);  
**ruptured** ['rʌptʃəd] **strand** — оторванная, разорванная жила;

## S

**safeguard** — гарантия; защита; охрана || гарантировать; защищать; охранять;

**sandbar** — песчаная полоса;  
**sap** — заболонь; сок растений;  
**sap flow** — передвижение сока;  
**saprophytes** ['sæprəfəɪt] — сапрофиты (микроорганизмы, питающиеся органическими веществами отмерших организмов);  
**sapwood** — заболонь древесины;  
**satellite** ['sætələɪt] **monitoring** — спутниковый мониторинг;  
**saturate** ['sæt.ʃəreɪt] — насыщать; сатурировать; пропитывать;  
**save** — спасать; охранять, защищать; беречь, экономить;  
**saw** — пилить(ся); распиливать;  
**scale leaf** — прилистник; почечная чешуйка;  
**scalping** — обнажение (почвы), удаление растительного слоя;  
**scalping machines** — обдирочный станок;  
**scaly** ['skeɪli] — чешуйчатый, покрытый чешуей; слоистый;  
**scarce** — недостаточный, скудный; редкий, дефицитный;  
**scarifying machine (scarifier** ['skærɪfaɪə]) — культиватор-рыхлитель;  
**scatter** — разбрасывать, рассеивать || разброс;  
**scattered** ['skætəd] **tree** — отдельно растущее дерево;  
**scenery** — вид, пейзаж; ландшафт;  
**Scots pine** — сосна обыкновенная;  
**seasonal increment** ['iŋkrɪmənt] — сезонный прирост;  
**second growth** — молодое насаждение; вторичный (производный) лес; второй ярус;  
**secure natural regeneration** — гарантировать; обеспечивать естественное возобновление;  
**seed** — семя;  
**seed production** — семяобразование; производство семян;  
**seed shell** — оболочка, скорлупа семени;  
**seed-bearing** — семяносный;  
**seed-bearing organ** — семяобразующий орган;  
**seed-eater / seed-eating bird** — птицы, поедающие семена;  
**seedling** — сеянец; саженец, рассада; зернышко;  
**seedlot** — земельный участок для посева;  
**seed-tree** — семенное дерево; семенник;  
**selection cutting** — выборочная вырубка;  
**semi-desert** [,semi'dezət] — полупустыня;  
**semipermanent** — почти неизменный; полупостоянный;  
**sensor network** — сеть датчиков (сенсоров);  
**sepal** ['sepəl] — чашелистик;  
**separate** — изолированный; обособленный; отдельный;  
**seral** — сукцессионный, серийный;  
**seral pattern** — сукцессионная, серийная модель.

**serene beauty** — безмятежная, невозмутимая красота;  
**sessile** ['sesail] — сидячий; бесчерешковый;  
**shade** — тень; полумрак;  
**shallow roots** — поверхностные корни;  
**shape** — форма; конфигурация;  
**shed snow** — сбрасывать снег;  
**shelter** — заградительные насаждения;  
**shelter belt** — лесополоса;  
**shield** — щит;  
**shoot** — прорасти || выбрасывание ростков; побег, росток;  
**shortage of food** — нехватка, недостаток пищи;  
**shower** [ʃaʊə] — ливень, ливневый дождь;  
**shrub** [ʃrʌb] — куст, кустарник;  
**Siberian thrush** — дрозд сибирский;  
**sieve tube** — ситовидная трубка;  
**silver fir** — пихта европейская;  
**silvicultural** ['silvi,kʌltʃərəl] — лесоводческий;  
**silvicultural practices** — лесоводческая практика, деятельность;  
**silviculture** ['silvi,kʌltʃə] — лесоводство;  
**similar (to)** ['similə] — подобный; похожий, сходный;  
**similarity** [,simə'lærəti] — сходство, подобие;  
**single aged stand** — древостой из деревьев одного возраста;  
**single specied stand** — древостой из деревьев одной породы;  
**sink** — просачиваться; впитываться; оседать;  
**site** — место, участок;  
**site preparation** — расчистка территории, участка;  
**slope** — уклон; склон;  
**slough off** — отторгаться;  
**slow down the velocity** — снижать скорость, замедлять;  
**smolder** ['sməuldə] (= smoulder) — тлеть;  
**smooth** — гладкий, ровный; однородный;  
**soil** — почва, грунт, земля;  
**soil drainage** — дренаж почвы;  
**soil formation** — образование, формирование почвы;  
**soil preparation** — подготовка почвы;  
**soil properties** — свойства почвы;  
**solar** — солнечный;  
**soluble compounds** — растворимые соединения;  
**solve** — растворять;  
**sound** — правильный; обоснованный; здравый; здоровый, крепкий;  
**sparrow** — воробей;  
**specific name** — видовое название; собственное имя (в отличие от родового);

**spectacular** — впечатляющий; эффектный;  
**specimen** ['spesəmin] — образец; экземпляр; особь;  
**spine thorn** — колючка, шип;  
**spiral** — спираль; виток (спирали);  
**spirally inserted** — винтообразно, спирально расположенный;  
**split** — раскалывать(ся); разрушать; расщеплять(ся);  
**split open** — раскрываться;  
**sponge** [sprɒndʒ] — губка; вытирать или мыть губкой;  
**spontaneous** [sprɒn'teiniəs] — стихийный; неподготовленный, спонтанный;  
**spot** — место, местность; участок;  
**spring up** — возникать, появляться; прорасти;  
**sprout** [spraut] — давать почки, пускать ростки, давать побеги, расти; || побег, росток; отросток;  
**sprouting** — всход; росток; побег; давать ростки, распускаться (о листьях);  
**spruce** — ель;  
**spur shoot** — укороченный побег;  
**squirrel** ['skwɪrəl] — белка;  
**stable** — стойкий; устойчивый; крепкий, прочный; постоянный;  
**stamen** ['steimən] — тычинка;  
**staminate** ['stæminɪt] **flower** — тычиночный цветок;  
**stand** — лесонасаждение; древостой;  
**standing trees** — деревья на корню;  
**starch** — крахмал;  
**stem tip** — верхушка ствола;  
**sterile** ['sterail] — бесплодный; неспособный к деторождению; стерильный;  
**stipule** ['stɪpjʊ:l] — прилистник;  
**stock** — совокупность объектов; запас(ы);  
**stock** — ствол, пень;  
**stoma** ['stəʊmə] (*pl.* stomata) — устьице (дыхательное отверстие листа);  
**storage** ['stɔ:ridʒ] — сохранение, хранение;  
**storage tissue** ['tɪsjʊ: / 'tɪfju:] — запасаящая ткань, паренхима;  
**stout** [staut] — крепкий, плотный, прочный;  
**straightforward** — прямой; откровенный;  
**stratifying media** — способ, средство стратификации;  
**stream** — река, ручей; поток, струя;  
**strength** — прочность; интенсивность, мощность;  
**stunt growth** — останавливать рост;  
**style** — *бот.* столбик;  
**subfamily** — подсемейство; субсемья, вторичная семья, семья второго поколения;  
**subject (to)** — подвергать(ся) склонный, предрасположенный (к чему-л.);  
**subsequent** ['sʌbsɪ:kwənt] **thinnings** — последующее прореживание (леса);  
**subtundra forests** — лесотундра;



**terminate** — кончать(ся), завершать(ся) (чем-л.);  
**terrestrial biome** ['baɪ,əɪm] — наземный биом; живущий на земле или в земле;  
**thinning** — прореживание (леса); рубка ухода;  
**threat** — угроза;  
**threaten / endanger with extinction** — подвергать опасности исчезновения;  
**thrive** — процветать; пышно расти, разрастаться;  
**thrush** — дрозд;  
**tight** — плотно прилегающий, тугой;  
**timber** — лесоматериалы; строевой лес; древесина;  
**tiny** — крошечный;  
**tip (of the cone)** — кончик (шишки); верхушка, верхний конец;  
**tolerant** ['tɒlərənt] — толерантный, выносливый; терпимый;  
**tolerate** ['tɒləreɪt] — выносить, терпеть;  
**total** — общий, совокупный, суммарный;  
**total precipitation** — общее количество осадков;  
**totality** [təʊ'tælɪti] — полнота, цельность; целостность; вся сумма целиком, все количество;  
**tough** [tʌf] — грубый, жесткий;  
**trace** — проследить, установить; различить, разглядеть;  
**tramp** — топтать, утапывать, утрамбовывать;  
**transpiration** [,træns'paɪreɪʃn] — испарение; выделение жидкости (из организма в виде паров);  
**transpire** [træns'paɪə] — испаряться; проступать в виде капель;  
**transplant** — пересаживать;  
**treat** — подвергать (технологической) обработке, обрабатывать; очищать;  
**treatment** — лечение; обращение; обработка; очистка;  
**tree genetics** [dʒɪ'netɪks] — генетика деревьев;  
**tree trunk** — ствол дерева; (древесный) хлыст;  
**treeplanting** — облесение, посадка леса;  
**treestand = stand** — лесонасаждение; древостой;  
**treestand age** — возраст древостоя;  
**trembling aspen** — осина дрожащая; тополь осинообразный (*Populus tremuloides*);  
**trophic level** — уровень питания;  
**trophy** — трофей; добыча;  
**tropical rain forest** — тропический влажный лес;  
**twig** — веточка, прут;

## U

**under climatic conditions** — в климатических условиях;  
**under competition** — в условиях конкуренции;  
**undergo chemical change** — подвергаться химической реакции;

**undergrowth** — подлесок; подрост;  
**undisturbed** — нетронутый; ненарушенный (деятельностью человека);  
**undisturbed area** — ненарушенная (деятельностью человека) территория;  
**unfavourable** — неблагоприятный;  
**unfavourable soil** — неблагоприятная почва;  
**unfit for lumber** — непригодный для лесоматериалов, пиломатериалов;  
**unfortunately** — к несчастью, к сожалению;  
**unhampered** [ʌn'hæmpəd] — беспрепятственный, свободный; нестеснённый;  
**unhealthy** — вредный, опасный; больной, нездоровый;  
**uni(bi-)sexual flower** — однополый (двуполый) цветок;  
**uninodal** [ˌjuːni'nəʊdəl] — одномутовчатый;  
**unisexual flower** — однополый цветок;  
**unpredictable** — непредсказуемый;  
**upset** — нарушать; срывать; опрокидывать;  
**upset the balance** — нарушить равновесие;

## V

**value** ['væljuː] — значение, значимость; достоинство, ценность;  
**values** ['væljuːz] — достоинства, ценности;  
**vapour / vapor** ['veɪpə] — пар; туман; испарение;  
**variable** — переменная (величина); переменный; изменчивый, непостоянный;  
**variables** ['vɛəriəblz] — переменные (величины);  
**vascular** ['væskjulə] — васкулярный, сосудистый;  
**vascular tissue** — сосудистая ткань; сосудистая сеть, сплетение;  
**vascular bundle** — сосудистый пучок;  
**vegetative cover** — растительный покров;  
**vein** — жилка, прожилка; вена;  
**venation** [vi:'neiʃn] — жилкование; расположение жилок (на листе); венозная сеть;  
**vessel** ['vesl] — сосуд;  
**vestigial** [ves'ti:dʒiəl] — рудиментарный; остаточный;  
**viable populations** — жизнеспособные популяции;  
**vigour** — сила, энергия;  
**vine** — вьющийся стебель, лоза, плеть;  
**virulent strain** ['virulənt] — вирулентный (опасный) штамм;  
**vital** ['vaitəl] — жизненный; (жизненно) важный, насущный, существенный; необходимый;  
**volcano eruption** [vɒl'keɪnəʊ] — извержение вулкана;

## W

**want** — недостаток; необходимость || желать, хотеть;  
**warbler** ['wɔːblə] — певчая птица; славка (*Sylviidae*);

**warmth-loving species** — теплолюбивый вид;  
**wasp** ['wɔːsp] — оса;  
**waste** — потеря, ущерб; отходы || терять даром, тратить впустую;  
**water vapor** — водяные пары;  
**watershed** — водораздел, бассейн реки;  
**watershed protection** — охрана водораздела;  
**wavelength** — длина волны;  
**weak acid** — слабая кислота;  
**weasel** — ласка, горностай; куньи, куницы, куницеобразные (*Mustelidae*);  
**web of interactions** — сеть, система взаимосвязей;  
**weeping willow** — плакучая ива;  
**welfare of the tree** — благоденствие (процветание) дерева;  
**well-stocked forest** — достаточно густой лес;  
**white-throated sparrow** — белошейная воробьиная овсянка (*Zonotrichia albicollis*);  
**whorl** ['wɜːl] — мутовка; виток; изгиб;  
**wild** — дикий (о животных), дикорастущий (о растениях);  
**wilderness** ['wildənɪs] — пустыня; дикая местность;  
**wildfire** ['waɪldfaɪə] — лесной пожар; пожар (разрушительной силы);  
**wildfire fighting** — борьба с лесными пожарами; тушение лесного пожара;  
**wildlife** — дикий животный и растительный мир;  
**willow** — ива;  
**wilt** — вилт (увядание растений) || вянуть, поникать, увядать;  
**wind velocity** — скорость ветра;  
**wind-dispersed** — распространяемые ветром; ветроопыляемый;  
**windstorm** — буря, метель;  
**wolf** (*pl.* wolves) — волк;  
**wolverine** ['wʊlvəriːn] — росомаха;  
**wood** — древесина;  
**wood production** — производство древесины;  
**wood wasps** — рогахвосты (перепончатокрылые);  
**woodland** — лес; (лесо)насаждение; лесная площадь;  
**woodland caribou** ['kærəbuː] — лесной карibu (*Rangifer tarandus caribou*);  
**wood-pigeon** — вяхирь (*Columba palumbus*);  
**wrinkled** ['rɪŋkld] — морщинистый; складчатый;

## X

**xylem** ['zailəm] (= sapwood) — ксилема (основная проводящая ткань);  
**xylem** ['zailəm] **vessels** — сосуды ксилемы;

## Y

**yew** [juː] — тис европейский, тис ягодный.

## **ЗАКЛЮЧЕНИЕ**

В условиях интеграции российской науки и практической деятельности в единое мировое профессиональное пространство владение английским языком становится неременным условием успеха для будущих специалистов. Наше учебное пособие рассчитано на студентов, устремления которых не ограничиваются близкой перспективой, на тех, кто собирается совершенствоваться профессионально, опираясь на знание английского языка. Специалист сегодняшнего дня должен иметь доступ к мировому опыту, используя иностранный язык как инструмент повседневной практической деятельности. Объем информации на английском языке, поступающей через научные публикации и по оперативным каналам, заметно увеличивается с каждым годом. Эти объемы не по силам целым армиям профессиональных переводчиков. Кроме того, ценность информации заключается в ее своевременности и оперативности.

Авторы считают, что изучив все разделы учебного пособия «Лес и лесное хозяйство» и приложив достаточно старания студенты, несомненно, будут готовы к дальнейшей самостоятельной работе с использованием английского языка как профессионально значимого инструмента.

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**ЛЕСА И ЛЕСНОЕ ХОЗЯЙСТВО**

Учебное пособие для студентов специальностей «Лесное хозяйство» и «Лесное дело»  
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