Elżbieta Kloc

ENGLISH IN FORESTRY

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OD AUTORKI

Książka przeznaczona jest dla studentów wydziałów leśnych uczelni rolniczych, którzy uczą się się języka angielskiego na poziomie średniozaawansowanym lub wyższym (B1–B2), oraz dla leśników praktyków pragnących pogłębić swoją znajomość angielskiej terminologii leśnej.

Dobór tekstów, zadań i materiałów dodatkowych ma na celu zapoznanie z fachowym słownictwem używanym w leśnictwie. Opanowanie zaproponowanego materiału ułatwi korzystanie z fachowej literatury anglojęzycznej.

Książka została podzielona na trzy części: wstęp, podstawy leśnictwa i leśnictwo szczegółowe. Do książki dołączone są nagrania ułatwiające zapoznanie się z wymową trudniejszych terminów (pliki w formacie .mp4 można pobrać ze strony internetowej Lasów Państwowych www.lasy.gov.pl, w zakładce Informacje>Publikacje> In English). W razie problemów i wątpliwości związanych z wymową słówek polecam również słowniki internetowe, np. Merriam-Webster.

Podręcznik *English in Forestry* nie mógłby powstać bez pomocy wielu osób, które poparły pomysł na książkę, wspierały mnie przy pisaniu oraz pomogły w jej wydaniu. W szczególności dziękuję wydawcy podręcznika – Centrum Informacyjnemu Lasów Państwowych oraz leśnikom praktykom z RDLP Kraków i Katowice, a także pracownikom Wydziału Leśnego Uniwersytetu Rolniczego w Krakowie, którzy dzielili się ze mną swoją wiedzą fachową i udzielali cennych wskazówek. Serdecznie dziękuję dr. inż. Krzysztofowi Michalcowi za konsultację merytoryczną, ogromną życzliwość oraz cierpliwość w wyjaśnianiu mi zawiłości zagadnień leśnych, jak również za zasugerowanie literatury pomocnej przy opracowywaniu poszczególnych tematów, dr. inż. Piotrowi Grubie, który przeczytał wszystkie teksty, dzieląc się swoimi uwagami, a także Ramonowi Shindlerowi, który dokonał korekty językowej.

Elżbieta Kloc

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PART I

INTRODUCTION

1

STATE FORESTS IN POLAND

Forests in Poland are mainly state-owned and cover 7,367,000 hectares. Less than half of them (44.7 per cent) serve the productive, economic function which is timber production. State-owned forests are administered by a self-financing unit, called the State Forests, which governs 7,609,500 hectares of national property, consisting of afforested and non-afforested areas, wastelands, farmlands and waters, on behalf of the Treasury.

The objectives of the State Forests

The objectives of the State Forests can be divided roughly into two categories: productive and non-productive. The former encompasses activities and goods that bring profit (mainly timber and non-timber forest products) whereas the latter focuses on the ecological, recreational, scientific and educational aspects of forests.
Ecological education provided by the State Forests plays a crucial role in making society aware of the importance of issues such as nature conservation, promotion of biodiversity, wildlife protection and restoration of endangered species, to mention but a few.

Organisation of the State Forests

Directorate-General of the State Forests
17 Regional Directorates of the State Forests
430 Forest Districts

The job of a forester

The State Forests in Poland employ about 26,000 people, many of whom are well-educated and are graduates of the faculty of forestry at one of the Polish universities. In order to become a forester you must have a broad knowledge encompassing the biological aspects of growing trees as well as the technical and economic ones because foresters are experts in many fields. They know not only how to take care of forests but also how to draw maps, fight fires, build roads or even bridges. Finally, foresters have to be good managers because forests are treated like a company that produces goods and brings profit.

Based on: *Statistical Yearbook of Forestry*,
GUS, Warszawa 2020.

Worth remembering
state forests, the State Forests, state-owned, afforested areas, timber, nature conservation, timber/non-timber forest products, promotion of biodiversity, wildlife protection, restoration of endangered species, forest district

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. By what are state-owned forests in Poland administered?
2. How many hectares do the State Forests administer?
3. What are the goals of the State Forests?
4. How many Regional Directorates of the State Forests are there in Poland?
5. How many people do the State Forests employ?
6. What does a forester job include?

II. Match the words on the right with the ones on the left to make collocations.

1. cut	A. forest products
2. plant	B. fires
3. fight	C. animals
4. state	D. species
5. forest	E. conservation
6. bring	F. -owned
7. non-timber	G. profit
8. endangered	H. production
9. nature	I. down trees
10. timber	J. trees

FOLLOW-UP

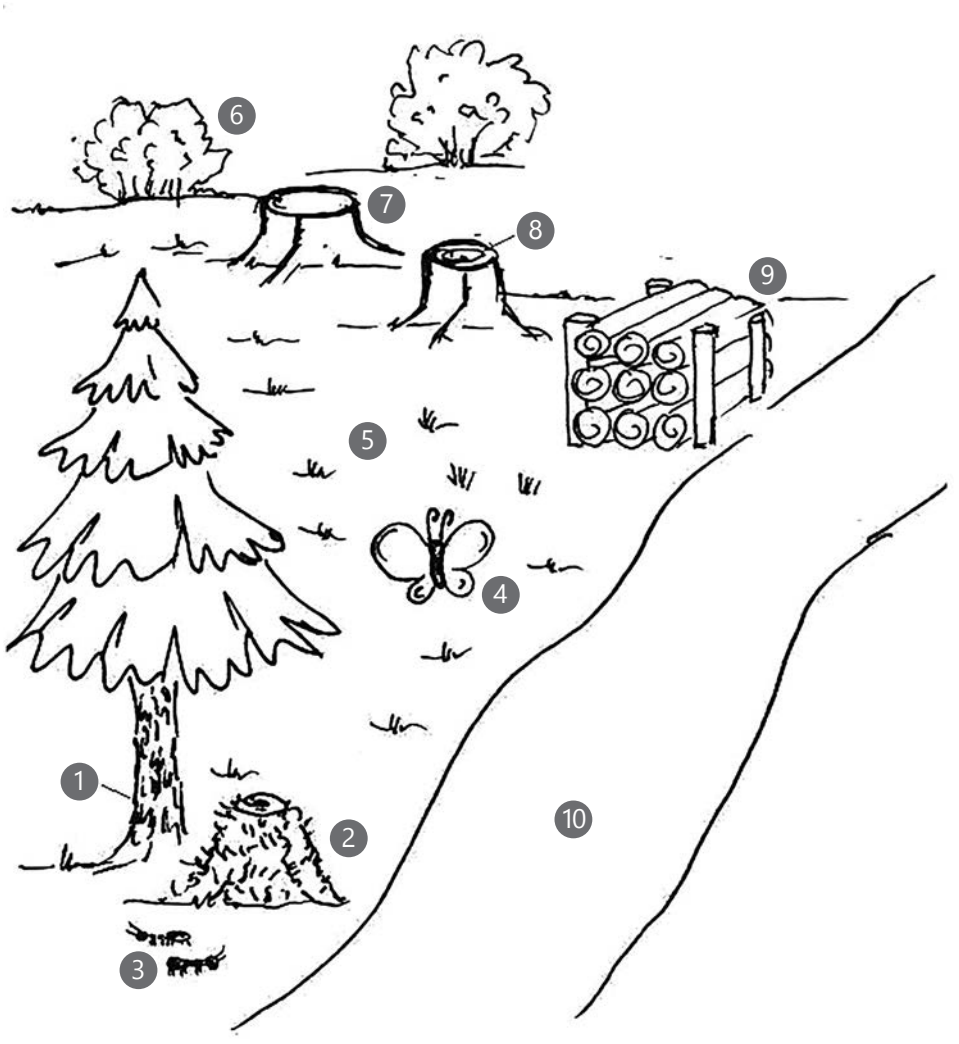
I. Where are the following units of the State Forests located? Use the words from the box.

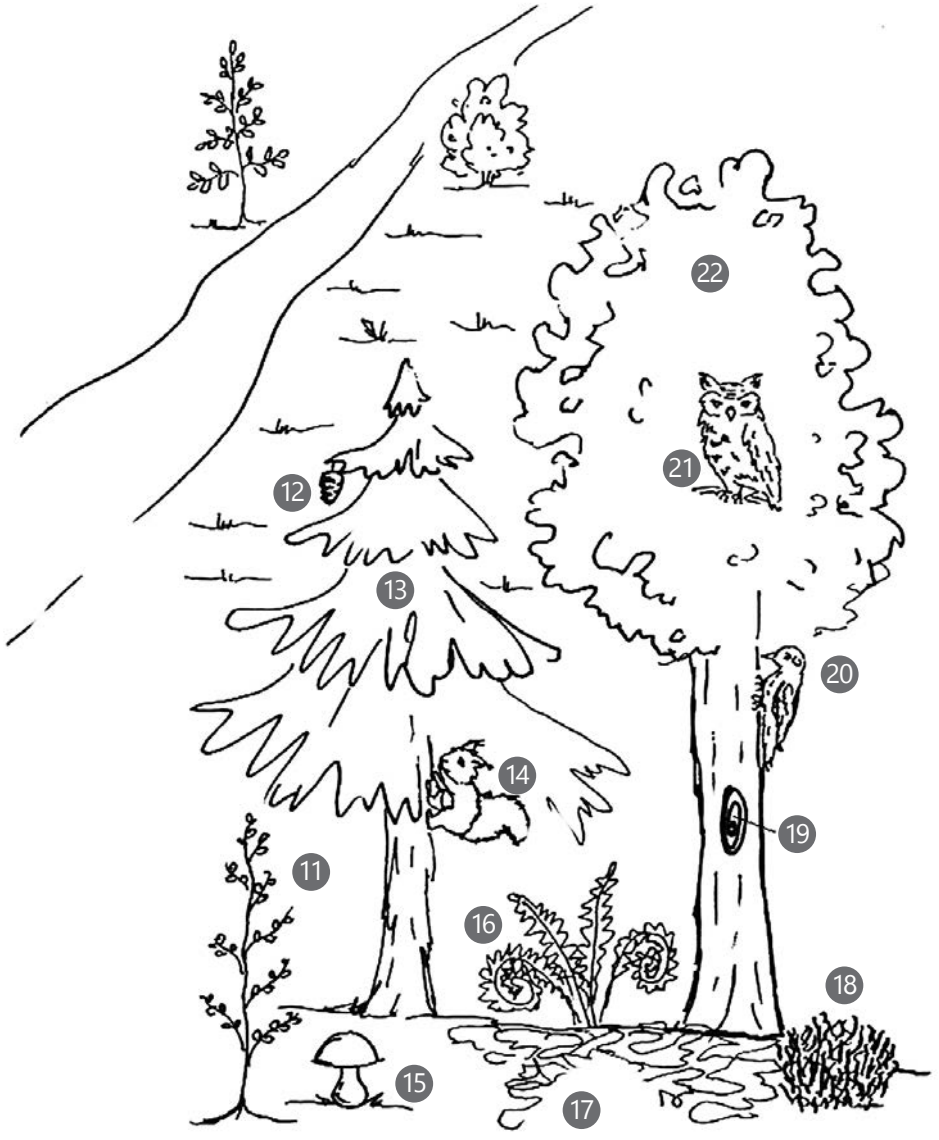
Gołuchów	Warsaw	Sękocin	Bedoń	Jarocin	Miłków

1. The State Forests Information Centre
2. The Centre for Research and Implementation
3. The Forest Technology Centre
4. The State Forests IT Department
5. The Coordination Centre for Environmental Projects
6. The Kostrzyca Forest Gene Bank
7. The Forest Culture Centre

II. Study the drawings and match the words from the box with the numbers 1–22 in the pictures.

butterfly	moss	stump	ant	broad-leaved tree
sapling	grass	litter	owl	stack of logs/wood
anthill	fern	squirrel	cone	annual rings
woodpecker	bark	hollow	bush/shrub	coniferous tree
mushroom	forest track			

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2

FOREST MANAGEMENT TODAY

In the past, forests were perceived by many as a never-ending supply of wood or, considering them in economic terms, huge factories generating large profits with comparatively low operating costs. Paying attention only to the economic side of the enterprise and neglecting biological ones produced, in many cases, disastrous and far-reaching effects because ruthless exploitation of forests resulted in deforestation, drought or forest degeneration reflected in ecosystem change and the dying out of numerous species of plants or animals which lost their habitat.

Nowadays, forests are no longer seen as wood factories only, but complex ecosystems performing several different tasks such as preventing soil erosion and landslides, reducing air pollution, protecting wildlife habitats, promoting biodiversity or recreation. Forests have also positive effects on local climate and water cycle. They prevent floods, protect water resources, act as windbreakers, reduce temperature extremes. They are also a source of non-timber products, such as venison, fruit, medicinal plants or mushrooms.

Although the approach to forest management has changed significantly, timber production still remains its most important component simply because it is the most profitable. However, it is worth remembering that production of timber takes a lot of time (at least 30–40 years) and therefore it ought to be carefully planned. Timber production consists of three consecutive, transitional and dynamic stages: regeneration, stand tending and harvesting.

Regeneration can be artificial or natural. The latter is seldom practised in forest management because it is slow, there is no control over tree species composition and it depends heavily on other factors such as seed production and distribution.

Stand tending concentrates on creating favourable conditions for tree growth ensuring at the same time a high quality of timber. Harvesting ends the production cycle and means cutting down trees. Once trees are felled the process begins again.

However, it is worth remembering that nowadays wood production integrates economic aspects of forest management with social, ecological and recreational ones. It should be carried out in such a way that the number of trees harvested should be established at a level that enables the forest to regenerate and does not disturb the delicate balance of the whole ecosystem. The number of trees which are cut down in a particular forest is not the same every year because it is modified by its age, fire, outbreaks of diseases, pest attacks and other factors that influence the number or health of trees.

The concept of forest management enabling their indefinite harvesting without lowering their productivity, yield quality or disturbing the additional, above-mentioned roles forests perform, is called sustained yield forestry. In sustainable forests not only economic aspects but also biological and social ones are taken into account. By implementing such an approach to forest management, forests are preserved for future generations for further, constant use and enjoyment.

Worth remembering
deforestation, die out, species, habitat, ecosystem, soil erosion, landslide, air pollution, wildlife, biodiversity, water resources, windbreaker, non-timber products, venison, medicinal plants, regeneration, stand tending, harvesting, fell trees, timber, forest management, outbreak of disease, pest, sustained yield forestry, sustainable forest

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. What was forest management based on in the past?
2. What were the results of such forest management?
3. What has changed in forest management over the years?
4. What roles do forests play?
5. What does timber production consist of?
6. What is the difference between factory production and timber production?
7. Which type of forest regeneration is the most popular?
8. How many trees can be felled every year?
9. What does their number depend on?
10. Explain the term ‘sustainable forest’.

II. In the text find the words that mean:

1. the process during which all trees covering a certain area are cut down or destroyed
2. become extinct, disappear completely
3. the place where plants grow or animals live
4. meat from wild animals
5. plants that can be used to cure diseases
6. cut down trees
7. an insect or small animal that damages crops and trees

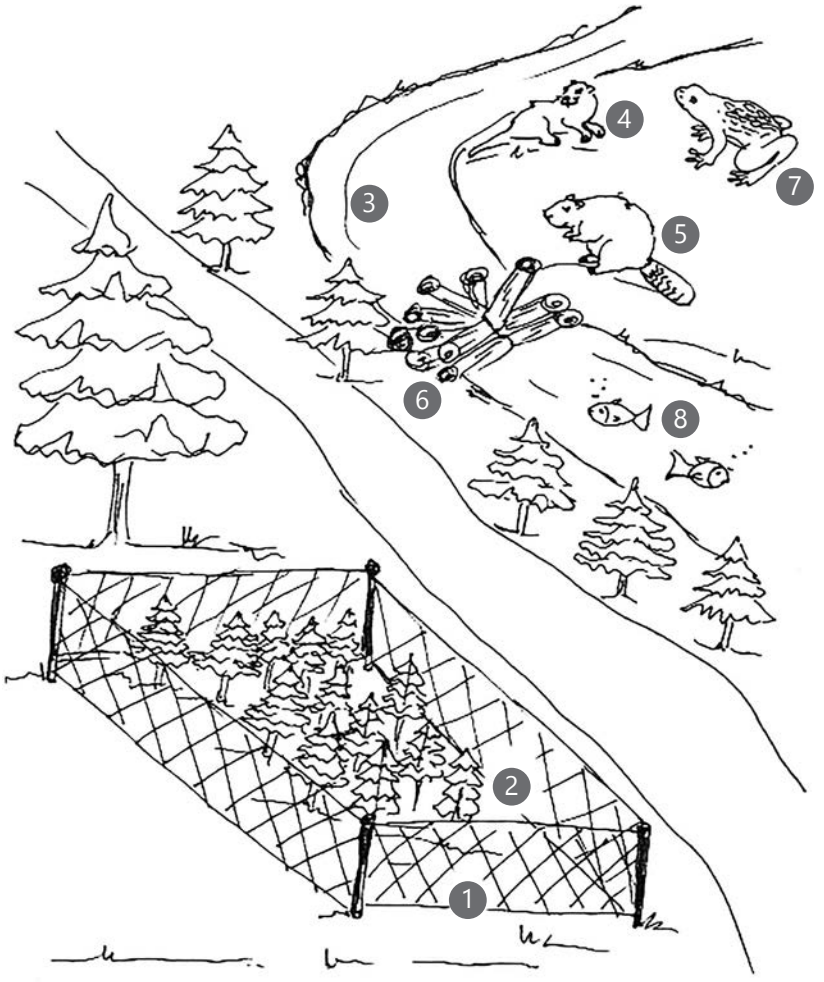
III. If the previous exercise was too difficult, match the definitions from exercise II with the words from the box.

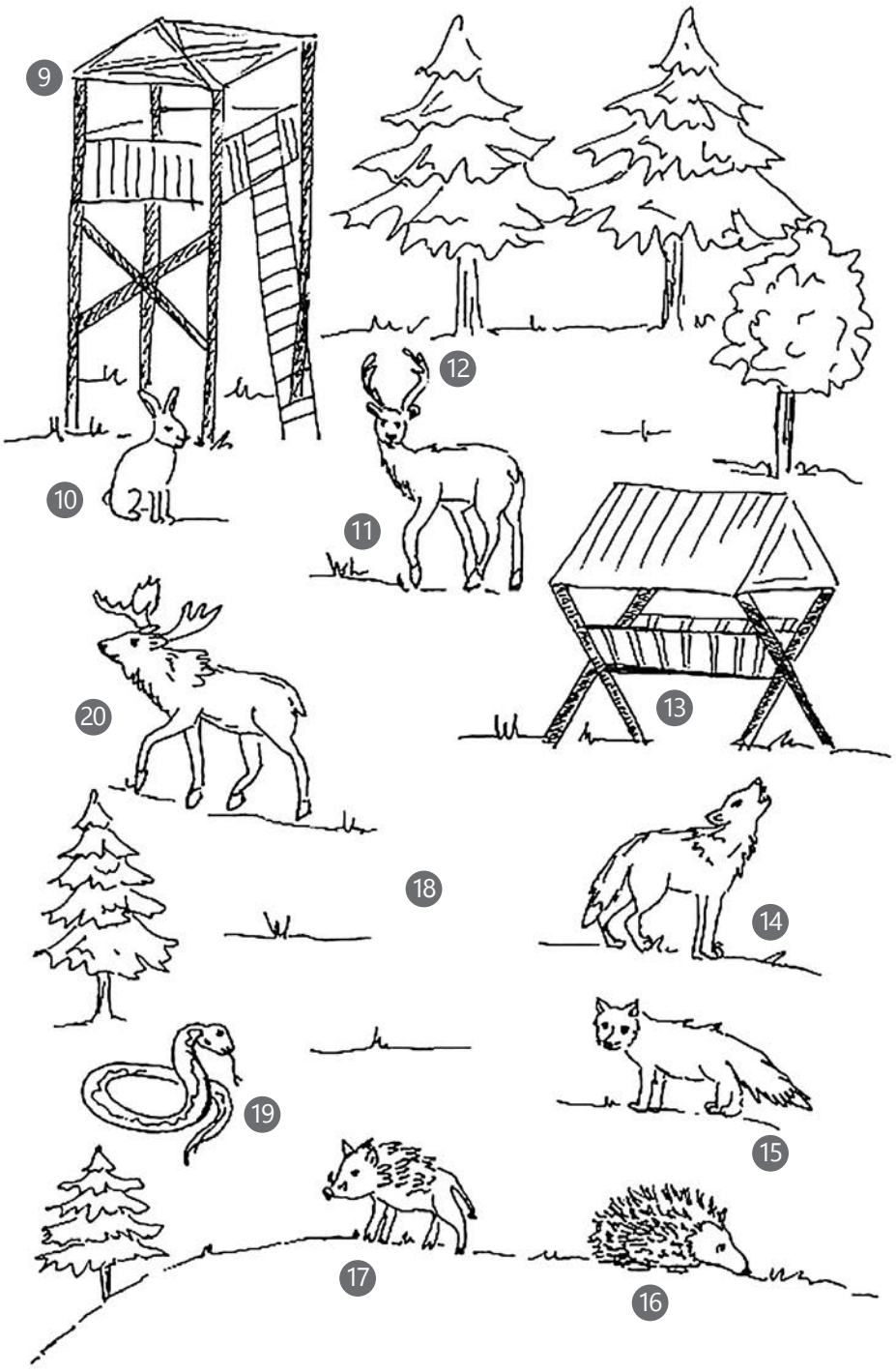
habitat	pest	fell	die out	medicinal plants	deforestation	venison

'FOREST' FOLLOW-UP

I. Study the drawing and match the words from the box with the numbers 1–20 in the picture.

fish	antlers	frog	hare
forest nursery	hedgehog	deer	snake
raised stand/hide	beaver	elk/moose	fox
winter feeding place	stream	fence	dam
wild boar	clearing/glade	wolf	otter

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POLISH FORESTS IN NUMBERS

I. How much do you know about Polish forests? Check your knowledge and answer the quiz questions.

QUIZ

1. Forests in Poland occupy:
   a. 10 per cent of the country's area
   b. almost one third
   c. more than 40 per cent
2. The percentage of area covered by forests is highest in:
   a. the Lubuskie province
   b. Małopolskie
   c. Podkarpackie
3. The percentage of area covered by forests is lowest in:
   a. the Śląskie province
   b. Dolnośląskie
   c. Łódzkie
4. The majority of Polish forests are:
   a. coniferous
   b. broad-leaved
   c. mixed
5. The most popular tree species in Polish forests is:
   a. birch
   b. spruce
   c. pine
6. Most of the forests in Poland are:
   a. 1–20 years old
   b. 21–60 years old
   c. 60–80 years old
7. Private forests constitute:
   a. 19.3 %
   b. 25.2 %
   c. 28.9 % of all forests
8. Private forests in Poland are almost non-existent:
   a. along the eastern border
   b. along the western border
   c. in the Mazowieckie province
9. The highest percentage of private forests is in:
   a. the Dolnośląskie and Śląskie provinces
   b. Świętokrzyskie and Podlaskie
   c. Małopolskie and Mazowieckie

II. Read the text and check whether your quiz answers are correct.

FACTS ABOUT POLISH FORESTS

- There is 0.241 of a hectare of forest per Polish citizen.
- Forests cover 29.6 per cent of the area in Poland. However, the distribution of forests across the country is not even. For instance, in the Łódzkie province afforested areas occupy only 21.5 per cent whereas in Lubuskie it is 49.3 per cent. The percentage of area covered by forests in other provinces is as follows:
  - up to 25%: Mazowieckie, Lubelskie, Kujawsko-Pomorskie;
  - 25–30%: Wielkopolskie, Dolnośląskie, Opolskie, Świętokrzyskie, Małopolskie;
  - 30–35%: Śląskie, Podlaskie, Warmińsko-Mazurskie;
  - 35–40%: Podkarpackie, Pomorskie, Zachodniopomorskie.
- As far as the age of forests is concerned less than half of them (37.5%) fall into the 21–60 year-old bracket. Young forests (1–20 years old) constitute only 11.9% and 81–100 years old 14.5%.
- The majority of Polish forests are coniferous. Among conifers pine and larch are the most numerous (68.8%). Other common tree species include:
  - spruce, fir and Douglas fir (7.1%);
  - oak, ash, maple, sycamore, elm (14.2%);
  - birch (7.1%);
  - alder (5.6%);
  - beech (6.1%).
- As far as ownership is concerned only 19.3% of forests is in private hands whereas the rest is state-owned. Private forests are almost non-existent along the western border (about 2%) whereas their percentage is the highest in the Małopolskie and Mazowieckie provinces (43.5% and 45% respectively).

Based on: *Statistical Yearbook of Forestry*, GUS, Warszawa 2020.

Worth remembering
coniferous, conifers, spruce, fir, Douglas fir, oak, ash, maple, sycamore, elm, birch, alder, beech

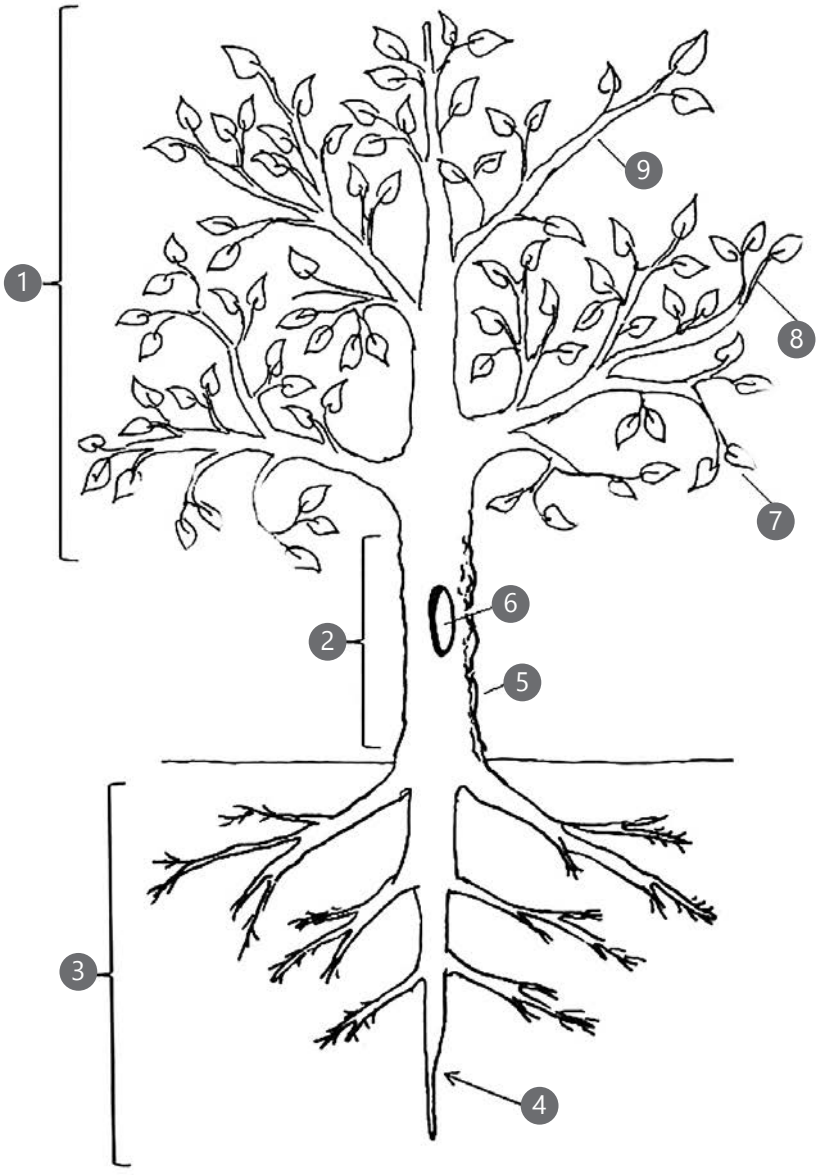
'TREE' FOLLOW-UP

I. When a tree grows alone it is just called a tree, but when there are more of them in the vicinity they have collective names. Look at the words in the box and put them into three categories: a small group of trees, a medium-sized group and a large one.

wood	coppice	clump	cluster
forest	grove	woodland	jungle

II. Look at the picture and name the tree parts. Use the words from the box.

trunk	leaf	root system	twig	hollow
crown	bark	branch	taproot	



III. Words have often more than one meaning. Try to guess the different meanings of words used in exercise II. Match the words on the left with their meanings on the right.

1. bark	A. empty inside
2. bud	B. in American English a boot of a car
3. leaf	C. the sound dogs make
4. limb	D. a part of a company representing it elsewhere
5. trunk	E. a page of a book
6. branch	F. an arm or a leg
7. hollow	G. word used in American English to address a man (*informal*)

IV. Fill in the blanks with the words from the box. Change the form of the verb when necessary.

shake like a leaf	go out on a limb	take a leaf out of sb's book
nip sth in the bud	twig	bark up the wrong tree

1. Well, if you want to borrow some money you …… . I'm broke.
2. He hasn't …… how to load the dishwasher properly although I explained it in detail.
3. By deciding to wear a black wedding dress she definitely ……..…… .
4. The quarrel ……..…… by a hostess who smiled disarmingly and offered some snacks and drinks.
5. Before the job interview last week I ……..…… .
6. My boss keeps telling Tom that he should ……..… Mary's ……..……. because she hasn't been late for work for weeks!

BRITISH MYTHS, BELIEFS AND SUPERSTITIONS ABOUT TREES

- It is said that aspens tremble because the trees are ashamed of the fact that their wood was used to make the cross on which Christ was crucified.
- It was believed that in order to stay young you should carry an acorn around with you.
- Rowan wood was used to make babies' cradles because it was supposed to protect babies against magic spells and different forms of witchcraft.
- Throwing pips of the crab apple into a fire can tell you whether you are truly loved. If they explode the answer is 'Yes', if they don't, don't worry, you will find true love some other time!
- A woman who wants to meet her future husband soon should put an ash leaf in her left shoe.

Based on: *A Companion to the Folklore, Myths & Customs of Britain* by Marc Alexander.

V. Name the following trees and bushes.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REVISION I (TEXTS 1–3)

I. Put the trees from the box into two categories: coniferous and broad-leaved.

sycamore	fir	juniper	elm	aspen
Douglas fir	ash	rowan	pine	spruce

coniferous:.....
broad-leaved:.....

II. Match the English tree names with their Latin ones:

1. oak	A. *Tilia*
2. maple	B. *Alnus*
3. linden/lime	C. *Robinia pseudoacacia*
4. beech	D. *Larix*
5. black locust	E. *Carpinus*
6. poplar	F. *Quercus*
7. alder	G. *Pinus*
8. hornbeam	H. *Salix*
9. larch	I. *Fagus*
10. willow	J. *Populus*
11. pine	K. *Acer*

III. Read the definitions and guess which words they describe.

A. covers a tree trunk
B. a coniferous tree that sheds its leaves in autumn
C. cut down trees
D. the most profitable forest product
E. a small branch
F. the main tree root
G. opposite of 'coniferous'
H. a small, green part of a tree that takes part in photosynthesis

IV. If the previous exercise was too difficult, match the words from the box with the definitions in exercise III.

taproot	larch	bark	broad-leaved
twig	fell	leaf	timber

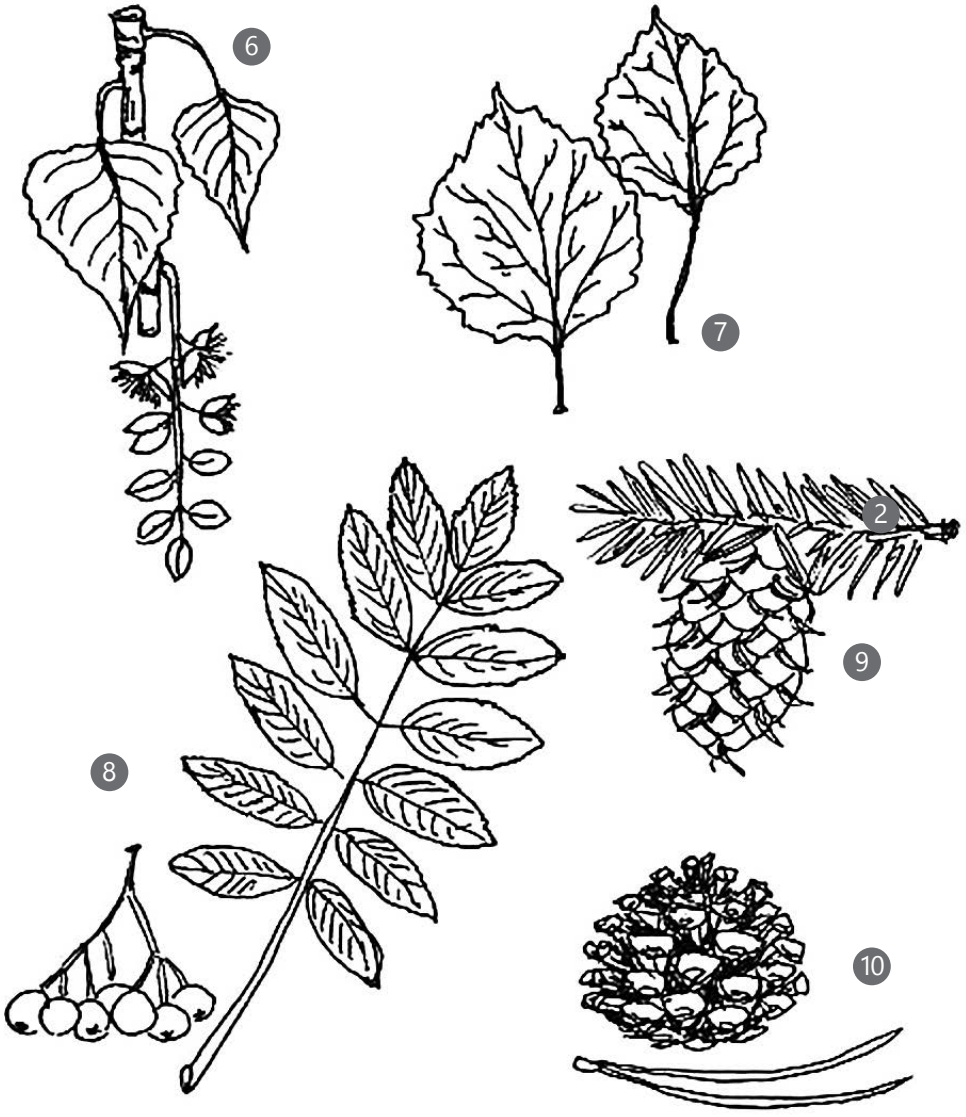
V. Choose the correct answer a, b or c.

1. The most numerous tree species in Polish forests is:
   a. oak
   b. pine
   c. sycamore
2. The most profitable branch of forest management is:
   a. hunting
   b. non-timber forest products
   c. timber
3. Meat obtained from wild animals is called:
   a. venison
   b. venom
   c. venue
4. Timber production consists of:
   a. regeneration, stand tending and harvesting
   b. harvesting, processing and conservation
   c. harvesting, felling trees and distribution
5. Non-timber forest products include:
   a. mushrooms, medicinal plants, wood and fruit
   b. mushrooms, medicinal plants, venison and fruit
   c. mushrooms, medicinal plants, venom and fruit
6. Forests prevent:
   a. floods, biodiversity and recreation
   b. soil erosion, wildlife habitat and floods
   c. soil erosion, floods and landslides
7. The majority of Polish forest trees are:
   a. coniferous
   b. deciduous
   c. in private hands

VI. Give your own definitions of the following words.

1. hollow – .....
2. wildlife – .....
3. species – .....
4. tree crown – .....
5. root system – .....
6. coniferous trees – .....
7. cone – .....
8. an afforested area – .....

VII. Name the following tree species.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PART II

FORESTRY BASICS

2

FOREST TREES

There are many ways trees can be described and classified. One of them is their seed appearance. As far as seeds are concerned, trees can be divided into gymnosperms (the seeds are 'naked') and angiosperms (the seeds are protected, usually by a mature ovary). The biggest group of gymnosperms in Polish forests are conifers, e.g. pine, spruce, fir or larch. They are cone-bearing trees with needlelike leaves. The majority of them are evergreen with the exception of the larch which sheds its leaves in autumn.

Angiosperms are divided into monocots and dicots represented by trees such as oak, beech, birch, hornbeam, maple, elm, alder or rowan, to mention but a few. All these plants growing in Poland are deciduous and shed their foliage in autumn.

However, the botanical classification is not the only one in which foresters are interested. They know whether a tree can be propagated asexually by, for instance, suckers, and which trees grow more slowly and which ones are fast growing, e.g. birch, poplar. They also know what kind of root system trees have because the ones with a deep taproot are much more resistant to winds, e.g. pine, oak or elm. On the other hand, trees with a shallow root system, such as spruce or aspen, are much more prone to windthrow. Neither should one forget that the development of roots is determined not only by tree species but also by other factors, such as soil. For example when the soil is poor and dry, trees tend to grow deeper roots no matter to what species they belong.

In forest management knowledge about shade tolerance or intolerance is of utmost importance because it often determines stand density and how long young trees can grow under the canopy of older ones. For instance, pine, birch or larch need more light to grow and develop than fir or beech which are shadebearing. The latter also form denser stands.

Foresters are a mine of information on other interesting facts about trees, such as their longevity, soil or water requirements or wood hardness.

As far as longevity is concerned, willow and poplar are comparatively short-living (up to 70–80 years), birch can live up to 100 years, spruce or ash up to 300 years and oak or fir as long as 700 years.

Foresters also know, for example, that pine is very tolerant as far as soil and water is concerned, fir and beech prefer fertile soil and spruce does not tolerate lack of water because of its shallow root system.

A tree system of classification can be also based on wood hardness. Trees can be put into the following categories:

- very soft wood, e.g. poplar, willow, spruce;
- soft, e.g. linden, larch, birch;
- medium hard, e.g. elm;
- hard, e.g. oak, beech, hornbeam.*

*According to Mörath's classification based on Brinell's hardness.

Worth remembering
propagate, sucker, gymnosperm, angiosperm, conifer, ovary, pine, spruce, fir, larch, cone, evergreen, leaf, monocot, dicot, oak, beech, hornbeam, maple, elm, alder, rowan, deciduous, foliage, taproot, aspen, windthrow, shadebearing

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. How can forest trees be classified?
2. What is the difference between conifers and deciduous trees?
3. Name at least three examples of coniferous and four of deciduous trees.
4. Which trees are more resistant to windthrow and why?
5. Which trees form less dense stands?
6. Which tree lives longer: fir or birch?
7. Give examples of hard and soft wood.

II. What do the following definitions refer to?

A. the same as leaves
B. the main, biggest, straight root of a plant
C. a tree uprooted by wind
D. the highest forest tree branches and leaves that shade all plants below
E. a relatively uniform group of trees in forests occupying a certain site
F. a reproduction method that does not require the formation of gametes followed by fertilisation

III. Match the words with their antonyms.

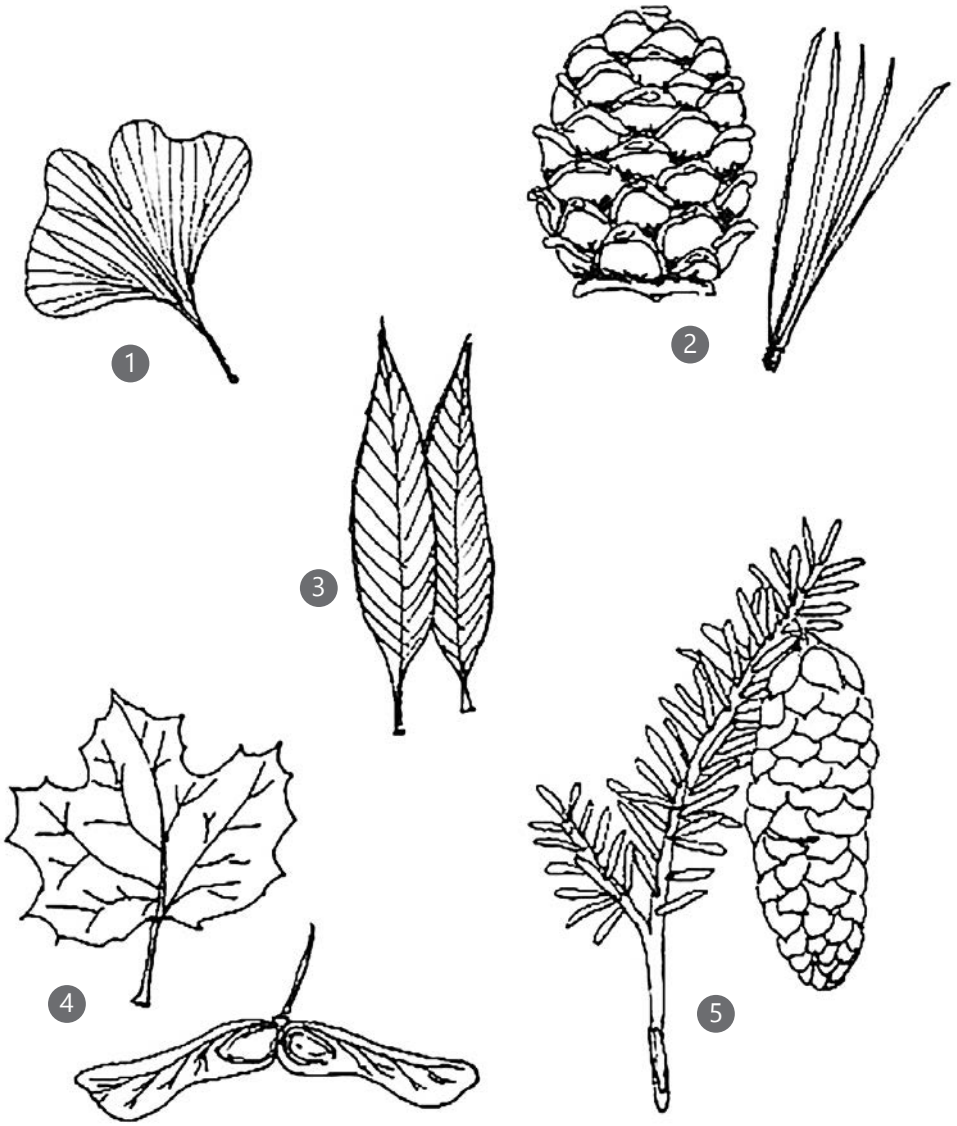
1. monocots	A. fertile
2. angiosperms	B. broad-leaved
3. coniferous	C. shadebearing
4. fast-growing	D. dicots
5. poor soil	E. gymnosperms
6. shade intolerant	F. slow-growing

MORE FACTS ABOUT TREES

- Broad-leaved trees are also known as hardwoods and conifers as softwoods, although the former may have quite soft wood, e.g. aspen.
- Conifers are not the only tree representatives of gymnosperms in Poland. The others include ginkgo – a tree which does not have needlelike leaves.
- Trees can be also divided into monoecious (a plant that has both male and female flowers), e.g. pine, birch, beech, and dioecious with separate male and female plants, e.g. poplar, willow.

FOLLOW-UP: TREE AND SHRUB SPECIES

I. Name the following tree and shrub species.

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2

TREE PROPAGATION

Trees, like many other plants, can be reproduced sexually or asexually. Sexual reproduction, known also as seed propagation, is based on passing traits from parent plants to their offspring. The new plant is a result of gamete fusion and therefore differs from its parents. Sexual reproduction consists of flower development, pollination, fertilisation and seed production. The final steps of forest tree propagation include: seed dispersal, germination and seedling establishment.

Sexual reproduction is the most common method of forest regeneration. Seeds can be dispersed naturally (natural seeding), be sown on a site (direct seeding) or used to grow seedlings in nurseries.

Asexual propagation uses the plant ability to develop fully from its part. An offspring, or in fact a clone, looks exactly the same as the plant from which it was taken. This type of propagation does not require gamete formation and is also known as vegetative. It enables preservation of the most desirable features of the parent plant in its offspring.

There are several methods of asexual propagation. The one which can be noticed in forests, but not implemented in establishing stands, is based on the ability to produce shoots by remaining after felling roots or stumps in the soil. This process is known as coppicing. Stump sprouts develop from dormant buds on stumps, e.g. oak, whereas root suckers from roots, e.g. poplar (*Populus*), black locust (*Robinia pseudoacacia*). Plants that regenerate from cut down trees are characterised by many stems instead of a main one.

Apart from stump sprouts or root suckers, trees can be propagated from stem cuttings by grafting or tissue culture (micropropagation).

Willow and poplar can be propagated from stem cuttings – a part of a plant that is severed from a parent plant, whereas some shrubs, e.g. dogwood, by layering, which means forming roots by a stem or branch that is bent to the ground and covered with soil. In the case of trees such a method is uncommon. However, it occurs in black spruce (a native American species).

Grafting is another method of tree propagation, widely used in horticulture and concerning the production of fruit trees. This method is labour-intensive because in grafting two plant parts are joined. The first is called a scion and is taken from a tree possessing the most desirable features, the second is called a rootstock, or stock, and provides healthy, strong roots. In forestry grafting is used in establishing seed orchards enabling the production of superior seeds used in further tree propagation.

Tissue culture, known also as micropropagation, is based on the fact that a single cell possesses genetic information sufficient for the formation of a new plant. Micropropagation can use single cells, their groups, tissue fragments or a part of a plant. It is effective, quick, and enables production of disease-free plants. However, in contrast to horticulture, tissue culture is not widely used in forestry.

Worth remembering
sexual reproduction, propagation, asexual reproduction, traits, pollination, fertilisation, seed dispersal, germination, seedling, nursery, forest regeneration, natural seeding, sow, vegetative reproduction, clone, coppice, stump, root sucker, stump sprout, shoot, felled tree, coppice, oak, poplar, black locust, stem, cutting, dogwood, willow, layering, scion, rootstock, stock, grafting, seed orchard, tissue, tissue culture, micropropagation, cell

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. What is the difference between sexual and asexual propagation?
2. In which case does a new plant look like its parent?
3. What is 'coppicing'?
4. Which species can regenerate from stump sprouts?
5. Define the term 'root sucker'.
6. What is the difference between cuttings and layering?
7. On what is grafting based? How many plant parts are used? What are their names and roles?
8. What are the advantages of micropropagation?

II. Match the words from the box with their definitions below.

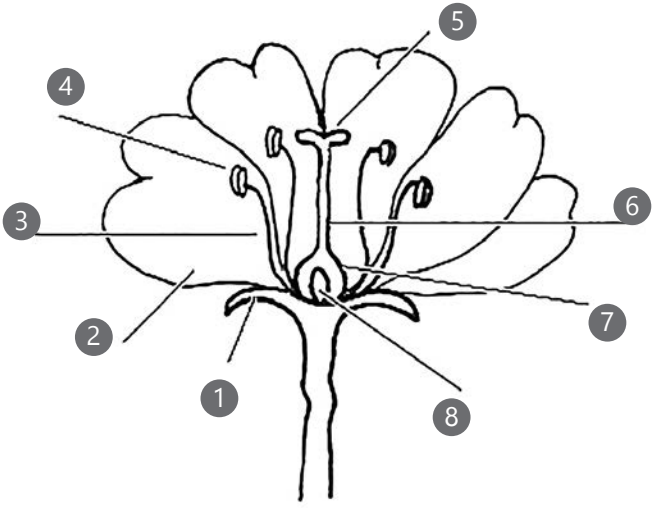
nursery	clone	germination	sow	pollination
fell	stump	seedling	micropropagation	fertilisation
cell	stem	propagation		

1. transfer of pollen from a male part of a flower to a female one
2. a process in which two gametes are joined
3. development of a new plant from a seed
4. a vegetatively reproduced plant
5. a basal part of a trunk with its roots left after a tree has been cut down
6. to put seeds into soil
7. a small part of any living organism, their group forms tissues
8. a place where plants are propagated
9. a small plant that has developed from a seed
10. production of new plants
11. to cut down a tree
12. a kind of vegetative reproduction that is performed in laboratories
13. a part of a plant that has leaves

FOLLOW-UP: PARTS OF A FLOWER, A PLANT BODY

I. Look at the picture and name the parts of the flower. Use the words from the box.

sepal	anther	stigma	ovule
style	filament	ovary	petal



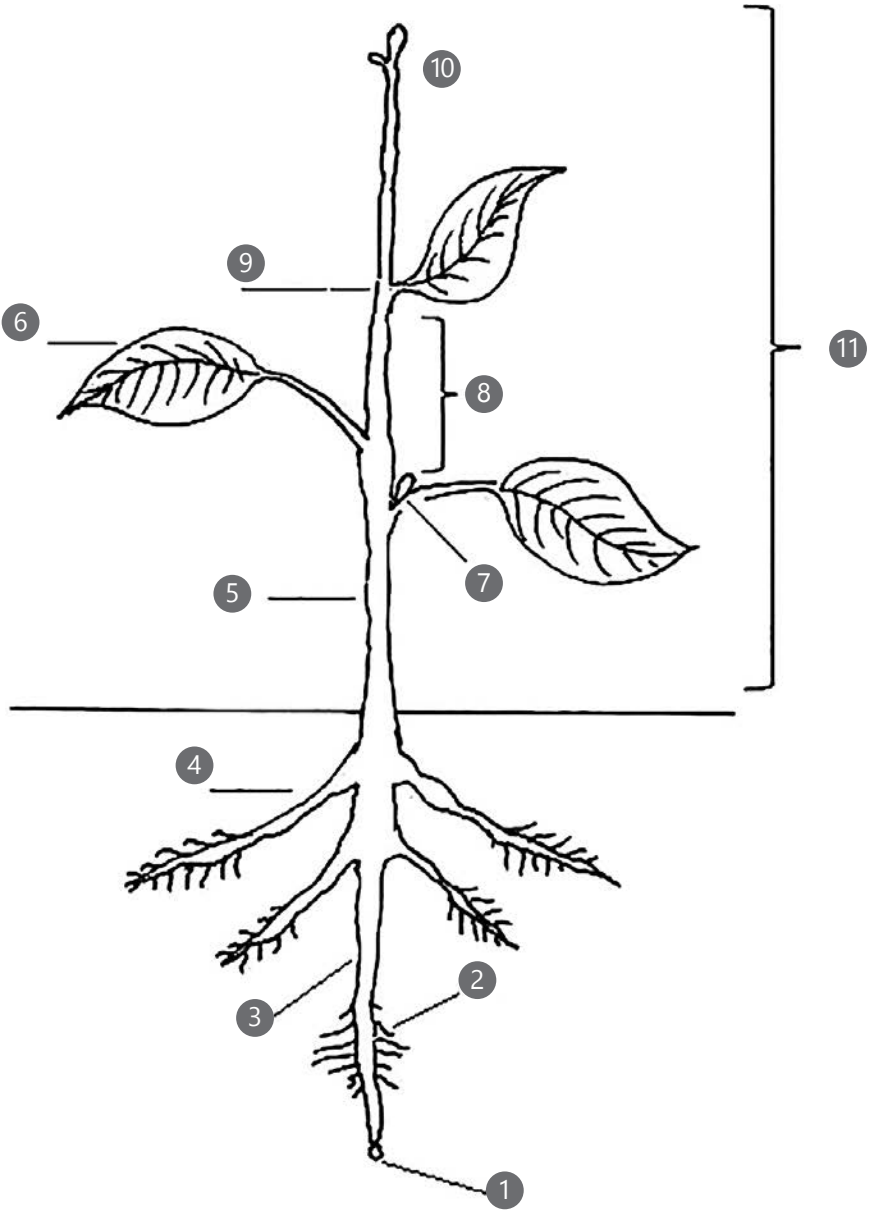
II. Fill in the table below with the words from the box.

blade	anther	ovary	vein	style
margin	filament	stigma	petiole	ovule

stamen	**pistil**	**leaf**

III. Look at the picture of a plant body. Name its parts. Use the words from the box.

secondary root	leaf	apex	root hairs	primary root	node
axillary/lateral bud	stem	shoot	internode	root cap	



3

TEMPERATE FOREST STRATIFICATION

The term 'forest stratification' refers to various strata or layers of forests.

The soil in forests is covered with organic matter, such as fallen leaves, twigs, branches, remnants of dead animals in different stages of decomposition. This layer, called litter, is also a home for bacteria, fungi,* earthworms and other organisms which can quicken the decomposition process releasing nutrients and making them available for plants again.

The next layer is composed of lichens, fungi (including mushrooms) and short plants such as mosses, ferns, herbaceous plants (which can be annual, biennial or perennial) and seedlings of trees and bushes. Lichens are particularly useful for foresters because they indicate the level of pollution – when it is too high they are simply not present. Other interesting organisms occupying this layer are fungi. They play different roles in forests. On the one hand, fungi can be harmful and cause diseases, on the other, beneficial acting as decomposers or forming symbiotic relationships with some tree roots (myccorhiza). Apart from lichens and fungi, this layer includes some well-known plants such as: wild strawberry (*Fragaria vesca*), bilberry (*Vaccinium myrtillus*), lily of the valley (*Convallaria majalis*) or asarabacca (*Asarum europaeum*).

Bushes form the next forest stratum. This layer is represented by such plants as: blackthorn (*Prunus spinosa*), hawthorn (*Crataegus* spp.), alder buckthorn (*Frangula alnus*), juniper (*Juniperus communis*) and hazel (*Corylus avellana*), to mention but a few.

The last two layers comprise trees only: young ones known as saplings and higher ones which create the forest canopy.

The above-mentioned classification consisting of litter and three to four layers of vegetation is a very general one because the number of layers and the way they look may vary considerably. The differences may be caused by several factors such as stand age, soil type and climate conditions determining the growth of particular species. For instance, even a layman knows that coniferous forest floors, e.g. spruce ones, do not look like broad-leaved ones and beech ones can be recognised immediately due to the fact that the leaves take a long time to decompose and hamper development in the ground layer.

* There are many types of fungi, including moulds, yeasts, mildews and mushrooms (the ones that are picked up in forests; some are edible, others poisonous).

Worth remembering

temperate forests, forest stratification, forest layer/stratum, organic matter, twigs, branches, decomposition, nutrients, moss, lichen, fungus, fern, herbaceous, annual, biennial, perennial, earthworm, seedlings, myccorhiza, bilberry, wild strawberry, lily of the valley, asarabacca, blackthorn, hawthorn, alder buckthorn, juniper, hazel, sapling, canopy, stand, coniferous, broad-leaved, beech

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. Explain the term 'forest stratification'.
2. What role do lichens and fungi play in forests?
3. How many layers are there usually in temperate forests?
4. What factors can modify the number of layers?
5. Does litter always look similar? Give examples.

II. In the text find the words that mean:

1. the same as layers (paragraph 1)
2. the process of organic matter decay (paragraph 1)
3. substances that provide plants with what they need to grow and develop (paragraph 1)
4. a small plant that has germinated from a seed (paragraph 2)
5. a plant which can be used as a medicine or in cookery (paragraph 2)
6. a young tree (paragraph 3)
7. the leaves and branches of trees that form a 'forest roof' (paragraph 3)

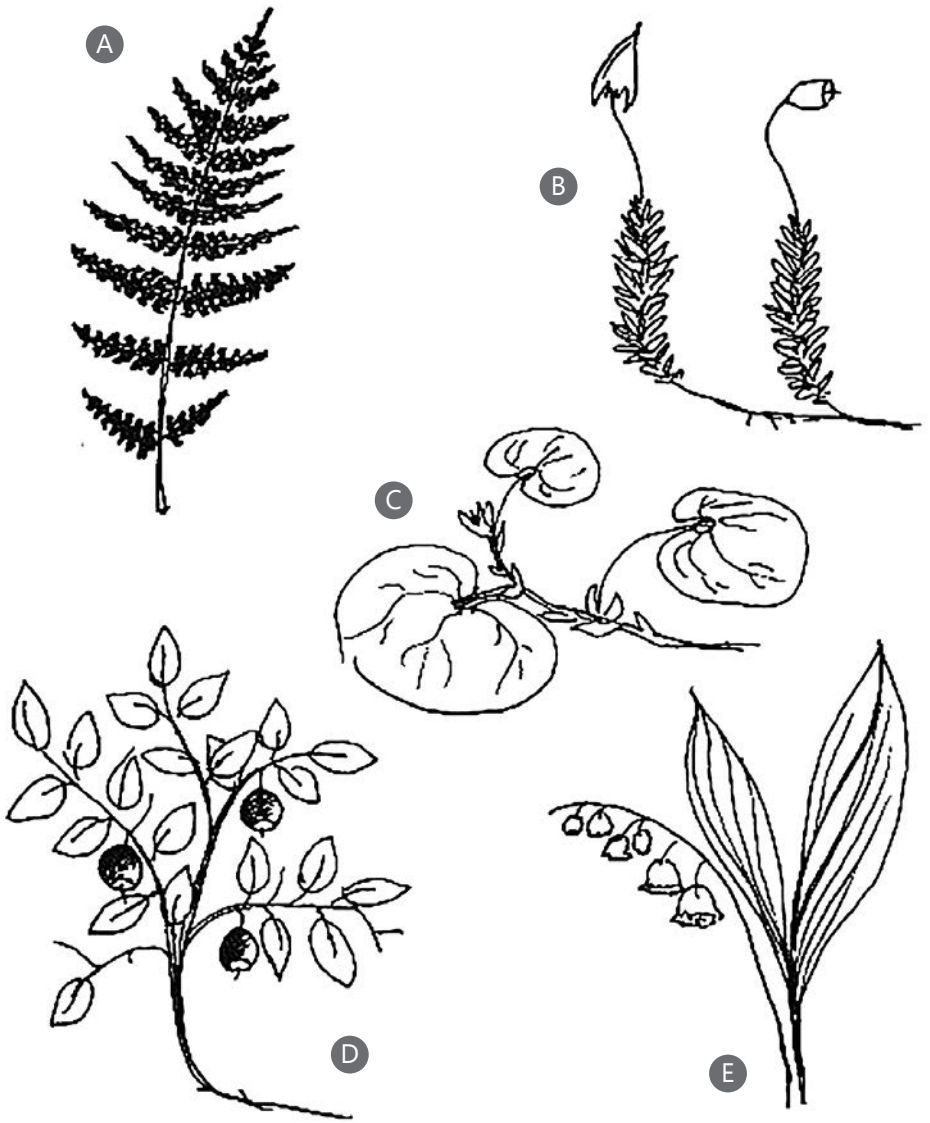
DID YOU KNOW?

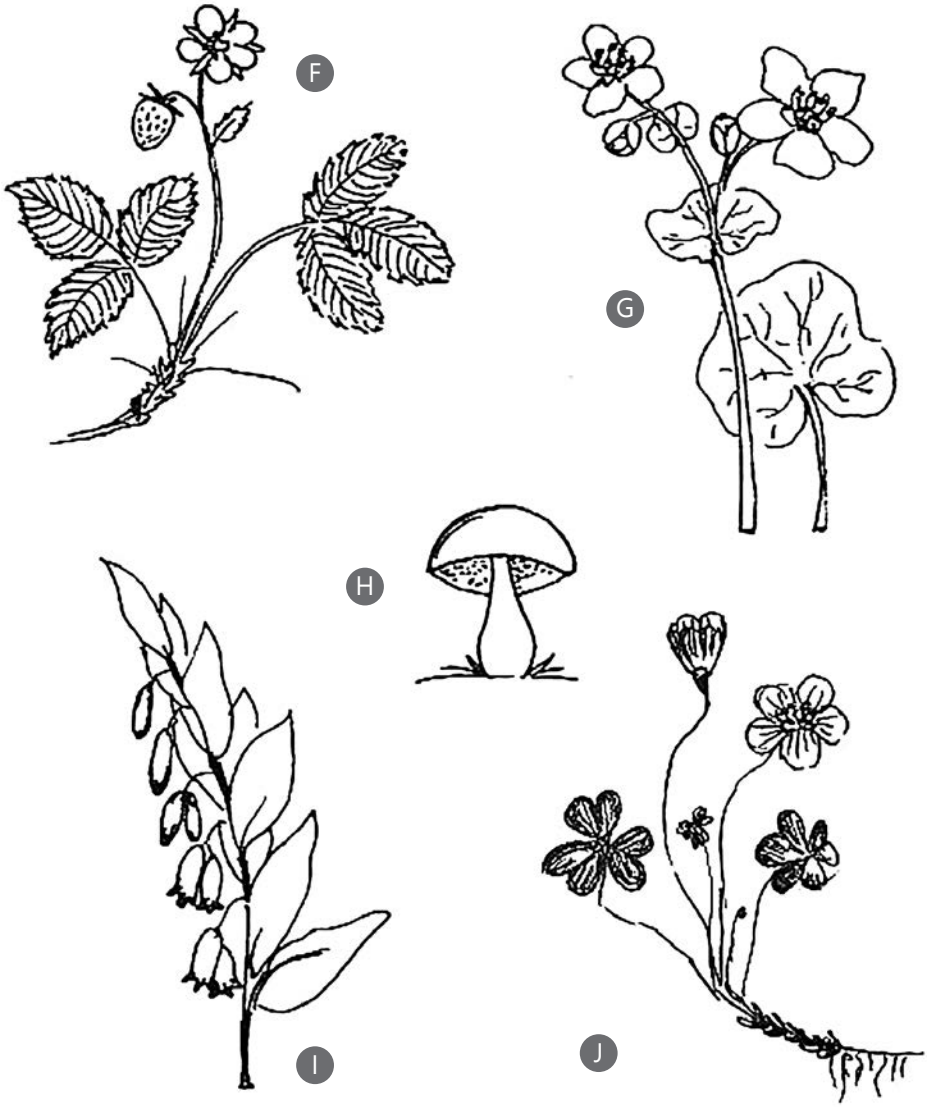
- In Celtic mythology hazel symbolised wisdom.
- During their long sea voyages Vikings didn't suffer from scurvy because they used pine needles, rich in vitamin C, to brew beer.
- A famous city in Italy, Venice, is built on black alder poles.
- In Old English the word 'hornbeam' meant 'hard wood'.
- In the past things such as water supply systems, gutters, rainwater pipes and boats were made of mountain elm (*Ulmus glabra*) because its wood does not rot in water.
- In 500 B.C. a Greek doctor Hippocrates, treated his patients with white powder obtained from the bark of white willow (*Salix alba*). The medicine proved effective against fever and as a general painkiller. Nowadays, the same substance, salicin, can be found in mass-produced aspirin.
- Romans believed that hawthorn protected people from illnesses so they tied its twigs to the cradles of newborn babies.
- Gin production would not be possible without juniper berries which give this alcoholic drink its unique flavour.
- The word 'gin' comes from French 'ginevre' which means juniper.
- According to Norse mythology the first human being was created from common ash (*Fraxinus excelsior*).
- A trunk constitutes 60% of the total tree weight.

Based on: *Drzewa. Kieszonkowy przewodnik* by J. Linford.

FOLLOW-UP:
A. PLANTS OF THE FOREST FLOOR

I. Name the following plants.

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J

B. SOIL AND ITS QUALITY PLANT INDICATORS

I. Read the information about soil and do the exercises.

Soil is a very important component of ecosystems because plants absorb water and nutrients from the soil.

A typical soil profile consists of three layers: topsoil (contains minerals and humus), inorganic subsoil beneath and the parent rock at the bottom.

In contrast to non-forest soils the forest ones are rarely tilled and are covered with litter consisting of organic matter in different stages of decomposition.

A. Match the adjectives describing soils (1–6) with their synonyms (A–F).

1. shallow	A. rich
2. damp	B. acidic
3. fertile	C. infertile
4. acid	D. clayey
5. barren	E. thin
6. clay	F. moist

B. Match the adjectives describing soil (1–5) with their antonyms (A–E).

1. deep	A. acidic
2. waterlogged	B. poor
3. rich	C. heavy
4. alkaline	D. dry
5. light	E. shallow

II. Read the information below and do the exercise.

Plants growing in forests can give us a lot of information about its soil properties. For instance, sandy soils are mainly covered with pine whereas wet or periodically flooded with black alder. Plants that provide information about soil quality are known as plant indicators. The most popular ones that grow in Poland are listed below. Match their English and Latin names (A–K) with the Polish ones (1–11).

A. bilberry (*Vaccinium myrtillus*)
B. asarabacca (*Asarum europaeum*)
C. snowdrop anemone (*Anemone sylvestris*)
D. common heather (*Calluna vulgaris*)
E. ground elder, bishop's weed (*Aegopodium podagraria*)
F. wood sorrel (*Oxalis acetosella*)
G. wood avens, herb Bennet (*Geum urbanum*)
H. ramsons / broad-leaved garlic / bear's garlic (*Allium ursinum*)
I. greater burdock (*Arctium lappa*)

J. small-flowered cranesbill / small geranium (*Geranium pusillum*)
K. greater celandine (*Chelidonium majus*)

1. wrzos zwyczajny
2. kuklik pospolity
3. łopian większy
4. kopytnik
5. glistnik jaskółcze ziele
6. zawilec leśny/wielkokwiatowy
7. bodziszek drobny
8. borówka czarna
9. szczawik zajęczy
10. czosnek niedźwiedzi
11. podagrycznik

III. Which plants (listed in exercise II) are indicators of: acidic, neutral, alkaline, sandy, clayey and loamy soils?

acidic soils:	
neutral soils:	
alkaline soils:	
sandy soils:	
clayey soils:	
loamy soils:	

4

BASIC CHARACTERISTICS OF FOREST STANDS

A forest stand is a part of a forest consisting of a relatively uniform group of trees growing close together and covering a particular area. Such a tree group can be described by several characteristics. The basic ones include: stand origin, species composition, age, stratification, stand and canopy density.

Stand origin

This characteristic tells us whether the stand was regenerated naturally or artificially. In the case of natural regeneration a forest regenerates itself by producing seeds which are later dispersed. The seeds germinate and new trees start to grow.

Artificial regeneration is achieved by sowing seeds, planting seedlings, stem cuttings or, very rarely, sprouts. The latter can be stump or root ones.

Species composition

Species composition is a criterion used not only in a stand description but also in forest type classification. As far as stands are concerned they can be divided into single-species or mixed ones usually containing one dominant species and some others as secondary components constituting no more than 50 per cent of species composition. An admixture, which can be permanent or temporary, plays a very important role in forests because it contributes to litter production, increases soil moisture, protects the dominant species from unfavourable weather conditions (e.g. too much sun, drought), promotes biodiversity and provides shelter for beneficial insects and animals.

Age

There is no one universal characteristic identifying stand age because it can be described in different ways taking into account the tree age differences within a stand, growth stages of its trees or age classes.

Trees covering a particular area can be approximately the same age and such a stand is called even-aged. In an uneven-aged one much younger and older trees grow together.

In the case of even-aged stands the description concerning tree growth stages (a seedling, sapling, pole, mature tree) applies to the whole stand as well. In some classifications the pole stage or stand is further divided into a small pole stand and high pole one. Sometimes one additional class, known as a maturing stand, is also added.

In age classes trees are grouped according to their age. Twenty years is a usual period of time limiting one class, which means that the age differences between the youngest and the oldest trees cannot be more than the above-mentioned span.

The typical age classes include trees 1–20 years old, 21–40, 41–60 and so on.

Stratification

It tells us how many tree layers or strata there are from the forest floor to the tree tops. Stands are divided into single-storey and multi-storey.

Stand density

Stand density reflects tree competition for space, light, nutrients and so on. It also describes how trees use the site, e.g. when the stand is too dense, trees grow slower. However, for some foresters stand density and stocking means exactly the same and is understood as an optimal number of trees per hectare that creates the best conditions for their growth and development and results in maximum timber production (measured by volume). Stand density depends not only on a number of trees per hectare but also their sizes (height and diameter) as well as crown cover known also as canopy closure. The latter parameter tells us how close the crowns of neighbouring trees are (whether the closure is full, moderate, broken or open) or defines whether the closure relates to one or more forest layers.

Worth remembering
forest stand, species composition, natural/artificial regeneration, disperse, sprout, stump/root sprouts, single-species/mixed-species stand, admixture, dominant species, litter, even-aged/uneven-aged stand, small/high pole stand, stocking, mature/maturing stand, crown cover/canopy closure, single-storey, multi-storey, full/moderate/broken/open/horizontal/vertical crown closure

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. Name the basic characteristics of forest stands.
2. What is the difference between natural and artificial regeneration?
3. How can stands be divided as far as species composition is concerned?
4. What role does an admixture play?
5. What is the difference between even-aged and uneven-aged stands?
6. Name tree growth stages.
7. What are age classes?
8. Explain the terms: single-storey, multi-storey.
9. What does stand density depend on?
10. Define ‘canopy closure’. What does it refer to?

FOLLOW-UP: TYPES OF TREES IN A STAND

I. Match tree growth stages (1–6) with their definitions (A–F).

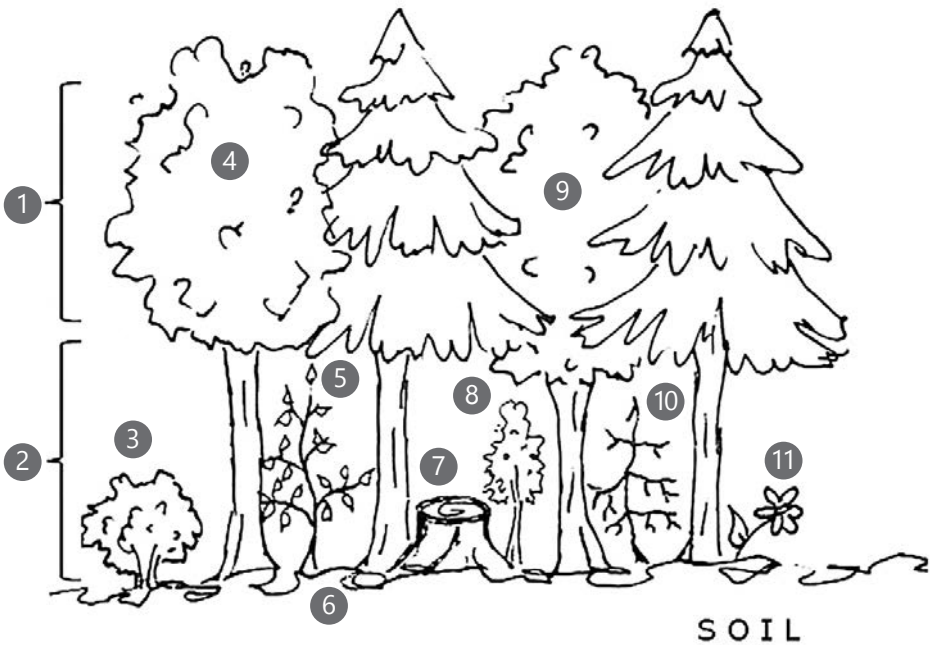
1. high pole	A. a standing, dead tree
2. sapling	B. a small plant that has germinated from its seed
3. small pole	C. natural loss of branches, up to a certain height stops
4. snag	D. a young tree having all living branches
5. mature tree	E. natural loss of lower branches begins, trees grow mainly in height
6. seedling	F. a tree producing seeds

II. Match the words from the box with their definitions.

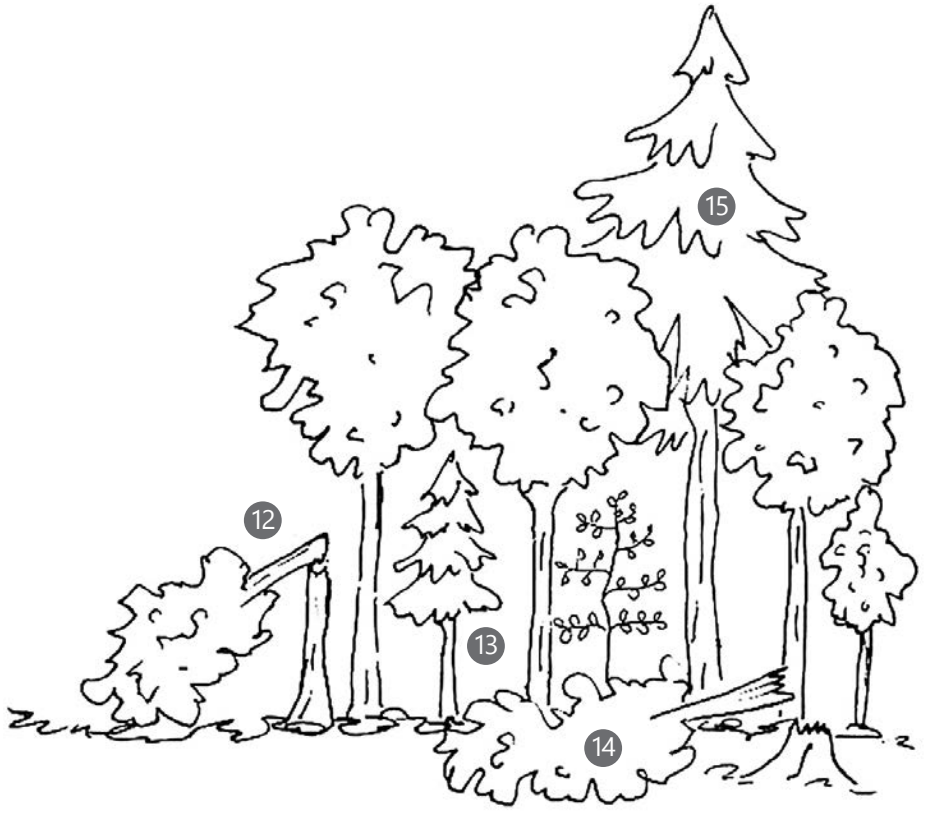
herbaceous	dominant tree	emergent/overtopping tree
codominant tree	suppressed tree	intermediate tree

1. a tree that has lost its vigour as a result of getting not enough sunlight
2. a tree that is much taller than the average in the stand. Such trees are very common in rainforests
3. not woody
4. a tree whose crown extends to the bottom level of forest canopy
5. a high tree forming the forest canopy. It gets sunlight from above and around the crown
6. a tree that forms the forest canopy but is a bit shorter than the surrounding trees and therefore captures sunlight mainly from above

III. Look at the picture and match the words from the box on the next page with the numbers (1–15).

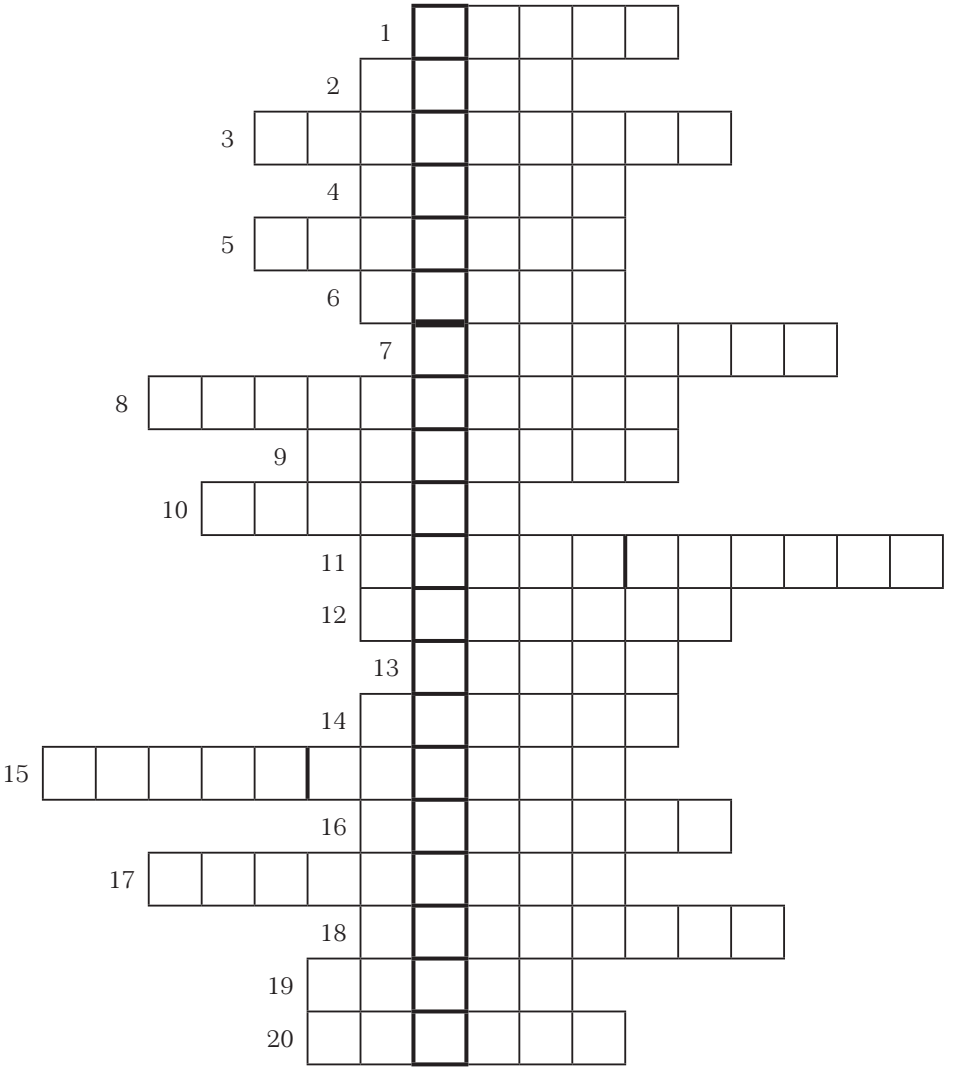


sapling	herbaceous plants	canopy
dominant tree	understorey/understory	overtopping tree
litter	codominant tree	shrub
suppressed tree	broken tree	intermediate tree
stump	standing dead tree /snag	fallen tree



REVISION II (TEXTS 1–4)

I. Do the crossword and find the hidden words.



1. the group of organisms represented by moulds, yeasts, mildews and mushrooms
2. small plants growing in moist areas, often seen on rocks and walls
3. N, P, K are major plant ……
4. plants possessing medicinal properties; they are also used in cooking
5. a place where plants are propagated and grown

6. a part of a forest consisting of a relatively uniform group of trees growing close together and covering a particular area
7. a small plant that has recently germinated
8. *Prunus spinosa* in English
9. a layer
10. *Populus* in English
11. a part of a tree developing from dormant buds on stumps; it is used in asexual propagation
12. organisms consisting of fungi living in a symbiotic relationship with algae
13. forest plants with feather-like leaves; they do not produce flowers
14. fallen leaves, twigs etc. covering the forest soil
15. *Robinia pseudoacacia* in English
16. a young tree
17. trees that constitute less than 50 per cent of a forest stand
18. a small plant possessing very tasty small black berries
19. a plant that has the same genes as a parent plant
20. tree crowns in a forest

II. Give synonyms of the following words.

1. crown cover = ...
2. propagation = ...
3. shade tolerant = ...
4. asexual propagation = ...
5. tissue culture = ...

III. Put the parts of a tree in the proper order – from the smallest to the largest. Use the words from the box.

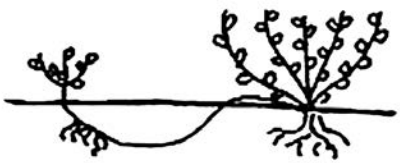
bough/limb	cell	twig	tissue
leaf	branch	bud	trunk

IV. Give antonyms of the following words and expressions.

1. natural regeneration ≠ .....
2. dominant tree species ≠ .....
3. deciduous ≠ .....
4. soft wood ≠ .....
5. permanent admixture ≠ .....
6. sexual propagation ≠ .....
7. even-aged stands ≠ .....
8. angiosperms ≠ .....
9. horizontal crown closure ≠ .....
10. deep root system ≠ .....
11. shade tolerance ≠ .....
12. single-storey stands ≠ .....

V. Look at the picture and name the propagation methods.

1



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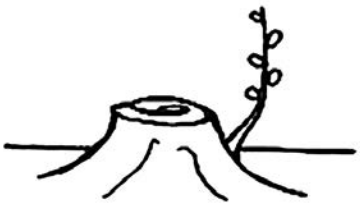

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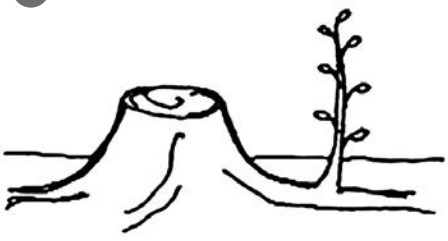


6

VI. Put the stages of natural sexual reproduction in order. Use the words from the box.

fertilisation	germination	seed production
flower development	seedling establishment	pollination
seed dispersal		

VII. True or false?

1. All coniferous trees are evergreen.
2. Birch grows faster than oak.
3. Pine needs a lot of shade when it is young.
4. There are two types of tree propagation: vegetative and sexual.
5. On the average fir lives longer than willow.
6. Hornbeam has softer wood than spruce.
7. Seed propagation is the same as sexual propagation.
8. In asexual propagation an offspring is a clone of the parent plant.
9. Coppicing means growing seedlings in nurseries.
10. In grafting, a scion and rootstock are joined to produce a new plant.
11. Forest stratification means decomposition of fallen leaves, twigs and dead animals.
12. There are no beneficial fungi in forests.
13. Fungi can form a symbiotic relationship with trees.
14. Hawthorn, buckthorn and asarabacca are the examples of forest bushes.
15. Twenty years is a usual period of time limiting one age class in forests.

VIII. Put the following tree growth stages in the proper order. Use the words from the box.

mature tree	sapling	seedling	pole

1. .....
2. .....
3. .....
4. .....

5

WOODLAND BIRDS

According to *The Checklist of the Birds of Poland* there were 446 identified bird species in the country at the end of 2008. The list is an invaluable source of knowledge about Polish birds because it includes wild birds occurring naturally as well as those which were introduced by man, common and endangered, residents and migrants. All of them are important components of forest ecosystems because they can help in seed dispersal or reduction of rodents and insects which are forest and agricultural pests. Birds also take care of other dead animals by eating their flesh or, as in the case of waterfowl, can regulate the amount of nutrients in water.

Like all living organisms birds occupy different levels in a food chain. Some of them are herbivorous which means that they prefer plants in their diet. Among them there are also birds that eat mainly fruit or grain, e.g. sparrows.

Carnivores feed on meat. Birds of prey, such as hawks or owls, are flesh-eating animals whereas scavengers, e.g. magpies, crows and ravens, feed on carrion. Omnivores, such as jays or mallards, are birds that are not particularly choosy and can eat anything that is edible.

The classification of birds based on their feeding habits is not very precise because most of them may turn to a different diet at times. For instance, the majority of herbivores feed their young with insects and larvae, blackbirds eat mainly earthworms but, like starlings, they are fond of strawberries and sweet cherries when they are available.

Birds can also be classified according to their zeal for travelling. Some of them stay in the same area all year long, others do not. The former are called resident birds, e.g. woodpeckers, partridges, the latter – migrants, e.g. robins, storks.

Another criterion that can characterise birds is their breeding habits. For instance, the partridge is monogamous whereas the pheasant is polygamous. The cuckoo lives alone. It does not need a partner to raise its young because it is a brood parasite which means that it lays eggs in other birds' nests. Young birds often need their parents' attention for some time because when they hatch they are usually blind and naked. However, there are species which are hatched with a heavy coat of down and can live an independent life fairly quickly, e.g. ducks.

Worth remembering
waterfowl, herbivore, carnivore, prey, hawk, owl, scavenger, carrion, magpie, crow, raven, jay, mallard, woodpecker, stork, robin, sparrow, great white egret, partridge, goldeneye, peregrine, osprey, barn owl, pheasant, hatch, down

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. Why are birds so important in forest ecosystems?
2. How can birds be classified according to their feeding habits?
3. What is the difference between resident and migrant birds?
4. How do the breeding habits of birds differ? Give examples.

'BIRD' FOLLOW-UP

I. Match the words (1–5) with their antonyms(A–E).

1. migrant	A. diurnal
2. nocturnal	B. herbivorous
3. carnivorous	C. resident
4. monogamous	D. scavenger
5. flesh-eating animal	E. polygamous

II. What do the following birds eat? Match the words describing types of birds (1–7) with the food they prefer (A–G).

1. granivorous	A. fruit
2. herbivorous	B. insects
3. frugivorous	C. fish
4. omnivorous	D. grain
5. piscivorous	E. meat
6. carnivorous	F. plants
7. insectivorous	G. anything that is edible

III. What do the bullfinch, goldfinch, nightingale and skylark have in common?

FACTS ABOUT BIRDS

- On Earth there are more house sparrows (*Passer domesticus*) than people.
- Thanks to feathers and down covering owl's feet the bird can move noiselessly and catch its prey unawares.
- Birds used to be killed for their feathers. For example, at the end of the 19th century 200,000 great white egrets (*Egretta alba*) were killed every year. Their feathers were used to decorate women's hats.
- Five days after hatching a goldeneye chick (*Bucephala clangula*) can live an independent life.
- Osprey (*Pandion haliaetus*), barn owl (*Tyto alba*), and great white egret can be found all over the world except polar regions.
- Peregrine falcon (*Falco peregrinus*) can fly 360 kph when diving after its prey.

6

FOREST MAMMALS, REPTILES AND AMPHIBIANS

Apart from woodland birds, which were mentioned in the previous text, Poland is inhabited by 90 species of mammals, 18 species of amphibians and 9 species of reptiles. As far as forest mammals are concerned, deer, wild boar and hare are probably the best-known because they are game, which means that they are hunted, either for their meat or, despite protests, for pleasure, or in order to regulate their number and prevent damage they may cause.

Mammals can be classified according to their feeding habits – herbivores, omnivores or carnivores such as wolf, bear or lynx. The latter play a crucial role in forest ecosystems because they eliminate weak animals and keep the number of herbivores in check.

Mammals can occupy different forest habitats. Some of them prefer streams or ponds, e.g. otter – a semi-aquatic animal, or beaver – the biggest Polish rodent, an excellent swimmer, famous for building dams. However, it is difficult to spot because it is a nocturnal creature and as such is active mainly at night.

Water is not the only habitat preferred by mammals. For instance, squirrels can live in tree crowns where they often use hollows to build their nests. Marmots, on the other hand, dig their burrows in the ground (just like foxes or rabbits). There are also mammals which spend most of their lives in the ground, e.g. moles.

Another fascinating fact about mammals is the way they spend winter. Some of them do not have to suffer from cold and strive for food. Among the lucky ones are, for instance, marmots because they hibernate. The same applies to hedgehogs which are more resistant to poison than other animals and hunt even for adder – the only venomous snake living in Poland.

Apart from the adder, Polish reptiles include: European pond turtle, lizards, slowworm, grass snake, smooth snake and the Aesculapian snake which is extremely rare. Despite the fact that the latter is hard to spot in the wild it can be often seen in cities because it is still associated with medicine and is often a part of the chemist's logo.

Forests are also inhabited by amphibians such as newt, fire salamander, fire-bellied toad, yellow-bellied toad and different kinds of frogs and toads. One should not forget that almost all of Polish amphibians and reptiles are protected (see *The Red List of Threatened Species*).

Worth remembering

game, mammal, amphibian, reptile, deer, wild boar, hare, bear, lynx, habitat, otter, beaver, dam, marmot, mole, hedgehog, adder, European pond turtle, lizard, slowworm, grass snake, smooth snake, Aesculapian snake, newt, fire salamander, yellow-bellied toad, fire-bellied toad, frog, toad, hollow, elk/moose, reindeer, roe deer, chamois, scale, fallow deer

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. How can forest animals be classified? Name four main groups.
2. When can animals be called 'game'?
3. What is the difference between herbivores and carnivores? Why are the latter so important?
4. Where do mammals live? Name at least one animal occupying each habitat.
5. How do animals spend winter? Why are marmots special?
6. Are there many venomous animals in Poland? Give examples.
7. Name at least three Polish reptiles and amphibians.

'ANIMAL' FOLLOW-UP

I. Match male animals with their female counterparts. What species do they belong to? Use the words from the box.

fox	goose	wolf	bison/buffalo	duck	red deer	wild boar

MALE	FEMALE
1. dog	A. goose
2. drake	B. hind
3. boar	C. vixen
4. gander	D. duck
5. stag	E. cow
6. bull	F. sow
7. dog	G. bitch

II. Match the animals with the parts of their bodies from the box.

feather	tufted ears	sharp tusks	bill	orange teeth	wings
hooves	whiskers	scaly tail	down	antlers	

1. beaver ……..……, ……..……
2. deer ……..……, ……..……
3. duck ……..……, ……..……
   ……..……, ……..……
4. wild boar ……..……
5. lynx ……..……, ……..…….

III. Whose young are they? Match the species on the left (1–11) with their young on the right (A–K).

1. bear	A. bunny
2. duck	B. calf
3. goose	C. pup
4. rabbit	D. eaglet
5. wolf	E. gosling
6. wild boar	F. kitten
7. bison/buffalo	G. tadpole
8. eagle	H. cub
9. lynx	I. fawn
10. deer (generally)	J. piglet
11. frog	K. duckling

'ANIMAL' PROVERBS

IV. Can you guess what the following proverbs mean?

1. A bird in the hand is worth two in the bush.
2. The early bird catches the worm.
3. A leopard cannot change its spots.
4. One swallow does not make a summer.
5. If you chase two rabbits, you will not catch either of them.

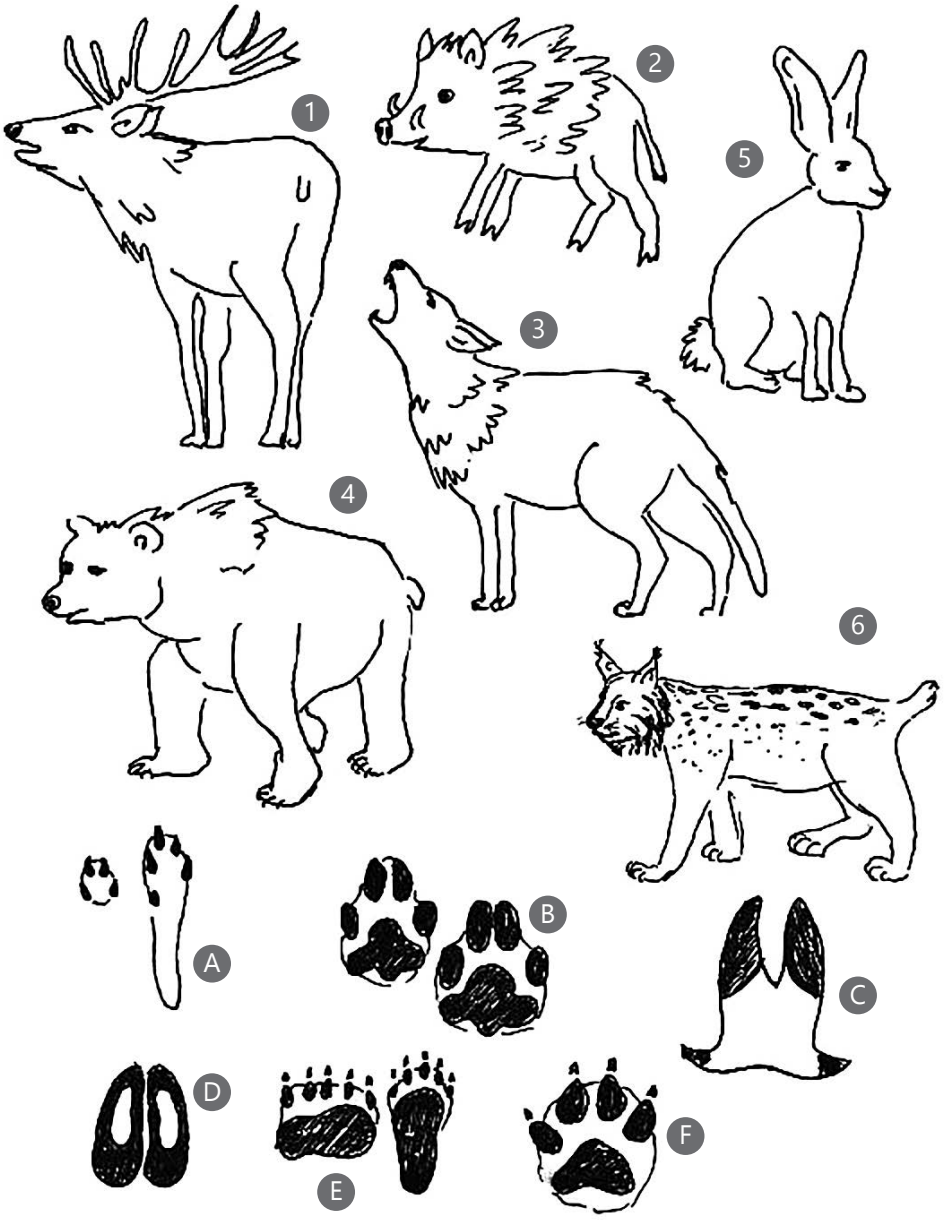
V. Which proverb means that:

A. a single success at the beginning does not guarantee the final one?
B. bad and unpleasant people never change?
C. it is not a good idea to do two things at the same time because you will complete neither?

FACTS ABOUT ANIMALS

- There are 600 wolves and 200 lynx living in Poland.
- The family *Cervidae* consists of animals with antlers. The family includes, among others, elk, reindeer, roe deer, fallow deer, red deer and moose – the member of the deer family living in America.
- The European roe deer (*Capreolus capreolus*) was the inspiration for the artist who created the cartoon character Bambi.
- The chamois (*plural* chamois or chamoix) is related both to the goat, as its Polish name indicates, and to the antelope. They all belong to the same *Bovidae* family.
- In the 19th century beavers were eaten by Christians on Friday because people thought that they were fish due to the fact that they lived in water and their tails were covered with scales.

VI. Whose tracks are they? Match the animals (1–6) with their tracks (A–F).



7

WILDLIFE MANAGEMENT

Wildlife management includes its conservation, pest and disease control as well as game management. The latter encompasses activities aimed at:

- protection of game seen as an integral part of forest ecosystems;
- creating favourable conditions for its breeding, growth and development;
- keeping its number in check.

As far as protection of animals and controlling their number are concerned hunting can be carried out only during the open season and is banned during the closed season (the time when game reproduces and takes care of the young). Hunters kill animals only when they are injured, weak, disabled or ill (infected by rabies included) or in order to counteract overpopulation of some species when there are no or not enough natural enemies. Hunters also fight poaching (illegal hunting) and help animals caught or injured by different kinds of traps, e.g. snares. Another aim of game management is breeding and introducing animals into woodland, e.g. hare, partridge, pheasant. Last but not least, protection of rare or endangered species and promotion of biodiversity are also important.

Creating favourable conditions means, among other things, protecting breeding grounds and water resources, providing proper shelter where game can hide or rest and enough food to keep animals away from fields or recently planted young trees where they can cause considerable damage. Such actions include: cultivating root crops, corn, legumes or planting young trees or bushes, which are a source of juicy shoots deer is so fond of. The above-mentioned food plots must be available for animals and are often situated at the edge of the forest so game can stop there to feed and therefore enter farmland less often. A similar policy is adopted in the case of creating grazing areas by mowing forest meadows, which not only stimulates the growth of herbs so favoured by the deer family (*Cervidae*) but also provides hay, used in winter to feed animals.

Animals need food not only in summer but all year round. Bearing this in mind, hunters help animals to survive the time when the weather conditions are harsh, the ground is covered with snow, or plants have not yet appeared. In spring and winter additional food and salt is provided. However, some scientists claim that animals need a proper habitat rather than artificial feeding because it may lead to the spread of diseases, disruption of their natural behaviour and lack of natural selection, to mention but a few.

Habitat enhancement is not limited to providing food and shelter only. It also tries to safeguard all the best conditions for the well-being of animals. This means all steps taken to improve their safety and health, such as disease prevention – vaccination against rabies included.

Worth remembering
wildlife, open/closed season, rabies, overpopulation, poach, traps, snares, breeding, hare, partridge, pheasant, biodiversity, root crops, corn, legumes, food plots, graze, mow, meadow

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. What is wildlife management focused on?
2. When can animals be hunted?
3. What animals are killed by hunters?
4. What is the difference between hunting and poaching?
5. What does creating favourable conditions for animals include?
6. Why are food plots so important?
7. Why are salt and food provided for animals in winter?
8. Why is artificial feeding a controversial issue?

II. Find the words in the text that mean:

1. animals hunted for their meat, fur etc. (paragraph 1)
2. killing animals legally (paragraph 2)
3. forbid, not allow (paragraph 2)
4. the time when killing animals is forbidden (paragraph 2)
5. the time when killing animals is not forbidden (paragraph 2)
6. a disease that makes animals and people go mad (paragraph 2)
7. too many animals living in a particular area (paragraph 2)
8. killing animals when such an action is against law (paragraph 2)
9. a trap for catching animals consisting of a wire loop (paragraph 2)
10. plants that are able to fix nitrogen from air (paragraph 3)
11. a new part of a plant, e.g. stem (paragraph 3)
12. a grassy area in a forest (paragraph 3)
13. a place when an animal lives or a plant grows, their natural environment (paragraph 4)
14. an injection preventing an animal or human from catching a disease (paragraph 5)

III. Now match the definitions 1–14 in exercise II with the words from the box.

legumes	poaching	vaccination	overpopulation
shoot	rabies	snare	open season
meadow	hunting	closed season	habitat
	game	ban	

FOLLOW-UP

I. Fill in the blanks with idiomatic expressions from the box. Change the verb form if necessary. All idioms are about animals.

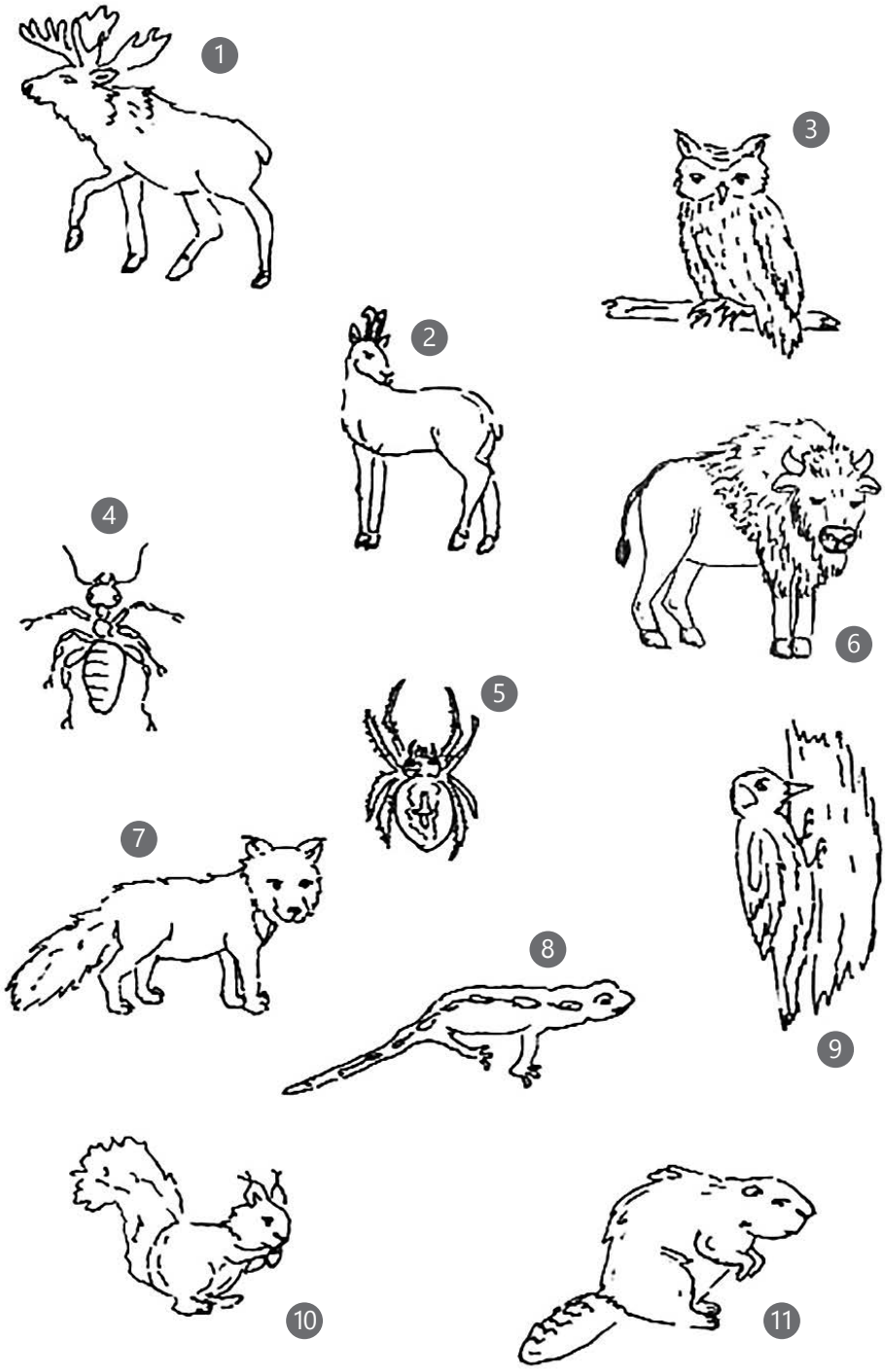
to be foxed	like a bear with a sore head	a lone wolf
hare-brained	feel like a fish out of water	an eager beaver
one swallow	doesn't make a summer	a snake in the grass
make a beeline for	take to something like a duck to water	

1. Don't be such …… because the boss won't give the rest of us a raise!
2. My last holiday was a disaster! I ……..…… among all those business people talking shop all the time.
3. Don't trust Janet. If I were you, I wouldn't leave her alone with your boyfriend. She is ……..…… .
4. His first article was brilliant and insightful but our boss, who is a journalist herself, knows that …… . She would like to see more of his work before she employs him full-time.
5. If I were you, I wouldn't ask Peter for help today. He's ……..…… .
6. Whenever I come back home my dog ……..…… for the kitchen hoping for some snacks.
7. My wife ……..…… driving ……..…… .
8. I don't know much about my neighbour. He's ……..…… .
9. Although the exam wasn't particularly difficult I …… really ……..…… by the last question. How did you answer it?
10. I'm fed up with my girlfriend's ……..…… idea about becoming a model. If she had hoped for such a career, she should have tried years ago but not now when she is 29!

II. Match the idioms in exercise I with their meanings (A–J).

A. angry, impatient, bad-tempered
B. a person who cannot be trusted
C. a person who doesn't enjoy company, keeps himself to himself
D. a person who works too hard and is too enthusiastic about his/her job
E. it's not a good idea to form an opinion judging by a single fact or event
F. feel awkward
G. learn something very quickly
H. foolish, impractical
I. go directly and quickly towards something
J. be confused, not understand something or solve it

III. Look at the picture and name the animals.



REVISION III (TEXTS 5–7)

I. Choose the correct answer.

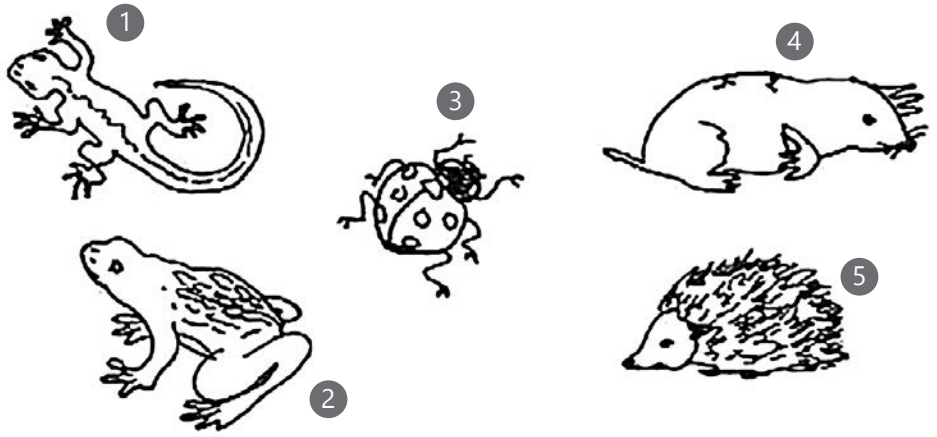
1. Birds living close to rivers, lakes or streams are called:
   a. waterfowl
   b. watershed
   c. waterspout
2. To 'hatch' means:
   a. to feed on meat
   b. a process during which an egg breaks and a young animal comes out
   c. to lay eggs in other birds' nests
3. Birds of prey are represented by:
   a. sparrows and blackbirds
   b. ravens and magpies
   c. owls and hawks
4. Birds eating remnants of dead animals are called:
   a. carrion
   b. scavengers
   c. herbivores
5. Polish reptiles include:
   a. lizards, slowworms and adders
   b. newts, beavers and grass snakes
   c. toads, European pond turtles and lizards
6. Animals can be hunted:
   a. all year long
   b. during the open season
   c. during the closed season
7. 'Game' means:
   a. all activities aimed at controlling the number of animals in the forest
   b. animals hunted for sport or food
   c. the same as snares
8. A dangerous animal disease is called:
   a. rabbits
   b. rodents
   c. rabies
9. During the closed season animals:
   a. are hunted
   b. reproduce and take care of their young
   c. migrate
10. Squirrels:
    a. build dams
    b. dig burrows in the ground
    c. live in hollows

11. Marmots:
    a. are small reptiles
    b. hibernate
    c. are game
12. Moles:
    a. live in the ground
    b. are semi-aquatic
    c. live in tree crowns

II. Decide whether the following statements are true or false.

1. poaching means hunting not permitted by law
2. snares are traps that injure animals
3. an open area in forests covered with grass is called enhancement
4. herbivores prefer carrion in their diet
5. woodpeckers and partridges are resident birds
6. owls are nocturnal creatures
7. lynx is herbivorous
8. hedgehogs are smaller than otters
9. smooth snakes are poisonous
10. some forest animals are vaccinated against rabies

III. Look at the pictures and name the following animals.



8

FORESTS IN DANGER. PART I

Trees in forests are exposed to danger caused by severe or extreme weather conditions, human activity and also pests and diseases. Unfortunately for trees, the threats mentioned above are often interconnected and have a cumulative effect on forest health. For instance, adverse weather can damage trees which, as they become weaker, are more susceptible to pathogens and insect attack.

Abiotic damage

Abiotic factors such as precipitation (rain, snow, hail), drought, strong wind, frost, temperature fluctuations or lightning can damage the whole tree or its parts such as buds, foliage, shoots, twigs, branches, stems, trunks, bark or even roots. Whole trees can be uprooted due to strong wind, avalanche or snow accumulation on a tree canopy whereas lightning can kill the whole tree or injure its top or bark.

Buds which are no longer dormant, young tree parts which have started to grow and whose tissues are still soft can be damaged by late spring frost. Early autumn frost can be dangerous as well because during this period of time plants are usually not properly prepared for winter (they have not yet gone through the process of hardening off). Frost is also the reason of dieback of different parts of a tree as well as seedling frost heaving. The latter damage happens in spring when frozen soil melts during the day and pushes seedlings upwards. When it freezes again their roots are broken and young plants topple.

Foliage can suffer from low temperatures as well. In addition, it can be affected by high temperature, e.g. leaf dieback or 'red belt'. Leaves are also damaged by heavy rain or hail.

Stems and trunks are affected by frost and too strong sunshine. Frost lesions, frost cracks, frost ribs, cankers and sunscald (visible bark injury on the south-west side of the trunk) are among the most common tree injuries caused by the above-mentioned factors.

Limbs, branches, stems and seedlings are often damaged by snow, ice or hail. As a result, they are broken, bent or deformed.

Unfortunately for trees the danger list does not end here. Forests are also affected by drought, fire or climate change, to mention but a few.

Worth remembering

abiotic damage/injury, pathogen, hail, lightning, bud, foliage, twig, limb, branch, trunk, bark, avalanche, uproot, dormant, hardening off, tissue, dieback, frost heaving, 'red belt', drought

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. Name three groups of factors causing damage to forests.
2. Why are all these factors interconnected?
3. What kinds of abiotic factors are mentioned in the text?
4. Explain in your own words what 'precipitation' is.
5. Why are late spring frost and early autumn ones so dangerous?
6. Name other injuries caused by frost.
7. What is the difference between sunscald and frost crack?

II. Match the following terms (1–10) with their definitions (A–J).

1. windfallen tree
2. frost crack
3. abiotic damage
4. hail
5. sunscald
6. dieback of shoot tips
7. blowdown/windthrow
8. bark scorch / heat canker
9. 'red belt'
10. frost rib

A. a tree injury caused by weather
B. frost crack heals and is filled with callus forming a ridge
C. needles turn red when temperature is high during the day, low at night and soil is frozen. Leaves lose water but they cannot replenish it from the soil
D. the same as a windfallen tree
E. a tree uprooted by wind
F. sapwood shrinks across growth rings and a tree trunk cracks
G. tips die due to temperature fluctuations in winter
H. often happens after thinning when bark is suddenly exposed to direct sunlight
I. the same as sunscald
J. precipitation in the form of small ice balls

'WEATHER' FOLLOW-UP

I. Put the words from the box into the following categories: ice, snow, rain, rain+snow, wind.

glaze	sleet	avalanche	rime
breeze	flake	drizzle	gale
downpour	blizzard	hailstorm	

9

FORESTS IN DANGER. PART II

Apart from abiotic threats, forests can also suffer man-made damage as well as that caused by biotic factors, such as insects and fungi, which can be blamed for the majority of injuries and diseases affecting trees.

Anthropogenic factors

Human activities such as careless or irresponsible use of forests for recreation, artificial regeneration preferring single-species and even-aged plantation, harmful harvesting practices, e.g. clearcutting, are only a few examples of threats posed by man to forests. Unfortunately, trees are also damaged by other factors such as fire or air pollution.What most people find hard to believe is the fact that only about 10 per cent of fires are natural whereas 90 per cent of them are man-made and due to negligence, e.g. unattended campfires, sparks from equipment or vehicles, discarded burning cigarettes, burning pastures and wastelands, or arson.

Air pollution affects forests directly by damaging foliage causing, for instance, discoloration, necrosis, premature leaf shedding or indirectly by changing soil quality. The most common problem is soil acidification leading to depletion of nutrients which become unavailable for roots. What is more, when the soil pH decreases metals such as mercury, aluminum or lead are easily released and become toxic to plants. Some of the most harmful pollutants for trees include: sulphur dioxide (SO_2), nitrogen dioxide (NO_2), fluorine (F_2) and its compound hydrogen fluoride (HF), ammonia (NH_3) and oxidants, e.g. ozone (O_3), to mention but a few.

Biotic damage

Biotic damage in forests falls into the following general categories: diseases and injuries. The former are caused mainly by bacteria and fungi, the latter by pests (insects and other animals).

Bacterial diseases are not very numerous whereas fungal ones pose a serious threat to our forests. Needle cast, pine twisting rust, powdery mildew of oak and annosum root rot are only a few examples of the most common diseases caused by fungi.

Biotic damage is also caused by insects which can attack healthy trees as well as ones previously weakened by abiotic factors or other pests.

Healthy trees are attacked mainly by foliophagous (known also as defoliating) insects such as: pine lappet moth (*Dendrolimus pini*), nun moth (*Lymantria monacha*), pine sawfly (*Diprion pini*), pine looper moth (*Bupalus piniaria*), pine beauty (*Panolis flammea*) and green oakroller moth (*Tortrix viridana*), to mention but a few.

Secondary insect pests invade weakened or dying trees. The most popular include bark beetles and larger or lesser pineshoot beetles. Unfortunately for trees, insects can damage each part of a plant, such as buds, cones and seeds, as well as posing a threat to any developmental tree stage.

Animals such as beavers fell trees and build dams flooding the neighbouring area.

Deer often trample seedlings, browse young and juicy parts of trees or rub antlers on trees damaging their bark. Red squirrels strip bark, destroy lateral and terminal shoots, buds and cones. Wild boars churn up the soil, causing agricultural damage, destroy forest plants by trampling them and contribute to soil erosion by digging along stream banks and ponds.

Worth remembering
anthropogenic, single-species, even-aged, clearcutting, discoloration, mercury, lead, sulphur dioxide, nitrogen dioxide, fluorine, ammonia, needle cast, pine twisting rust, powdery mildew of oak, annosum root rot, pine lappet moth, nun moth, pine sawfly, pine looper moth, pine beauty, green oakroller moth, secondary insect, bark beetle, large/lesser pineshoot beetle, large/lesser weevil, browse, squirrel, churn up

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. Name the two main groups of factors damaging forests.
2. What is the difference between anthropogenic and biotic damage?
3. What are forest fires caused by?
4. How does air pollution affect trees?
5. What is its impact on soil?
6. Name the most common air pollutants.
7. What are tree diseases caused by? Name some of them.
8. Why are insect pests so dangerous to forests?
9. Define the term 'secondary insect pest'.
10. What kind of damage can other animals cause? Give examples.

'FIRE' FOLLOW-UP

I. Match the words (1–7) with their meanings (A–G).

1. fire station	A. a container with chemicals which can put out fire
2. firefly	B. a big, red car used by fire fighters
3. fire engine	C. cannot be damaged by fire (adjective)
4. firing squad	D. an insect that produces light at night
5. fireproof	E. soldiers killing somebody who has committed a serious war crime
6. fire extinguisher	F. strong alcoholic drink (*informal*)
7. firewater	G. a building where fire fighters work and fire engines are kept

10

THE EUROPEAN SPRUCE BARK BEETLE

Among insect pests the European spruce bark beetle (known also as the eight--toothed spruce bark beetle) is definitely a celebrity. This infamous insect decimates European forests (Polish included) by attacking spruce over vast areas. The bark beetle's sinister activities lead not only to ecosystem disruption but also to the lowering of timber commercial value. Mobile insect developmental stages, such as adults (both males and females) and larvae, take an active part in the attack by boring systems of tunnels called galleries and drilling holes known as chambers.

A tree invasion starts with males looking for an appropriate host tree – usually an old, weakened, windthrown or a dying one. However, during an insect outbreak even the healthy ones are not safe because beetles in large numbers are able to overcome the tree's natural defence against them.

Once the host is found the destruction begins. Males are the first to set to work. They prepare a nuptial chamber under the bark which serves as a 'house' for females and their offspring. Next, a male attracts one to four females. After mating females excavate tunnels called egg galleries and lay eggs. When the larvae are hatched they continue the act of destruction initiated by their parents by boring more tunnels (larval galleries). Larvae are voracious creatures and feed on inner bark for approximately three to four weeks. At the end of the tunnels, known as pupal chambers, the pupation takes place. It usually takes one to two weeks. Then, young adults take over and feed in the wood. Beetles overwinter in the adult stage under the trees where they developed or under the bark.

The number of generations per year ranges from one to three and depends on weather conditions. When winter is long and summer rainy and cold only one generation is produced. The first spring flight takes place when the temperature rises to about 20°C.

Bark beetles are extremely invasive and destructive pests which can cause a lot of damage in a short period of time. Apart from direct damage to trees, bark beetles also spread pathogenic blue stain fungi belonging to two genera: *Ophiostoma* and *Ceratocystis* which are responsible for vascular wilt. The fungi block xylem vessels and, as a result, the transport of water is disturbed which leads to premature death of trees. What is more, the above-mentioned pathogens lower the tree's natural defence against bark beetles and cause wood discoloration lowering its commercial value.

Worth remembering

European spruce bark beetle (eight-toothed spruce bark beetle), males, females, offspring, mating, hatch, larva, pupa, pupation, nuptial/pupal chamber, egg/larval gallery, lay eggs, overwinter, blue stain fungi, vascular wilt, wood discoloration

READING AND LISTENING COMPREHENSION

I. Answer the following questions.

1. Why are bark beetles so well-known?
2. Why are they so harmful?
3. Which developmental stages are the most dangerous?
4. How does a tree invasion begin?
5. What trees are attacked?
6. How does each developmental stage damage a tree?
7. How do beetles spend winter?
8. What is the number of generations determined by?
9. What fungi do bark beetles spread?
10. What do they cause?

FACTS ABOUT INSECTS

- The pond skater known also as the water strider (*Gerris* sp.) slides on water thanks to long legs and feet covered with hair preventing it from drowning.
- Formic acid produced by ants is treated by animals as an ectoparasite repellent. Birds catch ants and rub them into their feathers while other animals simply wallow in anthills.
- Some ants, e.g. leafcutter ants, are keen gardeners – they grow fungi and later feed on them. Others take care of aphids because they provide ants with honeydew – a valuable source of sugar and proteins.
- A dragonfly's sex life requires a lot of agility and precision because insects mate while flying. Next, a male flies around a female which drops eggs into water.
- When a ladybird is frightened it falls from a leaf or twig and pretends to be dead.
- The forest caterpillar hunter (*Calosoma sycophanta*) can be spotted in tree crowns and on trunks. During its four years of life one beetle can eat 1,600 caterpillars of nun or gypsy moths.
- The dor beetle (*Geotrupes stercorosus*) is a faithful partner. During the mating season (spring and summer) it is monogamous.
- Mosquito larvae are like small submarines. They spend most of the time just under the surface of the water but when in danger they submerge and remain on the bottom of a water reservoir until they are safe again.
- The common green lacewing (*Chrysoperla carnea*) changes its colour according to the season. In autumn they turn brown, in spring they are green again.

Based on: *Atlas owadów* by H. Bellman.

11

DANGER IN THE FOREST

Forests are beautiful, tranquil and relaxing, but not always safe because some animals living in forests can be dangerous or transmit diseases which are fatal for humans. What is more, there are several species of plants or mushrooms that are poisonous, so in order to avoid any health risk, it is a good idea not to gather or eat anything with which we are not familiar. If we follow this simple piece of advice, time spent in the forest can be enjoyable, pleasant and safe.

Animals inhabiting forests avoid humans by nature and attack only when they are frightened, ill or defending their young. If a wild animal seeks our company, we should be extremely careful and not approach it. An animal that exhibits such unusual behaviour is likely to bite or scratch us and in such a way may transmit a very serious viral disease – rabies, which attacks the central nervous system. The first symptoms of rabies are similar to a cold or flu (fever, weakness and headache). The illness is very dangerous because the incubation period is rather long (usually between three weeks and three months) and when symptoms appear it is too late to help and the person dies. However, if we are bitten or scratched by a wild animal, we should not panic but wash the injured skin with plenty of water and soap or disinfectant. Next, we should see a doctor as soon as possible because the sooner proper treatment is administered the more effective it is.

Fortunately, the probability of being infected with rabies is rather low. The same applies to encountering a bear in the wild. Although bears are relatively rare in Poland it is worth remembering that they are not cuddly teddy bears but fast, strong animals which can attack or even kill. Therefore, if you do not want to be injured by a bear never come between a mother and her young or an animal and its prey or food. It is also a good idea not to attract its attention or provoke it in any way.

The adder (*Vipera berus*) is the only venomous snake in Poland. Its bite rarely kills (fatalities are no more than one per cent) but it is painful and may cause swelling, sweating, fever, nausea, vomiting, a quickened heart rate and lower blood pressure. If we are bitten by an adder, we should not panic and move as little as possible as the less we move, the slower venom spreads in our body. Next, we should seek medical help.

The risk to our health is usually estimated in terms of the probability of our encountering a dangerous animal. It goes without saying that the possibility of being attacked by bears, bitten by adders or rabid animals is relatively low in Poland. However, the chance of encountering other tiny, barely visible creatures – ticks, is quite high. These small arachnids (merely 2 or 3 millimetres long) pose a grave threat to our health because they are vectors of Lyme disease, causing skin inflammation taking the form of a characteristic red ring around the bite. If the disease is not treated, it attacks the joints, heart and nervous system.

Ticks prefer wet, grassy areas, forests – usually broad-leaved or forest fringes covered with high grass or shrubbery. If we want to avoid being infected with bacteria of the genus *Borrelia* that are transmitted by ticks and cause the disease, we should

wear clothes protecting our skin (long trousers, long-sleeved shirts, no sandals but boots) and examine our bodies for ticks after coming back home.

When we notice a tick, it should be immediately removed. It is a good idea to examine the skin for the next few days to see whether any typical visible symptoms have developed.

Apart from animals, danger in forests may also come from plants so it is advisable not to pick and eat anything with which we are not familiar as a lot of plants are poisonous, e.g. lily of the valley, yew, belladonna/ devil's berries (*Atropa belladonna*), mezereon (*Daphne mezereum*) and common foxglove (*Digitalis purpurea*), to mention but a few. However, it is worth remembering that many of them in small doses are not lethal but possess medicinal properties.

Mushrooms may pose a serious threat to human health as well. The poisonous ones are very dangerous because they may damage the kidneys, liver or heart. What is more, symptoms may sometimes occur even two weeks after eating mushrooms and then it is too late to do anything to save somebody's life. The most dangerous mushrooms in Poland include: the *Amanita* family, e.g. death cap (*Amanita phalloides*), false morel (*Gyromitra esculenta*), deadly fibrecap / redstaining fibrecap (*Inocybe erubescens*), livid pinkgill (*Entoloma sinuatum*), fool's webcap (*Cortinarius orellanus*).

Worth remembering

transmit a disease, viral, rabies, rabid, adder, venomous, venom, tick, arachnid, vector, Lyme disease, lily of the valley, yew, belladonna (or devil's berries), mezereon, common foxglove, death cap, false morel, deadly fibrecap (or redstaining fibrecap), livid pinkgill, lethal webcap

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. When do animals attack people?
2. What should we do when we encounter a friendly wild animal in a forest?
3. Why may a wild animal's bite pose a threat to our health?
4. How should we behave if we see a bear?
5. What are the symptoms of an adder bite? What action should be taken next?
6. What are ticks? Are they numerous in Poland?
7. What is Lyme disease caused by? What are its typical symptoms?
8. What can be done to avoid Lyme disease infection?
9. Give examples of poisonous plants.
10. Why is mushroom poisoning dangerous?

REVISION IV (TEXTS 8–11)

I. True or false?

1. Abiotic damage in forests can be caused by: weather conditions, pathogens and pests.
2. Precipitation means snow, rain or hail.
3. Lightning is not dangerous for trees.
4. Dormant buds are more resistant to frost than the ones that have already opened in spring.
5. Hardening off is a process during which plants become more resistant to unfavourable weather conditions, e.g. frost.
6. 'Foliage' means the same as 'leaves'.
7. Frost ribs are examples of the most common leaf injuries caused by early spring frost.
8. Anthropogenic factors include pathogens and pests.
9. The most harmful air pollutants include: fluorine, nitrogen dioxide, carbon dioxide and sulphur dioxide.
10. Forest diseases are caused by insects and other animals.
11. Fungi and insects cause extensive biotic damage in forests.
12. Secondary insect pests attack healthy trees.
13. Insect developmental stages include: eggs, larvae, pupae and adults.
14. Ticks transmit rabies.
15. *Borrelia* species cause Lyme disease.
16. Adders are not dangerous.
17. Ticks are arachnids.
18. Mezereon, common foxglove and wild strawberry are examples of poisonous plants.

II. Form adjectives using the following words.

1. bacterium – .....
2. fungus – .....
3. virus – .....
4. pollution – .....
5. fatality – .....
6. venom – .....
7. poison – .....
8. rabies – .....
9. danger – .....
10. dormancy – .....
11. pathogen – .....
12. toxin – .....

III. Which animals:

1. are vectors of Lyme disease?
2. transmit rabies?
3. are venomous?

IV. What animals are to blame for the following damage?

1. felling trees and flooding the neighbouring area
2. trampling seedlings and damaging bark with antlers
3. digging along streams, damaging fields and crops, causing soil erosion
4. damaging weakened or dying trees
5. destroying leaves
6. damaging inner bark and wood
7. stripping bark, destroying buds and cones

V. Match the following chemical elements or compounds with their symbols or formulae from the box.

NH_3	O_3	Hg	N	NO_2	S	Al	Pb	SO_2	F_2

1. fluorine – .....
2. sulphur – .....
3. mercury – .....
4. nitrogen dioxide – .....
5. lead – .....
6. ozone – .....
7. sulphur dioxide – .....
8. nitrogen – .....
9. ammonia – .....
10. aluminium – .....

VI. Give antonyms of the following words.

1. biotic ≠ .....
2. flood ≠ .....
3. natural ≠ .....
4. male ≠ .....
5. domesticated, tame ≠ .....

PART III

FORESTRY IN PRACTICE

1

HOW TO CONTROL FOREST PESTS AND DISEASES. PART I

For foresters it goes without saying that maintaining vigorous trees results in forests more resilient to pests and diseases so any action which aims at making forests more healthy is worth implementing because only integrated methods of fighting pests and diseases produce the most desirable and long-term results. There are several techniques used, including silvicultural ones as well as biological, mechanical and chemical control.

Prevention is better than cure

Proper forest management and treatment of stands help to create unfavourable conditions for pest and disease outbreaks. Choosing tree species the best suited to local conditions, promoting and conserving biological diversity, avoiding even-aged stands, favouring individual tree and species resistance, protecting the site (its soil included), minimising injury from logging and fire and removing suppressed, diseased and overmature trees are only a few examples of methods and techniques foresters have at their disposal as far as prevention of pest and disease attack is concerned. Others include: stimulation of recovery of devastated stands and conservation of natural enemies.

Forester's allies

Many animals and microorganisms living in forests are natural enemies of pests damaging and destroying trees. Such organisms should be protected because they help to keep the number of insects and rodents in check. Pest population can be reduced by:

- microorganisms such as viruses, bacteria, e.g. *Bacillus thuringiensis*, *Enterobacter* sp., *Pseudomonas* sp., and fungi, e.g. *Empusa aulicae*, *Beauveria* sp., *Entomophtora* sp. as well as protozoa, e.g. *Noena lymantriae*, *Haplosporidium ypographi*, *Plistophora schubergii*;
- spiders;
- parasitic and predatory insects. The most beneficial are the ones that destroy eggs, e.g. *Trichogramma*, and larvae, e.g. insects belonging to the *Braconidae*, *Ichneumonidae* and *Tachinidae* families. Parasitic insects are represented by ants whose adults and larvae are capable of destroying all developmental stages of insects. Beetles, ladybird included, and the *Syrphidae* family, that are predators of aphids, also help in reducing pest population;
- amphibians, e.g. toads, frogs and reptiles, such as slowworms and lizards, which are insectivorous, as well as adders that feed on mice and other rodents. However, their importance in fighting pests is marginal because they are either relatively rare or restricted to a certain habitat as in the case of amphibians which inhabit areas in close proximity to water;
- birds which can eat rodents and different developmental stages of insects, e.g.

swallows prey on flying insects, jackdaws prefer grubs, while goldcrests and tits eat caterpillars;
- mammals such as bats, moles, hedgehogs, wild boars, foxes and squirrels feed on adult insects, caterpillars, pupae and grubs, ground inhabiting included.

Natural enemies are used in biological control in two ways: they are either protected or introduced to the areas where they are not present or where their population is sparse.

Worth remembering
resilient, outbreak, even-aged stand, logging, natural enemies, protozoan, parasitic, predatory, aphid, swallow, tit, goldcrest, jackdaw, grub, bat, hedgehog

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. Why is maintaining vigorous trees so important?
2. What can be done to achieve this goal?
3. How can pest and disease outbreaks be prevented?
4. Name the natural enemies of different groups of pests.
5. What types of insects are helpful in reducing pest population?
6. Why do reptiles and amphibians not play an important role in fighting forest pests?
7. Name some of the birds and mammals which are the forester's allies in pest control.

FOLLOW-UP: ENTOMOLOGICAL TERMS

I. Match the words with their definitions.

1. antenna	A. a parasite that lives on the outside of its host
2. parasite	B. an organism that eats wood
3. maggot	C. eating insects
4. grub	D. long, thin organs on an insect's head
5. endoparasite	E. a legless larva with reduced head
6. vector	F. a parasite that attacks another parasite
7. IPM	G. a parasite that lives inside its host body
8. parasitoid	H. a larva with thoracic legs and a well-developed head
9. ectoparasite	I. a parasite that kills its host
10. entomophagous	J. an organism that is harmful to its host but usually does not kill it
11. hyperparasite	K. integrated pest management in which all available methods are used
12. xylophage	L. an organism that transmits a pathogen from one host to another

2

HOW TO CONTROL FOREST PESTS AND DISEASES. PART II

Apart from prevention and conservation of natural enemies there are also other techniques which aim at suppressing forest pests and pathogens. The methods can be roughly divided into mechanical, biological and chemical.

Mechanical methods

Mechanical methods include: hand-picking of insects, using different types of traps consisting of fresh bark or fallen trees, isolating nurseries by means of shallow ditches (20–30 centimetres deep) and removing infested trees. Unfortunately, most of these methods are time-consuming, not very effective and quite expensive due to the cost of labour. As a result, they are not widely used.

Biological control

Biological control is gaining popularity because it is selective, harmless to humans and other organisms, beneficial included, safe and relatively cheap, because once the natural enemies are established their effect can be long-lasting.

What is more, the pest does not develop resistance to biological control agents as happens in the case of chemical pesticides.

Biological methods use natural enemies such as viruses, bacteria and fungi (microbial control) and others able to control pests. Biopesticides including microorganisms are applied in the same way as chemical ones.

Augmentation is the name of another technique aiming at increasing the population of entomophages. They are introduced into the areas outside their natural range or within when their population is not dense enough to suppress pests successfully, e.g. artificial southern/red wood ant colonisation in Polish forests.

Biological methods also include creating favourable conditions for natural enemies such as providing sources of food they prefer, e.g. melliferous plants for true flies (*Diptera*) and *Hymenoptera*, and protecting their breeding grounds.

Chemical control

Application of pesticides in forests should be treated as a last resort. Their use should be limited because it can lead to environmental disruption and contamination (pesticides often leach to water, persist in soil and food chains, poison animals, mushrooms and plants: berries and herbs included). Pesticides can reduce plant diversity, kill beneficial insects, e.g. bees, and natural enemies as well as lead to developing resistance against pesticides. As a result, chemical control becomes less effective and more expensive.

In forests insecticides, fungicides and herbicides (against weeds) are used more often. Others, such as nematicides, acaricides and rodenticides are less common.

Semiochemicals

Semiochemicals are non-toxic, natural substances used as means of communication between individuals of the same species (pheromones) or different ones (allelochemicals). Nowadays their synthetic equivalents are mass-produced and sold as commercial crop protection products. Semiochemicals can play different roles such as those of attractants or repellents.

The most widely used are sex pheromones which are indispensable components of traps used to attract and catch insects in order to detect them, monitor their population level or simply destroy them.

The role of repellents is to keep pests away. For instance, Repentol 6 or Emol 5 reduce deer browsing and damage caused by hares and rabbits among recently planted young trees.

Integrated pest and disease management

Integrated pest and disease management means applying as many different methods of fighting forest enemies (pest and diseases) as possible, e.g. prevention, biological and chemical control and use of semiochemicals. It is worth remembering that only such an approach is the best solution because one method complements the other and together they produce beneficial effects.

Worth remembering

biological/chemical/microbial control, biological control agents, biopesticides, augmentation, entomophage, red wood ant, melliferous, pesticides, insecticides, fungicides, herbicides, nematicides, acaricides, rodenticides, semiochemicals, pheromones, allelochemicals, attractants, repellents

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. What techniques can be used to control forest pests and pathogens?
2. What do mechanical methods combine?
3. Why is biological control recommended in forests?
4. Explain the term ‘microbial control’.
5. What is augmentation based on?
6. Why is chemical control not recommended in forests?
7. What kinds of pesticides are used in forestry?
8. What are semiochemicals? How can they be divided?
9. What is the difference between pheromones and allelochemicals?
10. What roles can semiochemicals play?
11. How are they used in forestry?
12. Why is the integrated method the best solution?

3

FOREST ESTABLISHMENT

When a new forest begins to grow, the process can be described in different terms referring either to an area it starts to occupy or the way it regenerates.

As far as the area is concerned, young trees can develop on a site where a forest existed before but has been destroyed by natural disasters such as fire, strong winds, snow or biotic factors, e.g. forest pest and diseases. Trees may also be damaged by pollution or removed by other anthropogenic activities such as logging. The process of renewing a forest on former forest land is called reforestation.

Afforestation, on the other hand, refers to creation of a forest on an area such as waste or farmland, dunes, mine dumps or other areas degraded by improper agricultural use, deforestation, industralisation causing pollution, quarries, open-pit mining and the like. Afforestation can be accomplished either by establishing tree plantations for commercial purposes or creating a forest for environmental ones. The choice of trees in both cases is different. In that of plantations (usually monocultures) fast-growing species are preferred. They can provide, for example, Christmas trees, supply fuelwood or timber. Plantations are frequently grown on former agricultural land (although they can be also a part of reforestation) and consist mainly of single--species and even-aged stands. The most common species used for this purpose include: poplar, birch, larch, black alder, willow and spruce.

Both afforestation and reforestation should be thoroughly planned taking into account native vegetation, tree species composition and local environmental conditions such as soil, climate and water resources because such an approach can prove beneficial to the whole ecosystem. Properly chosen tree species prevent soil degradation, help to reduce air pollution, promote water conservation and biodiversity, to mention but a few.

Forests can regenerate in a natural or artificial way. Natural regeneration, as the name indicates, is left to Mother Nature which takes its course at its own pace and manner. As a result, it is rather slow and difficult to predict because there is not much control over the species colonising the site. The same applies to the amount of their seeds which can be carried by wind or animals from the neighbouring area or produced by the trees occupying the site, not to mention the number of stump sprouts or root suckers. Natural regeneration heavily relies on seed crops and their dispersal, weather condition and results in uneven distribution of seedlings. On the other hand, it is not expensive, usually leads to the establishment of mixed, uneven--aged and multi-storey stands preserving indigenous ecotypes well adapted to local conditions. What is more, the local microclimate is not disturbed, soil is protected from erosion and seedlings avoid transplant shock.

Artificial regeneration is based on sowing seeds or planting seedlings. In contrast to natural regeneration, an artificial one can be planned and controlled. Foresters decide about species composition, arrangement of plants, seed quality and quantity.

Artificial regeneration allows more plants to survive and develop (especially in the case of planting) and the process is quicker than in natural regeneration but more expensive. It is due to the fact that a site requires careful preparation and the costs of planting seedlings and taking care of them afterwards are high.

Worth remembering
renewing, renewal, reforestation, afforestation, wasteland, mine dumps, timber, degraded areas, plantation, monoculture, fuelwood, water resources, water conservation, natural regeneration, seed dispersal, artificial regeneration, seedling

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. Name four terms that can be used to describe how forests start to grow.
2. What do these terms refer to?
3. What is the difference between reforestation and afforestation?
4. What areas are used for afforestation?
5. What purposes does afforestation serve?
6. Name tree species most commonly grown in plantations. By what qualities are they characterised?
7. How can forests regenerate?
8. What is the difference between natural and artificial regeneration?
9. Which way of regeneration is cheaper and which more reliable?
10. What does the success of natural regeneration depend on?
11. What are the advantages of artificial regeneration?

II. What do the following definitions refer to? All words appear in the text.

1. protection
2. a reproductive part of a plant growing from its root
3. wood used for making things or building
4. growing one plant species over a big area
5. a young plant which has grown from a seed
6. wood that is burnt in order to produce heat
7. an empty area that is not cultivated
8. a shoot growing from a stump. It can be used in asexual propagation

4

ARTIFICIAL REGENERATION

Artificial regeneration means that foresters decide about almost everything concerning forest establishment. This involves: the choice of species that are best adapted to local conditions, tree composition and distribution. Foresters also control the amount of seeds and their quality and choose a method of regeneration (sowing seeds or planting seedlings).

Direct seeding is usually implemented in the case of areas that are difficult to reach (swampy grounds or located high in the mountains). Seeds are broadcast by hand. Direct seeding is not recommended when germination conditions are poor, e.g. sandy soils, those with inappropriate draining or those subject to flooding.

In natural regeneration a significant number of seeds and seedlings can be reduced by birds or other animals that can eat them or damage seedlings by grazing or trampling. In order to prevent such a situation in artificial regeneration seedlings are often treated with repellents.

Planting seedlings is a tried-and-tested method that takes precedence over sowing seeds in forest regeneration. Seedlings are grown in nurseries. The majority of them are bare-root although more and more of them are produced in containers. The survival rate of the latter is much higher which allows significant reduction of their number (up to 40 per cent) in comparison with bare-root ones when planting is concerned.

Site preparation is extremely important for the success of artificial regeneration. It aims at diminishing abundant forest floor vegetation (weeds, shrubs, grass) that competes with seedlings for light, nutrients and water. It also involves exposing mineral soil mainly by ploughing, because a too thick litter layer or dense vegetation impairs germination and seedling growth.

Early spring, when seedlings are still dormant, or autumn, after they have shed their leaves, is the best time for planting. As planting material one-year-old seedlings can be used, e.g. pine, oak, beech, larch. Species like fir, spruce or ash need longer to produce adequate seedlings for planting. Choosing proper planting time is one of the key factors ensuring regeneration success. The time depends on weather, local conditions (soil included) as well as species characteristics. For instance, it is worth remembering when certain species break their dormancy. The ones that do it first, e.g. birch, larch, aspen, should be planted respectively.

When the temperature is too high, the soil is still frozen or too dry, it is not a good idea to plant seedlings. Seedlings should be planted as soon as possible after they have been transferred from a nursery. Haste is necessary because it prevents seedlings from drying out, which may be the reason for regeneration failure.

Worth remembering
sow, plant, broadcast, trample, treat, repellent, graze, bare-root, dormant, dormancy, unwanted vegetation, nutrients

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. What do foresters control in artificial regeneration?
2. In which cases is direct seeding recommended? When is it not advisable?
3. Why do we have to plant more bare-root seedlings?
4. What does site preparation involve?
5. What is the best time for planting seedlings?
6. How old should seedlings be?

FOLLOW-UP

A. 'TREE' WORDS, EXPRESSIONS AND IDIOMS

I. Fill in the blanks with the words and expressions from the box.

trunk	tree-lined	tree-hugger	out of your tree
tree surgery	treetops	tree diagram	annual rings
treeless	grow on trees	tree house	family tree

1. You can estimate the age of a tree by counting its …….. .
2. When I was a child, my father built us a ……..…. in the garden where I used to play with my brothers.
3. I live in a ……..…… street.
4. My sister often goes to the park to listen to the birds singing in the …… .
5. During our last meeting the boss explained changes in the company by means of a ……..…… .
6. My brother is a ……..…… . Last week he protested against building a dam because it may lead to some aquatic species extinction.
7. My girlfriend studies horticulture because she wants to specialise in …… .
8. For me, ……..…… areas are very monotonous and depressing.
9. The ……..…… of Queen Victoria is very interesting. We studied it during our last history lesson.
10. A tree ……..…… is the main stem of a tree.
11. Sorry, but we can't afford a Mercedes. Money doesn't ……..……., you know.
12. Are you going to marry him? You are ……..…… !

II. Which expression means:

a. not to think clearly?
b. an environmental campaigner?
c. that you shouldn't waste money?

B. HOW TO PLANT A TREE

In order to ensure successful tree establishment it is very important to choose the proper seedlings which means those that are best suited for local conditions and with a well-developed root system. The majority of seedlings used in forest regeneration are bare-root due to the fact that they are the cheapest. B&B (balled and burlapped) or container-grown seedlings are more expensive and therefore less often planted.

I. Put the following stages of planting a tree in the proper order.

A. Pack down the soil during refilling in order to prevent air pockets. .....

B. Water carefully. Monitor the soil mixture for the next 2–3 months and water the seedling if necessary. .....

C. If the soil is dry, water the hole a bit. Place the seedling at the bottom. Make sure that the roots are straightened and do not bend upwards. .....

D. Until planting time keep the seedlings in a moist soil and in the shade. Plant the seedlings as soon as possible. .....

E. Reduce transplant shock by handling seedlings with care during lifting and transport. Do not allow roots to dry out. .....

F. Hold the tree. Start refilling the hole with the soil. Plant the tree at the same depth as it has grown in a nursery. .....

G. Roughen the sides of the hole and leave a heap of soil at the bottom. Place the rest of the soil near the hole. .....

H. Dig a hole. .....

II. Look at the pictures and describe how to plant a tree.

1

2

3

4

5

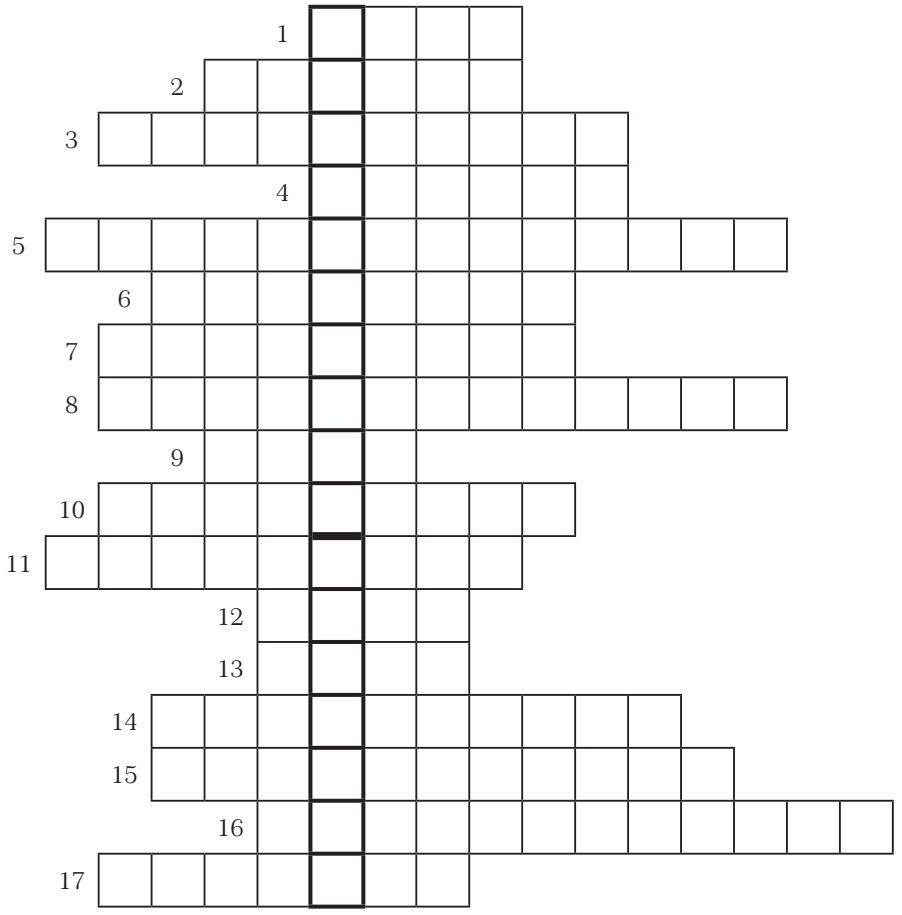
6

7

8

REVISION V (TEXTS 1–4)

I. Do the crossword to reveal the hidden words.



1. beneficial insects
2. a small creature with eight legs, a natural enemy of forest pests
3. substances used as means of communication between individuals of the same species
4. a reptile with a long body and a long tail
5. a group of organisms represented by viruses and bacteria
6. a small mammal whose back is covered with sharp spikes
7. a chemical used against weeds
8. an adjective describing an animal that eats insects
9. a device for catching animals

10.a chemical that keeps pests away
11.a chemical substance used to fight pathogenic fungi
12.an amphibian that looks like a big frog
13.small insects that live in big groups
14.chemicals used in agriculture and forestry to kill unwanted plants or animals
15.opposite of 'repellents'
16.chemicals used to kill mice
17.the type of insect represented by ladybirds

II. Choose the correct answer.

1. Afforestation means establishing a forest on:
   a. a former forest land
   b. forest clearings
   c. an area where a forest has not grown before
2. Natural regeneration refers to:
   a. the place where a forest is established
   b. the way of forest regeneration
   c. the way of forest destruction
3. Natural regeneration results in:
   a. establishing mixed, multi-storey stands
   b. even-aged and single-species stands
   c. evenly distributed trees on the regenerated area
4. Reforestation is mainly used to:
   a. recultivate degraded, industrial areas
   b. renew a forest on former forest land
   c. produce Christmas trees and establish poplar plantations
5. Artificial regeneration is:
   a. quicker than natural
   b. difficult to control
   c. less expensive than natural
6. Artificial regeneration is mainly based on:
   a. direct seeding
   b. root suckers and stump sprouts
   c. planting seedlings
7. The best time to plant seedlings in spring is:
   a. when the soil is still frozen
   b. when seedlings are dormant and temperature is not too high
   c. at least two weeks after they have been transferred from a nursery

5

BASIC SEED TERMINOLOGY

Understanding natural regeneration, planning an artificial one, running seed collection and storage as well as production of seedlings in a nursery require understanding basic seed physiology which can be described by such terms as: viability, dormancy and germination.

The first term, viability, refers to a seed's ability to germinate and produce a plant. Some seeds cannot be stored for a long time because they lose their viability quite quickly whereas others can stay viable for years. Information which tells us to which group the seeds of a certain species belong is of utmost importance to foresters in ensuring tree establishment success.

Another term worth mentioning is dormancy – a case when viable seeds do not germinate. Dormancy can be determined either by morphological factors or physiological ones. The former are usually caused by an immature embryo whereas the latter by too hard or thick seed coat. In a natural habitat dormancy can be overcome by moisture and changing temperatures. Seeds of trees and shrubs which are produced in autumn do not germinate at that time of the year because their seedlings would not stand a chance of surviving winter. Instead, their seeds delay germination until spring. In the meantime, moist soil helps to soften a seed coat and penetrate it by water. This process, known as imbibition, combined with changing temperatures, exposing seeds to low ones in winter, enables not only seed coat softening but removing growth inhibitors as well. These two factors stimulate germination and seedling growth.

Foresters can control germination and, as a result, production of seedlings because they know how to mirror natural conditions. The methods employed to achieve such a goal are called stratification and scarification. The former term refers to subjecting seeds to low temperatures in a moist environment whereas the latter aims to damage or soften the coat. There are three methods applied. The first involves immersing seeds in hot water, the second is based on acid treatment, and the third is mechanical (coats are weakened by sandpaper or nicked with a knife).

Once seed coats no longer hamper water and air penetration into a seed, dormancy is broken and germination begins. It is a complex process influenced by temperature, oxygen, water and, in some cases, light. Oxygen aids metabolic processes while water dissolves nutrients in endosperm making them available to the embryo which starts to grow. Optimal germination temperatures vary depending on individual species requirements.

Finally, the coat is split and the root, called a radicle, emerges, followed by the shoot consisting of the stem and leaves. A new plant can now start an independent life.

Worth remembering
viability, viable, dormancy, dormant, germinate, germination, seed coat, imbibition, stratification, scarification, break dormancy, radicle, endosperm, embryo

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. What are the three basic terms describing seed physiology?
2. Explain the term 'viability'.
3. What is 'dormancy'? How is it broken in nature?
4. What is 'imbibition'?
5. What is the difference between scarification and stratification?
6. Name four environmental factors influencing germination.
7. What role does water play in germination?

II. In the text find the words that mean:

1. a seed that is able to germinate is ….. __ i __ __ __ __
2. a young plant inside a seed: __ m __ __ __ __
3. a seed cover: __ __ e __ __ __ __ __
4. absorption of water by a seed: __ __ __ __ __ i __ __ __ __
5. a substance that blocks a process: __ __ __ __ __ i __ __ __
6. food storage inside a seed: __ __ __ __ __ __ e __ __
7. the first root: __ __ __ i __ __ __

FOLLOW-UP: RELATED VOCABULARY

I. Match the words from the box with their definitions below.

treated	indehiscent	zoochory	longevity
legume	vernalisation	dehiscent	stone
pip	hydrochory	seed	processing

1. an adjective describing a fruit that opens and releases its seeds
2. a period of cold weather that can break dormancy
3. a dehiscent pod
4. seed dispersal by animals
5. an adjective describing seeds with pesticide coating
6. a hard, inedible part of a peach or apricot
7. a hard, inedible part of an apple or orange (there are many of them inside)
8. not dehiscent
9. seed extraction, from e.g. cones, fruit followed by cleaning and sorting
10. refers to seed life span, how long seeds remain viable
11. seed dispersal by water

6

SEED PRODUCTION

Seed production is unpredictable and variable because the crop is determined by many contributing factors such as tree genotype, soil type, availability of nutrients, light, precipitation, the length of growing season, pollinators (necessary in the case of insect-pollinated species), pests and diseases, to mention but a few. Weather, especially at the time of flowering, also affects seed production. Hail, drought, storms or frost create unfavourable conditions for flower development, pollination, seed setting and ripening. Frost can be especially dangerous for species blooming early in spring, e.g. birch, hazel, alder, because it can be one of the reasons for flower or fruit abortion.

Heavy rain continuing for a long period of time does not promote seed production, either. Sometimes strong wind as well as low temperatures can cause problems, especially in the case of insect-pollinated species such as willow, black locust and linden. Windy, rainy and cold days do not encourage pollinators, such as bees and other insects, to visit trees and transfer pollen from male parts of flowers to female ones. As a result, poor seed yield can be observed.

As far as frequency of seed production is concerned, tree species can be roughly divided into three categories. Poplar, willow, alder, elm and the majority of shrubs produce seeds abundantly almost every year. Maple and ash less often, whereas oak and beech quite rarely. In the case of beech, good seed yield happens every 8–10 years.

Apart from previously mentioned factors, there are some more common phenomena that can be observed as far as seed production is concerned. For instance, for foresters it goes without saying that:

- shrubs produce seeds earlier than trees. Some of them reach the generative reproductive stage even when they are three years old.
- the longer-living a certain tree species is, the later it starts setting seeds. On average, trees start to produce seeds when they are 15–25 years old.
- large-seeded species, e.g. oak, beech, produce seeds at lengthier intervals than small-seeded ones, e.g. poplar, maple, willow.
- trees in stands produce seeds later in comparison to trees that grow at its periphery or alone, without any others in the vicinity.
- asexually reproduced trees set seeds earlier than those reproduced sexually.

Worth remembering

nutrients, growing season, pollination, seed setting, bloom, flower/fruit abortion, pollinators, pollen, large-seeded species, small-seeded species, insect-pollinated, wind-pollinated, crop, yield, ripen

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. Why can seed crop not be exactly forecast?
2. Which species are particularly susceptible to spring frost and why?
3. What weather conditions are responsible for poor seed crop of insect-pollinated species?
4. Do all tree species produce seeds regularly?
5. Which species produce seeds at lengthier intervals?
6. How do stands affect seed production?

II. In the text find the words that mean:

1. rain, snow, sleet etc. (paragraph I)
2. transfer of pollen to female parts of a flower (paragraph I)
3. mature (paragraph I)
4. to blossom (paragraph I)
5. insects taking part in pollination (paragraph I)
6. crop (paragraph II)
7. in large amounts (paragraph III)

DID YOU KNOW?

- Acorns are very nutritious and used as pig fodder. They were also eaten by North American Indians. Nowadays, acorns are gaining popularity as human food again and many recipes on how to prepare acorn soup, bread, stew or even coffee can be found in cookery books.
- Acorns vary in taste. All of them, however, are bitter due to tannin content. Tannic acid must be removed before acorns are used for dish preparation. The method of eliminating tannin is simple because it can be easily leached by boiling or soaking in water.
- Tannin has antiseptic properties and can be used as a dye as well.
- Cone serotinity is a phenomenon which enables trees to store seeds for a rainy day. Viable seeds can stay in closed cones on trees for more than a year despite the fact that new seeds have already been produced. Pine is one of the species where serotinous cones can be observed.
- In the majority of cases gymnosperm seeds are enclosed in a cone. However, some species produce not cones but fruit that does not open and looks like a berry, e.g. juniper. Others produce seeds partially covered by a red, fleshy band called the aril, e.g. yew.
- Oil obtained from black locust flowers is used in the perfume industry.

7

SEED COLLECTION AND PROCESSING

In order to improve pest and disease resistance, wood quality and its faster production, seeds are not collected from all trees but only from those which are indigenous and superior to others in terms of the above-mentioned characterisics. In practice they are gathered from individual trees (in natural parks, nature reserves and the like), seed stands or seed orchards. Seed stands consist of selected seed trees, sparsely distributed over the area. Their offsprings are likely to inherit their parents' desirable traits which, in turn, leads to general improvement of forest reproduction material. Seed orchards are established from seeds collected from seed stands or by means of asexual propagation (usually grafting). As a rule, seeds of unknown provenance are not used in forest regeneration. Indigenous ones are preferred as they are best adapted to local conditions.

Taking into account the economic aspect of forest management, seed collection is carried out only when a potential high yield is expected. Seed crop forecasting or scouting is usually performed three times: before flowering, during bloom and, finally, during fruition. The assessment starts in autumn and is based on observation of flower bud clusters, e.g. poplar, spruce, larch, Douglas fir, or inflorescence (birch, hazel, alder).

Seeds can be collected from the ground under the trees (they fall or are shaken from branches) or from standing or cut down trees, or even from water, e.g. alder. The choice of a proper technique depends on the seed characteristics, the way of dispersal included. In Polish forests the following methods are implemented for particular species:

- beech nuts and acorns are collected from the ground.
- maple, hornbeam and elm seeds are shaken from the branches.
- fir, larch, birch and aspen seeds are collected from standing trees.
- pine, spruce and alder seeds are sometimes collected from felled trees. Seed collection is often carried out alongside logging.

Weather and proper time play an important role in ensuring good quality seeds and preventing any losses due to, for instance, pests and diseases. Seeds should be collected during dry weather and as soon as they are mature. Any delay may considerably reduce yield quality and quantity.

In forestry, seed collection very often means harvesting cones and different types of fruit such as legumes (robinia) or fleshy fruit (rowan), to mention but a few. Next, seed processing involves threshing, drying, depulping, tumbling and so on. The seed extraction method depends on the tree species. For instance, cones are usually dried because it leads to scale opening, which in turn, makes seed removal easier. Dry cones break up easily, e.g. fir, or can be crushed without damaging seeds, e.g. larch. Drying is often followed by dewinging and separating other impurities by winnowing. However, in some cases, such as ash or maple, dewinging is not carried out.

Before storage, moisture content and seed health are evaluated as well as their purity and viability. Seed purity is the proportion of pure seeds to impurities in a sample. If seed purity is, for instance, 90%, it means that 10% of a sample consists of weed or other species seeds, parts of leaves, wings, damaged seeds, soil, sand and the like. Another important piece of information provided by laboratories is the weight of 1,000 seeds. However, it is worth mentioning that in English-speaking countries another term is often used. It is called seed count and refers to the number of seeds per pound.

Other tests carried out in laboratories include germination and cutting. The latter means evaluation of embryo maturity and health after it has been incised from fruit. Seeds can also be X-rayed, which helps to detect internal injuries as well.

Worth remembering
indigenous, natural park, nature reserve, seed stand, seed orchard, provenance, trait, flowering, scouting, fruition, flower bud, inflorescence, dispersal, seed extraction, seed processing, pod, threshing, drying, depulping, tumbling, scale, dewinging, purity, viability, seed count, impurities, winnow

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. Where are seeds collected from and why is the proper choice of trees so important?
2. How are seed orchards established?
3. Are seeds about whose origin foresters are not sure used in forest regeneration?
4. When is seed collection profitable? How can it be assessed?
5. Name widely used seed collection methods.
6. What are the ideal conditions for collecting seeds?
7. What is seed purity?
8. What is the difference between weight of 1,000 seeds and seed count?
9. What other tests are carried out?

II. In the text find the words that mean:

1. local, native (paragraph 1)
2. progeny (paragraph 1)
3. characteristic (paragraph 1)
4. origin (paragraph 1)
5. a period when a plant produces fruit (paragraph 2)
6. to remove seeds by hitting (paragraph 5)
7. separating seeds from impurities by an air current (paragraph 5)

8

SEED STORAGE

Seed storage varies according to species. Generally speaking, seeds fall into two categories as far as maintaining viability during storage is concerned. The first group includes seeds that tolerate drying (dessication) and low temperatures. Such seeds are called orthodox and do not lose viability during long-term storage. The second category comprises seeds with high water content which do not survive drying and very low temperatures. Such seeds, known as unorthodox or recalcitrant, are usually stored until the next spring but no longer than three years. Longer preservation of recalcitrant seeds, e.g. acorns, chestnuts, is possible but complicated and fairly expensive as it involves storage in liquid nitrogen. Finally, there are seeds that are neither recalcitrant nor orthodox. They are called intermediate, and can be placed between the above-mentioned categories as far as storage requirements are concerned.

There are several methods of seed storage which let seeds maintain their viability usually until they are sown. The most popular techniques vary according to species and include:

- storing seeds in a well-ventilated layer, sack, box or any other container which enables air circulation.
  Not only can seeds be stored that way but cones or fruit as well. This method is short-term and ensures maintaining viability between harvesting and the earliest possible sowing. It can also be treated as a prerequisite to proper storing.
- keeping dried seeds in airtight containers in the dark at lower temperatures.
  Every two or three months moisture is checked. In such conditions seeds remain viable longer in comparison to the previous method.
- storing seeds in controlled moisture.
  There are several ways of such storage. For instance, seeds can be stored outdoors in pits where seeds and sand or peat are placed in alternated layers. Seeds should be stored at a depth of 20–80 centimetres where they are well insulated from frost.
  Rodents may cause heavy losses so pits must be protected against them usually by juniper twigs which are placed at the pit bottom, top and sides. Small amounts of seeds can be also kept in boxes placed in cellars.

Long-term seed storage is mainly aimed at conserving gene resources. Preservation of genetic diversity takes place in gene banks that enable the creation of proper conditions for long-term storage such as cryopreservation, maintaining low temperature (about 0°C) and considerable reduction of seed water content (usually to 4%). Seeds in gene banks are viable up to 15–20 years. In Poland a forest gene bank is located in Miłków.

Worth remembering
dessication, orthodox seeds, unorthodox/recalcitrant seeds, liquid nitrogen, gene resources, genetic diversity, cryopreservation, water content, gene bank

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. Can all seeds be stored in the same way?
2. What is the difference between orthodox and unorthodox seeds?
3. Why is long-term storage of recalcitrant seeds not easy?
4. Name three basic methods of seed storage.
5. Which method is used for storing cones?
6. Why are juniper twigs placed in pits?
7. Why are seeds stored in gene banks?
8. Why is Miłków an important place for foresters?

FOLLOW-UP: 'FRUIT' AND 'SEED' IDIOMS AND EXPRESSIONS

I. Fill in the blanks with the words from the box. Change the verb form when necessary.

seeded	seeds	come to fruition	fruit fly	seedless	fruity
fruitful	bear fruit	seed leaves	go to seed	fruitless	seedy

1. My son eats only …….. grapes.
2. He's invested so much money and effort in the enterprise so I'm sure it'll finally …….. .
3. Cotyledons are sometimes called …….. .
4. A …….. (*Drosophila melanogaster*) is a small insect used in scientific experiments.
5. She knows what poverty and injustice mean. Although she is a successful businesswoman now, she was born and brought up in a …….. part of our town.
6. The meeting was …….. . We finally decided which subjects should be introduced into the curriculum.
7. When I cook I always use …….. tomatoes no matter what dish I prepare.
8. My sister prefers …….. perfumes and shampoos.
9. She didn't want to believe that her husband had an affair, but when she saw him embracing another woman the …….. of doubt were sown.
10. Unfortunately, the peace talks were …….. . They didn't help to end the conflict.
11. I doubt that the takeover of the company will …….. .
12. After her husband's death she …….. . I didn't recognise her when I saw her the other day.

REVISION VI (TEXTS 5–8)

I. Give synonyms of the following words.

1. trait = ...
2. ripe = ...
3. yield = ...
4. bloom = ...
5. dessication = ...
6. provenance = ...
7. recalcitrant = ...

II. Describe what happens between the flower bud stage and sowing seeds. Put the expressions in the box in the proper order.

seed ripening	seed storage	pollination	seed processing
seed setting	flower development	seed harvesting	

III. Give antonyms of the following words.

1. orthodox ≠ .....
2. large-seeded ≠ .....
3. mature ≠ .....
4. long-term storage ≠ .....
5. not local, foreign ≠ .....
6. purity ≠ .....

IV. What is the difference between:

1. scarification and stratification
2. dormancy and germination
3. morphological and physiological dormancy
4. the weight of 1,000 seeds and seed count
5. short-term storage and cryopreservation

V. Form adjectives. Use the given words.
Example: conifer – coniferous

1. dormancy – .....
2. viability – .....
3. purity – .....
4. moisture – .....
5. ripen – .....
6. gene – .....
7. maturity – .....

VI. Match two parts of the definitions. What do they refer to?

1. removing soft parts of fleshy fruit in order to
2. one of the methods of asexual propagation
3. a part of
4. removing wings
5. weed seeds, wings, sand and the like
6. insects that transfer pollen
7. an adjective describing seeds that do not lose viability during drying and which
8. a place where seeds are stored

A. from male parts of flowers to female ones
B. during seed processing
C. in order to preserve gene resources
D. which can be used to establish seed orchards
E. can be stored for a relatively long time
F. a cone (not seeds)
G. extract seeds
H. in a seed sample

VII. Now check your answers with the words in the box.

a gene bank	orthodox	impurities	depulping
pollinators	dewinging	a scale	grafting

VIII. True or false?

1. Seed storage does not differ between tree species.
2. It is possible to store seeds outdoors.
3. Storing seeds outdoors is called cryopreservation.
4. Windy, rainy and cold days are not preferred by pollinators.
5. Oak and beech produce seeds in large quantities every year.
6. Trees growing alone produce seeds later than the ones in stands.
7. Dormancy can be overcome by moisture and changing temperatures.
8. Scarification methods include: immersing seeds in acid, hot water or damaging seeds mechanically.
9. Seeds are collected from all trees in the forest.
10. Seed processing often involves threshing, drying, depulping and tumbling.

9

FOREST NURSERIES: SITE SELECTION AND PREPARATION

Collected seeds can be either directly sown in order to establish a forest or used to produce planting stock for forest regeneration. The latter method is much more common and takes place in forest nurseries which produce seedlings well adapted to local conditions because they are grown from seeds whose provenance is known. Successful planting stock production is determined by many factors among which proper site selection is often the key.

Before establishing a nursery it is a good idea to take a closer look at the land form. Level grounds or slight slopes are the best. Areas along streams or rivers should be avoided because at night cold air slides down the slopes and fills the low-lying terrain, where young plants are often damaged by frost. Such a phenomenon is called a frost hollow or a cold pool (a larger area). Periodically flooded or swampy grounds should be excluded as well.

Nurseries are often established in forests on recently logged sites where surrounding trees protect seedlings from harsh weather conditions such as strong wind, frost or too high temperature. In such a favourable microclimate young plants grow better. However, it is worth remembering that trees in the vicinity should belong to a different species than the produced planting stock because of the danger of disease transmission or pest attack.

Topography and microclimate are not the only factors taken into account as far as proper site selection is concerned. Others include: precipitation, the length of the growing season and type of soil which should not be too heavy or too light but with adequate drainage and thickness. Last but not least, easy access to the nursery by road and proximity of water resources are also important.

As mentioned before, forest nurseries are usually located on recently logged areas. However, before the production of planting stock begins, the site should be carefully prepared. The preliminary preparation usually includes: tree uprooting or stump extraction as well as removal of logging debris, stones, weeds and any vegetation which can hamper seedling development. Next, typical agricultural equipment can be used, e.g. ploughs, harrows or cultivators. Tillage may also encompass organic or inorganic fertiliser application.

Organic fertilisers such as green manure, compost or peat are safer for the environment. They are also beneficial for soil structure because they provide organic matter important for microorganisms living in soil and improve soil water retention. Inorganic fertilisers are applied after soil analysis is performed. They contain nutrients in a water-soluble, concentrated form. The most commonly used in forestry consist of major plant nutrients: nitrogen (N), phosphorus (P) and potassium (K). They can supplement nutrients directly to the soil for root uptake or by foliar application. They can come in two forms: liquid or solid.

Once the site is prepared and seedbeds formed it is time to start nursery stock production.

Worth remembering
nursery, site selection, planting stock, frost hollow, disease transmission, precipitation, growing season, heavy/light soil, drainage, tree uprooting, stump extraction, weeds, plough, harrow, cultivator, tillage, organic/inorganic fertilisers, fertiliser application, green manure, compost, peat, water retention, nutrient, water-soluble, nitrogen, phosphorus, potassium, seedbed, nursery stock

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. How can collected seeds be used in forest regeneration?
2. Why should a nursery site be chosen wisely?
3. What areas are not proper for establishing a forest nursery and which ones are preferred?
4. Why is it a good idea to establish a nursery on a recently logged site?
5. What other factors are crucial for site selection?
6. How is the area for a nursery prepared?
7. What are the advantages of organic fertilisers?
8. How are inorganic ones applied?

II. Find the words in the text that mean:

1. seedlings produced in nurseries used later in artificial regeneration
2. a place where young plants, e.g. shrubs or trees, are produced
3. an area at the foot of a hill or mountain where at night the temperature is lower than on the surrounding slopes; as a result, frost damage is a common phenomenon
4. extracting a whole tree with its roots from the ground
5. pulling the basal part of a tree trunk and its roots out of the ground
6. agricultural equipment that turns under the soil
7. soil preparation for planting or sowing
8. opposite of ‘organic’
9. plants that are grown in order to enrich soil with nutrients and organic matter
10. dissolving in water
11. elements important for plant growth and development
12. taking fertilisers in by roots
13. spraying fertilisers on leaves
14. opposite of ‘solid’

10

SOWING SEEDS AND TAKING CARE OF SEEDLINGS

Forest nursery production includes seedlings grown from seeds as well as asexually reproduced plants such as rooted cuttings. Nursery stock can be bare-root or containerised, grown outdoors in seedbeds or under cover in greenhouses.

In order to ensure high quality of seedlings proper site preparation is of utmost importance. One of its components is providing nursery soil with fungi that form a symbiotic relationship with tree roots. Such a relationship is called mycorrhiza and is beneficial for both partners. Due to fungi trees are more vigorous and healthy because fungi increase water and nutrient uptake. What is more, they produce chemicals that hamper the development of soil pathogens. Symbiosis with trees is beneficial to fungi as well because host plants supply carbohydrates which are necessary for fungus existence. Mycorrhizal fungi are introduced into nurseries in the form of inoculum or soil coming from vigorous stands. Inoculation takes place before or during sowing seeds or sometimes after germination. In some cases it is applied to seedling roots before outplanting.

Seeds are sown either in spring or in autumn. The choice of the adequate sowing time depends on soil moisture and temperature, occurrence of early spring or late autumn frost and, finally, individual species characteristics. For instance, in autumn foresters sow seeds whose storage is difficult, e.g. acorns, or ones that do not germinate well in spring. However, it is worth remembering that seeds in autumn should be sown as late as possible in order to prevent their germination because young, delicate plants are seriously damaged by frost and therefore their field survival is very low.

In contrast to autumn sowing, spring sowing should take place as early as possible when soil is not frozen but still moist after winter. What is more, early spring sowing gives seedlings more time to grow and develop before winter. Different species have varied requirements as far as germination temperature is concerned. Some trees, such as alder, hornbeam, ash and yew germinate better at a lower temperature whereas pine or spruce prefer a higher one. There are also such species that tolerate a wide range of temperature during germination, e.g. elm, larch. After sowing seedbeds are often covered with different types of synthetic or organic water-permeable material such as polypropylene crop cover, straw, branches and the like. Covering seedbeds prevents soil erosion, blowing off the seeds by wind or leaching them by heavy rain, reduces evaporation, slows the cooling of the soil and protects seeds from seed predators. After germination the cover is removed.

Taking care of young seedlings requires a lot of work and involves: protecting them from seed predators, pests, diseases, very strong wind, frost and sunshine, keeping soil moist and free of weeds and providing nutrients in the form of fertilisers. In nurseries, when necessary, seedling density is controlled by thinning.

In order to promote development of a compact and bushy seedling root system, roots are undercut. Shortening of roots (both taproots and lateral ones) takes place when seedlings grow in a nursery longer than a year and is usually carried out when seedlings are still dormant. However, in some cases, e.g. spruce, a taproot is undercut in spring while lateral ones are pruned in the middle of a growing season.

Worth remembering
nursery stock, bare-root, containerised, greenhouse, mycorrhiza, mycorrhizal, nutrient and water uptake, pathogen, symbiosis, symbiotic, carbohydrates, fungus, inoculation with mycorrhizal fungi, inoculum, sow seeds, seed predators, thinning, undercut, taproot, lateral roots, prune

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. What is grown in forest nurseries?
2. Where can nursery stock be produced?
3. What is 'mycorrhiza'?
4. What advantages does it have to trees and fungi?
5. When are seeds sown?
6. What determines the choice of sowing time?
7. Why should seeds not be sown in early autumn?
8. What seeds are usually sown in autumn?
9. Which species should be sown early in spring and which ones later?
10. Explain the term 'thinning'.
11. How can growth of a compact root system be stimulated?
12. Which roots are shortened?

II. In the text find the antonyms of the following words.

1. outdoors ≠ .....
2. sexually propagated ≠ .....
3. containerised ≠ .....
4. weak and unhealthy ≠ .....
5. harmful ≠ .....
6. decrease ≠ .....
7. improper ≠ .....
8. the same ≠ .....
9. impervious, impenetrable ≠ .....

FOLLOW-UP: FRUIT TYPES, SEEDLINGS OF DIFFERENT SPECIES

I. Look at the forest fruit and name the species. Use the words from the box.

black locust	ash	hazel	alder
beech	oak	maple	rose

-

1 

2 

3 

4 

5 

6 

7 

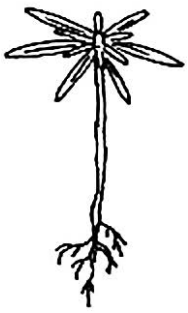
8 

II. Match the species from exercise I with the fruit names. Use the words from the box.

samara 2×	hazelnut	beechnut/beechmast	acorn
rose hip	pod/legume	cone-like fruit	

III. Look at the seedlings. Name the species. Use the words from the box.

hornbeam	pine	sycamore	spruce	beech	fir

1 

4 

2 

5 

3 

6 

11

SEEDLING LIFTING, STORING AND OUTPLANTING

Seedlings are grown in nurseries for one to three years. Usually when they are one or two years old they are lifted. Such seedlings can be either used directly in forest regeneration or transplanted and grown in nursery beds for the next one or two years until they are of an adequate size for outplanting.

Lifting takes place in autumn or spring when soil is not frozen but seedlings are still dormant. The choice of proper lifting time is determined by many factors, such as weather, nursery logistics, crop rotation including, and, finally, individual species characteristics. For instance, autumn is a better lifting time for species that resume their growth early in spring, e.g. larch, birch. After lifting seedling quality is assessed. The following characteristics are evaluated: root length and volume, shoot diameter and its height. The worst seedlings are eliminated.

In order to ensure better field survival after transplanting as well as vigorous growth of seedlings, lifting should be performed with utmost care in order to avoid mechanical damage of young plants. What is more, special attention ought to be given to roots because they are more susceptible to dessication and frost than stems. If roots are not properly taken care of they are damaged and are no longer able to provide seedlings with water and nutrients from the soil which, in turn, results in poor quality establishment. Bearing that in mind, roots must be kept moist during procedures such as lifting, transporting and storing which can be shortened to a minimum when lifting directly precedes planting.

Seedling storage can be short- or long-term. The former occurs when harvesting and planting take place in the same season. Seedlings are usually placed in a shaded area outdoors. Seedlings are placed in moist containers or in the field where their roots are covered with soil. The latter type of storing is called heeling-in. It can be both short- or long-term.

When seedlings are lifted in autumn they are stored until spring planting. During storage the temperature must be lowered to such a level that seedlings remain dormant until planting time. Long-term storage includes the above-mentioned heeling-in as well as refrigerated storage where temperature is controlled.

As far as planting seedlings is concerned, the topic has already been dealt with (for details see the text *Artificial Regeneration,* p. 82).

Nursery stock can be produced not only outdoors but indoors as well, e.g. in greenhouses, where temperature, humidity and light intensity can be modified to suit individual species needs. In contrast to seedlings grown in the open air, those grown in greenhouses need some time to adapt to outdoor harsh conditions. The process, called hardening off, is gradual and usually takes a fortnight during which plants are exposed to lower temperature, moisture, wind and direct sunshine. At the beginning the time spent in unfavourable conditions is short but is slowly lengthened, mirroring those outdoors.

Worth remembering
seedling lifting, crop rotation, transplanting, heeling-in, greenhouse, humidity, light intensity, hardening off, outplanting

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. How long does the production of nursery stock take?
2. What happens to lifted seedlings?
3. When is the best time for lifting?
4. What seedling characteristics are assessed?
5. Why and how should roots be protected during harvesting, dispatching and storing?
6. Explain the term 'heeling-in'.
7. What is the difference between outdoor and under shelter production of nursery stock?
8. What is 'hardening off '?

II. Ask the questions that give the following answers.

1. When they are one or two years old.
2. It is determined by weather, nursery logistics and species characteristics.
3. It should be performed with utmost care.
4. Humidity is controlled in greenhouses.

FOLLOW-UP: RELATED VOCABULARY

I. Match the definitions with the words from the box.

stool beds	transplant	plugs	a lifting window
seed lot	outplanting	plough pan / soil pan	soil amendments

1. time when seedlings are harvested
2. seeds of known provenance collected in a given year
3. a young seedling that has been lifted and replanted somewhere else
4. components added to soil in order to improve its structure, water retention and other physical properties, e.g. organic fertilisers, perlite
5. container seedlings are often called ……
6. a hard, compacted, impermeable layer in the soil often resulting from the usage of heavy agricultural equipment
7. rows of plants in a nursery from which cuttings used in asexual propagation are collected
8. the last stage of nursery production

REVISION VII (TEXTS 9–11)

I. Give antonyms of the following words.

1. water-insoluble ≠ .....
2. heavy soil ≠ .....
3. synthetic ≠ .....
4. organic ≠ .....
5. liquid ≠ .....
6. harmful ≠ .....
7. short-term ≠ .....
8. dry ≠ .....
9. taproot ≠ .....
10. outdoors ≠ .....

II. Read the text and fill in the blanks with the words from the box.

Inoculation	soil pathogens	vigorous	mycorrhiza
Mycorrhizal	host plants	germination	symbiotic
inoculum	carbohydrates	beneficial	outplanting
seedling	nutrient uptake	fungi	Symbiosis

Some tree species form a **1.** ..... relationship with **2.** ..... . Such relationship is called **3.** ..... and is **4.** ..... for both partners. Due to fungi trees are more **5.** ..... and healthy because fungi increase water and **6.** ..... . What is more, they produce chemicals that hamper the development of **7.** ..... . **8.** ..... with trees is beneficial to fungi as well because **9.** ..... supply **10.** ..... which are necessary for fungus existence. **11.** ..... fungi are common in forests and can be also introduced into nurseries in the form of **12.** ..... or soil coming from vigorous stands. **13.** ..... takes place before or during sowing seeds or sometimes after **14.** ..... . In some cases it is applied to **15.** ..... roots before **16.** ..... .

III. Give definitions of the following words:

1. tillage – .....
2. planting stock – .....
3. heeling-in – .....
4. hardening off – .....
5. leaching (minerals from the soil) – .....

IV. Match the beginnings of the definitions with their ends. Compare them with your own definitions from exercise III. Are they different?

A. a method of storing seedlings outdoors
B. soil preparation
C. removal of minerals by water
D. seedlings produced
E. gradual preparation of plants

1. in nurseries or greenhouses
2. in shallow pits where plant roots are covered with soil
3. grown indoors for harsh outdoor conditions
4. passing through the soil
5. for sowing seeds or planting

V. Put the nursery site preparation stages in the proper order.

A. ploughing
B. removal of logging debris, stones, weeds and any vegetation which can hamper seedling development
C. organic or inorganic fertiliser application
D. harrowing
E. tree uprooting or stump extraction

VI. Read the text and fill in the blanks with the words from the box.

potassium (K)	water retention	foliar application	uptake
peat	nutrients	Organic	
concentrated	green manure	organic matter	

1. …… fertilisers such as **2.** ……, compost or **3.** …… are safer for the environment. They are also beneficial for soil structure because they provide **4.** …… important for microorganisms living in soil and improve soil **5.** …… . Inorganic fertilisers are applied after soil analysis is performed. They contain **6.** …… in a water-soluble, **7.** …… form. The most commonly used in forestry consist of major plant nutrients: nitrogen (N), phosphorus (P) and **8.** …… . They can supplement nutrients directly to soil for root **9.** …… or by **10.** …… . They can come in two forms: liquid or solid.

12

FOREST STAND IMPROVEMENT

I. Fill in the blanks (1–9) from the list below (A–I).

A. pests and diseases
B. can be pruned all year long
C. spread of pests and diseases
D. or intermediate treatments
E. crooked
F. that their natural form is maintained
G. who try to improve the quality of the stand
H. for light, water and nutrients
I. profitable production of timber

Once the initial stage of forest regeneration is completed, seedlings are not left alone but constantly monitored by foresters **1.** …… as a whole. Depending on key objectives set, improvement may include: promotion of biodiversity, watershed protection, prevention of soil erosion and floods, recreational and aesthetic values, improvement of sanitary conditions, species composition and **2.** ……..… . The latter goal, in many cases, takes precedence over the others. All practices taking place between forest establishment and harvesting are known as forest stand improvement, tending the forest **3.** …… .

Having finished the establishment stage, young trees grown for timber are sometimes pruned in order to shape them in such a way **4.** …… . Such pruning is called training or formative pruning and applies mainly to broad-leaved trees, such as oak, ash or beech.

Pruning changes the appearance of the plant by removing or reducing its parts. It usually includes: favouring a single leader, cutting dominant or undesirable branches, e.g. fork ones, over-crowded, criss-crossing and the like. It should be carried out when plants are dormant with the exception of dead branches which **5.** …… . Although it is time-consuming and labour-intensive it is worth the effort because it results in production of high quality timber.

The next phase of forest stand improvement is called thinning and focuses on creating favourable conditions for the growth of desirable trees. Such a goal can be achieved by gradual reduction of stand density which, in turn, decreases competition **6.** …… and results in the production of healthy, straight, tall, mature trees.

Trees which are removed from the stand belong to several categories. The first one encompasses trees damaged by biotic factors (**7.** ……..……) or abiotic ones such as wind, snow or ice. The second involves plants of improper form, e.g. forked, **8.** …… or representing undesirable species. The third, trees that hinder the growth of desirable ones. They are too tall or interfere with the development of desirable species.

Removal of damaged trees from a stand is called sanitation cutting. It prevents 9. …… . Undesirable species and trees with improper form are topped in cases when their removal would break the canopy closure. The same applies to overtopping ones or hindering the growth of desirable species, e.g. wolf trees.

Worth remembering
timber, watershed protection, forest stand improvement, tending the forest, intermediate treatments, prune, training, formative pruning, leader, thinning, sanitation cutting, topping, overtopping, wolf trees

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. What may forest stand improvement comprise?
2. Which aspect of tending the forest is in many cases the most important?
3. What is the main aim of pruning?
4. What branches are removed?
5. What does pruning time depend on?
6. Why is thinning performed? What is it based on?
7. What kind of trees are thinned?
8. What is 'sanitation cutting'?
9. When are trees topped instead of being removed?
10. What happens to wolf trees and overtopping ones?

II. True or false?

1. Intermediate treatments are different from tending the forest.
2. The shape of a young tree is sometimes corrected.
3. A double leader is a favourable tree quality.
4. Trees can be pruned all year long no matter what part is removed.
5. Thinning means the same as removing undesirable trees.
6. Trees that threaten the development of desirable ones are removed.

13

FOREST HARVESTING SYSTEMS

Felling trees is a complex procedure that requires careful planning concerning the area and the volume of wood to be harvested, logging roads and skid tracks, choice of harvesting time as well as the method and equipment adequate for the planned operation. Last but not least, estimation of costs and future profit are also important.

No matter what harvesting system is chosen, all of them consist of the same, key steps, such as: cutting down trees, removing branches and tree tops, transferring logs to the roadside landing, sorting, short-term storing and transporting them to sawmills or other processing factories. Branches, tree tops and other logging residues are usually left in the forest in order to decompose.

The classification of a harvesting system is based on the number of trees that are logged during one operation and the time between felling called a cutting interval. There are many harvesting methods and their modifications. Basic ones include: clearcutting, shelterwood system and selection system.

Clearcutting is often considered a controversial issue because of its impact on the environment. Among all harvesting systems clearcutting is the most radical. It involves felling all trees in a certain area. As a result, forest microclimate disappears, temperature extremes are observed, the soil dries quickly due to wind and direct sunlight. What is more, food chains are broken, which leads to animal migration or even the dying out of some species inhabiting the area.

However, clearcutting is often a necessary evil, especially when stands are seriously damaged by wind, fire, insects or disease. When properly carried out, clearcutting creates favourable conditions for artificial regeneration of sun-demanding species, such as pine or birch, and results in even-aged stands. It is worth remembering that such stands are more susceptible to outbreaks of diseases and massive pest attacks and need to be carefully monitored.

In contrast to clearcutting, the selection system is aimed at disrupting the habitat as little as possible. It promotes biodiversity and growth of uneven-aged stands because it is based on felling single trees or their small groups scattered over the whole forest area. The process is gradual and extended over many years.

The selection method is rarely used in forest management. Despite the fact that it is the least radical, it is more complicated, time-consuming and expensive than other systems because it does not mean logging all trees on one big area as happens in the case of clearcutting. What is more, the whole operation must be carried out with utmost care in order to avoid damage of adjacent vegetation during logging mature trees. In practice it often means resorting to manual labour and using small equipment.

Shelterwood system is a method that can be placed between the harvesting systems mentioned above as far as its impact on the environment is concerned. Mature trees of desirable quality are left on the site to produce seeds and the young trees grow under the canopy of older ones.

Worth remembering
forest harvesting systems, skid tracks, skidding, fell/cut down trees, logging, cutting interval, clearcutting, shelterwood system, selection system

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. What should be taken into consideration before wood harvesting?
2. What stages does felling trees include?
3. Name three basic harvesting methods.
4. What is clearcutting based on?
5. How does it influence microclimate and wildlife?
6. When is it recommended?
7. How does the selection method influence the environment and harvesting logistics?

FOLLOW-UP:
A. RELATED VOCABULARY

I. What part of a tree is removed during the following operations?

debarking, delimbing, topping

II. Match the following terms (A–E) with their definitions (1–5).

A. FPI	1. a machine that transports trees by dragging
B. bucking	2. a machine that lifts trees from the ground and transfers them into another area
C. a skidder	3. Forest Product Industry
D. a forwarder	4. a tool for cutting down trees
E. a chainsaw	5. cutting felled trees into shorter parts

III. Fill in the blanks with 'log' expressions from the box. Change the verb form when necessary.

as easy as falling off a log	log	sleep like a log
log off/out	log cabin	log book

1. We spent the weekend in my friend's …..…… in the mountains.
2. When you finish using a computer you have to ……..…… .
3. When I was stopped by the police, they asked me to show a ……..…… .
4. At night my husband ……..…… . Nothing can wake him up.
5. All incoming phone calls are ……..…… .
6. Don't worry, you can manage. Baking this cake is ……..…… .

B. HOW TO CUT DOWN A TREE SAFELY

Felling a tree should be meticulously planned in advance because the whole operation is potentially dangerous and quite complicated. Planning primarily focuses on safety and the choice of proper equipment.

I. Fill in the blanks in the instruction about felling a tree from the list (A–I).

A. usually located at a 45 degree angle from the back
B. with a chainsaw or axe
C. whether the tree is decayed, damaged or leaning
D. use the escape route to retreat
E. slows the speed of falling
F. put off felling until the conditions improve
G. the lower branches of the tree
H. as well as any other obstacles nearby
I. performed only by qualified loggers

1. Inspect the felling area carefully, locate stumps, ditches, holes, electric pylons and lines, …… .

2. Examine the tree to be cut down: its height, branch distribution, …… . Remember that all these characteristics influence the course of falling.

3. Take into account weather conditions. If they are extreme, e.g. very strong wind or heavy frost, ……... .

4. Choose the right method and equipment. Remember that felling has to be …… . They have to be dressed in bright-coloured protective clothes (boots, trousers, gloves, glasses, ear protection and hard hats).

5. Choose the felling direction.

6. Remove small trees, bushes around the tree and on the escape route which is …… or sides of the felling zone.

7. Cut off ……. .

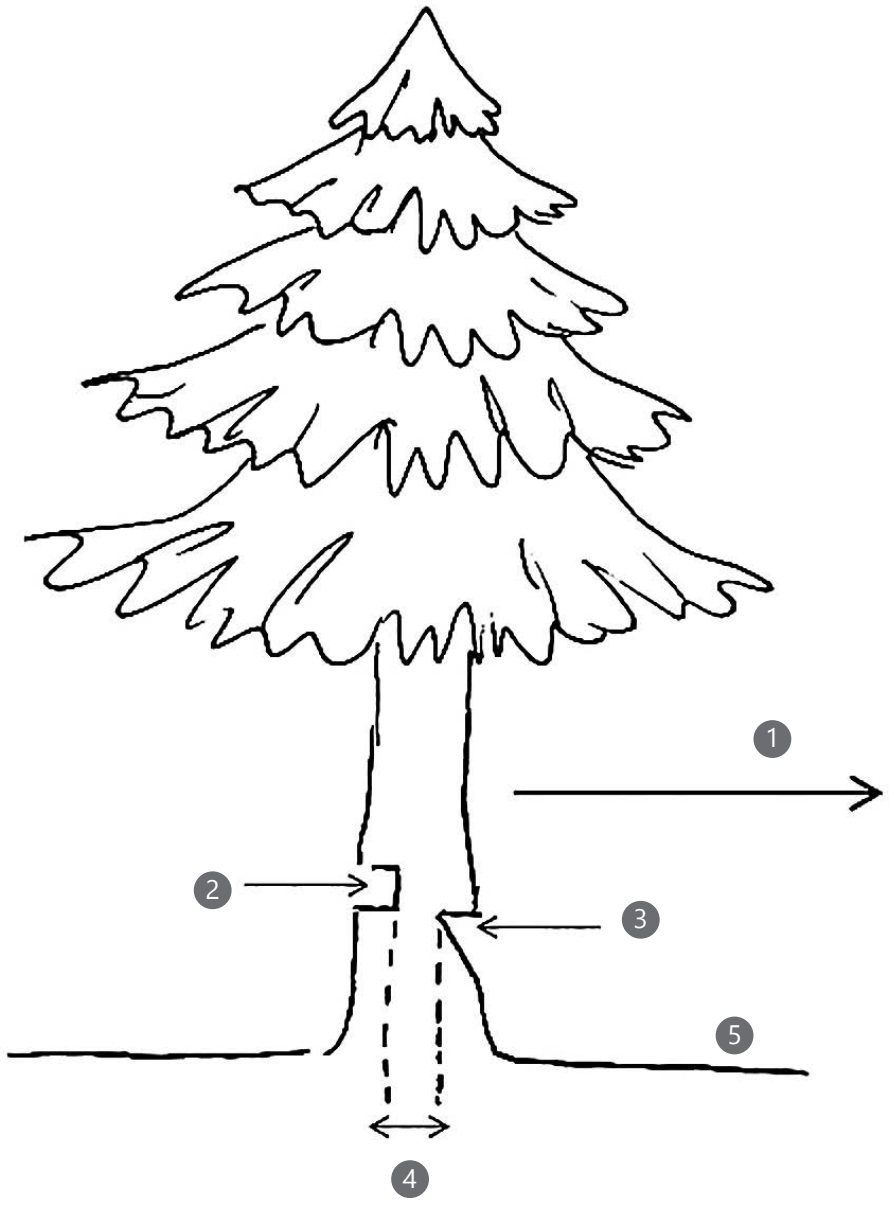
8. Make the undercut ……. . It faces the direction of the falling zone.

9. Make the back cut on the opposite site of the trunk leaving a hinge (a small amount of wood). It helps to control the direction of falling and …… .

10. When the tree starts to fall …… .

II. Look at the picture and match the numbers (1–5) with the words from the box.

fall path	face notch	hinge	back cut	felling direction



14

SHELTERWOOD SYSTEM

Shelterwood system is a gradual and carefully planned process which consists of selecting seed trees in a site, creating proper conditions for seed production, dispersal and germination as well as seedling survival and development which, in turn ensure the establishment of a new generation of trees.

The first step of the shelterwood system is based on selection of seed trees. Their fenotypes are thoroughly assessed and only the superior trees, which are likely to produce viable seeds and pass the most desirable characteristics to their offsprings, are chosen. Seed trees should be healthy and vigorous with height and diameter above average in the stand. In the case of large-seeded species they should be evenly distributed over the area. Bearing in mind that seed trees do not produce the same amount of seeds every year, it is a good idea to log the site before a good seed year occurs. The prediction is based on observation of flower clusters or flower buds. The next step involves gradual reduction of the number of remaining trees in the stand.

By removing trees from a site, canopy cover is fragmented letting more light reach the forest floor and seed trees. As a result, flower development is stimulated as well as seed crop. What is more, such conditions enhance germination and growth of new plants (seedlings and saplings). The decision concerning the amount of trees that are cut down as well as the number of cuttings (usually 4 or 5) depends on the stand type, tree species and their composition. For instance, trees that prefer shade when they are young, e.g. fir or beech, grow better under the canopy of older trees. With that in mind, trees are cut down gradually. In such a way favourable conditions for species mentioned above are created. When saplings are approximately 1.5–2.0 metres tall all remaining old trees are cut down. This practice is called removal cutting. Next, foresters inspect the stand. They assess tree distribution and, when necessary, plant seedlings in areas where seeds have not germinated or seedlings have not survived.

It is worth remembering that the shelterwood system has several modifications, but in each case a new generation of trees starts growing under the shelter of the older ones located over young plants, around them or on the sides.

Worth remembering
shelterwood system, seed trees, viable, large-seeded, canopy, sapling, seed year, cutting, logging, forest floor, removal cutting

READING AND LISTENING COMPREHENSION

I. In the text find the words that mean:

1. to scatter over an area: d _ _ _ _ _ _ _
2. a young tree: s _ _ _ _ _ _
3. able to germinate: v _ _ _ _ _
4. development of a plant from a seed: g _ _ _ _ _ _ _ _ _ _
5. a group of flowers on a stem: f _ _ _ _ _ c_ _ _ _ _ _

II. Answer the questions.

1. Name key steps of natural regeneration in forest management.
2. What qualities should a seed tree possess?
3. Where are they located?
4. What decides of the time of logging?
5. What happens when the number of trees in a site is reduced?
6. Name the factors that determine logging.
7. When is removal cutting performed?
8. What happens afterwards?

FOLLOW-UP: REGENERATION-RELATED VOCABULARY

I. Match the words from the box with their definitions below.

plus trees	barochory	seed predators
heterogeneity	advance vegetation	viable seeds
indigenous	seedbed	inflorescence

1. native, naturally growing in the area
2. a place where seeds are sown in order to produce seedlings
3. diversity
4. dispersal of seeds by gravity. In such a case a seed or fruit containing seeds falls from a tree and seedlings establish themselves under its canopy
5. existing seedlings in a forest which start to grow rapidly when the proper conditions are created, e.g. after logging
6. animals that feed on seeds, e.g. birds, mice or insects. They can significantly reduce the success of forest regeneration
7. selected trees from which seeds are collected
8. seeds that are alive, able to germinate and produce plants
9. flower clusters on a branch

REVISION VIII (TEXTS 12–14)

I. **Describe three basic harvesting systems. Fill in the table with the expressions below.**

A. results in uneven-aged stands
B. temperature extremes are observed
C. young trees grow under the canopy of older ones
D. rarely used in forest management
E. the most radical
F. is aimed at as minimal disruption of the habitat as possible
G. often used when stands are seriously damaged by biotic or abiotic factors
H. results in even-aged stands
I. the least radical
J. time-consuming and more expensive than other systems
K. forest microclimate changes drastically
L. used often in artificial regeneration of sun-demanding species
M. based on selection of seed trees
N. means resorting to manual labour and using small equipment
O. involves felling all trees in a certain area
P. the soil dries quickly due to wind and direct sunlight
R. promotes biodiversity
S. food chains are broken
T. animal migration or even dying out of some species inhabiting the area can be observed
U. used for regeneration of shadebearing species

selection system	shelterwood system	clearcutting

II. **Name 6 basic steps concerning all harvesting systems.**

.....
.....

III. Read the text and fill in the blanks with the words from the box.

timber	fork	removing	leader
all year long	dormant	labour-intensive	Pruning
criss-crossing		dead	

1. ……..…… changes the appearance of the plant by **2.** ……..…… or reducing its parts. It usually includes: favouring a single **3.** ……., cutting dominant or undesirable branches, e.g. **4.** …… ones, over crowded, **5.**…… and the like. It should be carried out when plants are **6.** ……..…… with the exception of **7.** ……..… branches which can be pruned **8.** …… . Although it is time-consuming and **9.** ……..…… it is worth the effort because it results in production of high quality **10.** ……..…… .

IV. Ask questions that give the answers in the exercise below.
Example:
What does the first step of the shelterwood system include?
The selection of seed trees.

1. ……..…… ?
They are left in the forest to decompose.

2. ……..…… ?
Cutting interval.

3. ……..…… ?
Choosing vigorous and healthy trees that are likely to produce viable seeds.

4. ……..…… ?
Felling all remaining old trees when saplings are 1.5–2.0 metres high.

5. ……..…… ?
Thinning.

6. ……..…… ?
It is the removal of damaged trees from the stand.

15

FOREST PRODUCTS

Forest products represent a wide variety of goods such as wood, bark, coniferous litter, resin, tree sap (usually birch or maple), edible plants and others that have ornamental or medicinal properties. They can also include venison.

Forest products can be roughly divided into two categories: wood-based and non-timber ones (NTFPs). However, it is worth knowing that the definition of forest products as well as their classification vary considerably in different countries.

The most important and profitable forest product is wood. Logs which are harvested in forests are transported to sawmills where they are further processed into an impressive range of products such as:

- roundwood,
  It is usually treated against pests, fungi, water or fire. Typical roundwood products are represented by posts, poles, piles and used for framing, building fences, gates or railings. They can even be seen supporting plants in orchards and vineyards.
- sawnwood,
  Roundwood is sawn into planks, squared timber and the like. Sawnwood is used to produce railway sleepers, furniture, parquet, doors, window frames, barrels, tools and their handles, toys, musical instruments, blind rollers, small household goods such as hangers, matches, toothpicks or manufacturing different types of packaging such as boxes, crates or pallets.
- veneer.
  This is a thin sheet of wood often used for covering surfaces made of cheaper materials.

Apart from roundwood, sawnwood and veneer, sawmills produce a considerable amount of fine wood which was considered in the past as waste material. Fortunately, nowadays, wood wool is used for packing fruit and breakable goods while bark, chips, wood shavings and sawdust have an application as mulch, fuelwood (when compressed) or animal sawdust bedding. Fine wood is also used for manufacturing panel products when veneer layers or small wood parts are glued together. Typical examples of such products include laminated wood, plywood, particleboard and fibreboard.

Wood can also be subjected to chemical treatment. The end products of chemical processing include paper, cardboard, cellophane, rayon cloth, to mention but a few. Other products such as resin and tannin are obtained from wood by extraction while charcoal is produced by heating wood up to 1000°C in the absence of air. This method is called pyrolisis.

Worth remembering
coniferous litter, resin, tree sap, bark, venison, non-timber forest products (NTFPs), roundwood, post, pole, pile, sawnwood, log, veneer, wood wool, chips, wood shavings, sawdust, mulch, fuelwood, panel products, laminated wood, plywood, particleboard, fibreboard, cardboard, rayon, tannin, charcoal, pyrolisis

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. What products are collected in forests?
2. How can forest products be classified?
3. Name typical sawmill products.
4. What is the difference between roundwood and sawnwood?
5. Which of sawmill products are used for framing and which ones for window frame production?
6. What kinds of packaging are manufactured from sawnwood?
7. What is the application of veneer?
8. Define 'fine wood'.
9. How can wood wool be used?
10. Name four examples of panel products.
11. What substances can be extracted from wood?
12. What is pyrolisis based on? What is it used for?

II. In the text find the words that mean:

1. a layer of coniferous needles covering forest soil
2. juice obtained from trees
3. a sticky substance produced by trees
4. game meat
5. a place where logs are processed
6. a type of roundwood pushed into the ground and used as foundations for piers, bridges and the like
7. pieces of wood on which rails are placed
8. a large box usually divided into compartments. It can be used for transporting bottles
9. a layer of organic or inorganic material covering the soil
10. a board manufactured from layers of wood glued together
11. a board produced from wood fibres. Wood is first subjected to pulping, later boards are formed
12. a board made of small pieces of wood glued together.
13. stiff, thick paper
14. coal produced from wood

16

WOOD DEFECTS. PART I

In contrast to goods manufactured in factories, wood as a product is highly variable and unpredictable as far as its properties are concerned. It is due to the fact that it is obtained from trees, which, as all other plants, are subjected to changeable environmental conditions. Abiotic, biotic as well as anthropogenic factors have considerable impact on tree growth and, in result, wood production and its quality, which can be impaired by different types of flaws influencing the market value of wood as well as its application. Typical wood defects include: irregularity of trunk form, wood structure aberration, knots, fissures, discoloration, mechanical damage and foreign bodies.

Defects of a trunk form include all imperfections that can be estimated even in standing trees. The most common include:

- Tapered timber (also known as tapered stem).
  The change of a stem diameter along its length. More than one centimetre per metre is considered a wood defect.
- Butt swell.
  The basal end of a tree trunk is much wider than the rest of the trunk
- Flutes.
  Folds on the surface of a trunk starting at its base.
- Ovality.
  A cross-section of a trunk is not round but oval. Ovality is often caused by multiple or eccentric pith as well as mechanical damage.
- Crookedness or curvature.
  A stem trunk or branch is not straight but bent in one or more directions.
- Burls.
  Deformation with rough surface seen on the outer part of the tree. The outgrowth is usually round and protruding.
  Wood structure defects are usually seen after logs have been processed. Typical ones encompass:
- Bark pockets.
  A bark pocket is a piece of bark seen on the cross-section of a trunk either on radial surfaces or as a separate piece inside, surrounded by wood.
- Resin pitch.
  A small sac in wood filled with resin.
- Multiple pith.
- Reaction wood.
  Reaction wood is called compression wood in conifers and tension wood in broad-leaved trees. It can be found in leaning trunks or branches. Due to a natural reaction of a tree trying to restore its natural position wood becomes denser. Varying density of wood makes it difficult to work with and prone to warping.
- Grain slope (also called slanting or spiral grain).
  Grain is not parallel, and as a result wood is prone to warping.

- Necrosis.
  A dead part of a tree, often resulting from mechanical damage. They can be open (when dead wood is visible) or overgrown by healthy, living tissues.

Worth remembering
knot, fissure, foreign body, tapered stem/timber, butt swell, flutes, pith, multiple pith, eccentric pith, crookedness, curvature, burl, bark pocket, resin pitch, reaction wood, compressed wood, tension wood, warp, grain, necrosis

READING AND LISTENING COMPREHENSION

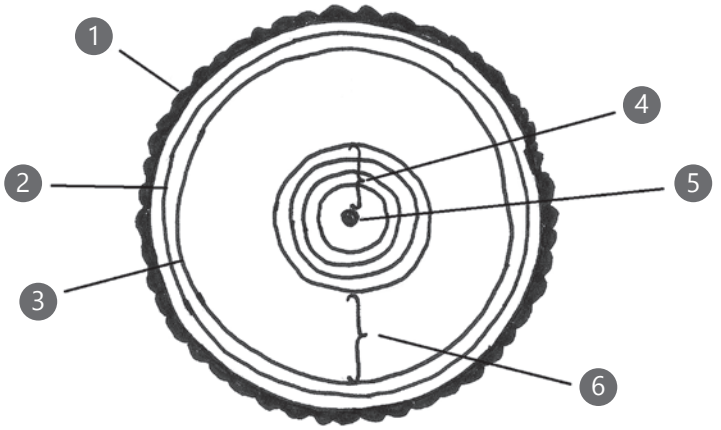
I. Answer the questions.

1. Why is wood quality difficult to predict?
2. Name typical wood defects.
3. What is the difference between flutes and butt swelling?
4. What may ovality be determined by?
5. What are 'burls'?
6. What is the difference between a bark pocket and a resin pitch?
7. What is reaction wood caused by? How does reaction wood influence wood quality?
8. What other wood structure defects are mentioned in the text?

FOLLOW-UP: TRUNK CROSS-SECTION

I. Name trunk parts. Use the words from the box.

cambium	heartwood	inner bark (phloem)
sapwood	outer bark	pith



CONSOLIDATION: WOOD DEFECTS

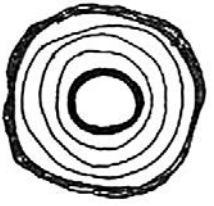
I. Match the pictures with wood defects. Use the words from the box.

bark pocket 2×	simple heart shake	knot	ovality
cup shake	burl	flutes	fork-shake
grain slope	ring shake	resin pitch	butt swell
multiple pith	star heart shake	curvature/crookedness	

1 

2 

3 

4 

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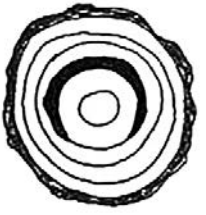
6 

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8 

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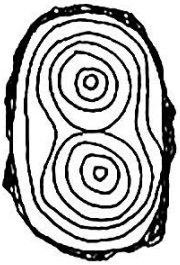

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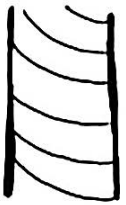

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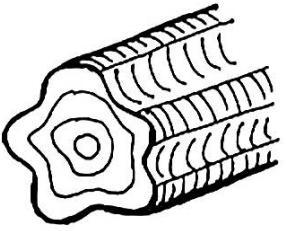

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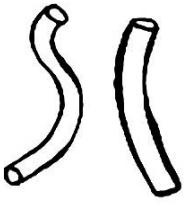

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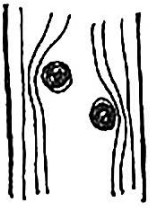

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WOOD DEFECTS. PART II

It is worth remembering that a wood defect is sometimes a subjective criterion because it depends on wood application. For instance, a multiple pith, crookedness or knots can be found attractive because of their ornamental value. Such wood can be used in manufacturing exceptional furniture. Apart from defects of a trunk form and the ones that concern wood structure there are others that were not described in the previous text. The most common include: knots, fissures, discoloration, mechanical damage and foreign bodies.

Knots are round, hard pieces of wood at the base of a branch. They can be sound or decayed, located at the side of a trunk or inside and be the same colour as, or diffrent from the surrounding wood.

Fissures encompass various types of splits, cracks and shakes. They can be caused by weather conditions, e.g. frost cracks, seasoning, for example shrinkage cracks or tree growth. Depending on split location there are end shakes, edge cracks or the ones that are a combination of both. If a crack appears along growth rings it is called a ring shake or cup shake (when only a part is split). If it is radial, originating from the pith, with cracked heartwood, it is known as a heart shake.

Wood discoloration may appear in standing trees, logged ones and be due to improper processing or storage. It can be caused by several factors, such as: fungi, light, temperature, moisture, chemical or biochemical reactions. Fungi are to blame for rot, mould and decay and cause the change of colour ranging from bluish-grey (blue stain) through red, brown to black. Chemical reactions are responsible for black iron tannin stains which are frequently seen in oak wood. They appear when wood comes into contact with iron objects such as nails or sawmill equipment. Biochemical discoloration often happens in alders after trees have been harvested.

Mechanical damage is often due to logging tools and equipment which cause blazes or bark stripping. Trees may also be damaged by fire, animals (e.g. wormholes, bird pecks) or, as a result of human activities such as resin or sap collection.

Foreign bodies are pieces of metal, stones and the like which can be found in wood. They often cause wood discoloration and are blamed for logging or sawmill equipment damage.

Worth remembering
knot, frost crack, seasoning, end shake, edge crack, growth ring, blue stain, rot, mould, decay, blaze, wormholes, foreign bodies

READING AND LISTENING COMPREHENSION

I. Answer the questions.

1. Do common wood defects always lower wood market value?
2. What are wood cracks due to?
3. How can cracks be classified?
4. What factors are to blame for wood discoloration?
5. Give examples of wood colour changes caused by chemical or biochemical reactions.
6. What are the reasons of wood mechanical damage?
7. What damage can animals cause?
8. What are 'foreign bodies'?

FOLLOW-UP: 'KNOT', 'CRACK' AND 'SPLIT' EXPRESSIONS

I. Fill in the blanks with the words and expressions from the box.

at the crack of	knot	tie the knot	split ends	cracks
splitting	in knots	split up	crack	knots

1. I must do something with my hair! Just look at these ……..…… .
2. Although the bank manager claimed that the bank had the state-of-the-art security system, the burglars managed to ……..…… the safe and escape with 1,000,000 pounds.
3. Look at this poor interviewee! She is so pale! I'm sure her stomach is ……..…… .
4. „Why is Mary so sad?"
   „Haven't you heard? She and John ……..…… last week."
5. My sister is going to ……..…… next month. The wedding invitations have already been sent.
6. Could you turn off the light and bring me a cup of tea? I have a …… headache.
7. My sister is an early bird. She often gets up ……..…… dawn.
8. It's fun working with Steve because he often ……..…… jokes.
9. A ……..…… of students was standing in front of the university building waiting for the exam results.
10. My father always ……..…… my brother's tie before his exam because he believes that it brings good luck.

18

NON-TIMBER FOREST PRODUCTS (NTFPs)

As mentioned before, the classification of non-timber forest products is not always clear and simple. What is more, further subdivision into edible fruit, mushrooms, plants possessing medicinal, ornamental or other desirable qualities is ambiguous as well because one forest product may comprise many properties.

The most common edible forest fruits belong to two families: *Ericaceae* (bilberry, cranberry) and *Rosaceae* (blackberry, wild strawberry and raspberry). Edible fruit can be eaten raw, dried or processed into juice, jam or alcohol.

However, edible fruits are not the only ones that can be picked in forests. Hawthorn, elder, juniper, rowan, rose, barberry or sea buckthorn fruit are also important forest products used as spice, medicine or in cosmetology.

The list of forest products possessing medicinal properties is fairly impressive and is represented by trees (e.g. pine, birch, linden, rowan, oak), shrubs (e.g. blackthorn, alder buckthorn, guelder rose, dog rose) and other plants such as lily of the valley, asarabacca, nettle, buckbean, to mention but a few. What is more, many fruits have application in curing a number of illnesses and ailments.

Collecting forest mushrooms is a hobby that combines adventure and learning about nature with a healthy outdoor activity. Mushrooms are valued in national cuisine all over the world because they make a dish recognisable due to their distinctive taste. The most popular edible mushrooms in Poland include: king bolete (*Boletus edulis*), bay bolete (*Xerocomus badius*), slippery Jack (*Suillus luteus*), chanterelle (*Cantharellus cibarius*) and honey fungus (*Armillaria mellea*).

Coniferous litter is another non-timber forest product. It finds application as mulch for plants preferring acidic soil because substances leached from litter lower soil pH. In addition, substances extracted from coniferous needles are widely used in medicine and cosmetology.

The application of different parts of conifers is not restricted to mulch, cosmetics and medicine only. Branches of fir, pine and spruce are used as greenery to make floral decorations which are widely used to embellish houses or public buildings especially at Christmas time.

The last important NTFP (charcoal) is the one campers, holidaymakers and city dwellers could not live without. They cannot imagine holidays or garden parties without grilling.

Worth remembering

bilberry, cranberry, blackberry, wild strawberry, raspberry, hawthorn, elder, juniper, barberry, sea buckthorn, blackthorn, alder buckthorn, guelder rose, dog rose, lily of the valley, asarabacca, nettle, buckbean, king bolete, bay bolete, slippery Jack, chanterelle, honey fungus

READING AND LISTENING COMPREHENSION

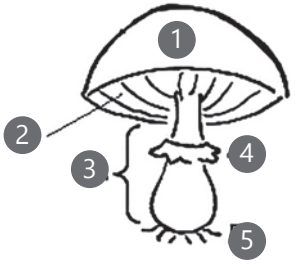
I. Answer the questions.

1. What do non-timber forest products encompass?
2. Name the most common forest fruits.
3. What is the application of other fruits collected in forests?
4. What trees can be used as medicine?
5. Why are mushrooms collected?
6. Name the most popular edible mushrooms in Poland.
7. How can coniferous needles be used?

'MUSHROOM' FOLLOW-UP

II. Name the parts of a mushroom. Use the words from the box.

mycelial threads	stem	ring	gills	cap



DID YOU KNOW?

- The first part of the wild strawberry's Latin name means 'pachnieć' (*fragare*) whereas the second means 'jadalny' (*vesca*) so *Fragaria vesca* refers to something edible which smells good.
- Cranberries can survive winter under snow. In spring they are often found still attached to twigs.
- Hazelnuts are more fattening than chocolate.
- Sea buckthorn was added to horse fodder in order to make their hide more lustrous.
- In Poland juniper was believed to keep devils at bay.
- The English name 'blackthorn' indicates that the plant has thorns. The same idea is reflected in its Latin name *Prunus spinosa* because *spinosus* means thorny.
- Cranberries float in water because each fruit contains several small air-bags.

REVISION IX (TEXTS 15–18)

I. Put the wood products into three categories according to their sizes.

squared timber	sawdust	roundwood
matches	railway sleepers	toothpicks
planks	wood wool	pallet

big: .....

smaller: .....

very small: .....

II. Match the two parts of definitions below and decide what they refer to.

1. a place where logs are cut
2. wood processed in
3. a long, thin
4. a thin layer of wood that is glued
5. a thick
6. a cloth made from
7. fuel obtained from wood
8. small, sour, red forest
9. a herbaceous plant with

A. on the top or front of other material
B. fruit belonging to the *Ericaceae* family
C. chemically treated wood
D. by machines into smaller parts
E. stinging small hairs
F. sawmills into other wood products
G. stiff piece of paper
H. piece of wood
I. during the process called pyrolisis

III. Put the wood products into three categories: made of wood, consisting parts of wood glued together, being a result of chemical treatment.

railings	parquet	plywood	cellophane
crates	rayon cloth	poles	fibreboard
pallets	particleboard	wood shavings	paper

made of wood: .....

parts of wood glued together: .....

result of chemical treatment: .....

IV. What do foresters call:

1. a piece of bark seen on a cross-section of the trunk?
2. a certain amount of resin in wood taking the form of a small sac?
3. a wood defect when the trunk is not round?
4. round, protruding deformation of the outer part of a tree?
5. change in wood colour caused by improper storage or processing?
6. round, hard pieces of wood of the same or different colour which can be observed on the cross-section of a tree?
7. stones or pieces of metal present in wood?

V. True or false?

1. A tapered timber is a stem that has the same diameter from its bottom to the top.
2. Crookedness describes a different wood defect than curvature.
3. Multiple pith means that a log has two piths or more.
4. Compression wood and tension wood are types of reaction wood.
5. Knots are the same as heart shakes.
6. Folds on the surface of a bole originating from its base are called ‘burls’.
7. Nettle, linden and blackthorn have medicinal properties.
8. Bilberry, blackberry and raspberry are representatives of the *Rosaceae* family.
9. Wood fissures can be caused by weather or seasoning.
10. Sea buckthorn is often used as spice.
11. Coniferous litter can be used as mulch.
12. A heart shake is a crack that appears along growth rings.
13. Shrinkage cracks appear during seasoning.
14. Coniferous litter lowers soil pH.

19

EPILOGUE
FORESTS BEYOND THE GROWING SEASON

Contrary to a widely held belief, foresters are also busy during late autumn, winter and early spring. In fact, work in forests never ends. Even when the ground is covered with snow, foresters have their hands full logging, supervising the care of game, hunting, collecting seeds of certain species or setting traps for some pests. Unlike farmers, foresters work all year long.

The majority of trees that are planned for logging in a given year should be felled in late autumn and winter. The choice of such a time is dictated by several factors such as:

- Wood quality.
  Wood obtained from dormant trees is better. Such felling time is of utmost importance in the case of broad-leaved species, particularly beech, which is prone to doatiness.
- Reduction of seedling and sapling damage.
  In some harvesting systems, e.g. shelterwood method, a new generation of trees develops under the canopy of older ones, which are gradually removed.
  Thick snow cover may protect, to some extent, seedlings and saplings from damage caused by logging old trees.
- Practical reasons.
  In late autumn and winter, when leaves of deciduous trees are shed, crowns are more visible. It helps in proper felling because it enables the spotting of hanging branches and the like which may change the course of tree falling.
  What is more, fewer people walk in forests at that time of year and workers are better seen which, in turn, makes the work safer.

During winter forest animals are monitored in order to count them and plan which species should be hunted and in what number. Next, the hunting is organised. Battue hunting takes place in Poland between the first of October and the fifteenth of January. Beyond this period only individual hunting is permitted in the open seasons for given species. Winter is also the time when salt and supplementary feeding is provided for animals. It is especially important when the ground is frozen, covered with a thick layer of snow and animals do not have access to their food. Although all work mentioned above is done by hunters, it is still supervised by foresters, who take care of a forest as one, complex ecosystem in which plants, animals and abiotic elements coexist and interact.

As mentioned before, late autumn, winter and early spring is a busy time in forests. Apart from logging and supervising the care of game and hunting, foresters collect the seeds of some species, e.g. pine, spruce, larch, alder as well as set traps for some pests, e.g. the pineshoot beetle. A forester's job is interesting and challenging but also demanding and requires broad knowledge of the whole forest ecosystem.

Work in forests all year round – more examples.

1. Collecting seeds

Species	Time when their seeds are collected
aspen	May
mountain and field elm	June
European birch	July–August
European ash	August–October
silver fir, yew	September
hornbeam, small-leaved linden	September–November
maple, sycamore	September–October
sessile and pedunculate oak, European beech, black locust, Norway spruce	October
black and grey alder	November–December
Scots pine, European and Polish larch	November–February

Based on: *Szczegółowa hodowla lasu* by E. Ilmurzyński.

2. Setting traps for pests

- February–March: setting traps for the pineshoot beetle and other pests with the similar life cycle.
- March–April: setting traps for the European spruce bark beetle and other pests attacking trees in late spring and summer.

3. Collecting and analysing data concerning stands in a given forest.

The data is used for planning all work that takes place in forests. Plans are prepared for a 10-year period. They are an indispensable element of forest management. Apart from them, once in 20–30 years additional data concerning forest soil and forest habitat is collected.

DID YOU KNOW?

- Some species are more frequently damaged by lightning than others. The ones that are struck more often include such species as: poplar, oak, ash, pine and spruce whereas beech, hornbeam and birch are seldom hit.
- Pine needles live 2–3 years, spruce 4–6 years and fir even up to 10 years.

SUGGESTED TOPICS FOR FURTHER READING AND DISCUSSION

1. Genetic engineering in silviculture.
2. Dogs and wolves – means of communication: sounds and body language.
3. Give other reasons (apart from those mentioned in the text *Wildlife Management,* p. 58) why supplementary wildlife feeding may cause a lot of harm.
4. Roles of different types of pheromones (e.g. sexual, alarm) and allelochemicals (allomones, kairomones, synomones, apneumones).
5. Poplar plantations.
6. Seed orchards step by step: types, establishment and so on.
7. Seed stands step by step: tree choice and number, site preparation, isolation distance, tilling, fertilisation and so on.
8. Compost production for forestry use.
9. Mycorrhiza and its types (endotrophic and ectotrophic). Tree species characteristic for both types of symbiosis.
10. Fertilisers and pesticides used in forest nurseries.
11. Equipment used in a forest nursery.
12. Equipment used in harvesting.
13. Primary and secondary succession.
14. The role of deadwood in forests.

KEY

PART I. INTRODUCTION

1. STATE FORESTS IN POLAND (page 10)

EX. II

1I 2J 3B 4F 5C/B 6G 7A 8D 9E 10H

FOLLOW-UP (page 11)

EX. I

1. The State Forests Information Centre in Warsaw – Centrum Informacyjne Lasów Państwowych w Warszawie
2. The Centre of Research and Implementation in Bedoń – Ośrodek Rozwojowo-Wdrożeniowy w Bedoniu
3. The Forest Technology Centre in Jarocin – Ośrodek Techniki Leśnej w Jarocinie
4. The State Forests IT Department in Sękocin – Zakład Informatyki Lasów Państwowych w Sękocinie
5. The Coordination Centre for Environmental Projects in Warsaw – Centrum Koordynacji Projektów Środowiskowych w Warszawie
6. The Kostrzyca Forest Gene Bank in Miłków – Leśny Bank Genów Kostrzyca w Miłkowie
7. The Forest Culture Centre in Gołuchów – Ośrodek Kultury Leśnej w Gołuchowie

EX. II

1. bark	2. anthill	3. ant	4. butterfly
5. grass	6. bush	7. stump	8. annual ring
9. stack of logs/wood	10. forest track	11. sapling	12. cone
13. coniferous tree	14. squirrel	15. mushroom	16. fern
17. litter	18. moss	19. hollow	20. woodpecker
21. owl	22. broad-leaved tree		

2. FOREST MANAGEMENT TODAY (page 14)

EX. II
1.deforestation
2.die out
3.habitat
4.venison
5.medicinal plants
6.fell trees
7.pest

'FOREST' FOLLOW-UP (page 16)

EX. I
1. fence
2. forest nursery
3. stream
4. otter
5. beaver
6. dam
7. frog
8. fish
9. raised stand/hide
10. hare
11. deer
12. antlers
13. winter feeding place
14. wolf
15. fox
16. hedgehog
17. wild boar
18. clearing/glade
19. snake
20. elk/moose

3. POLISH FORESTS IN NUMBERS (page 18)

EX. I
1b 2a 3c 4a 5c 6b 7a 8b 9c

'TREE' FOLLOW-UP (page 19)

EX. I

small: clump = cluster
medium sized: coppice, grove
large: wood, woodland, forest, jungle

EX. II

1. crown 2. trunk 3. root system 4. taproot 5. bark
6. hollow 7. leaf 8. twig 9. branch

EX. III

1C 2G 3E 4F 5B 6D 7A

EX. IV

1. are barking up the wrong tree – to do sth that will not bring the results you want
2. twigged – to understand suddenly (*informal*)
3. went out on a limb – to do or say something that people usually don't
4. was nipped in the bud – to eliminate the problem at its beginning
5. was shaking like a leaf – to be very cold, nervous or afraid
6. take a leaf out of … book – to do exactly the same as the other person does

EX. V

1. common birch
2. European ash
3. Polish larch
4. common hawthorn
5. European beech
6. horse chestnut
7. small/little-leaf linden
8. European hornbeam
9. hazel/ European filbert
10. silver fir

REVISION I (TEXTS 1–3) (page 24)

EX. I

coniferous: fir, pine, spruce, Douglas fir, juniper
broad-leaved: elm, aspen, ash, rowan, sycamore

EX. II

1F 2K 3A 4I 5C 6J 7B 8E 9D 10H 11G

EX. III, IV

A. bark
B. larch
C. fell
D. timber
E. twig
F. taproot
G. broad-leaved
H. leaf

EX. V.

1b 2c 3a 4a 5b 6c 7a

EX. VI.

1. an empty space inside a tree trunk
2. flora and fauna
3. a group of animals or plants possessing the same characteristics and able to produce offsprings within a given group
4. the upper part of a tree consisting of leaves, twigs and branches
5. the part of a tree that supplies water and nutrients from the soil
6. trees with needle-like leaves
7. fruit of coniferous trees
8. an area covered with a forest

EX. VII

1. Norway maple (*Acer platanoides*) – klon pospolity
2. black locust (*Robinia pseudoacacia*) – robinia akacjowa
3. grey alder (*Alnus incana*) – olsza szara
4. black alder (*Alnus glutinosa*) – olsza czarna
5. sycamore/ sycamore maple (*Acer pseudoplatanus*) – klon jawor
6. black poplar (*Populus nigra*) – topola czarna
7. aspen (*Populus tremula*) – osika
8. rowan (*Sorbus aucuparia*) – jarząb pospolity
9. Douglas fir (*Pseudotsuga menziesii*) – daglezja zielona
10. mountain pine (*Pinus mugo*) – kosodrzewina

PART II. FORESTRY BASICS

1. FOREST TREES (page 30)

EX. II

A. foliage
B. taproot
C. windthrow
D. canopy
E. stand
F. asexual/vegetative propagation

EX. III

1D 2E 3B 4F 5A 6C

FOLLOW-UP: TREE AND SHRUB SPECIES (page 32)

1. ginkgo
2. Arolla/Swiss pine – sosna limba
3. white willow – wierzba biała
4. Norway maple – klon pospolity
5. Norway spruce – świerk pospolity
6. European common yew – cis pospolity
7. European spindle – trzmielina pospolita
8. European white elm / spreading elm – wiąz szypułkowy
9. guelder rose – kalina koralowa
10. Scotch/Scots pine – sosna pospolita
11. pedunculate oak – dąb szypułkowy

2. TREE PROPAGATION (page 34)

EX. II

1. pollination
2. fertilisation
3. germination
4. clone
5. stump
6. sow
7. cell
8. nursery
9. seedling
10. propagation
11. fell
12. micropropagation
13. stem

FOLLOW-UP: PARTS OF A FLOWER, A PLANT BODY (page 36)

EX. I

1. sepal
2. petal
3. filament
4. anther
5. stigma
6. style
7. ovary
8. ovule

EX. II

stamen: filament, anther
pistil: stigma, style, ovary, ovule
leaf: blade, petiole, vein, margin

EX. III

1. root cap
2. root hairs
3. primary root
4. secondary root
5. stem
6. leaf
7. axillary/lateral bud
8. internode
9. node
10. apex
11. shoot

3. TEMPERATE FOREST STRATIFICATION (page 38)

EX. II

1. strata
2. decomposition
3. nutrients
4. seedling
5. herb
6. sapling
7. canopy

FOLLOW-UP:

A. PLANTS OF THE FOREST FLOOR (page 40)

EX. I

A. marsh fern – zachylnik błotny (*Thelypteris palustris*)
B. hair moss – płonnik pospolity (*Polytrichum commune*)
C. asarabacca – kopytnik (*Asarum europaeum*)
D. bilberry – borówka czarna, borówka czernica (*Vaccinium myrtillus*)
E. lily of the valley – konwalia majowa (*Convallaria majalis*)
F. wild strawberry – poziomka pospolita (*Fragaria vesca*)
G. marsh marigold – knieć błotna, kaczyniec, kaczeniec (*Caltha palustris*)
H. (edible) mushroom
I. angular Solomon's seal – kokoryczka wonna (*Polygonatum odoratum*)
J. wood sorrel – szczawik zajęczy (*Oxalis acetosella*)

B. SOIL AND ITS QUALITY PLANT INDICATORS (page 42)

EX. I A

1E 2F 3A 4B 5C 6D

EX. I B

1E 2D 3B 4A 5C

EX. II

A8 B4 C6 D1 E11 F9 G2 H10 I3 J7 K5

EX. III

acidic soils: bilberry (*Vaccinium myrtillus*), common heather (*Calluna vulgaris*), wood sorrel (*Oxalis acetosella*)

neutral soils: snowdrop anemone (*Anemone sylvestris*), wood avens / herb Bennet (*Geum urbanum*)

alkaline soils: ramsons / broad-leaved garlic / bear's garlic (*Allium ursinum*), asarabacca (*Asarum europaeum*), ground elder / bishop's weed (*Aegopodium podagraria*)

sandy soils: small-flowered cranesbill / small geranium (*Geranium pusillum*)

clayey soils: burdock (*Arctium lappa*)

loamy soils: celadine (*Chelidonium majus*)

4. BASIC CHARACTERISITICS OF FOREST STANDS (page 44)

FOLLOW-UP: TYPES OF TREES IN A STAND (page 45)

EX. I

1C 2D 3E 4A 5F 6B

EX. II

1. suppressed tree 2. emergent tree 3. herbaceous
4. intermediate tree 5. dominant tree 6. codominant tree

EX. III

1. canopy
2. understorey
3. shrub
4. dominant tree
5. sapling
6. litter
7. stump
8. suppressed tree
9. codominant tree
10. standing dead tree /snag
11. herbaceous plant
12. broken tree
13. intermediate tree
14. fallen tree
15. overtopping tree

REVISION II (TEXTS 1–4) (page 48)

EX. I

1. fungi
2. moss
3. nutrients
4. herbs
5. nursery
6. stand
7. seedling
8. blackthorn
9. stratum
10. poplar
11. stump sprout
12. lichens
13. ferns
14. litter

15. black locust
16. sapling
17. admixture
18. bilberry
19. clone
20. canopy

EX. II

1. canopy closure 2. reproduction 3. shadebearing
4. vegetative reproduction 5. micropropagation

EX. III

cell, tissue, bud, leaf, twig, branch, bough/limb, trunk

EX. IV

1. artificial regeneration
2. admixture
3. evergreen
4. hard wood
5. temporary admixture
6. asexual propagation
7. uneven-aged stands
8. gymnosperms
9. vertical crown closure
10. shallow root system
11. shade intolerance
12. multi-storey stands

EX. V

1. layering 2. stump sprout 3. seeds
4. tissue culture, micropropagation 5. root sucker 6. grafting

EX. VI

1. flower development
2. pollination
3. fertilisation
4. seed production
5. seed dispersal
6. germination
7. seedling establishment

EX. VII

1F 2T 3F 4T 5T 6F 7T 8T 9F 10T
11F 12F 13T 14F 15T

EX. VIII
1. seedling 2. sapling 3. pole 4. mature tree

5. WOODLAND BIRDS (page 52)

'BIRD' FOLLOW-UP (page 53)

EX. I
1C 2A 3B 4E 5D

EX. II
1D 2F 3A 4G 5C 6E 7B

EX. III
They are songbirds.

6. FOREST MAMMALS, REPTILES AND AMPHIBIANS (page 54)

'ANIMAL' FOLLOW-UP (page 55)

EX. I
1G – wolf lub 1C – fox, 2D – duck, 3F – wild boar, 4A – goose,
5B – red deer, 6E – bison/buffalo, 7C – fox lub 7G – wolf
* In the case of the moose: cow (female), bull (male)

EX. II
1. orange teeth, scaly tail
2. hooves, antlers
3. wings, feather, bill, down
4. sharp tusks
5. whiskers, tufted ears

EX. III
1H 2K 3E 4A 5C 6J 7B 8D 9F 10I 11G

EX. IV, V
1. Lepszy wróbel w garści niż gołąb na dachu.
2. Kto rano wstaje, temu Pan Bóg daje.
3. Natura ciągnie wilka do lasu. (B)
4. Jedna jaskółka nie czyni wiosny. (A)
5. Nie łap dwóch srok za ogon. (C)

EX. VI
1D – deer 2C – wild boar 3F – wolf 4E – bear 5A – hare 6B – lynx

7. WILDLIFE MANAGEMENT (page 58)

EX. II, III

1. game
2. hunting
3. ban
4. closed season
5. open season
6. rabies
7. overpopulation
8. poaching
9. snare
10. legumes
11. shoot
12. meadow
13. habitat
14. vaccination

FOLLOW-UP (page 60)

EX. I, II

1. an eager beaver, D
2. felt like a fish out of water, F
3. a snake in the grass, B
4. one swallow doesn't make a summer, E
5. like a bear with a sore head, A
6. makes a beeline for, I
7. took to … like a duck to water, G
8. a lone wolf, C
9. was ... foxed, J
10. hare-brained, H

EX. III

1. moose/elk – łoś
2. chamois – kozica
3. long-eared owl – sowa uszata
4. ant – mrówka
5. spider – pająk
6. bison – bizon
7. fox – lis
8. fire salamander – salamandra
9. woodpecker – dzięcioł
10. squirrel – wiewiórka
11. beaver – bóbr

REVISION III (TEXTS 5–7) (page 62)

EX. I

1a 2b 3c 4b 5a 6b
7b 8c 9b 10c 11b 12a

EX. II

1T 2T 3F 4F 5T 6T 7F 8T 9F 10T

EX. III

1. sand lizard – jaszczurka zwinka
2. toad – ropucha
3. ladybird – biedronka
4. mole – kret
5. hedgehog – jeż

8. FORESTS IN DANGER. PART I (page 64)

EX. II

1E 2F 3A 4J 5H 6G 7D 8I 9C 10B

'WEATHER' FOLLOW-UP (page 65)

EX. I

ice: hailstorm, glaze, rime
snow: blizzard, avalanche, flake
rain: drizzle, downpour
rain+snow: sleet
wind: breeze, gale

9. FORESTS IN DANGER. PART II (page 66)

'FIRE' FOLLOW-UP (page 67)

EX. I

1G 2D 3B 4E 5C 6A 7F

REVISION IV (TEXTS 8–11) (page 72)

EX. I

1F 2T 3F 4T 5T 6T
7F 8F 9F 10F 11T 12F
13T 14F 15T 16F 17T 18F

EX. II

1. bacterial
2. fungal
3. viral
4. polluted
5. fatal
6. venomous
7. poisonous
8. rabid
9. dangerous
10. dormant
11. pathogenic
12. toxic

EX. III

1. Ticks.
2. Rabid animals.
3. Adders (in Poland).

EX. IV

1. beavers
2. deer
3. wild boar
4. secondary insect pests
5. foliophagus/defoliating insects
6. the European spruce bark beetle or any other pest attacking wood
7. squirrels

EX. V

1. F_2
2. S
3. Hg
4. NO_2
5. Pb
6. O_3
7. SO_2
8. N
9. NH_3
10. Al

EX. VI

1. abiotic 2. drought 3. artificial 4. female 5. wild

PART III. FORESTRY IN PRACTICE

1. HOW TO CONTROL FOREST PESTS AND DISEASES. PART I (page 76)

FOLLOW-UP: ENTOMOLOGICAL TERMS (page 77)

EX. I

1D 2J 3E 4H 5G 6L 7K 8I 9A 10C 11F 12B

3. FOREST ESTABLISHMENT (page 80)

EX. II

1. conservation – ochrona
2. root sucker – odrośl korzeniowa
3. timber – drewno
4. monoculture – monokultura
5. seedling – siewka
6. fuelwood – drewno opałowe
7. wasteland – nieużytek
8. stump sprout – odrośl pniakowa

4. ARTIFICIAL REGENERATION (page 82)

FOLLOW-UP:
A. 'TREE' WORDS, EXPRESSIONS AND IDIOMS (page 83)

EX. I

1. annual rings
2. tree house
3. tree-lined
4. treetops
5. tree diagram
6. tree-hugger
7. tree surgery
8. treeless
9. family tree
10. trunk
11. grow on trees
12. out of your tree

EX. II

a. to be out of your tree
b. a tree-hugger
c. money doesn't grow on trees

B. HOW TO PLANT A TREE (page 84)

EX. I

1E 2D 3H 4G 5C 6F 7A 8B

EX. II

1. Reduce transplant shock by handling seedlings with care during lifting and transport. Don't allow roots to dry out!
2. Until the planting time keep the seedlings in a moist soil and in the shade. Plant the seedlings as soon as possible.
3. Dig a hole.
4. Roughen the sides of the hole and leave a heap of soil at the bottom. Place the rest of the soil near the hole.
5. If the soil is dry, water the hole a bit. Place the seedling at the bottom. Make sure that the roots are straightened and do not bend upwards.
6. Hold a tree. Start refilling the hole with the soil. Plant a tree at the same depth as it has grown in a nursery.
7. Pack down the soil during refilling in order to prevent air pockets.
8. Water carefully. Monitor the soil mixture for the next 2–3 months and water the seedling if necessary.

REVISION V (TEXTS 1–4) (page 86)

EX. I

1. bees
2. spider
3. pheromones
4. lizard
5. microorganisms
6. hedgehog
7. herbicide
8. insectivorous
9. trap
10. repellent
11. fungicide
12. toad
13. ants
14. pesticides
15. attractants
16. rodenticides
17. beetles

EX. II

1c 2b 3a 4b 5a 6c 7b

5. BASIC SEED TERMINOLOGY (page 88)

EX. II

1. viable
2. embryo
3. seed coat
4. imbibition
5. inhibitor
6. endosperm
7. radicle

FOLLOW-UP: RELATED VOCABULARY (page 89)

EX. I

1. dehiscent
2. vernalisation
3. legume
4. zoochory
5. treated
6. stone
7. pip
8. indehiscent
9. seed processing
10. seed longevity
11. hydrochory

6. SEED PRODUCTION (page 90)

EX. II

1. precipitation
2. pollination
3. ripe
4. bloom
5. pollinators
6. yield
7. abundantly

7. SEED COLLECTION AND PROCESSING (page 92)

EX. II

1. indigenous
2. offspring
3. trait
4. provenance
5. fruition
6. thresh
7. winnowing

8. SEED STORAGE (page 94)

FOLLOW-UP: 'FRUIT' AND 'SEED' IDIOMS AND EXPRESSIONS (page 95)

1. seedless – without seeds
2. bear fruit – be successful
3. seed leaves
4. fruit fly
5. seedy – in bad condition, having a bad reputation, involving illegal activities
6. fruitful
7. seeded – with seeds removed
8. fruity
9. seeds of – the source of, beginning
10. fruitless
11. come to fruition – happen
12. went to seed – stop looking attractive because you don't care or you are ill

REVISION VI (TEXTS 5–8) (page 96)

EX. I

1. characteristic
2. mature
3. crop
4. blossom
5. drying
6. origin
7. unorthodox

EX. II

1. flower development
2. pollination
3. seed setting
4. seed ripening
5. seed harvesting
6. seed processing
7. seed storage

EX. III

1. unorthodox
2. small-seeded
3. immature
4. short-term
5. indigenous
6. impurity

EX. IV

1. Scarification means damaging or softening the seed coat in order to stimulate germination, whereas stratification is subjecting seeds to low temperatures in order to overcome dormancy.
2. Dormancy – a case when viable seeds do not germinate, germination – the development of a plant from the seed.
3. Morphological dormancy is caused by an immature embryo whereas physiological dormancy is due to too hard or thick seed coat.
4. Seed count – the number of seeds per pound.
5. Short-term storage: storing seeds for a short period of time, usually up to 2–3 years depending on species, cryopreservation: long-term storage (up to 15–20 years) in low temperature (about 0°C). Seed water content is reduced to 4%.

EX. V

1. dormant
2. viable
3. pure
4. moist
5. ripe
6. genetic
7. mature

EX. VI, VII

1G – depulping
2D – grafting
3F – a scale
4B – dewinging
5H – impurities
6A – pollinators
7E – orthodox
8C – a gene bank

EX. VIII

1F 2T 3F 4T 5F 6F 7T 8T 9F 10T

9. FOREST NURSERIES (page 98)

EX. II

1. planting stock
2. nursery
3. frost hollow, cold pool
4. uprooting
5. stump extraction
6. plough
7. tillage

8. inorganic
9. green manure
10. water-soluble
11. nutrients
12. root uptake
13. foliar application
14. liquid

10. SOWING SEEDS AND TAKING CARE OF SEEDLINGS (page 100)

EX. II

1. under cover
2. asexually reproduced
3. bare-root
4. vigorous
5. beneficial
6. increase
7. adequate
8. varied
9. permeable

FOLLOW-UP: FRUIT TYPES, SEEDLINGS OF DIFFERENT SPECIES (page 102)

EX. I, II

1. hazel, hazelnut 2. maple, samara 3. oak, acorn
4. rose, rose hip 5. ash, samara 6. alder, cone-like fruit
7. beech, beechnut/beechmast 8. black locust, pod/legume

EX. III

1. fir 2. pine 3. spruce 4. beech 5. sycamore 6. hornbeam

11. SEEDLING LIFTING, STORING AND OUTPLANTING (page 104)

EX. II

1. When are seedlings lifted?
2. By what is lifting time determined? / What is lifting time determined by?
3. How should seedling lifting be performed?
4. What is controlled in greenhouses?

FOLLOW-UP: RELATED VOCABULARY (page 105)

1. a lifting window
2. seed lot
3. transplant
4. soil amendments

5. plugs
6. plough pan, soil pan
7. stool beds
8. outplanting

REVISION VII (TEXTS 9–11) (page 106)

EX. I

1. water-soluble
2. light soil
3. organic
4. inorganic
5. solid
6. beneficial
7. long-term
8. moist, wet
9. lateral root
10. indoors

EX. II

1. symbiotic
2. fungi
3. mycorrhiza
4. beneficial
5. vigorous
6. nutrient uptake
7. soil pathogens
8. Symbiosis
9. host plants
10. carbohydrates
11. Mycorrhizal
12. inoculum
13. Inoculation
14. germination
15. seedling
16. outplanting

EX. III, IV

1. tillage – B5
2. planting stock – D1
3. heeling-in – A2
4. hardening off – E3
5. leaching – C4

EX. V
1E 2B 3A 4D 5C

EX. VI
1. Organic
2. green manure /peat
3. peat/ green manure
4. organic matter
5. water retention
6. nutrients
7. concentrated
8. potassium (K)
9. uptake
10. foliar application

12. FOREST STAND IMPROVEMENT (page 108)

EX. I
1G 2I 3D 4F 5B 6H 7A 8E 9C

EX. II
1F 2T 3F 4F 5T 6T

13. FOREST HARVESTING SYSTEMS (page 110)

FOLLOW-UP
A. RELATED VOCABULARY (page 111)

EX. I
1. debarking – bark
2. delimbing – branches
3. topping – tree tops

EX. II
A3 B5 C1 D2 E4

EX. III
1. log cabin – a small house made of logs
2. log off/out – wylogować się
3. log book – książka wozu *BrE* an official document containing details about a car and its owner
4. sleeps like a log – śpi jak zabity
5. logged – officially recorded
6. as easy as falling off a log – very easy

B. HOW TO CUT DOWN A TREE SAFELY (page 112)

EX. I

1H 2C 3F 4I 6A 7G 8B 9E 10D

EX. II

1. felling direction 2. back cut 3. face notch 4. hinge 5. fall path

14. SHELTERWOOD SYSTEM (page 114)

EX. I

1. disperse 2. sapling 3. viable 4. germination 5. flower cluster

FOLLOW-UP: REGENERATION-RELATED VOCABULARY (page 115)

EX. I

1. indigenous
2. seedbed
3. heterogeneity
4. barochory
5. advance vegetation
6. seed predators
7. plus trees
8. viable seeds
9. inflorescence

REVISION VIII (TEXT 12–14) (page 116)

EX. I

selection system: A, D, F, I, J, N, R
shelterwood system: C, M, U
clearcutting: B, E, G, H, O, K, L, P, S, T

EX. II

1. cutting down trees
2. removing branches and tree tops
3. transferring logs to the roadside landing
4. sorting
5. short-term storing
6. transporting them to sawmills or other processing factories

EX. III

1. Pruning
2. removing
3. leader

4. fork
5. criss-crossing
6. dormant
7. dead
8. all year long
9. labour-intensive
10. timber

EX. IV

1. What happens to branches and tree tops after logging?
2. What is the period between felling trees called?
3. What is selection of seed trees based on?
4. What does 'removal cutting' mean?
5. How is gradual reduction of stand density called?
6. What is 'sanitation cutting'?

15. FOREST PRODUCTS (page 118)

EX. II

1. coniferous litter
2. tree sap
3. resin
4. venison
5. sawmill
6. pile
7. railway sleepers
8. crate
9. mulch
10. plywood
11. fibreboard
12. particleboard
13. cardboard
14. charcoal

16. WOOD DEFECTS. PART I (page 120)

FOLLOW-UP: TRUNK CROSS-SECTION (page 121)

EX. I

1. outer bark 2. inner bark (phloem) 3. cambium
4. heartwood 5. pith 6. sapwood

CONSOLIDATION: WOOD DEFECTS (page 122)

EX. I

1. ovality
2. fork shake
3. open bark pocket – zakorek otwarty
4. ring shake
5. simple heart shake
6. cup shake
7. closed bark pocket – zakorek zarośnięty
8. star heart shake
9. multiple pith
10. grain slope
11. burl
12. resin pitch
13. butt swell
14. flutes
15. crookedness/curvature
16. knots

17. WOOD DEFECTS. PART II (page 124)

FOLLOW-UP: 'KNOT', 'CRACK' AND 'SPLIT' EXPRESSIONS (page 125)

EX. I

1. split ends – rozdwojone końcówki
2. crack – włamać się
3. in knots – być zdenerwowanym
4. split up – rozstać się, zerwać ze sobą
5. tie the knot – pobrać się
6. splitting headache – głowa mi pęka
7. at the crack of dawn – o świcie
8. cracks, crack jokes – opowiadać kawały
9. knot – grupa
10. knots

18. NON-TIMBER FOREST PRODUCTS (page 126)

'MUSHROOM' FOLLOW-UP (page 127)

1. cap 2. gills 3. stem 4. ring 5. mycelial threads

REVISION IX (TEXTS 15–18) (page 128)

EX. I

big: roundwood, pallet
smaller: railway sleepers, planks, squared timber
very small: matches, toothpicks, wood wool, sawdust

EX. II

1D – sawmill
2F – sawnwood
3H – plank

4A – veneer
5G – cardboard
6C – rayon
7I – charcoal
8B – cranberry
9E – nettle

EX. III

made of wood: crates, parquet, poles, railings, wood shavings
parts of wood glued together: particleboard, fibreboard, plywood
result of chemical treatment: paper, cellophane, rayon cloth

EX. IV

1. bark pocket
2. resin pitch
3. ovality
4. burls
5. discoloration
6. knots
7. foreign bodies

EX. V

1F 2F 3T 4T 5F 6F 7T
8F 9T 10F 11T 12F
13T 14T

GLOSSARY

A

acaricides	środki roztoczobójcze
acidification	zakwaszenie
acidic	kwaśna
acorn	żołądź
adder	żmija zygzakowata
admixture	domieszka
Aesculapian snake	wąż Esculapa
afforestation	zalesienie
afforested	zalesiony
agricultural	rolniczy
alder	olsza
alder buckthorn	kruszyna
alkaline	zasadowy
ammonia	amoniak
amphibian	płaz
angiosperm	roślina okrytonasienna
angiospermous	okrytonasienny
angular Solomon' s seal	kokoryczka wonna (*Polygonatum odoratum*)
annosum root rot	huba korzeni (*Heterobasidion annosum*)
annual	jednoroczny
anther	pylnik
antlers	poroże
apex	wierzchołek, szczyt
aphid	mszyca
arachnid	pajęczak
artificial regeneration	odnowienie sztuczne
asarabacca	kopytnik pospolity (*Asarum europaeum*)
asexual reproduction	rozmnażanie wegetatywne
ash	jesion
aspen	osika (*Populus tremula*)
augmentation	zwiększenie
avalanche	lawina
axillary/lateral bud	pączek boczny

B

back cut	rzaz ścinający
bacterium *l.mn.* bacteria	bakteria
barberry	berberys
bare-root	z odkrytym systemem korzeniowym
bare-root seedling	sadzonka z odkrytym systemem korzeniowym

bark beetle	kornik
bark pocket	zakorek
barn owl	płomykówka
basal area	powierzchnia poprzecznego przekroju pnia
bat	nietoperz
battue hunting	polowanie z nagonką
bay bolete	podgrzybek
bear	niedźwiedź
beaver	bóbr
beech	buk
beechnut	bukiew
beetle	chrząszcz
belladonna, devil's berries	pokrzyk wilcza jagoda
biennial	dwuletni
bilberry	borówka czarna (*Vaccinium myrtillus*)
bill	dziób
biodiversity	bioróżnorodność
birch	brzoza
birch sap	oskoła
birds of prey	ptaki drapieżne
bison, buffalo	bizon
black alder	olsza czarna (*Alnus glutinosa*)
black locust	robinia akacjowa (*Robinia pseudoacacia*)
black poplar	topola czarna (*Populus nigra*)
blackberry	jeżyna
blackbird	kos
blackthorn	śliwa tarnina
blade	blaszka liściowa
blaze	zacios
blizzard	śnieżyca
bloom	kwitnąć, kwitnienie
blue stain	sinizna drewna
blue stain fungi	grzyby powodujące siniznę
bough	duża gałąź (literackie użycie)
Braconidae	męczelkowate
branch	gałąź
break dormancy	przerwać stan spoczynku
breeding	hodowla, rozmnażanie
breeze	wietrzyk
broadcast	siew rzutowy
broad-leaved	liściasty
broken crown closure	zwarcie przerywane
brood parasite	pasożyt lęgowy
browse	skubać np. trawę, liście (przez zwierzęta)
buckbean	bobrek trójlistny

bullfinch	gil
bunny	króliczek
burdock	łopian większy
burl	narośl
bush	krzew
butt	odziomek
butt swell	zgrubienie odziomkowe

C

calf	cielę, cielę żubra
cambium	kambium, miazga
canker	rak
canopy	okap drzewostanu, korona drzewa
cap	kapelusz grzyba
carbohydrates	węglowodany
cardboard	karton
carnivore	zwierzę mięsożerne
carrion	padlina
celandine	glistnik jaskółcze ziele
cell	komórka
chamois *l.mn.* chamois, chamoix	kozica
chanterelle	kurka
charcoal	węgiel drzewny
chips	zrębki
clearcutting system	rębnia zupełna, całkowita
clone	klon
closed season	okres ochronny zwierzyny
clump, cluster	kępa drzew
codominant tree	drzewo współpanujące
common birch	brzoza brodawkowata (*Betula pendula*)
common elm	wiąz pospolity/polny (*Ulmus campestris*)
common foxglove	naparstnica purpurowa
common hawthorn	głóg jednoszyjkowy (*Crataegus monogyna*)
common heather	wrzos zwyczajny
common horse chestnut	kasztanowiec pospolity (*Aesculus hippocastanum*)
common oak	dąb szypułkowy (*Quercus robur*)
common yew	cis pospolity (*Taxus baccata*)
compost	kompost
compression wood	drewno naciskowe, reakcyjne, twardzica (u gatunków iglastych)
cone	szyszka
conifer	roślina iglasta
coniferous	iglasty, szpilkowe
coniferous litter	ściółka iglasta

conservation	ochrona środowiska, zarządzanie zasobami naturalnymi
containerised seedling	siewka, sadzonka wyprodukowana w pojemniku
coppice	las odroślowy
corn	zboże, *AmE* kukurydza
cotyledon	liścień
crack	pęknięcie, szczelina, wada
cranberry	żurawina
crookedness, curvature	krzywizna
crop	plon
crop rotation	płodozmian
crow	wrona
crown	korona drzewa
crown cover, canopy closure	zwarcie
cub	niedźwiadek
cuckoo	kukułka
cultivator	kultywator
cup shake	pęknięcie okrężne łukowe
cut down trees	ścinać drzewa
cutting interval	nawroty cięć
cutting	cięcie, zrzez, sadzonka

D

dam	tama
deadly fibrecap, redstaining fibrecap	strzępiak ceglasty
death cap	muchomor sromotnikowy
decay	zgnilizna
deciduous	zrzucający liście
decompose	rozkładać
decomposition	rozkład
deer (generally)	jeleń, jeleniowate
deforestation	wylesienie
density	gęstość
depulping	usuwanie miąższu
dessication	odwadnianie, suszenie
dewinging	odskrzydlanie
dicot	roślina dwuliścienna
die out	wymierać
dieback	zamieranie
dioecious	dwupienne
Directorate-General of the State Forests	Dyrekcja Generalna Lasów Państwowych
discoloration	przebarwienia
disease	choroba

dispersal	rozsiew, rozsiewanie się, rozprzestrzenianie się
disperse	rozsiewać, rozprzestrzeniać się
doatiness	zaparzanie
dog rose	dzika róża
dogwood	dereń
dominant species	gatunek dominujący
dominant tree	drzewo panujące
dor beetle	żuk gnojowy
dormancy	stan spoczynku
dormant	w stanie spoczynku
Douglas fir	daglezja zielona, jedlica (*Pseudotsuga menziesii*)
down	puch
downpour	ulewa
dragonfly	ważka
drizzle	mżawka
duck	kaczka
duckling	kaczątko

E

eagle	orzeł
eaglet	orlątko
earthworm	dżdżownica
eccentric pith	rdzeń mimośrodowy
edge crack	pęknięcie boczne
egg gallery	chodniki macierzyste
elder	bez
elk	łoś
elm	wiąz
embryo	zarodek
emergent tree	drzewo górujące (przerost)
Empusa aulicae	owadomórka sówkowa
end shake	pęknięcie czołowe
endangered	zagrożony
endosperm	bielmo, endosperm
English holly	ostrokrzew (*Ilex aquifolium*)
entomophage	entomofag, organizm niszczący owady
escape route	ścieżka oddalania
European ash	jesion wyniosły (*Fraxinus excelsior*)
European beech	buk zwyczajny (*Fagus sylvatica*)
European bison, wisent	żubr
European hornbeam	grab zwyczajny (*Carpinus betulus*)
European pond turtle	żółw błotny
European spindle tree	trzmielina pospolita (*Euonymus europaea*)

European spruce bark beetle, eight-toothed spruce bark beetle	kornik drukarz
even-aged	jednowiekowy
even-aged stand	drzewostan jedno-/równowiekowy
evergreen	wiecznie zielony
extraction	wydobywanie, ekstrakcja

F

face notch	rzaz podcinający
fallow deer	daniel
false morel	piestrzenica kasztanowata
farmland	tereny rolnicze
fawn	młode jeleniowatych (ogólnie)
feather	pióro
fell trees	ścinać drzewa
felled tree	ścięte drzewo
felling direction	kierunek obalania
female	samica, żeński
fern	paproć
fertilisation	zapłodnienie, nawożenie
fibreboard	płyta pilśniowa
field	pole
filament	nitka pręcika
fine	drobny, mały, cienki
fir	jodła
fire salamander	salamandra plamista
fire-bellied toad	kumak nizinny
fissure	pęknięcie
flake	płatek np. śniegu
flower abortion	opadanie kwiatów
flower bud	pąk kwiatowy
flowering	kwitnięcie
fluorine	fluor
flutes	napływy korzeniowe
fodder	pasza
foliage	liście, listowie
fool's webcap	zasłonak rudy
foreign body	ciało obce
forest	las
forest caterpillar hunter	tęcznik liszkarz
forest district	nadleśnictwo
forest floor	dno lasu
forest harvesting systems	typy rębni
forest layers	piętra/warstwy lasu
forest management	gospodarka leśna

forest regeneration	odnowienie
forest stand improvement, tending the forest, intermediate treatments	zabiegi w lesie między jego powstaniem a wyrębem, pielęgnowanie lasu
forest stand	drzewostan
fork-shake, T-shake	pęknięcie rdzeniowe załamane
formative pruning	formowanie koron
fox	lis
frame	szkielet budynku, rama
frog	żaba
frost crack	pęknięcie mrozowe
frost heaving	gołomróz
frost hollow, cold pool	zastoisko mrozowe, zmrozowisko
frost rib	listwa mrozowa
fruit abortion	opadanie owoców, zawiązków
fruit fly	muszka owocowa
fruition	owocowanie
fuelwood	drewno opałowe
full crown closure	zwarcie pełne
fungal	powodowany przez grzyby (przymiotnik)
fungicides	środki grzybobójcze
fungus *l.mn.* fungi	grzyb

G

gale	wichura
game	zwierzyna łowna
game management	gospodarka łowiecka
gene bank	bank genów
gene resources	zasoby genetyczne
genetical diversity	różnorodność genowa
germinate	kiełkować
germination	kiełkowanie
gill	blaszka
ginkgo, maidenhair tree	miłorząb dwuklapowy (*Ginkgo biloba*)
gypsy moth	brudnica nieparka
glaze	gołoledź
goldcrest	mysikrólik (*Regulus regulus*)
goldeneye	gągoł
goldfinch	szczygieł
goose	gęś
gosling	gęsiątko
grafting	szczepienie roślin
grain	rysunek drewna, ziarno
grain slope	skręt włókien
grass snake	zaskroniec

graze	paść się
great white egret	czapla biała
green lacewing	złotook drapieżny
green manure	nawóz zielony
green oakroller moth	zwójka zieloneczka
greenhouse	szklarnia
grey alder	olsza szara (*Alnus incana*)
ground elder, bishop's weed	podagrycznik
grouse	szkocka kuropatwa
grove	zagajnik, lasek, gaj
growing season	okres, sezon wegetacyjny
growth ring	słój przyrostu
grub	pędrak
guelder rose	kalina koralowa (*Viburnum opulus*)
gymnosperm	roślina nagonasienna
gymnospermous	nagonasienny, nagozalążkowy

H

habitat	siedlisko, środowisko
hail	grad
hailstorm	gradobicie
hair moss	płonnik pospolity (*Polytrichum commune*)
hardening off	hartowanie, uodparnianie roślin
hardwoods	liściaste
hare	zając
harrow	brona, bronować
harvesting	pozyskiwanie, ścinka drzew, zbiór
hatch	wykluwać się
hawk	jastrząb
hawthorn	głóg
hay	siano
hazel	leszczyna
hazel, European filbert	leszczyna pospolita (*Corylus avellana*)
heart shake	pęknięcia rdzeniowe
heartwood	twardziel
hedgehog	jeż
heeling-in	dołowanie sadzonek
herb	zioło
herbicides	środki chwastobójcze
herbivore	roślinożerca
heterogeneity	różnorodność, rozmaitość
high pole stand/stage	drągowina
hinge	zawiasa
hollow	dziupla
honey fungus	opieńka miodowa

hoof *l.mn.* hooves	kopyto
horizontal crown closure	zwarcie poziome
hornbeam	grab
humidity	wilgotność
hunter	myśliwy
hunting	polowanie, łowiectwo
Hymenoptera	błonkówki

I

Ichneumonidae	gąsieniczniki
imbibition	chłonięcie, wchłanianie
impurities	zanieczyszczenia
indigenous	miejscowy, rodzimy, rdzenny
inflammation	zapalenie, zaognienie
inflorescence	kwiatostan
inner bark, phloem	łyko
inoculation	szczepienie
insecticides	środki owadobójcze
insect-pollinated	zapylane przez owady, owadopylne
intermediate tree	drzewo opanowane
ivy	bluszcz (*Hedera helix*)

J

jackdaw	kawka (*Corvus monedula*)
jay	sójka
joint	staw
juniper	jałowiec pospolity (*Juniperus communis*)

K

king bolete	borowik szlachetny
kitten	kocię, kocię rysia
knot	sęk

L

laminated wood	drewno klejone (deseczki klejone obok siebie)
landing	składnica drewna, miejsce załadunku
landslide	obsunięcia się ziemi
larch	modrzew
large pine weevil	szeliniak sosnowiec (*Hylobius abietis*)
larger pineshoot beetle	cetyniec większy (*Tomicus piniperda*)
large-seeded	ciężkonasienne
larva *l.mn.* larvae	larwa
larval gallery	chodniki larwalne
lateral	boczny
lay eggs	składać jaja

layering	rozmnażanie przez odkłady
lead	ołów
leader	przewodnik, główny pęd
leaf	liść
legumes	rośliny motylkowe/strączkowe
lesion	uszkodzenia, zmiany chorobowe
lesser pine weevil	szeliniak świerkowiec (*Hylobius pinastri*)
lesser pineshoot beetle	cetyniec mniejszy (*Tomicus minor*)
lichen	porost
lifting	wyjmowanie sadzonek
light demanding	światłożądny
lightning	piorun
lily of the valley	konwalia majowa (*Convallaria majalis*)
limb	duża gałąź
linden/lime	lipa
liquid nitrogen	ciekły azot
litter	ściółka
livid pinkgill	dzwonkówka trująca, wieruszka zatokowata
lizard	jaszczurka
loamy	ilasty
log	kłoda, dłużyca
logging	pozyskiwanie drewna, wyręb
logging road	droga wywozowa
Lyme disease	borelioza
lynx	ryś

M

maggot	czerw, robak
magpie	sroka
male	samiec, męski
mallard	krzyżówka
mammal	ssak
maple	klon
margin	brzeg liścia
marmot	świstak
marsh fern	zachylnik błotny (*Thelypteris palustris*)
marsh marigold	knieć błotna, kaczyniec, kaczeniec (*Caltha palustris*)
mate	łączyć się w pary
mature stand	drzewostan dojrzały/rębny
maturing stand	drzewostan dojrzewający/bliskorębny
meadow	łąka
medicinal plants	rośliny lecznicze
melliferous	miododajny
mercury	rtęć

mezereon	wawrzynek wilcze łyko (*Daphne mezereum*)
migratory birds	ptaki wędrowne
mildew	pleśń
mine dump	hałda górnicza
mixed-species stand	drzewostan wielogatunkowy, mieszany
moderate crown closure	zwarcie umiarkowane
mole	kret
monocot	roślina jednoliścienna
monoecious	jednopienny
moose	łoś
moss	mech
motor hoe	glebogryzarka
mould *AmE* mold	pleśń
mountain pine	kosodrzewina (*Pinus mugo*)
mow	kosić
multiple pith	wielordzenność
multi-storey stand	drzewostan wielopiętrowy
mushrooms	grzyby kapeluszowe
mycelium	grzybnia
mycorrhiza	mikoryza

N

natural regeneration	odnowienia naturalne
natural seeding	samosiew
nature reserve	rezerwat przyrody
necrosis	martwica, nekroza
needle cast	osutka sosny spowodowana przez *Lophodermium pinastri* i *L. seditiosum*
nematicides	środki nicieniobójcze
nematode *l.mn.* nematoda	nicień
nettle	pokrzywa
newt	traszka
nightingale	słowik
nitrogen	azot
nitrogen dioxide	dwutlenek azotu
nocturnal	nocny
Noena lymantriae	zarodnikowiec mniszkowaty
non-timber forest products	produkty użytkowania ubocznego
Norway maple	klon zwyczajny (*Acer platanoides*)
Norway spruce	świerk pospolity (*Picea abies*)
nun moth	brudnica mniszka
nuptial chamber	komora godowa
nursery	szkółka
nursery stock	materiał sadzeniowy, szkółkarski
nutrient	składnik odżywczy

O

oak	dąb
offspring	potomek
omnivores	wszystkożercy
open crown closure	zwarcie luźne
open season	sezon łowiecki
open-pit mine	kopalnia odkrywkowa
organic matter	materia organiczna
origin	pochodzenie
osprey	rybołów
otter	wydra
outbreak	wybuch choroby, gradacja szkodnika
outbreak of disease	wybuch, pojawianie się chorób
ovality	spłaszczenie
ovary	zalążnia
overtopping tree	przerost
overwinter	przezimować
ovule	zalążek
owl	sowa

P

pallet	paleta
parasitic	pasożytniczy
parent rock	skała macierzysta
parquet	parkiet
particleboard	płyta wiórowa
partridge	kuropatwa
pathogen	patogen
peat	torf
peregrine	sokół wędrowny
perennial plants	byliny, rośliny wieloletnie
permeable	przepuszczalny
pest	szkodnik
pest control	ochrona przed szkodnikami i ich zwalczanie
petiole	ogonek liściowy
pheasant	bażant
phloem	łyko
phosphorus	fosfor
piglet	prosiak, warchlak
pile	pal
pine	sosna
pine beauty	strzygonia choinówka
pine lappet moth	barczatka sosnówka
pine looper moth	poproch cetyniak

pine sawfly	borecznik sosnowiec
pine twisting rust	skrętak sosny spowodowany przez *Melampsora pinitorqua*
pith	rdzeń
plank	deska
plant	sadzić, roślina
planting stock	materiał sadzeniowy
plot	poletko
plough	pług, orać
plug	sadzonka z zakrytą bryłą korzeniową, sadzonka z bryłką
plywood	sklejka
poaching	kłusownictwo
pod/legume	strąk
pole	tyczka, słup, pal
Polish larch	modrzew polski (*Larix polonica*)
pollen	pyłek
pollination	zapylenie
pollinator	owad biorący udział w zapylaniu
pond skater, water strider	nartnik
poplar	topola
post	słupek, słup
potassium	potas
powdery mildew of oak	mączniak prawdziwy dębu spowodowany przez *Microsphaera alphitoides*
precipitation	opady
predatory	drapieżny
prey	ofiara
primary root	korzeń główny
propagate	rozmnażać
propagation	rozmnażanie
protozoan *l.mn.* protozoa, protozoans	pierwotniak
provenance	pochodzenie
prune	cięcie drzew, przycinanie
pup	wilczę, wilczątko, szczenię wilka
pupa *l.mn.* pupae	poczwarka
pupal chamber	kolebka poczwarkowa
pupation	przepoczwarczenie się

Q

quarry	kamieniołom

R

rabbit	królik
rabid	wściekły
rabies	wścieklizna
radicle	korzonek
railway sleepers	podkłady kolejowe
raised stand/hide, high seat	ambona myśliwska
ramsons, broad-leaved garlic, bear's garlic	czosnek niedźwiedzi
raspberry	malina
raven	kruk
rayon	sztuczny jedwab
reaction wood	drewno reakcyjne
red belt	przebarwianie liści na czerwono na skutek wysokich temperatur
red deer	jeleń szlachetny
reforestation	odnowienie
Regional Directorate of the State Forests	Regionalna Dyrekcja Lasów Państwowych
reindeer	renifer
removal cutting	cięcie uprzątające
renewal	odnowienie
repellent	repelent, środek odstraszający
reproduce	rozmnażać się
reptile	gad
resident birds	ptaki osiadłe
resilient	odporny
resin	żywica
resin pitch	pęcherz żywiczny
rime	szadź
ring shake	pęknięcie okrężne pełne
ripen	dojrzewać
roadside landing	składnica
robin	rudzik
rodent	gryzoń
rodenticides	środki przeciw gryzoniom
roe deer	sarna
root cap	czapeczka
root crops	rośliny korzeniowe
root hair	włośnik
root rot	zgnilizna korzeni
root sprout, root sucker	odrośl korzeniowa
root system	system korzeniowy
rootstock, stock	podkładka
rose hip	owoc róży

rot	mursz, zgnilizna
roundwood	drewno okrągłe
rowan	jarzębina pospolita (*Sorbus aucuparia*)

S

sanitation cutting	cięcie sanitarne
sapling	młode drzewko
sapwood	biel
satan's mushroom	borowik szatański
saw	piła
saw, sawed, sawn	piłować
sawdust	drobne trociny
sawmill	tartak
sawnwood	tarcica
scale	łuska, np. szyszki
scaly tail	ogon pokryty łuską
scarification	skaryfikacja
scavenger	padlinożerca
scion	zraz
Scot/Scots pine	sosna pospolita/zwyczajna (*Pinus sylvestris*)
scurvy	szkorbut
sea buckthorn	rokitnik
seasoning	sezonowanie drewna
secondary pest	szkodnik wtórny
secondary root	korzeń boczny
seed coat	łupina nasienna
seed dispersal	obsiew nasion, rozsiew nasion
seed lot	partia nasion
seed orchard	plantacja nasienna
seed setting	zawiązywanie nasion
seed stand	drzewostan nasienny
seed trees	drzewa nasienne
seed year	rok nasienny
seedbed	rabata, rozsadnik, teren pod siew
seedling	siewka, sadzonka
seedling lifting	wyjmowanie sadzonek
selection system	rębnia przerębowa
sexual reproduction	rozmnażanie generatywne, płciowe
shadebearing	cienioznośny
shake	pęknięcie
sharp tusks	kły, ciosy, szable (u dzika)
shavings	wióry
shelterwood system	rębnia częściowa
shoot	pęd
silver fir	jodła pospolita (*Abies alba*)

simple heart shake	pęknięcie rdzeniowe proste
single-species	jednogatunkowy
single-species stand	drzewostan jednogatunkowy, lity, monokultura
single-storey stand	drzewostan jednopiętrowy
skid track	szlak zrywkowy
skidding	zrywka półpodwieszona
skylark	skowronek
sleet	deszcz ze śniegiem
slippery Jack	maślak
slowworm	padalec
small-flowered cranesbill	bodziszek drobny
small pole stand/stage	tyczkowina
small/little leaf linden/lime	lipa drobnolistna (*Tilia cordata*)
small-seeded	lekkonasienny
smooth snake	gniewosz plamisty
snare	wnyki
snowdrop anemone	zawilec leśny/wielkokwiatowy
softwoods	iglaste
soil	gleba
southern/red wood ant	mrówka rudnica (*Formica rufa*)
sow, sowed, sown	siać
sparrow	wróbel
species	gatunek
species composition	skład gatunkowy
split	pęknięcie
sprout	odrośl
spruce	świerk
squared timber	krawędziaki (listwy o kwadratowym przekroju)
squirrel	wiewiórka
stamen	pręcik
stem	pęd, łodyga, trzonek (nóżka) grzyba
stigma	znamię
stand	drzewostan
stand density	zwarcie
stand tending	pielęgnowanie drzewostanu
star heart shake	pęknięcie gwiaździste
starling	szpak
stem	pęd, łodyga, trzonek (nóżka) grzyba
stem cutting	zrzez
stocking	zadrzewienie
storing in pits	dołowanie nasion
stork	bocian
stratification	podział lasu na warstwy/piętra, stratyfikacja
stump extraction	karczowanie pni

stump sprout	odrośl pniakowa
stump	pniak
style	szyjka słupka
subsoil	podglebie
sucker	odrost
sulphur dioxide	dwutlenek siarki
sunscald	zgorzel słoneczna, oparzenia słoneczne
suppressed tree	drzewo przygłuszone
sustainable development	rozwój zrównoważony
sustainable forest	las prowadzony zgodnie ze zrównoważoną gospodarką leśną
sustainable (yield) forestry	zrównoważone leśnictwo
sustainable forest management	zrównoważona gospodarka leśna
sustained yield	trwałość użytkowania, produkcji
swallow	jaskółka
sycamore, sycamore maple	klon jawor (*Acer pseudoplatanus*)
Syrphidae	bzygowate

T

Tachinidae	rączycowate
tadpole	kijanka
tapered stem, tapered timber	zbieżystość
taproot	korzeń palowy
temperate forests	lasy strefy umiarkowanej
tension wood	drewno napięciowe, reakcyjne, ciągliwe (u gatunków liściastych)
thinning	przerzedzanie, przerywanie, trzebież
thoracic	piersiowy
thresh	młócić
tick	kleszcz
till	uprawiać
tillage	uprawa gleby
timber	surowiec drzewny
tissue	tkanka
tissue culture, micropropagation	kultury tkankowe, rozmnażanie in vitro
tit	sikorka
toad	ropucha
topping	ogławianie
topsoil	górna warstwa gleby
training	formowanie koron
trait	cecha
trample	deptać
transplant	przesadka, sadzonka szkółkowana
transplanting	przesadzanie
trap	pułapka

treat	zaprawiać nasiona
tree sap	sok drzewa
tree uprooting	wyrywanie drzew z korzeniami, karczowanie drzew
Trichogramma	kruszynek
true flies	muchówki
trunk	pień
tufted ears	uszy z pędzelkami
tulip tree	tulipanowiec amerykański (*Liriodendron tulipifera*)
tumble	suszyć w suszarce bębnowej
twig	gałązka

U

undercut	podcinać
uneven-aged stand	drzewostan wielo-/różnowiekowy
uproot	wyrwać z korzeniami
uptake	pobieranie

V

vaccination	szczepionka
vector	nosiciel, przenosiciel choroby, wektor
vegetative reproduction	rozmnażanie wegetatywne
vein	żyłka
veneer	fornir
venison	dziczyzna
venom	jad, trucizna
venomous	jadowity
vertical crown closure	zwarcie pionowe
viability	żywotność
viable	żywotny
viral	wirusowy

W

walnut	orzech włoski (*Juglans regia*)
warp	paczyć się
wasteland	nieużytki
water content	zawartość wody
water resouces	zasoby wodne
water soluble	rozpuszczalne w wodzie
waterfowl	ptactwo wodne
watershed	zlewnia
weed	chwast
whisker	wąs kota
white poplar	topola biała (*Populus alba*)

white willow	wierzba biała (*Salix alba*)
wild boar	dzik
wild strawberry	poziomka pospolita (*Fragaria vesca*)
wildlife	fauna i flora
willow	wierzba
windbreak	pas drzew sadzony jako osłona od wiatru
windbreaker tree	drzewo sadzone w celu osłony od wiatru
wind-pollinated	wiatropylny
windsnap	wiatrołom
windthrow	wiatrował
winnow	wialnia
wolf	wilk
wolf tree	rozpieracz
wood	drewno, las
wood avens, herb Bennet	kuklik pospolity
wood discoloration	przebarwienie drewna
wood sorrel	szczawik zajęczy (*Oxalis acetosella*)
wood wool	wełna drzewna
woodland	teren leśny
woodpecker	dzięcioł

Y

yeast	drożdże
yellow-bellied toad	kumak górski
yew	cis
yield	plon

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