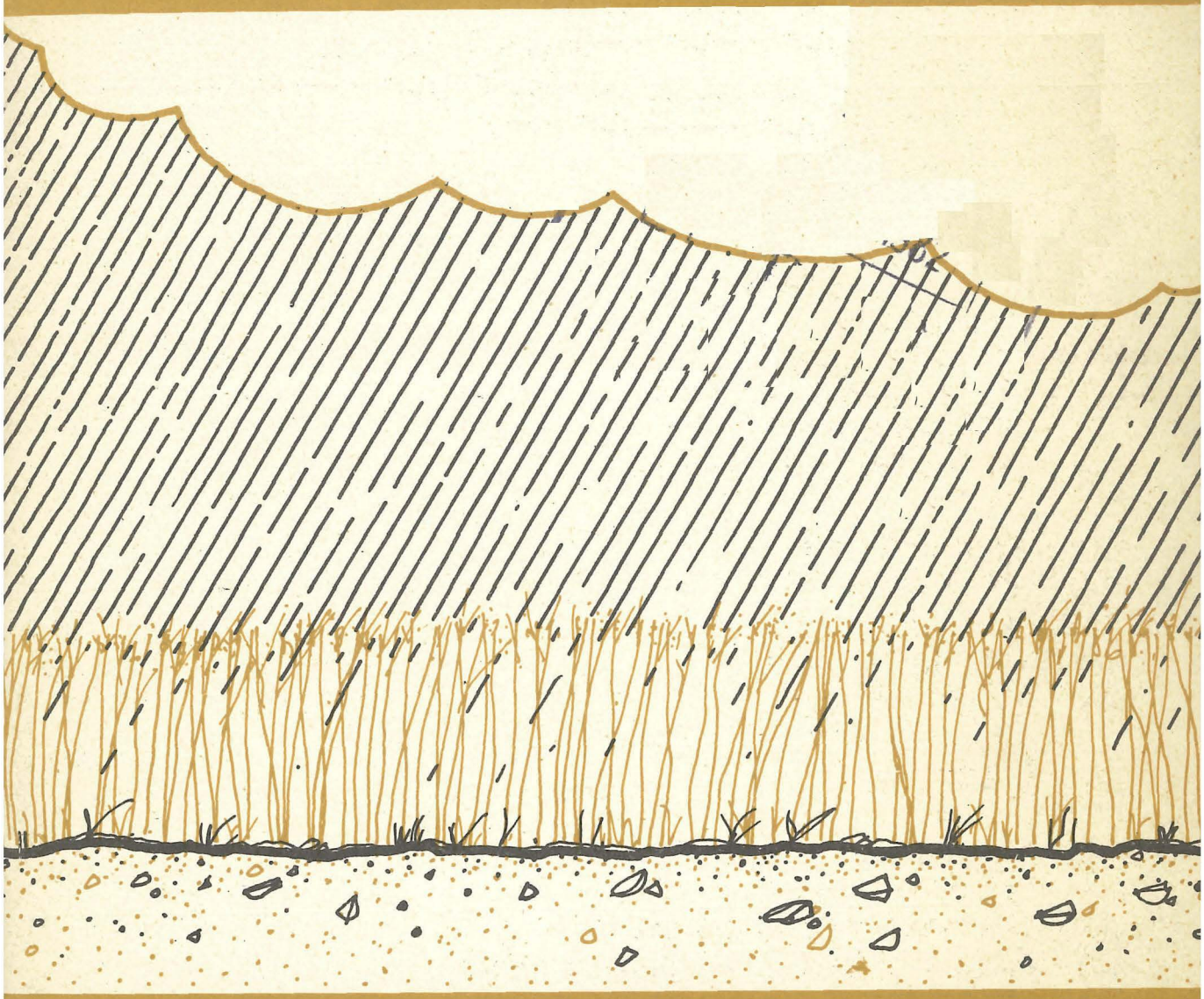
better farming series 28

1981 edition

water

where water comes from



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

FAO BETTER FARMING SERIES

Twenty-eight titles have been published in this series, designed as handbooks for agricultural education and training. They may be purchased as a set or individually.

FIRST YEAR

1. The plant: the living plant; the root
2. The plant: the stem; the buds; the leaves
3. The plant: the flower
4. The soil: how the soil is made up
5. The soil: how to conserve the soil
6. The soil: how to improve the soil
7. Crop farming
8. Animal husbandry: feeding and care of animals
9. Animal husbandry: animal diseases; how animals reproduce

SECOND YEAR

10. The farm business survey
11. Cattle breeding
12. Sheep and goat breeding
13. Keeping chickens
14. Farming with animal power
15. Cereals
16. Roots and tubers
17. Groundnuts
18. Bananas
19. Market gardening
20. Upland rice
21. Wet paddy or swamp rice
22. Cocoa
23. Coffee
24. The oil palm
25. The rubber tree
26. The modern farm business
27. Freshwater fish farming: how to begin
28. Water: where water comes from

Water

Where water comes from

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PREFACE

The FAO Better Farming Series is essentially based on the **Cours d'apprentissage agricole** prepared in the Ivory Coast by the **Institut africain de développement économique et social** for use by extension workers in contact with illiterate or semi-literate farmers. The approach is deliberately a general one, the intention being to constitute basic prototype outlines, to be supplemented in each area according to local conditions of agriculture.

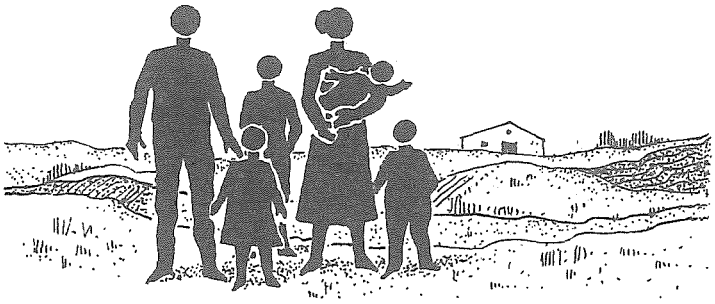
Many of the booklets deal with specific crops, while others, such as this one, are intended to give the farmer information concerning the general agricultural context, and thus to allow him to gain some understanding of **why** he does what he does, so that he will be able to do it better.

Adaptations of the series, or of individual volumes in it, have been published, among others, in Amharic, Arabic, Bengali, Creole, Hindi, Igala, Indonesian, Kiswahili, Malagasy, SiSwati and Turkish. This impressive list is some indication of the success, and also of the value, of the series. This volume is based on FAO Training Series No. 4/1, **Water for Freshwater Fish Culture,** prepared by the Inland Water Resources and Aquaculture Service, Fisheries Department, FAO.

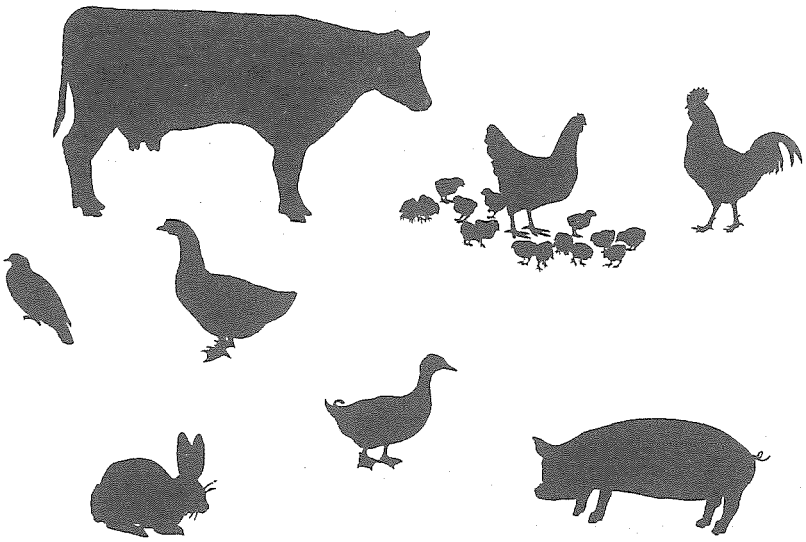
OUTLINE OF THE COURSE

WHY WE STUDY WATER

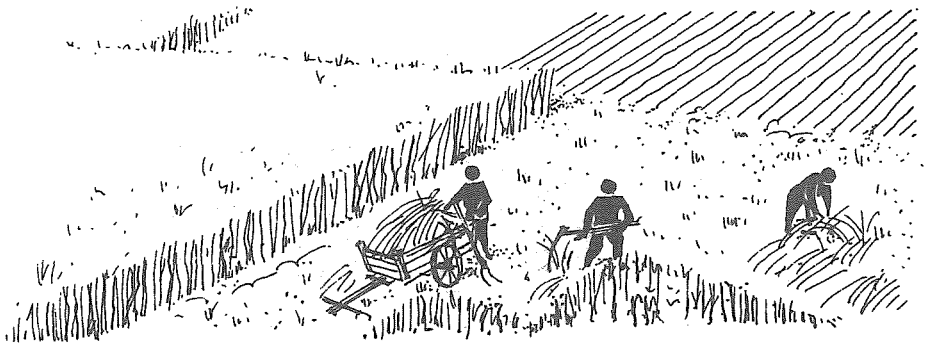
1. Water is necessary for life.
   We need water
   for ourselves and our families
   to drink and to wash in,



to give to our animals to drink



and to make our crops grow.

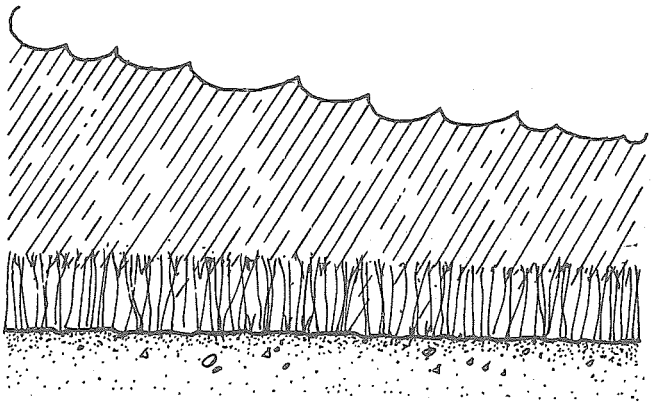


2. We should know about water
so that we can use water better.

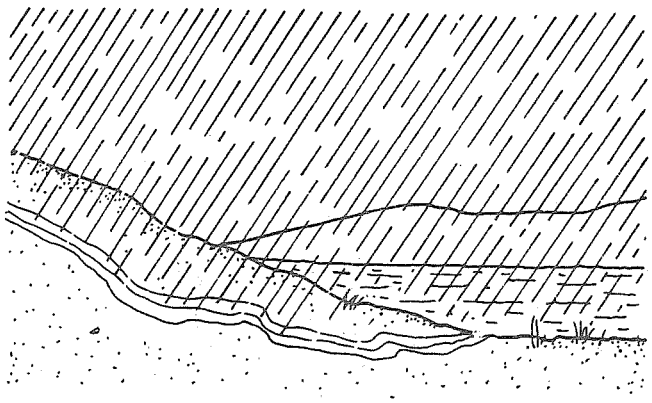
3. This is very important
if we do not have much water
for long periods of the year.

Rainfall

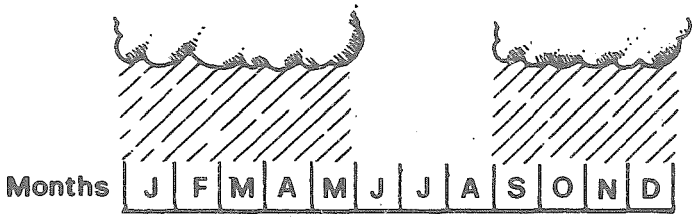
4. The water we use for ourselves,
for our animals and for our crops
comes from the rain
which falls from the clouds.



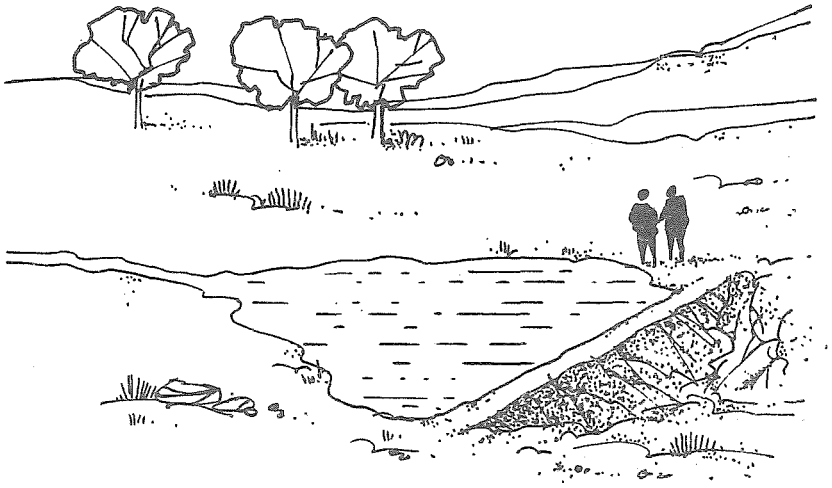
5. Even the water
in swamps, lakes and streams
comes first from the rain.
For us, rainfall is very important.



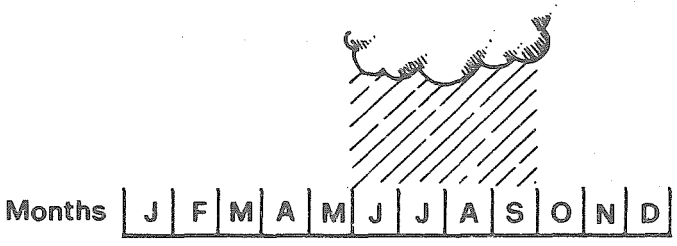
6. In some places it rains very much
but only during one
or two seasons of the year.
During the seasons
when it does not rain,
we may not have enough water.



7. We must learn how to store water
when it rains
so that we can have water
when it does not rain.

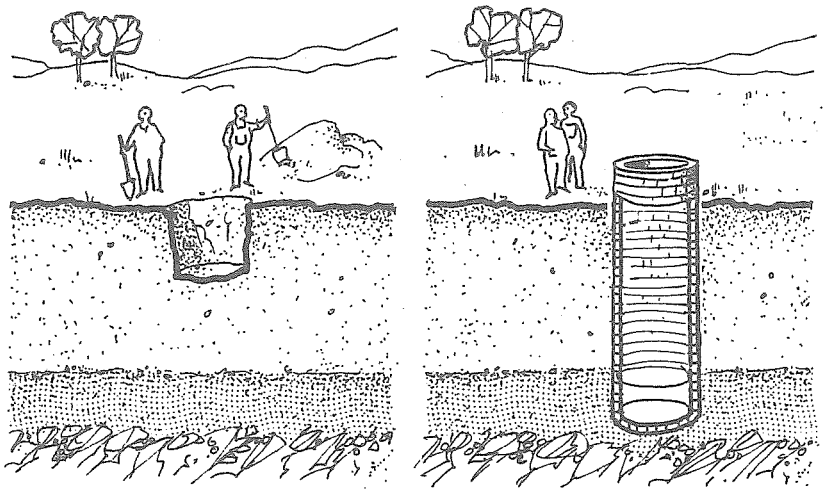


8. In some places it rains very little
and only at one season of the year.



In other places,
hardly any rain falls at all.

9. In these places,
we have too little water
and we must learn
to find water in the ground
or to store water
when it does rain
to use later.



10. To help us know more
about the water we use,
let us see:

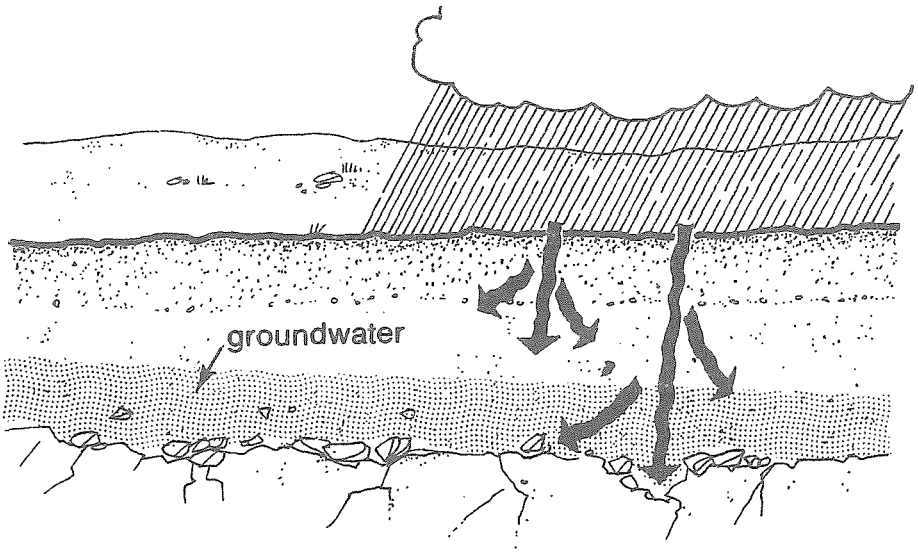
- what happens to the water
that falls as rain;
- where water goes after it rains;
- where water can be found
when it does not rain.

Water in the ground

11. When it rains,
some of the water goes into the ground.

12. This water may stay near the surface
or it may go very deep into the ground.

13. The water that goes very deep
is called **groundwater.**

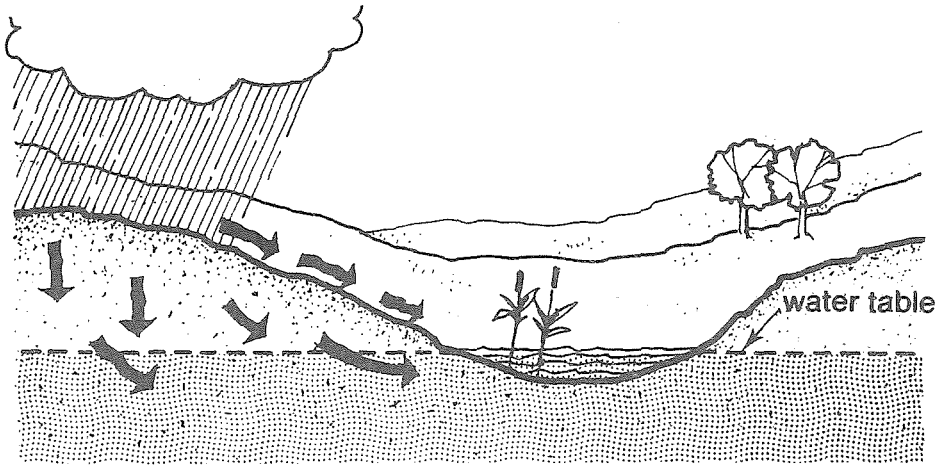


The water table

14. The level at which groundwater is found is called the **water table.**

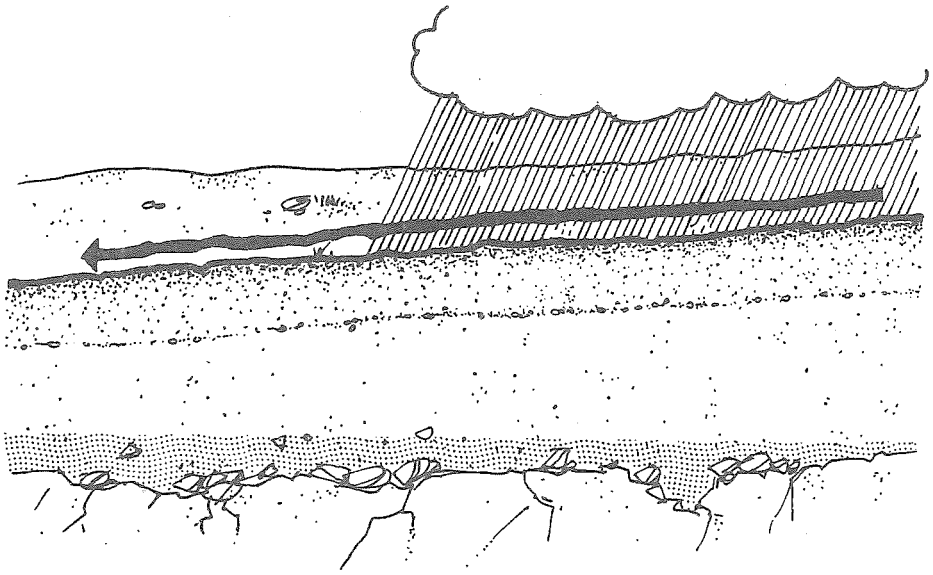
15. If there is little groundwater, the water table becomes lower. If there is very much groundwater, the water table becomes higher.

16. If the water table becomes so high that it lies above the surface of the ground, it forms swamps, lakes and streams.

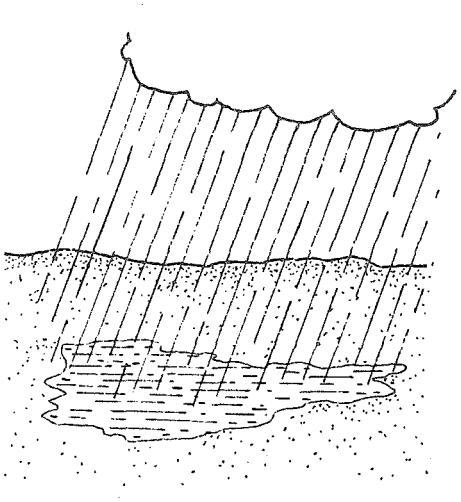


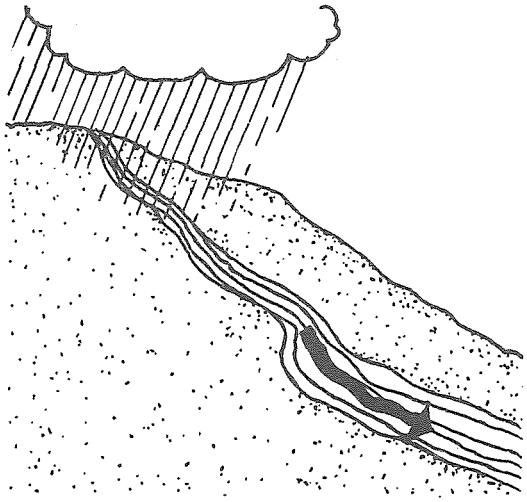
Water on the surface

17. When it rains,
all of the water
may not go into the ground.
Some of it
may stay on the surface.



18. Water which stays on the surface
will either lie in one place,
if the land is flat,
or it will run along the surface,
if the land is hilly.

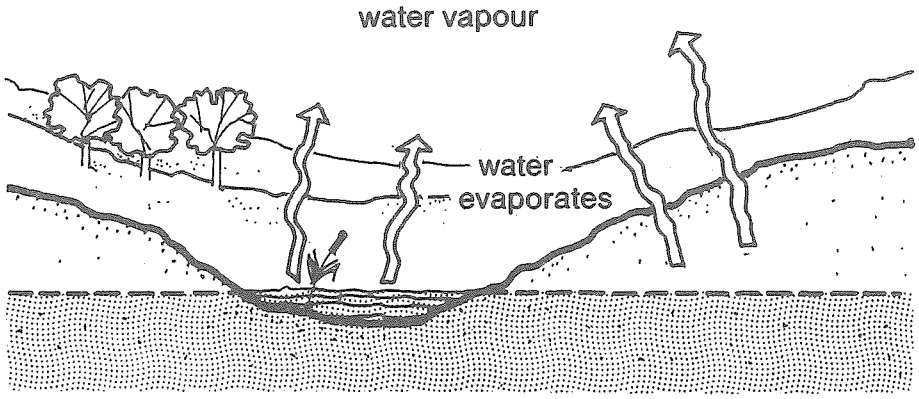




19. The water that lies on the surface
is called **surface water.**
The water that runs along the surface
is called **run-off** water.

Evaporation

20. At certain times water **evaporates**
from the surface of the soil
or from swamps, lakes or streams.
It becomes water vapour.

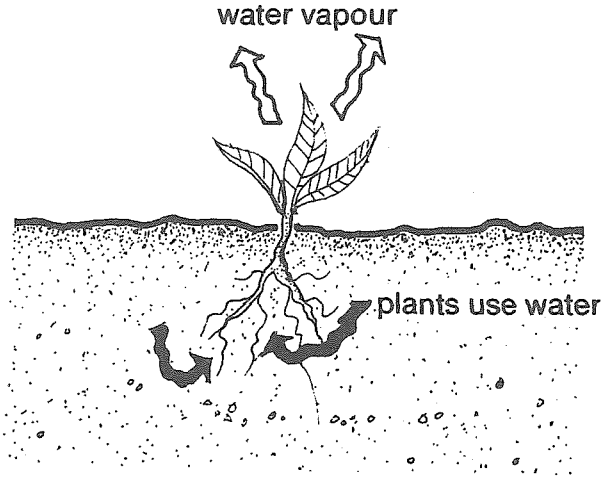


21. We cannot see water vapour.
We cannot use it.
Water vapour rises into the air
to form new clouds.

Transpiration

22. Water vapour
is also given off by plants.

23. Plants use the water in the ground
to live and grow,
and as they live they breathe
and give off water vapour
from stems and leaves.



24. This is called **transpiration.**

25. Like vapour given off by evaporation,
the water vapour from plants
rises into the air to form new clouds.

The process begins again

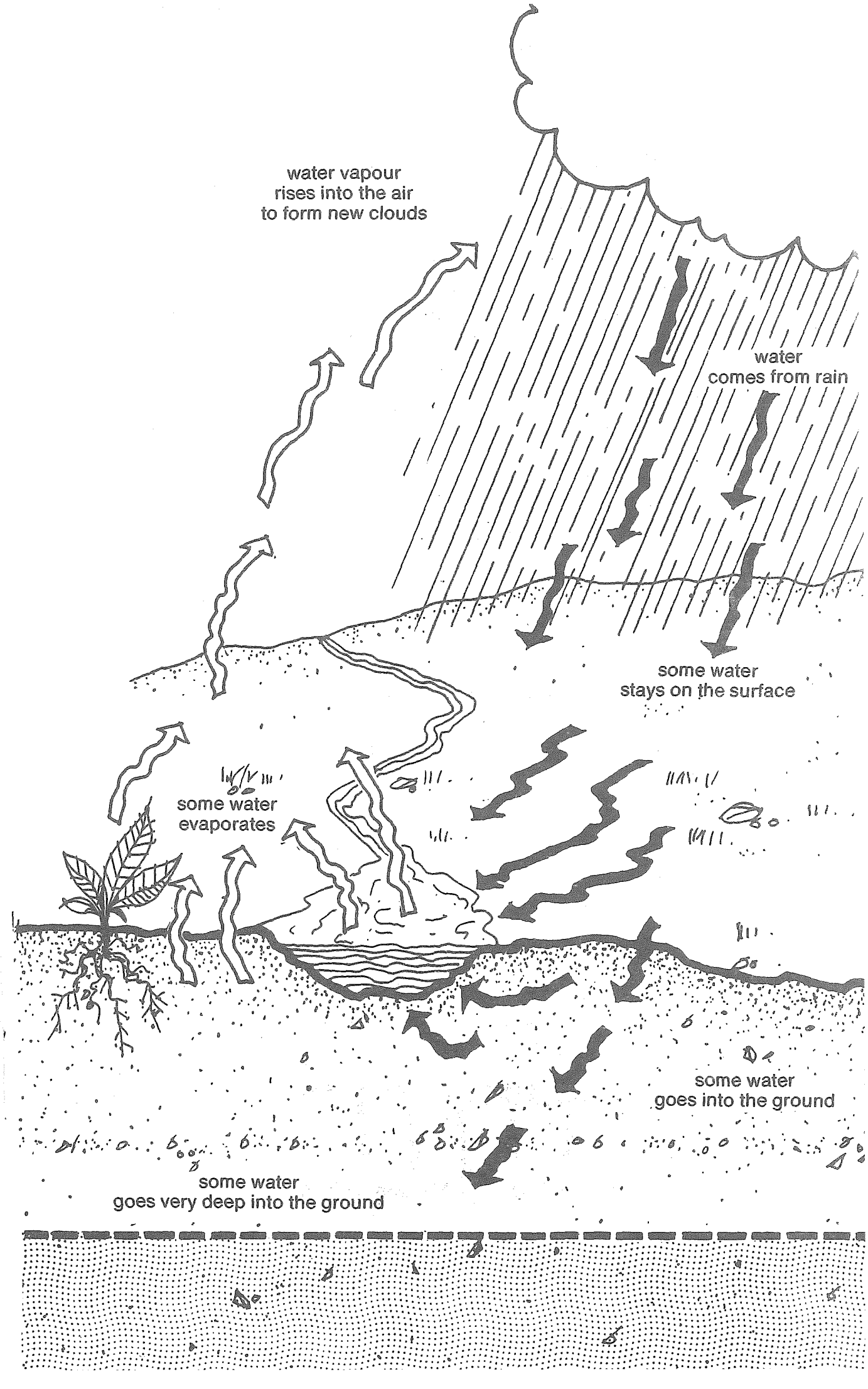
26. The water we use comes from rain
which falls from the clouds.

27. Some of the water stays on the surface.
Some of the water goes into the ground
and some of the water that goes into the ground
may go very deep.

28. Some of the water evaporates
from the surface of the soil
or from swamps, lakes and streams
and some of it is transpired by plants.
It becomes water vapour.

29. The water vapour
rises into the air to form new clouds.

30. The clouds give up the water vapour as rain
and **the process begins again.**


water vapour
rises into the air
to form new clouds
water
comes from rain
some water
stays on the surface
some water
evaporates
some water
goes into the ground
some water
goes very deep into the ground

WHEN RAIN FALLS

31. When it rains,
some of the water sinks into the soil
and some of the water stays on the surface
or runs along the surface.

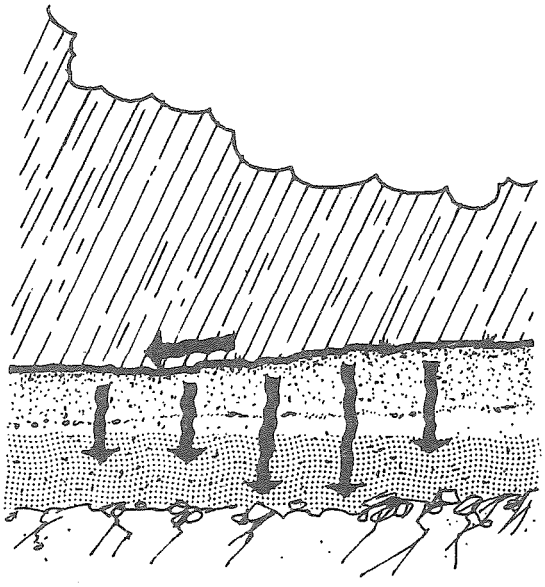
32. How much water sinks into the soil
and how much water stays on the surface
depends on several things.
It depends on:

- how much rain falls;
- the kind of soil
where the rain falls;
- the slope of the land
where it falls;
- how many plants there are
and what kind of plants they are
where the rain falls.

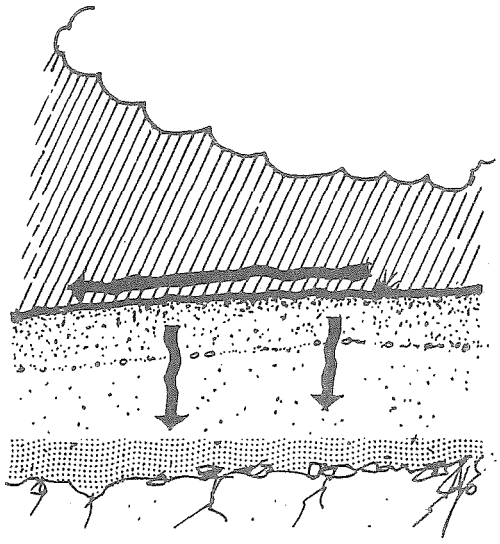
How much rain falls

33. Whether rain goes into the ground
or stays on the surface
depends on how much rain falls
and for how long it falls.

34. If a little rain falls for a long time,
more water is likely to go into the ground.



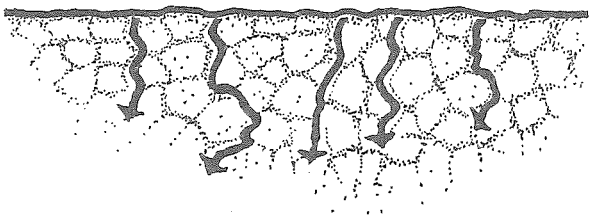
35. If much rain falls for a short time,
less water is likely to go into the ground
and more will stay on the surface.



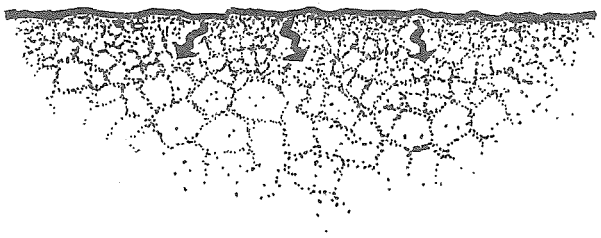
Kind of soil

36. Whether water goes into the ground
or stays on the surface
depends on the kind of soil
where the rain falls.

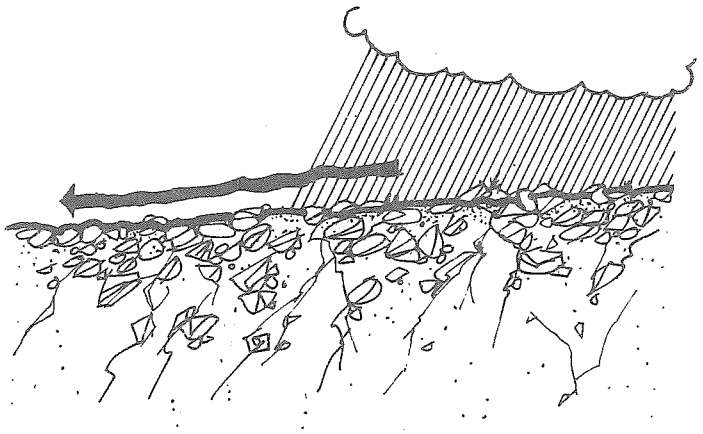
37. In some kinds of soil,
very much water sinks in.



In other kinds of soil
only a little water sinks in.



38. In some kinds of soil
which have a rocky surface,
no water at all may sink in.



39. If the structure of the soil is good,
water sinks in well.
Soil with a good structure
can hold more water.

40. The structure of the soil is good
when it is made up of sand, clay and silt
which are joined together
by a mixture of clay and humus.

41. If the structure of the soil is poor,
water does not sink in well.
Soil with a poor structure
holds less water.

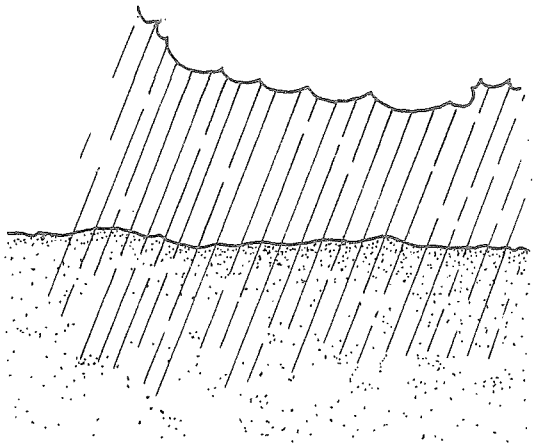
42. The structure of the soil is poor
when there is no humus
and the sand, clay and silt
are not joined together.

43. To understand better
about good and poor soil structure,
see Booklet No. 4, pages 24 and 25.

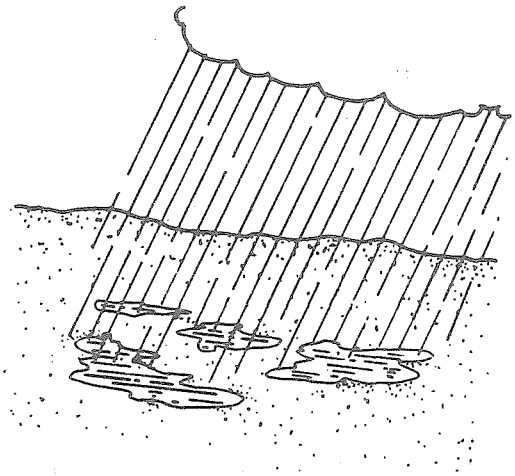
Slope of the land

44. Whether water goes into the ground
or stays on the surface
also depends on the slope of the land
where the rain falls.

45. If the land is flat,
rainwater is more likely
to sink into the ground.



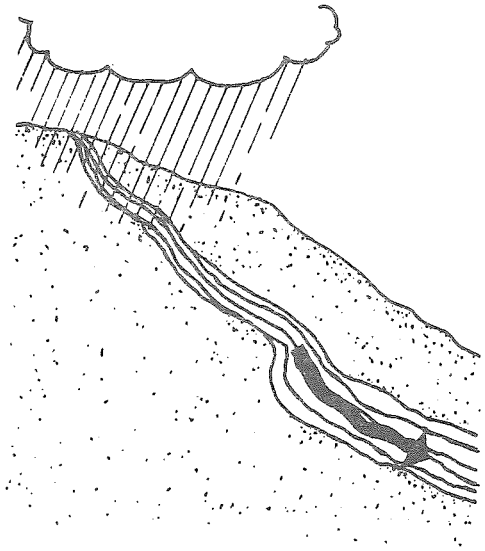
46. If the land is flat
and the soil structure is good,
all of the rainwater
will go into the ground
until the soil becomes so full of water
that it cannot hold more.



47. If the land is flat
and the soil structure is poor,
water remains in pools
on the surface.

After a while,
part of the water in the pools
may sink slowly into the ground
and the rest evaporates.

48. If the land is hilly,
water will run off more quickly
and very little
may sink into the ground.



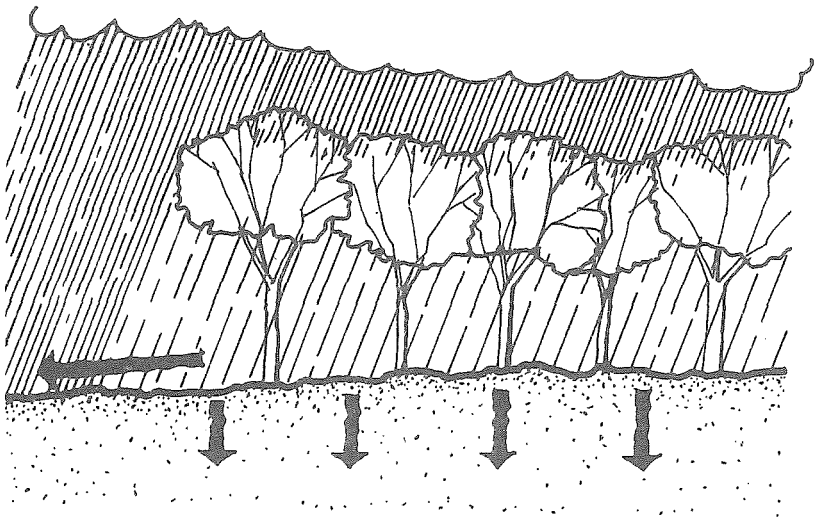
49. Hilly land with poor soil structure
holds very little water.
Hilly land with good soil structure
holds more water.
Land that is very hilly
holds less water
than land that is not very hilly.

Plants

50. Whether water goes into the ground
or stays on the surface
depends on the number,
size and kind of plants
that are growing there.

51. When rainfall is heavy
and very much water falls
in a short time,
there may be too much water
for the ground to hold
and much of the water
will stay on the surface.

52. When there are plants present,
their limbs, branches and leaves
help to slow the water as it falls.



53. Small plants with few leaves
will slow rainfall less
and more water
will stay on the surface.

54. Large plants with many leaves
will slow rainfall more
and less water
will stay on the surface.
More water sinks into the ground.

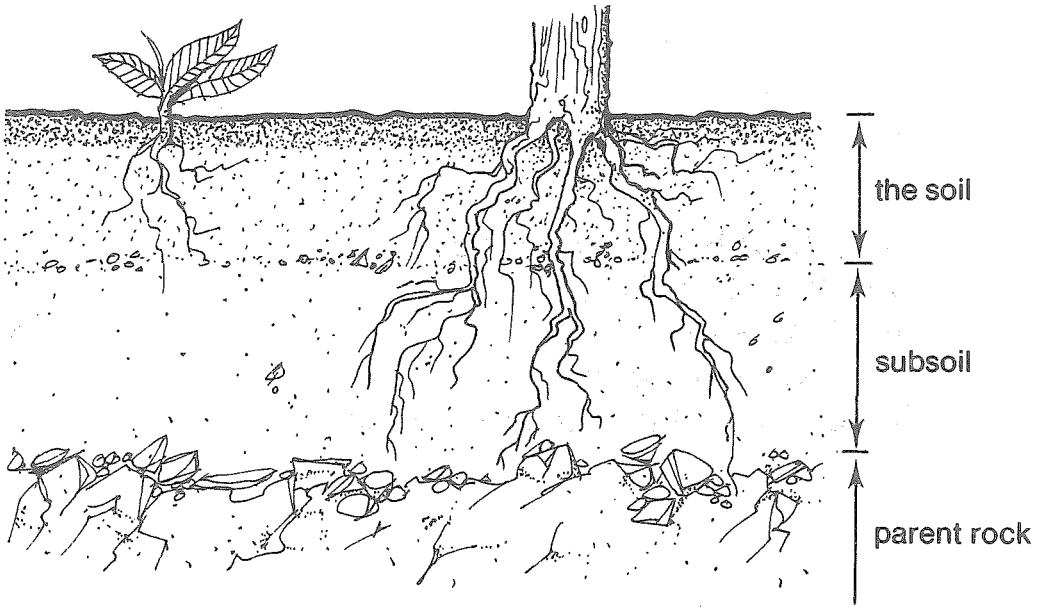
WATER IN THE GROUND

55. The ground is made up
of several different layers.
To know how water
goes into the ground,
let us first look
at these layers
(see Booklet No. 4, pages 6 to 10).

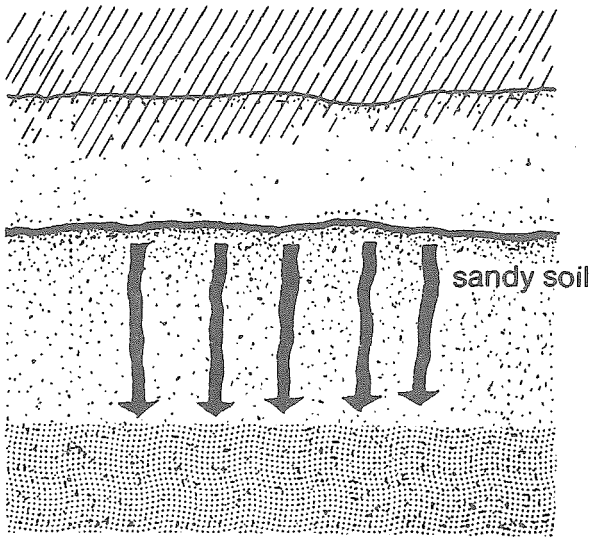
56. The top layer is **the soil.**
This layer may be very deep
or it may be quite shallow.
The roots of smaller plants
get their water here.

57. Below the soil is **the subsoil.**
The subsoil is much harder
than the soil.
The roots of larger plants and trees
get their water here.

58. Below the subsoil
we find stone or rock.
This is called **parent rock.**

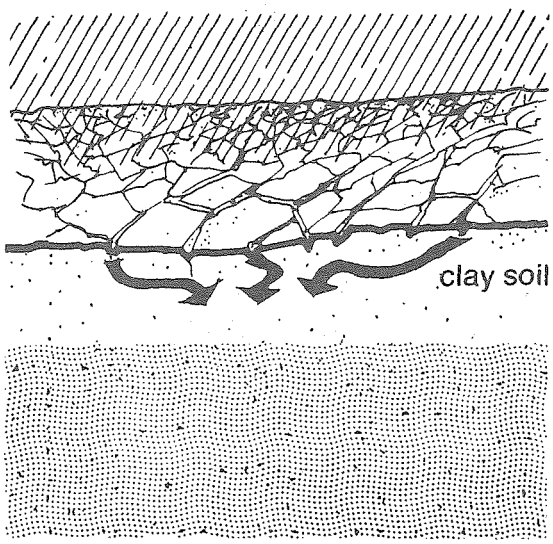


59. If the soil
has very much sand in it,
water sinks in
quickly and easily.



60. Little water stays
on the surface of sandy soils.
Because sand has poor texture
sandy soils hold little water.

61. If the soil
has very much clay in it,
water does not sink in
quickly or easily.

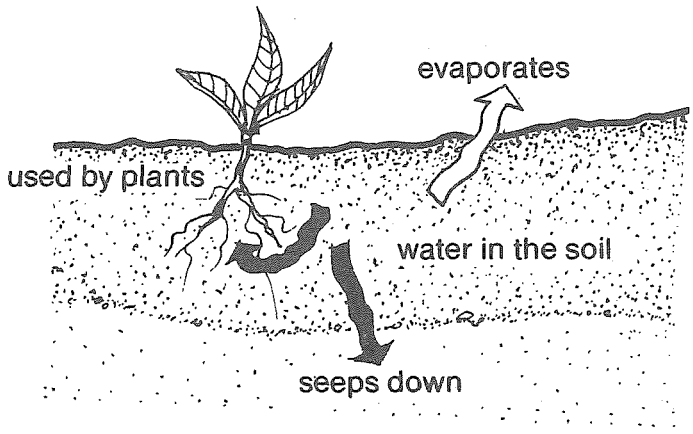


62. It takes a long time
for water to go into clay soils
and the more clay there is in the soil,
the longer it takes.
Because clay has good texture,
clay soils hold very much water.

63. Some of the water
that sinks into the ground
is held in the soil.

64. Part of this water
is used by plants
and part evaporates
from the soil at the surface.

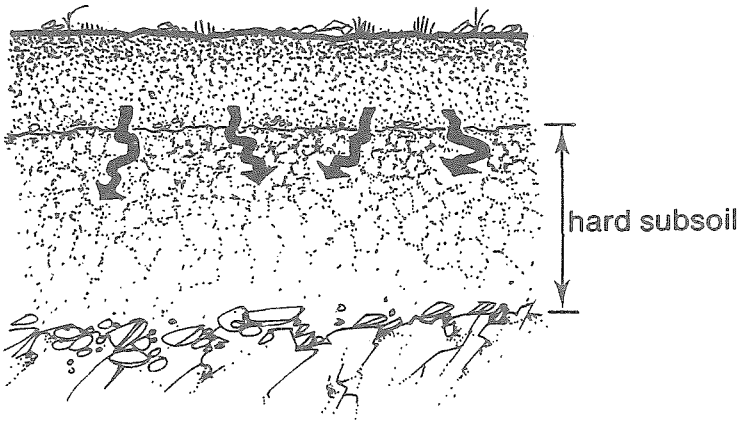
65. When water
is not held in the soil
and used by the plants
or evaporated from the surface,
it seeps down into the subsoil.



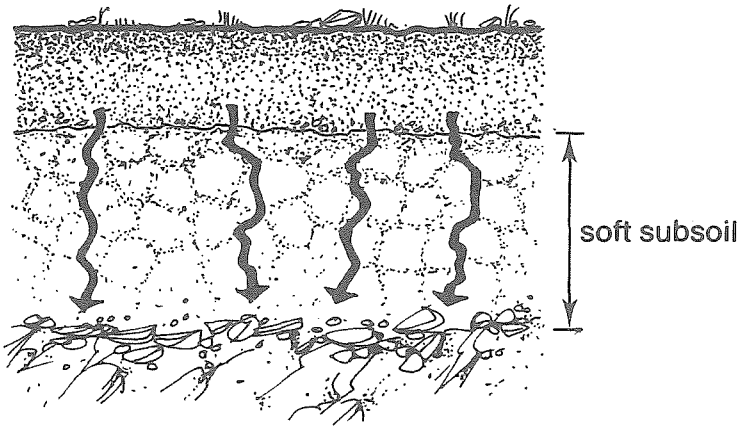
Water and the subsoil

66. How fast and how deep
water goes into the subsoil
depends on the structure of the subsoil.

67. Sometimes the subsoil is very hard
and holds little water.

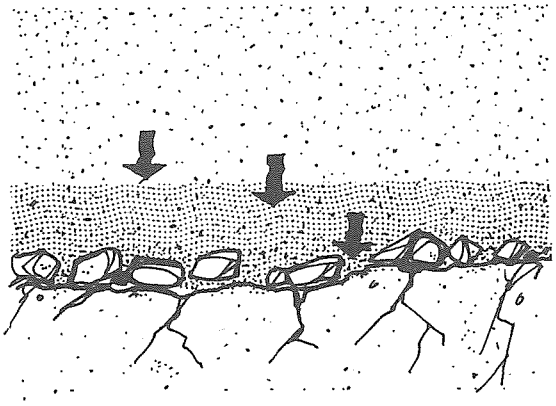


68. Sometimes the subsoil is soft
and has a structure
that holds water well.



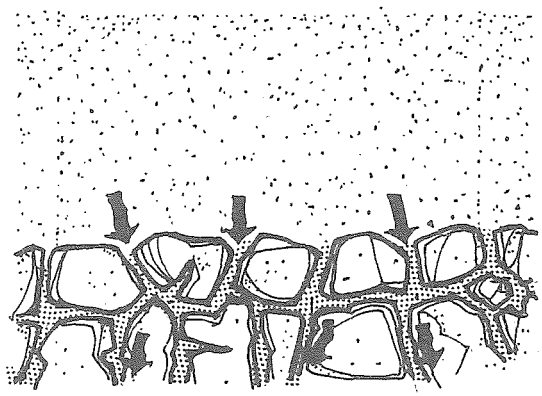
Water and parent rock

69. If the parent rock
that lies below the subsoil
is solid and unbroken,
water stays on top of the rock.



70. If the rock layer
is not too far below the surface,
it is not hard to reach this water.

71. If the parent rock
that lies below the subsoil is broken,
water can sink deep into the rock
and becomes hard to reach.

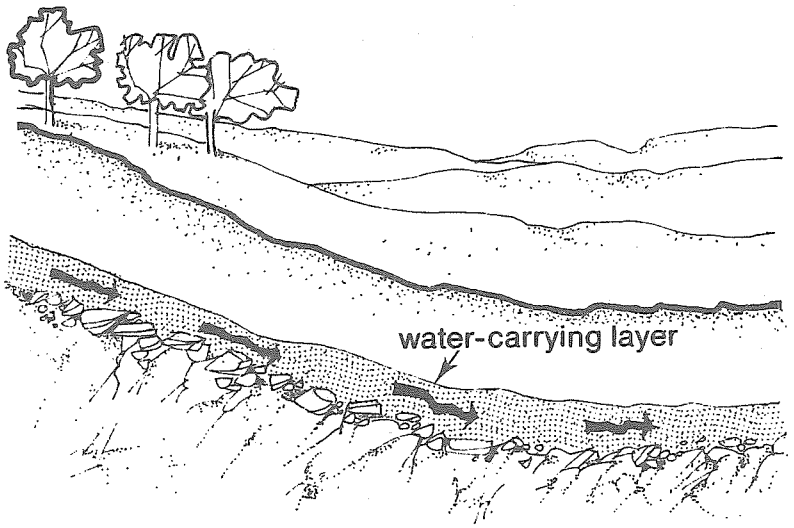


WHERE TO FIND WATER IN THE GROUND

72. We can find water in the ground

- in a water-carrying layer;
- at the level of the water table;
- on top of a solid rock layer;
- in a broken rock layer.

73. If there is a layer of sand,
pebbles or small stones in the ground,
sometimes water gathers there
and begins to run through the layer.



74. This is called a **water-carrying layer.**

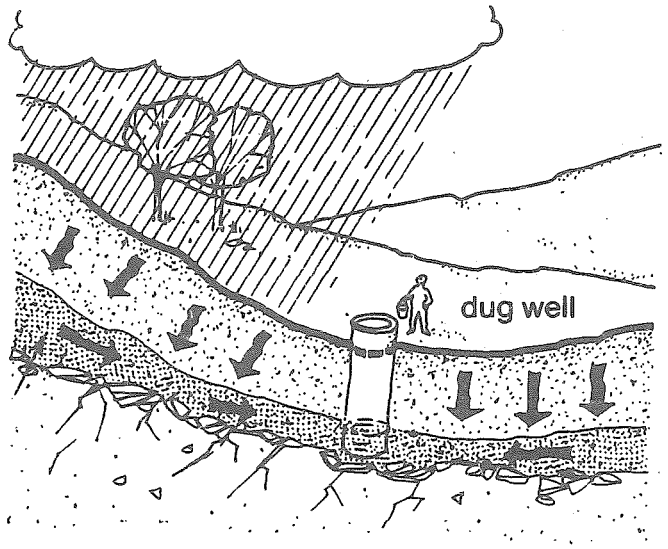
75. A water-carrying layer
may lie near the surface
or it may lie deep in the ground.

76. A water-carrying layer
may be very thin or very thick.

77. A water-carrying layer
may be very big
or very small.

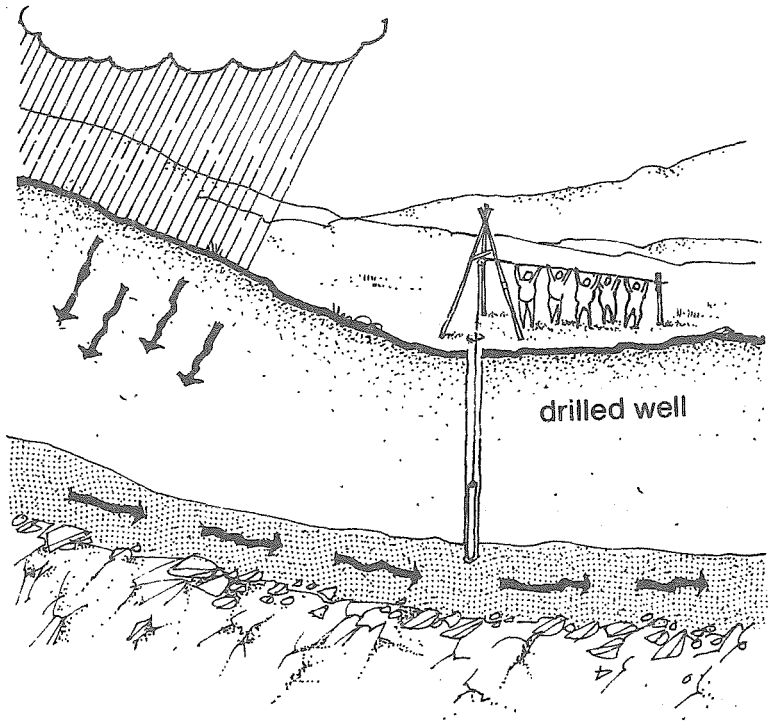
Wells

78. When the water table
is not too deep in the ground,
we may be able to dig a hole
down to the level of the water.



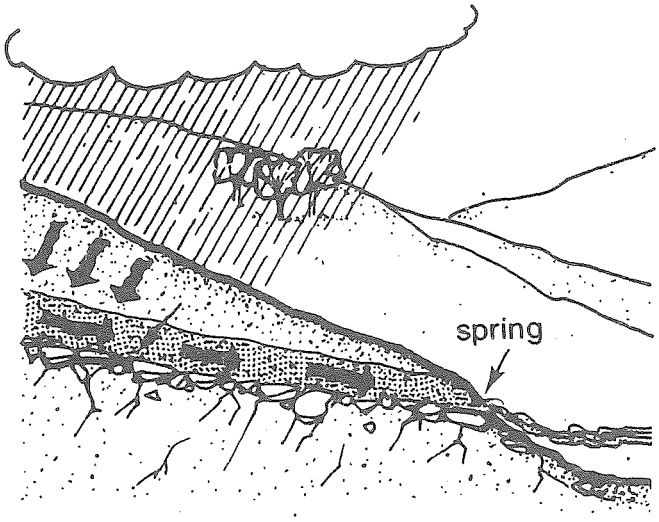
79. This is called a **well.**

80. If the water table
is very deep in the ground
or if the water sinks into broken rock,
we may be able to drill a deep well
down to the level of the water.



Springs

81. Sometimes a water-carrying layer
comes to the surface,
as in hilly land,
and water flows out of the ground.



82. This is called a **spring.**

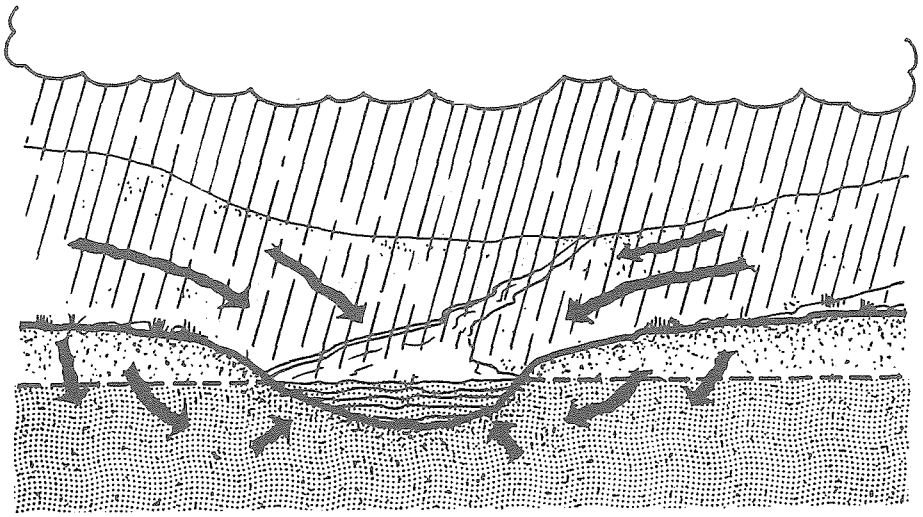
83. How much water
we can take from a spring
depends on how much
and how fast the water runs
through the water-carrying layer
and the slope of the layer.

84. During how much of the year
we can take water from a spring
depends on how much it has rained
and over how big an area
it has rained.

85. Some springs
give water all year long
and some springs give water
during only one or two seasons
of the year.

WATER ON THE SURFACE

86. Water on the surface
of the ground
comes from both groundwater
and from surface water run-off.

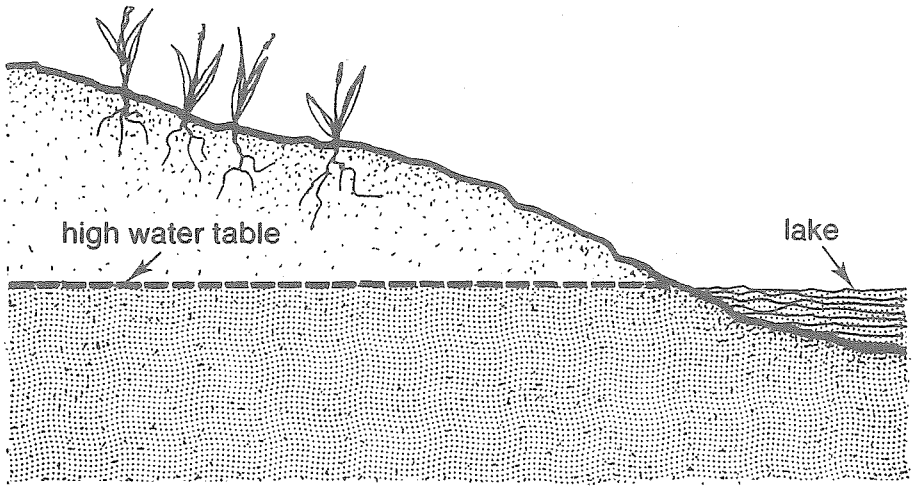


Groundwater can become surface water

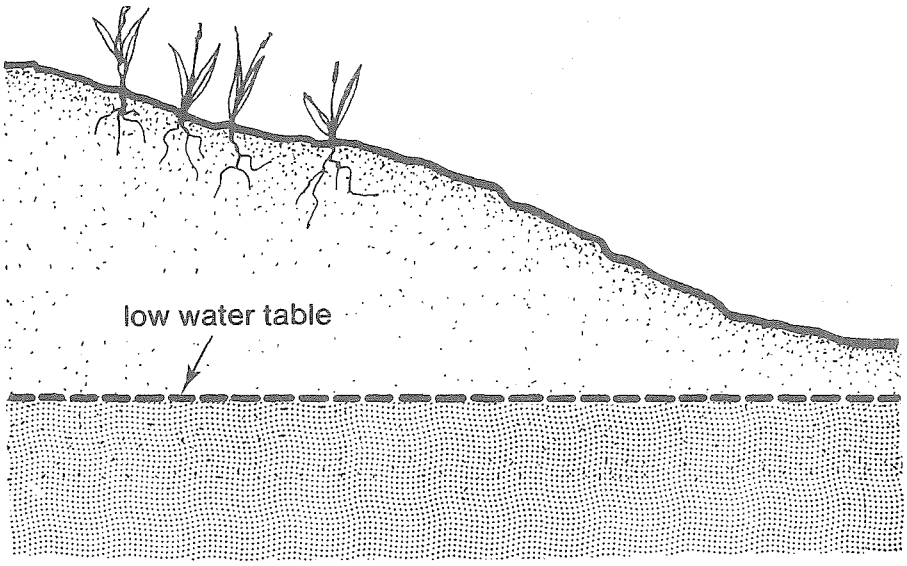
87. When it rains,
water sinks into the ground
and mixes
with the water already in the ground.

88. When there is more water
in the ground,
the water table becomes higher.

89. If the land is low
and the water table is high enough,
it may lie above the surface
of the ground.
Then there is more surface water.

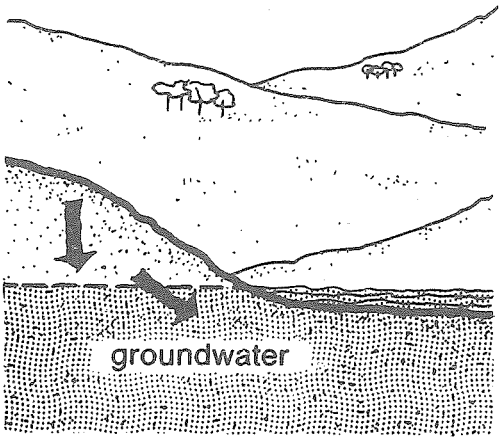


90. When it does not rain,
there is less water in the ground
and the water table becomes lower.



91. Then there will be less surface water.
This can be seen in dry times
in swamps, lakes and streams.

92. The effect of groundwater
on surface water
is hard to see
for it happens very slowly.

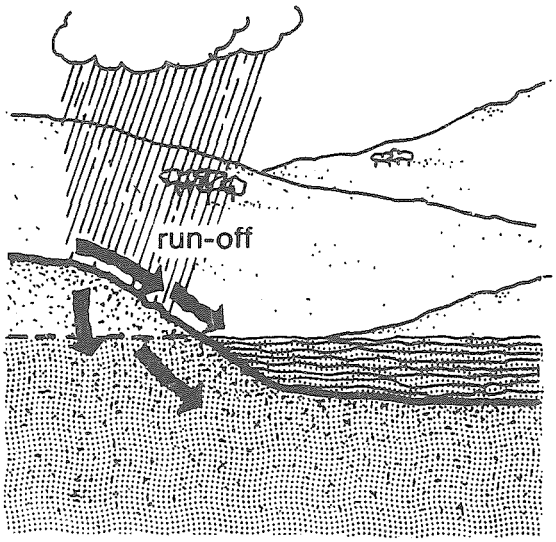


Surface water run-off

93. When it rains,
water which does not sink into the ground
runs over the surface into low land.

94. When there is very much rain,
more water runs over the surface
and low land quickly fills with water.
This can be seen during wet seasons
in swamps, lakes and streams.

95. The effect of run-off
on surface water
is easy to see
for it happens very quickly.



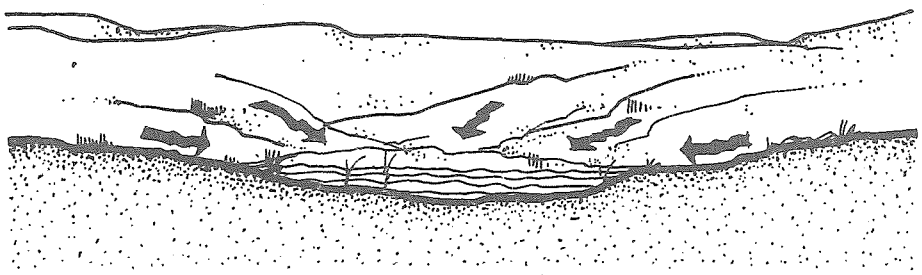
WHERE TO FIND SURFACE WATER

96. We can find surface water in

- swamps, ponds and lakes;
- streams and rivers.

Swamps, pond and lakes

97. When surface water
gathers in low land
and the water cannot flow away,
it forms swamps, ponds and lakes.

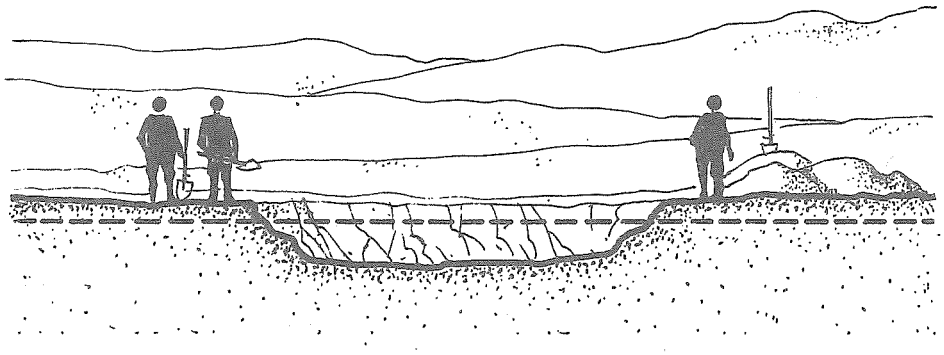


98. The level of water
in a swamp, pond or lake
may not stay the same all the time.

99. When there is little rain,
the level of water is lower.

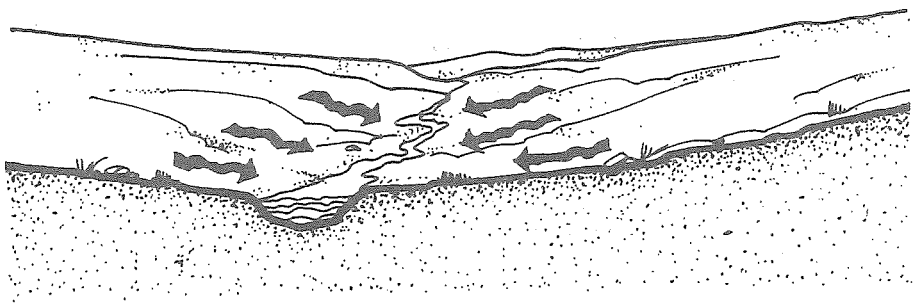
100. When there is much rain,
the level of water is higher.

101. If the water table
is very near the surface
in a place where water cannot flow away,
we can dig a pond
where we can go for our water.



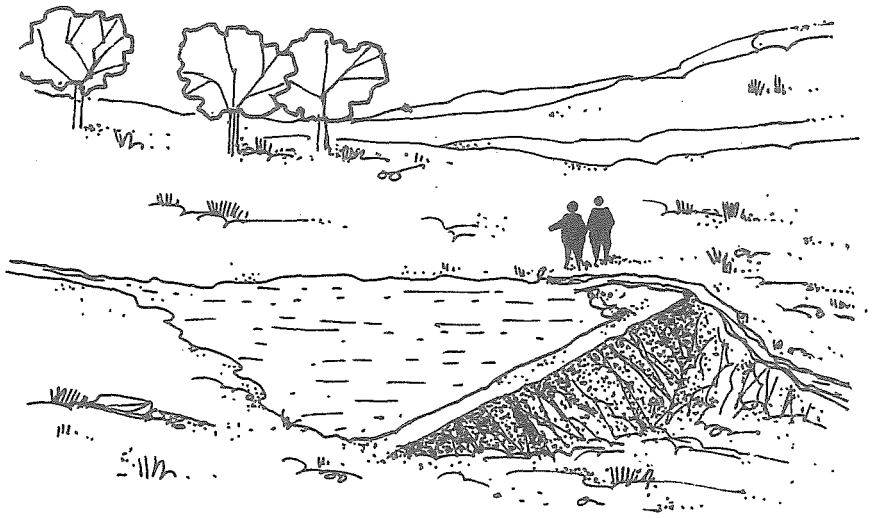
Streams and rivers

102. Streams and rivers
are sources of surface water
which has gathered in low land
where the water flows away.



103. Like swamps, ponds and lakes,
the level of water
in a stream or river
may not stay the same all the time
(see Items 109 and 110, this Booklet).

104. We can make a better water source
in a stream
by building an earth dam
to store water
so that we can use it later.



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