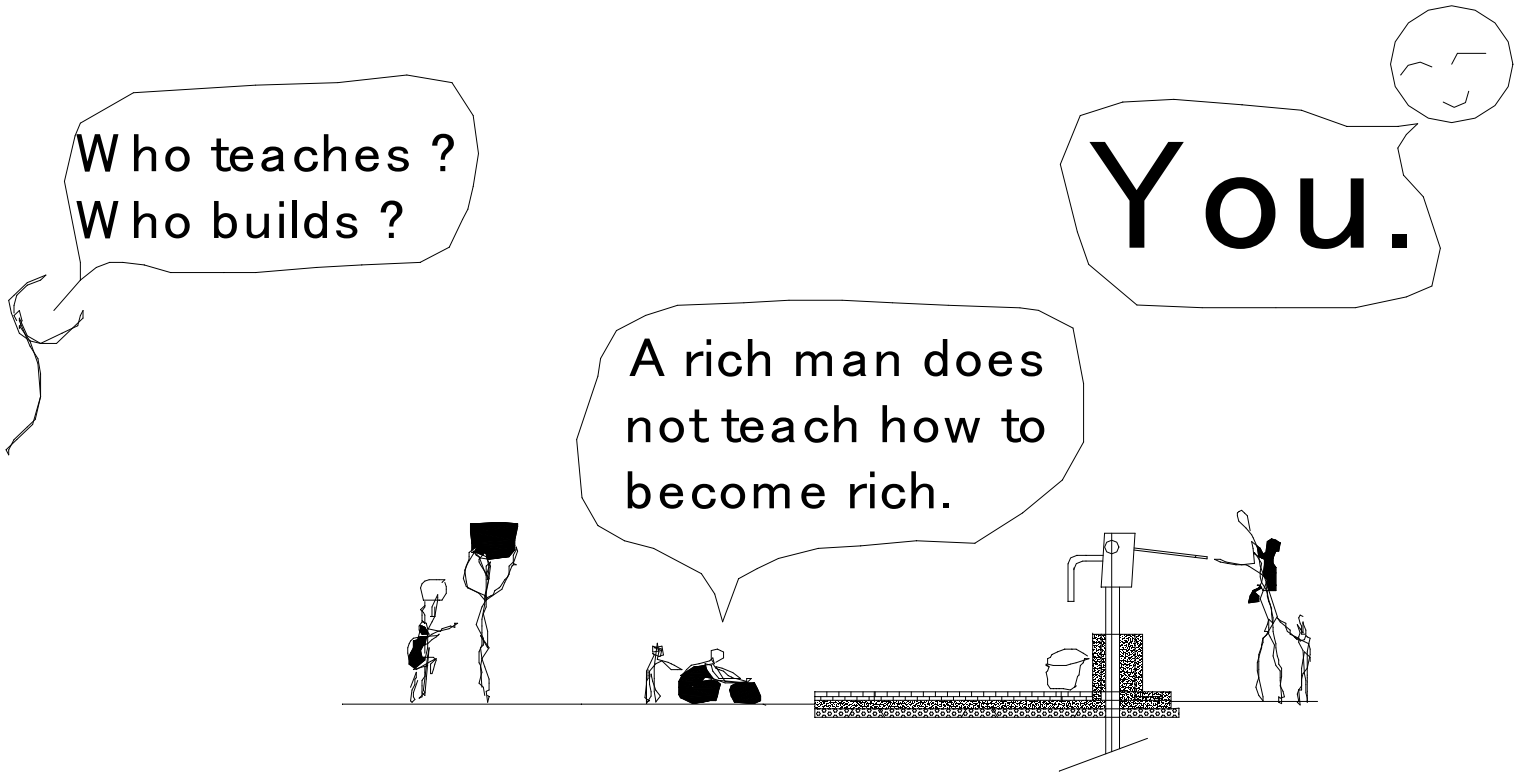
（ 01 ） How to Become Rich in Africa



只野敏夫
TADANO TOSHIO

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(560)	560 How to take cuttings	Agriculture
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(562)	562 Ringing and air layering	Agriculture
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(571)	571 How to uproot plants for transplanting	Tree
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(574)	574 Protect a young tree(1)	Tree
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(584)	584 Valley bottom cultivation and drainage	Irrigation
(585)	585 Methods of tapping groundwater	Irrigation
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(590)	590 Well Cover	Well
(591)	591 Windlass	Well
(592)	592 Apron and water run-off channel	Well
(593)	593 Bucket and chain	Well
(594)	594 Correct use of the well	Well
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(596)	596 Cross-section of concrete lined well	Well
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(600)	600 Outlet of water run-off channel (1)	Well
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(606)	606 Ground collector and water storage	Irrigation
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(622)	622 Sand filtration of water(1)	Sanitation
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(644)	644 Water runoff prevents the recharge of water tables	Water
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(657)	657 Prevent clearing and felling	Tree
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(672)	672 Reserve land for afforestation	Tree
(673)	673 Make people plant hedge	Agriculture
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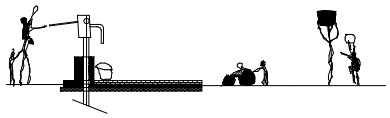
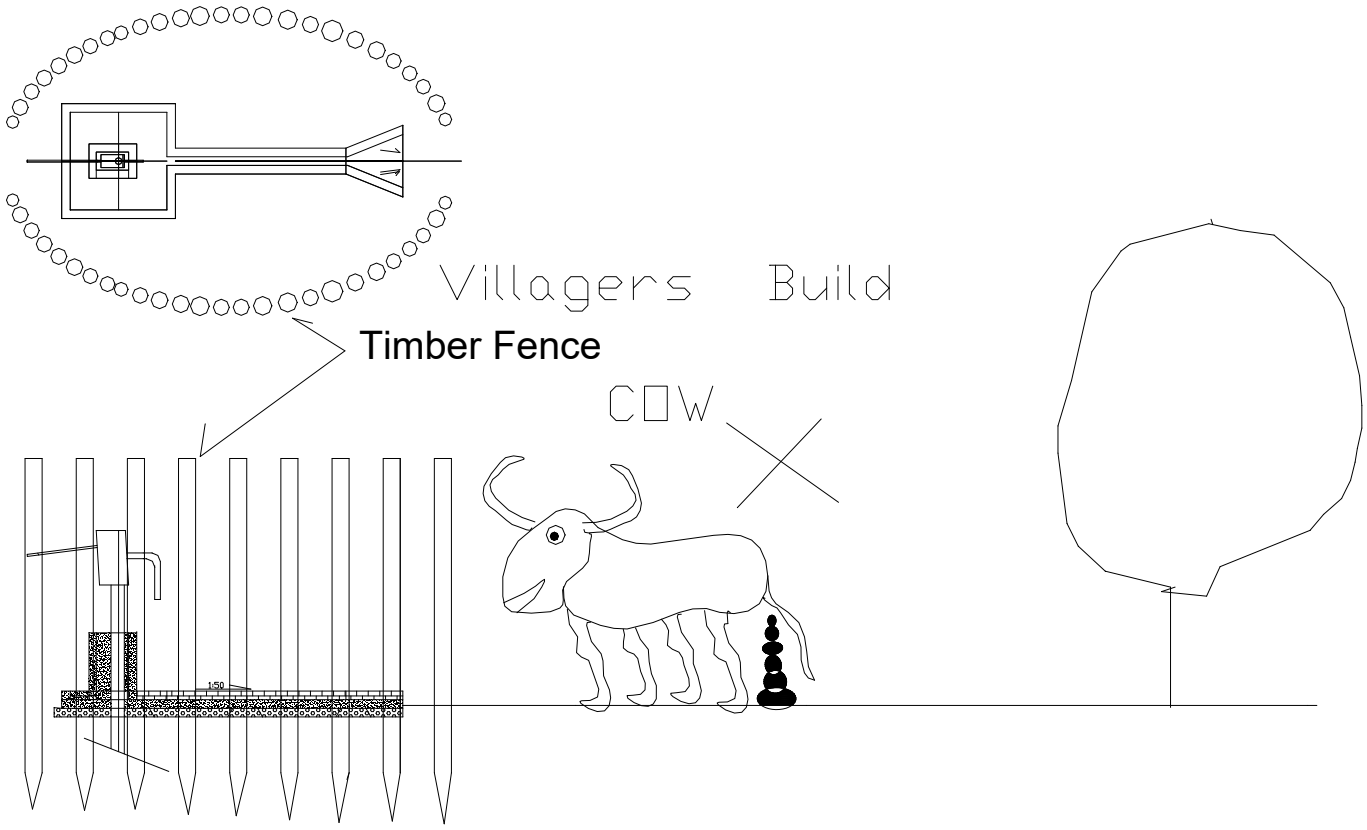
6.Exploring Earth And Space	Magnoli Douglass Ellis	Laidlaw
7.African Gardens and Orchards	Hugues Dupriez Philippe De Leener	MACMILLAN,TERRES ET VIE AND CTA
8.Rural Water Supplies And Sanitation	PETER MORGAN/BRL	MACMILLAN,TERRES ET VIE AND CTA
9.Vanishing Land and Water	Jean-Louis.Hugues Dupriez	MACMILLAN,TERRES ET VIE AND CTA
10.Land and Food	Robert Dellere	CTA The Technical Centre for Agricultural and Rural Cooperation
11.Soil Conservation in Ethiopia	Hans Hurni,Soil Conservation Research Project(SCRP)	Watershed Development and Land Use Department(WDLUD)
12.Agroforestry in dryland AFRICA	D.ROCHELEAU,F.WEBER	ICRAF(Science and Practice of Agroforestry)
13.Erosion Environment	Milos Holy	Pergamon
14.Elementary soil and water engineering	Schwab/Barnes/Frevert/Edminster	WILEY/TOPPAN
15. Water Resources and Agricultural Development in the tropics	Chris Brarrow	Longman Scientific and Technical



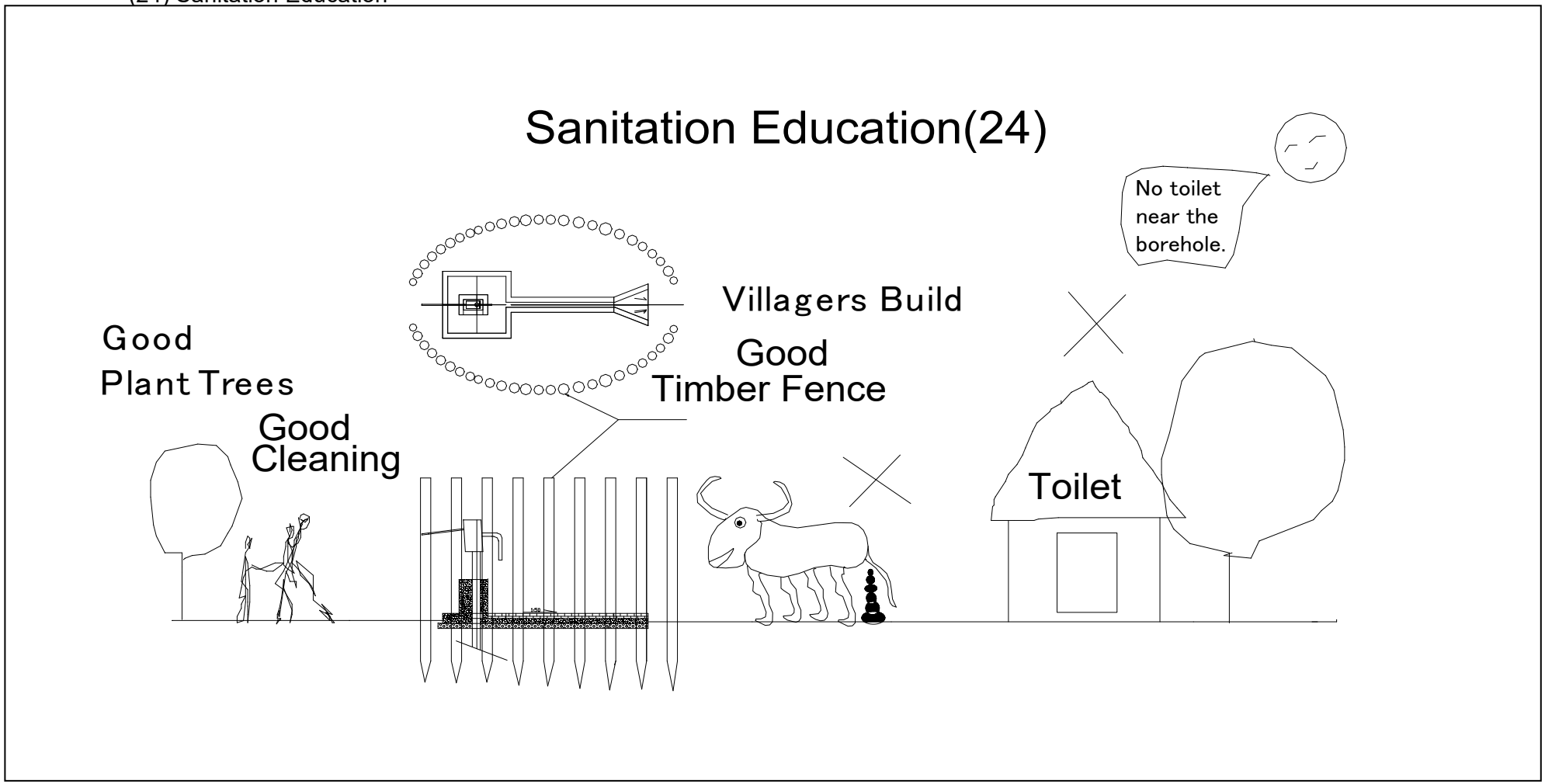
只野敏夫
TADANO TOSHIO

(5)Villagers Build Timber Fence

(5) Villagers Build Timber Fence

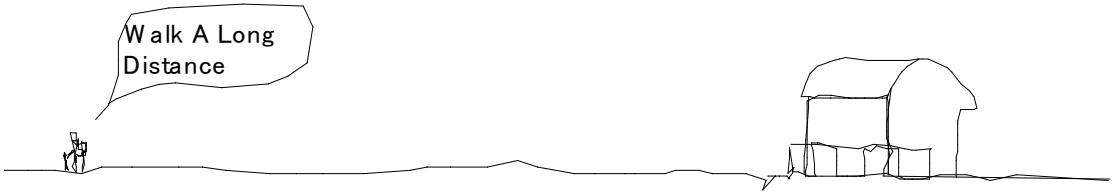


(24) Sanitation Education

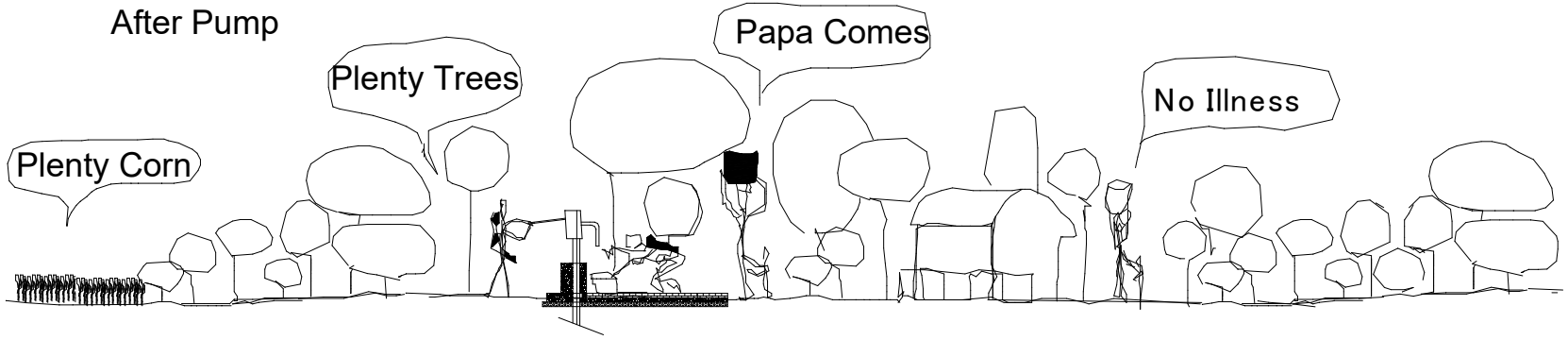


Before Pump,After Pump(69)

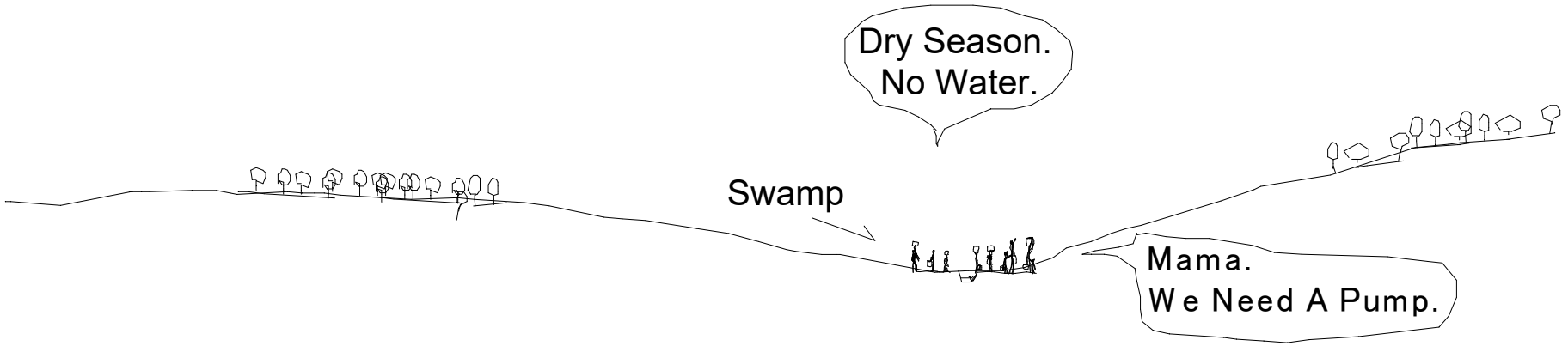
Before Pump



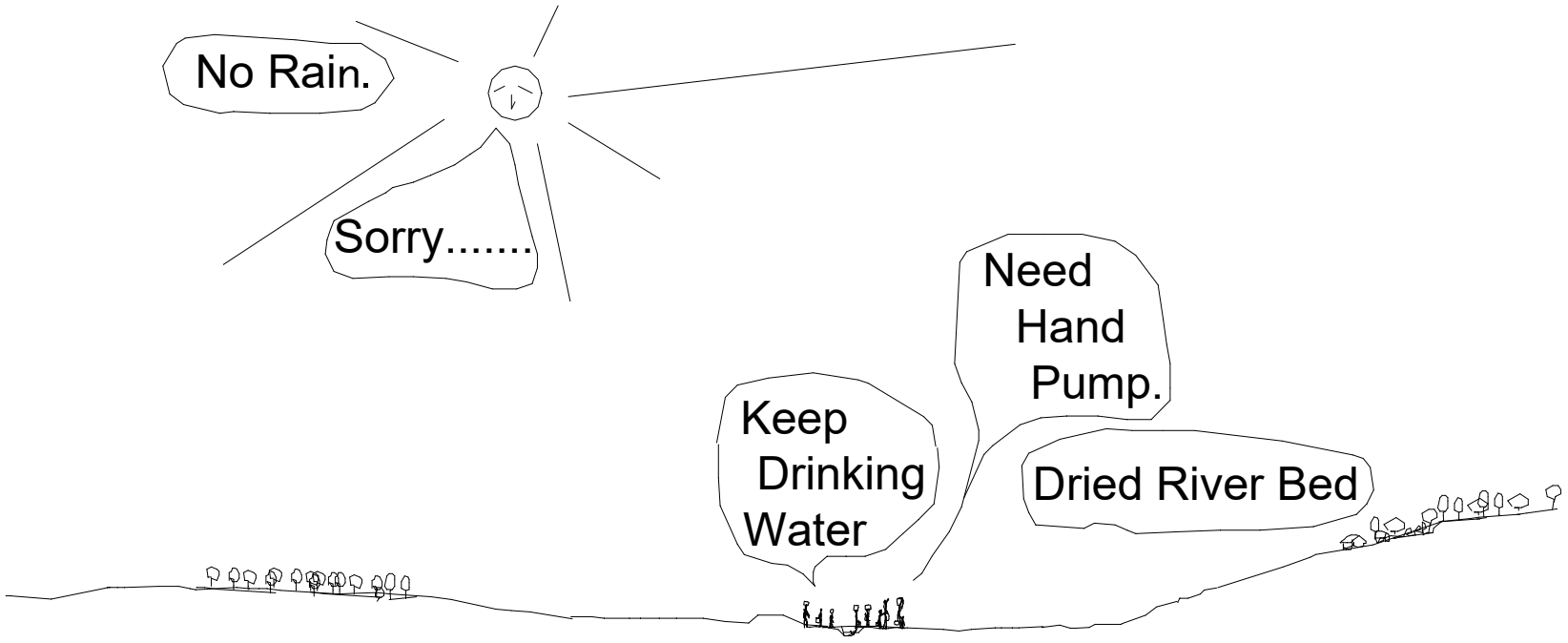
After Pump



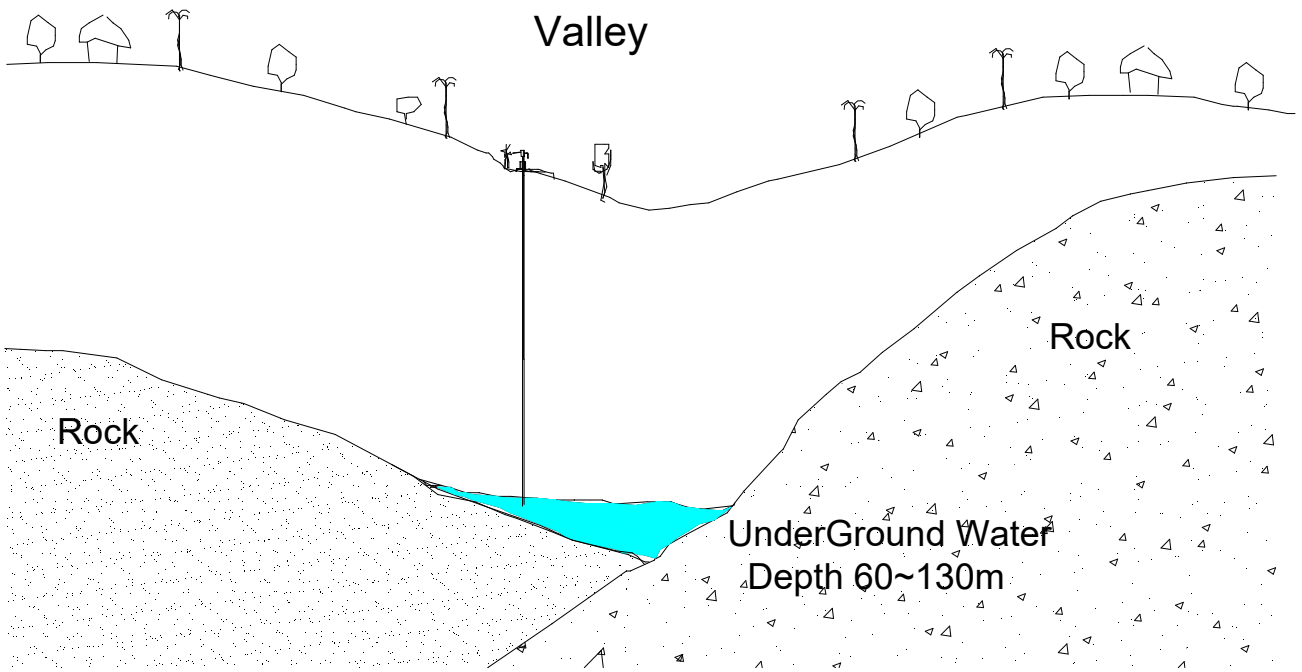
Drinking Water From Swamps(72)



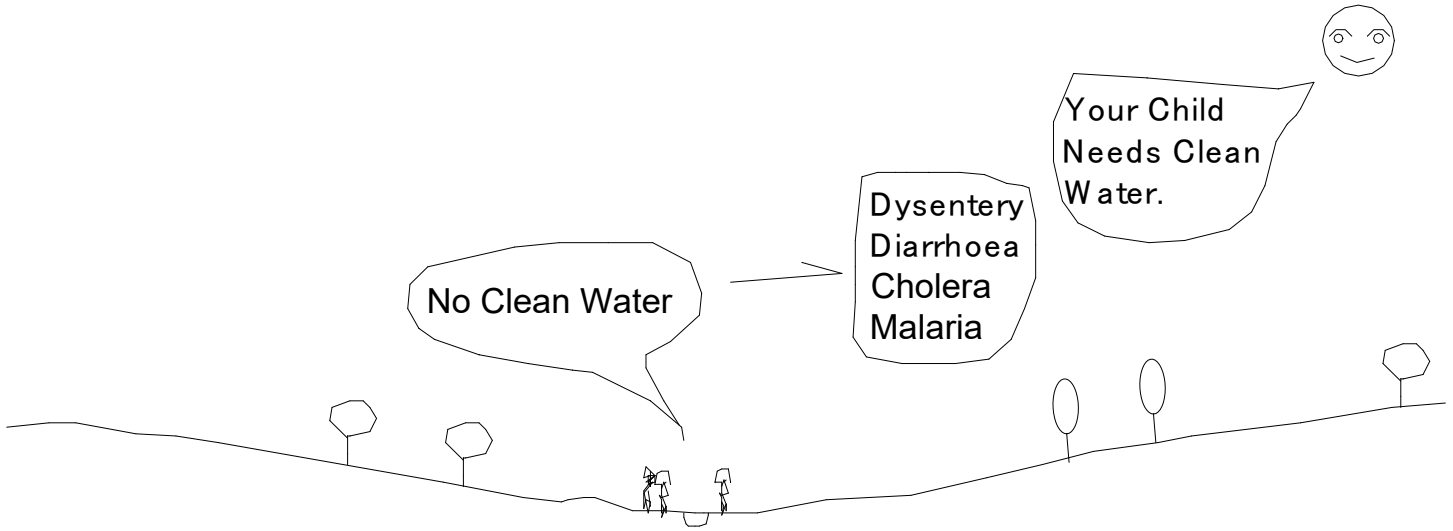
Drinking Water During Dry Season(73)



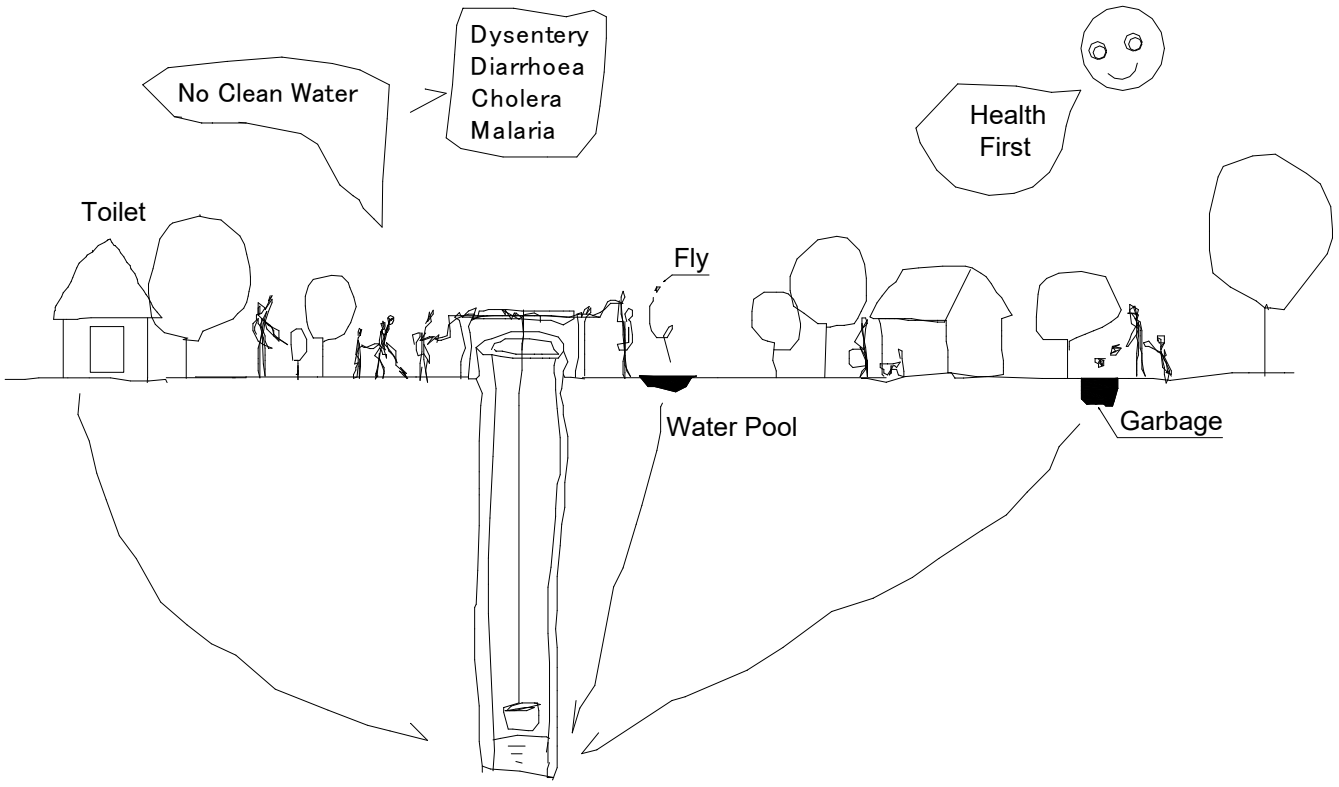
(123) UnderGround Water



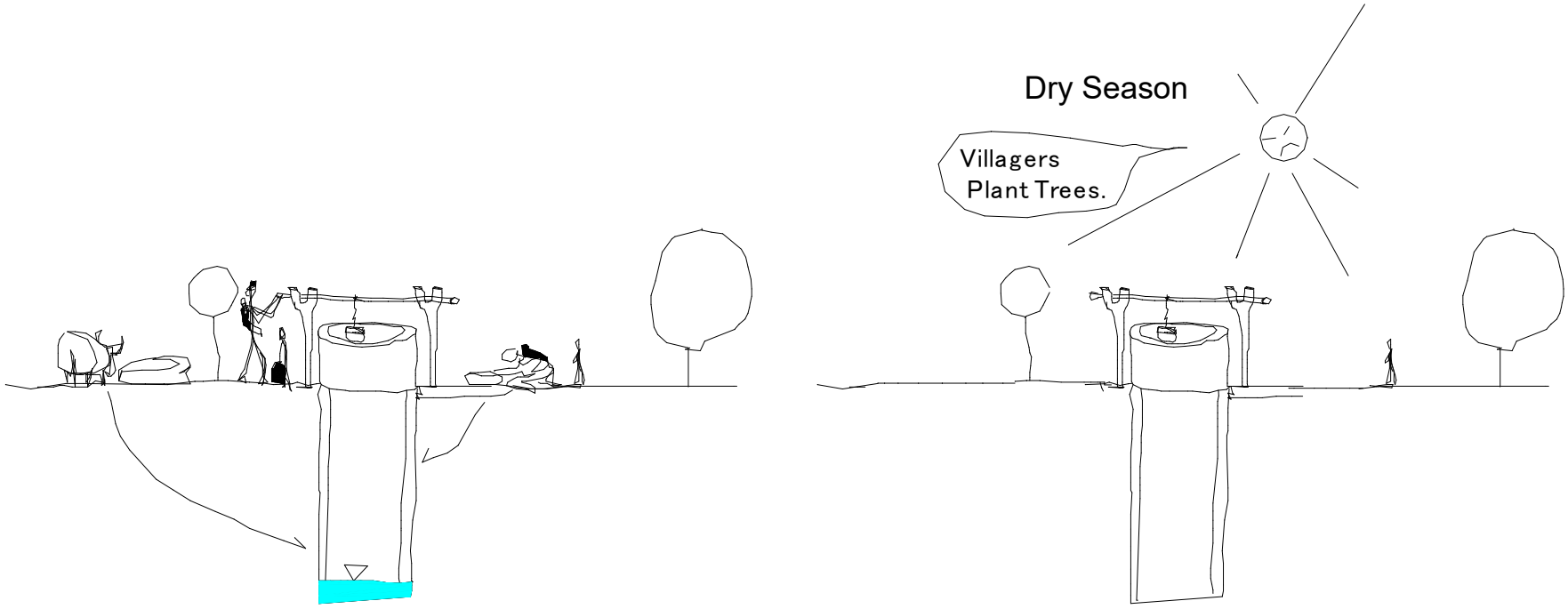
（127） Health and Sanitation



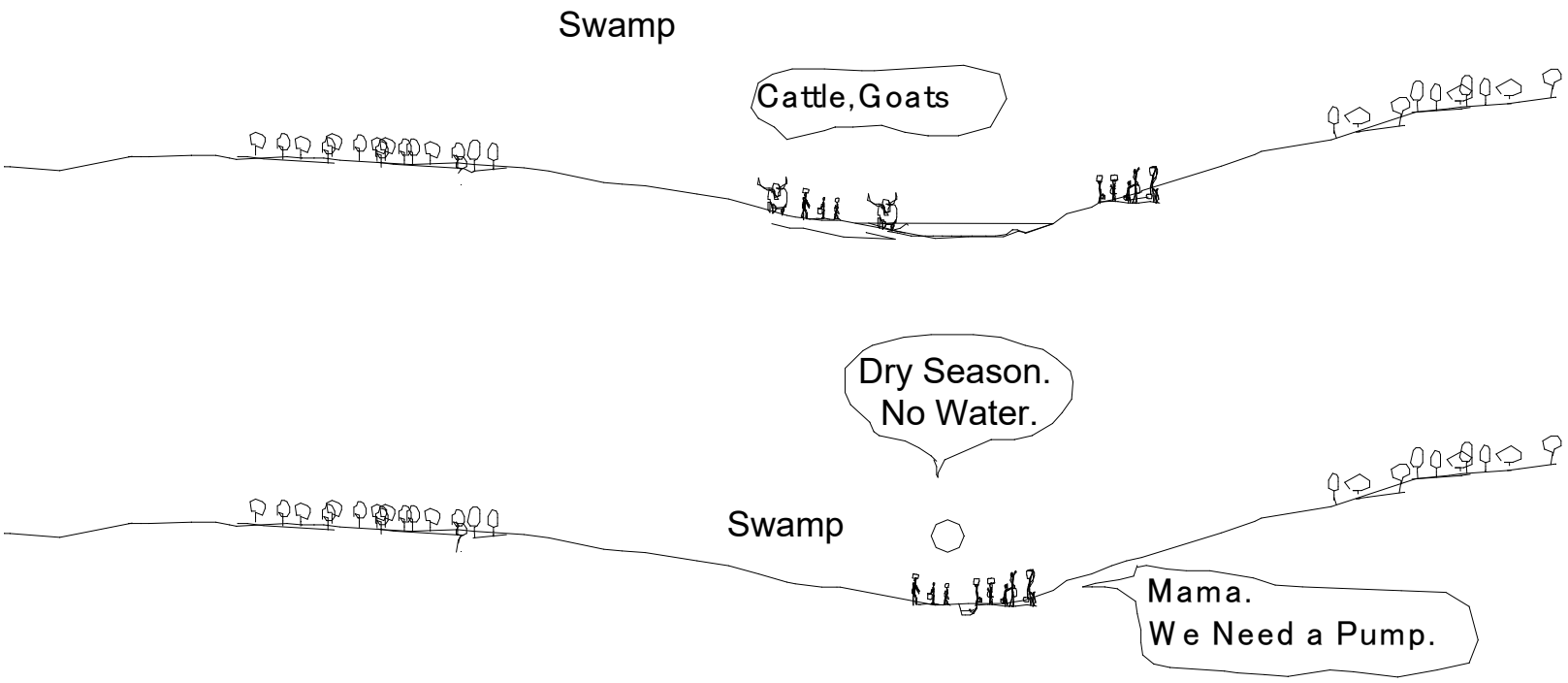
(128)Health Sanitation



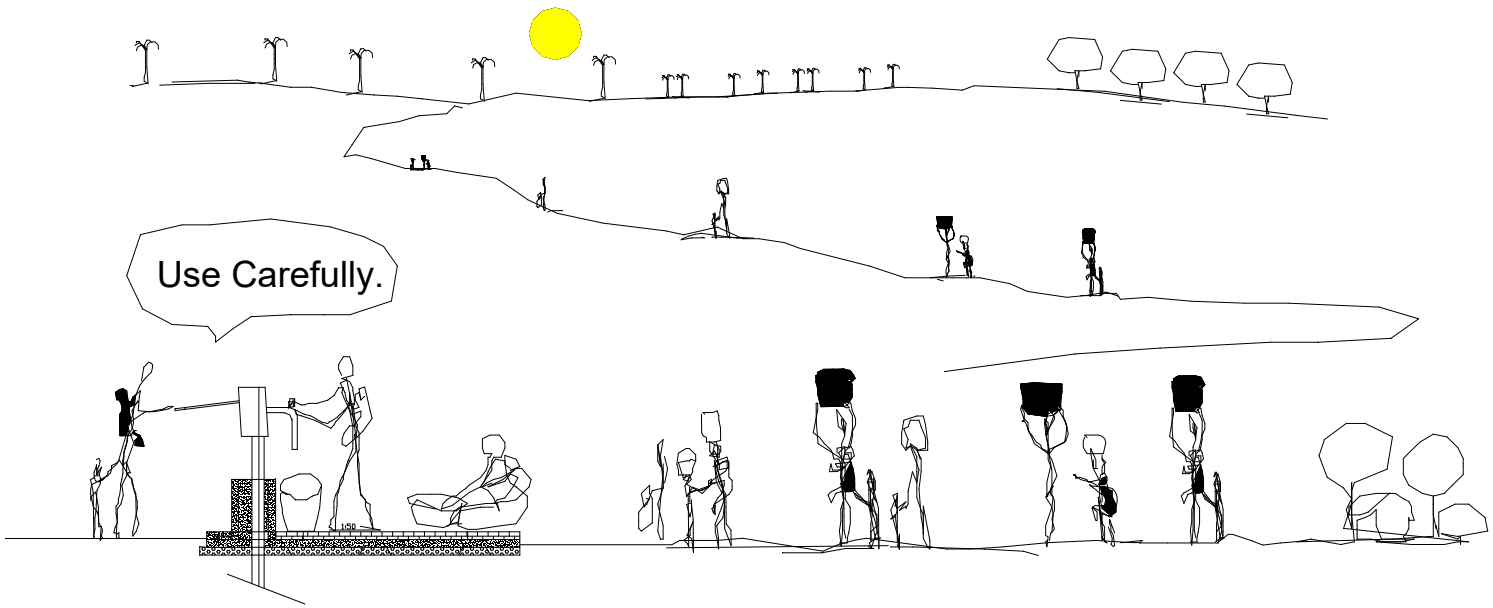
(131)Traditional shallow Well



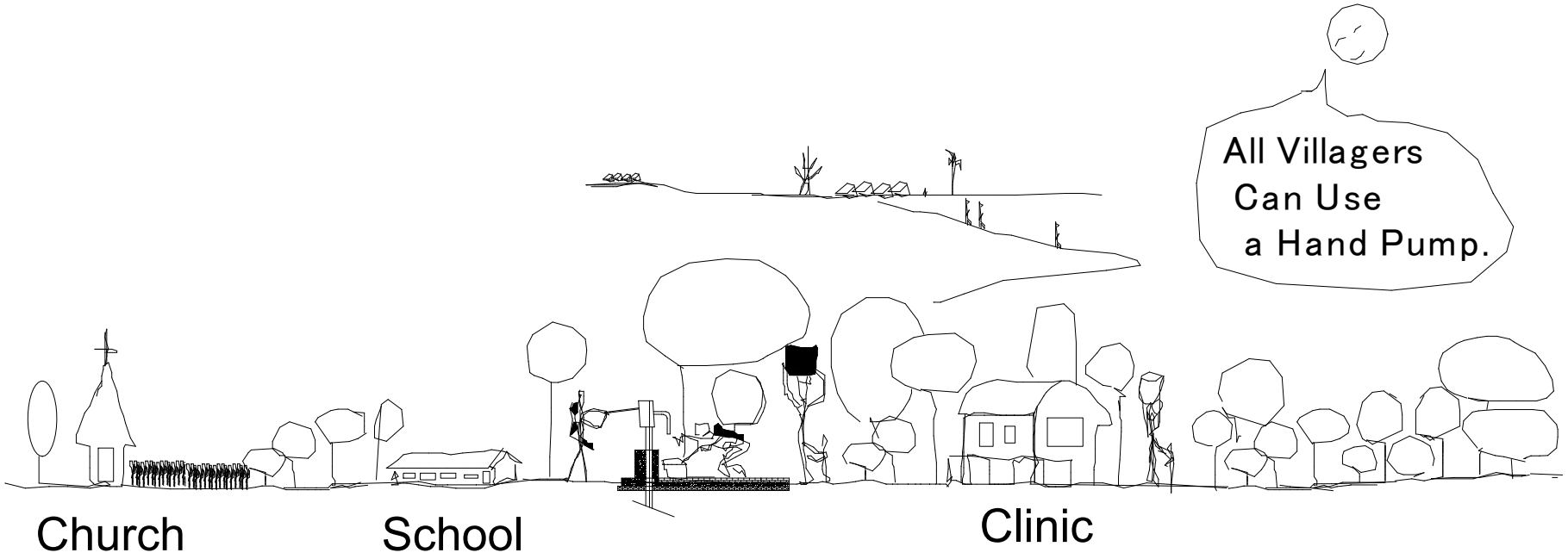
(132) Drinking Water from Swamp

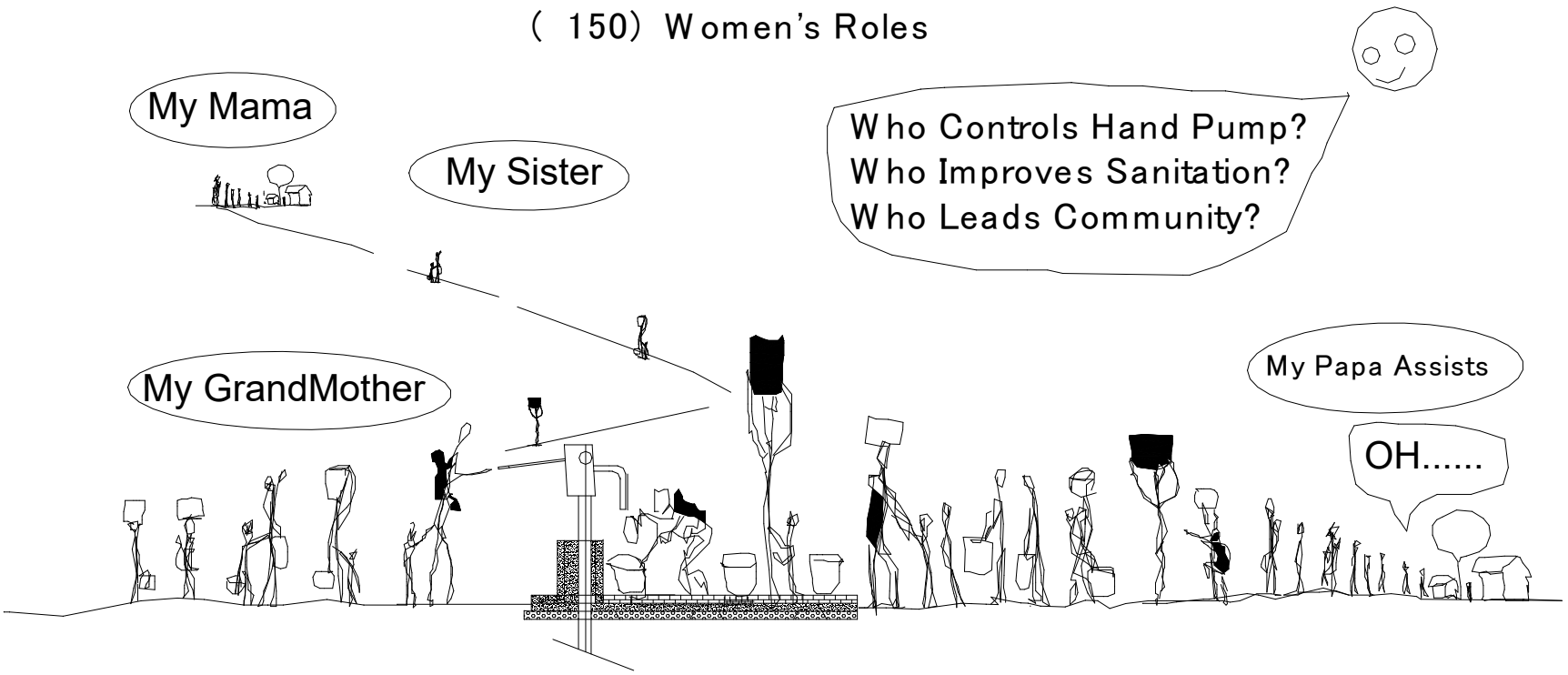


(141)Not Waste Water



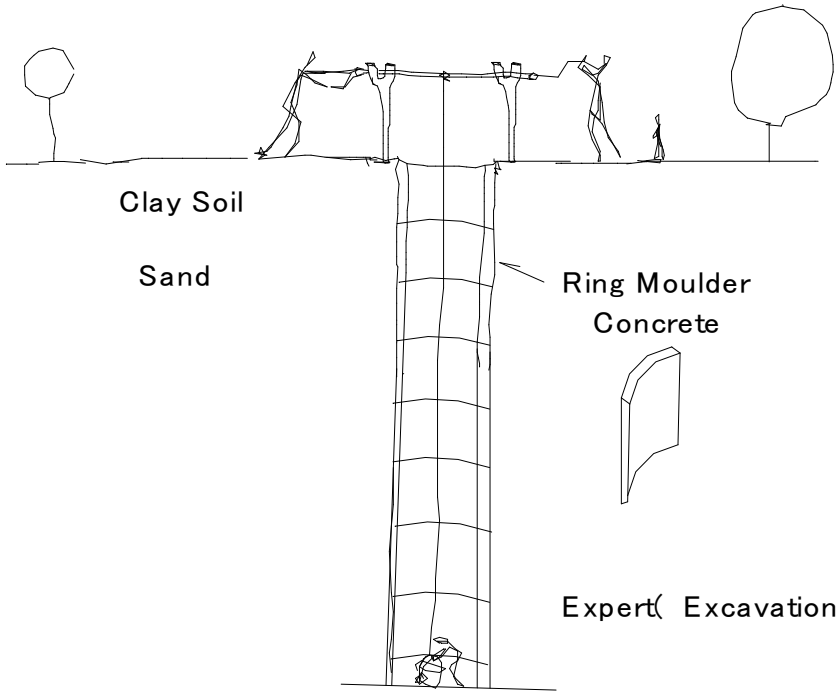
(143)Hand Pump Location




(150) Women's Roles
My Mama
My Sister
Who Controls Hand Pump?
Who Improves Sanitation?
Who Leads Community?
My GrandMother
My Papa Assists
OH.....

(151) Shallow Well(Itezhi-Tezhi)(1)

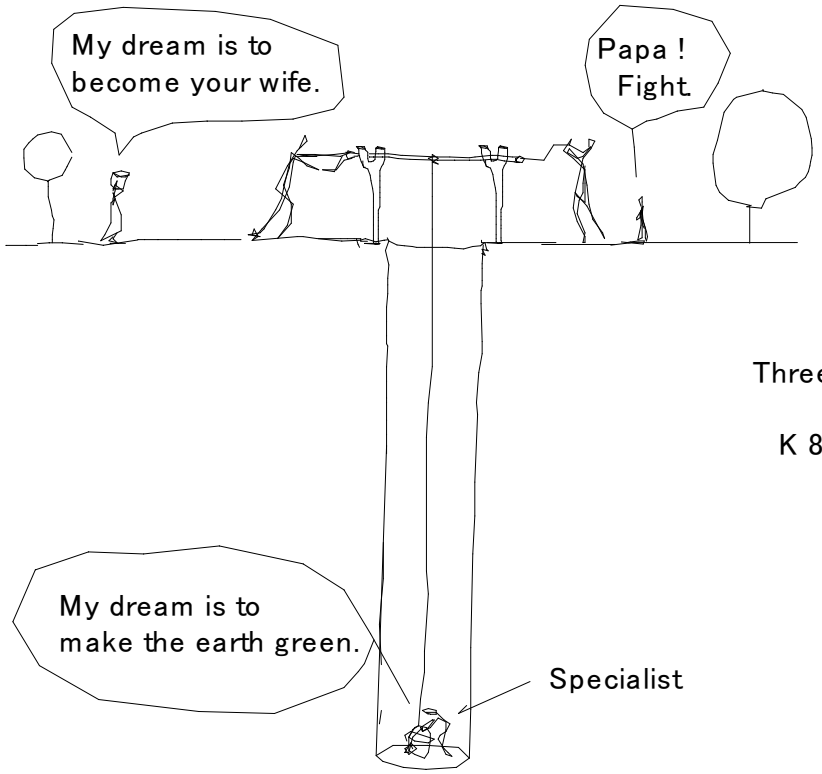
(151) Shallow Well (Itezhi-Tezhi) (1)



Expert(Excavation,Shuttering,Concreting)

(152) Shallow Well (Itezhi-Tezhi) (2)

(153) Shallow Well (Itezhi-Tezhi) (3)

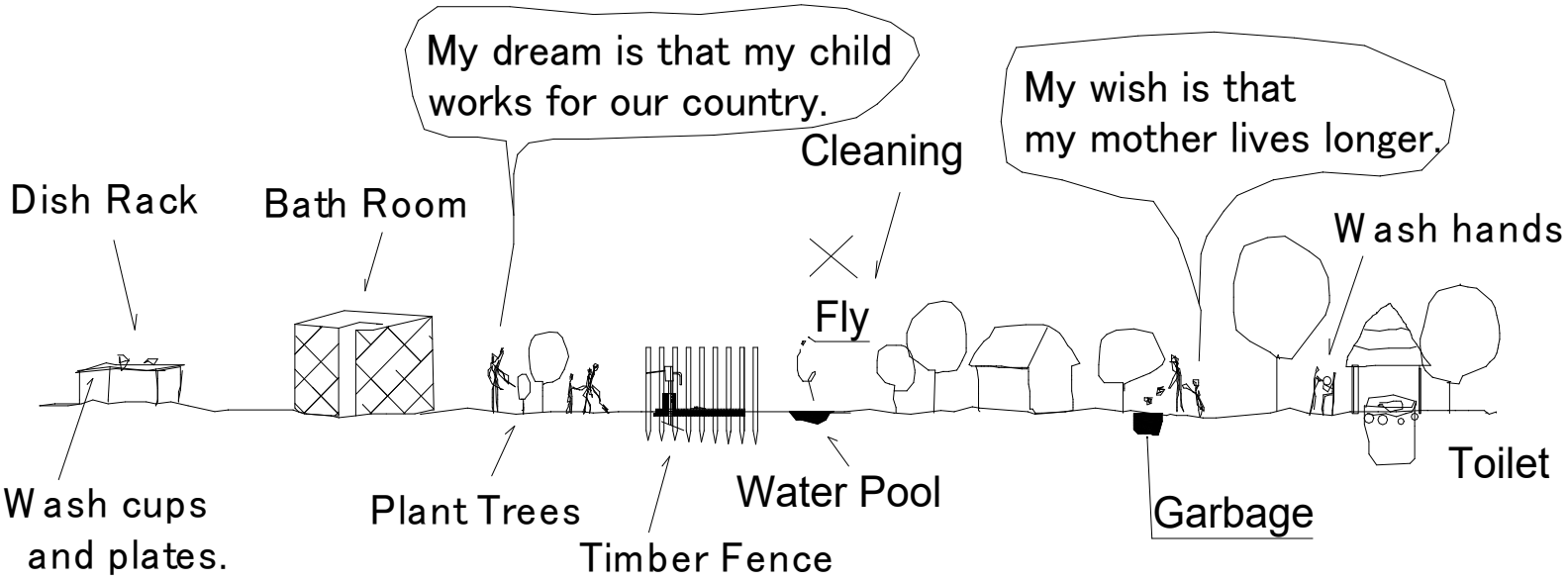


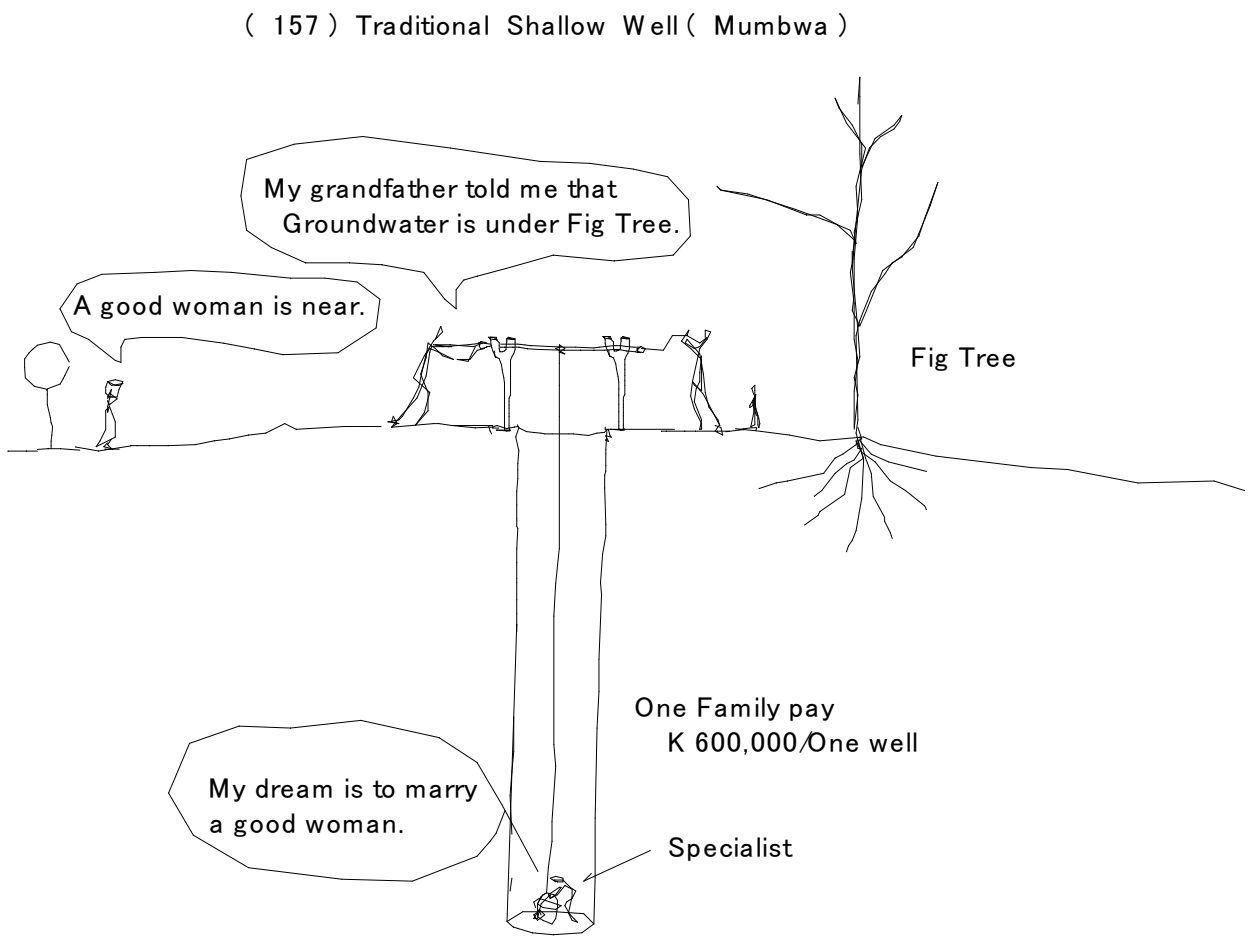
Three families pay

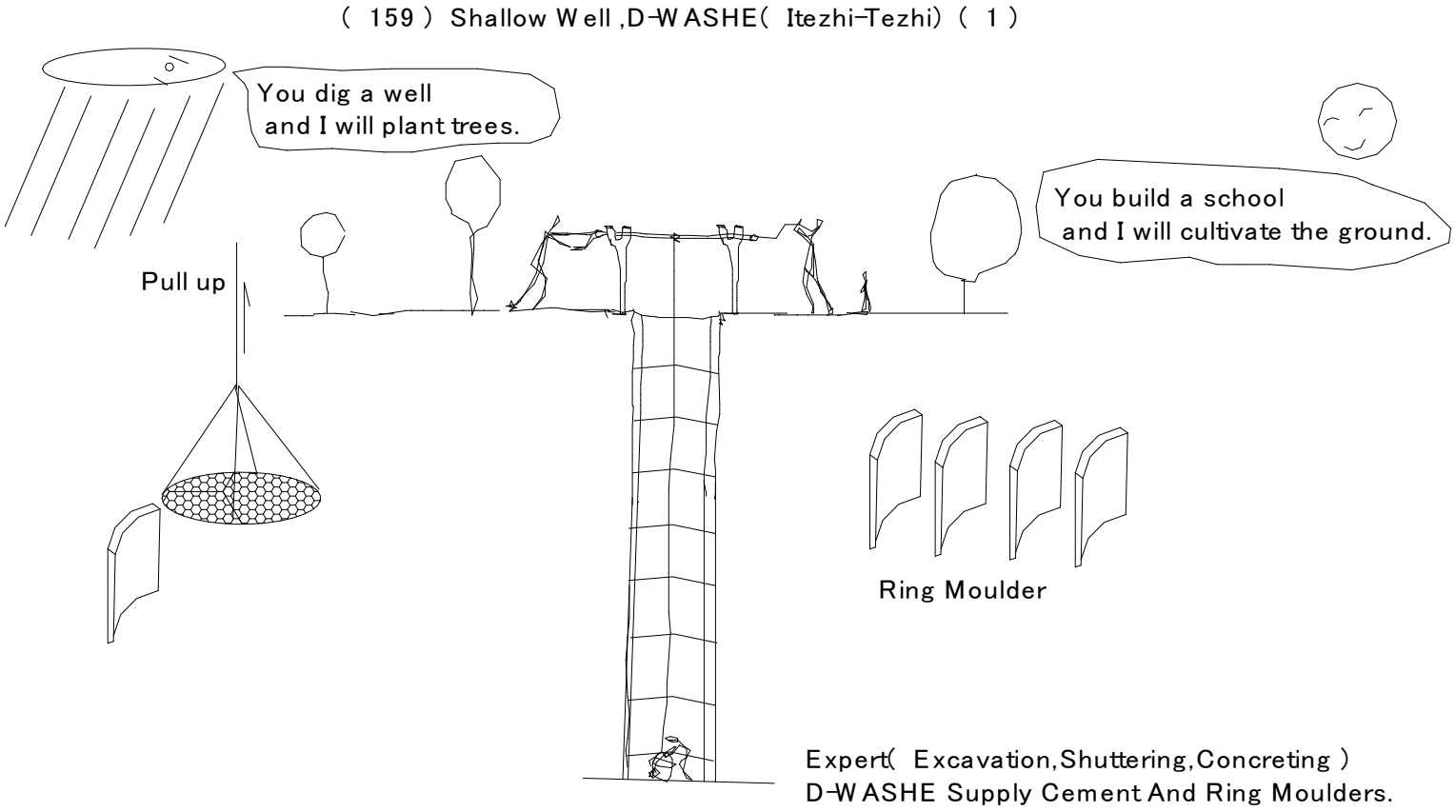
K 850,000/Well

(156) D-WASHE Sanitation Program(Itezhi-Tezhi)(2)

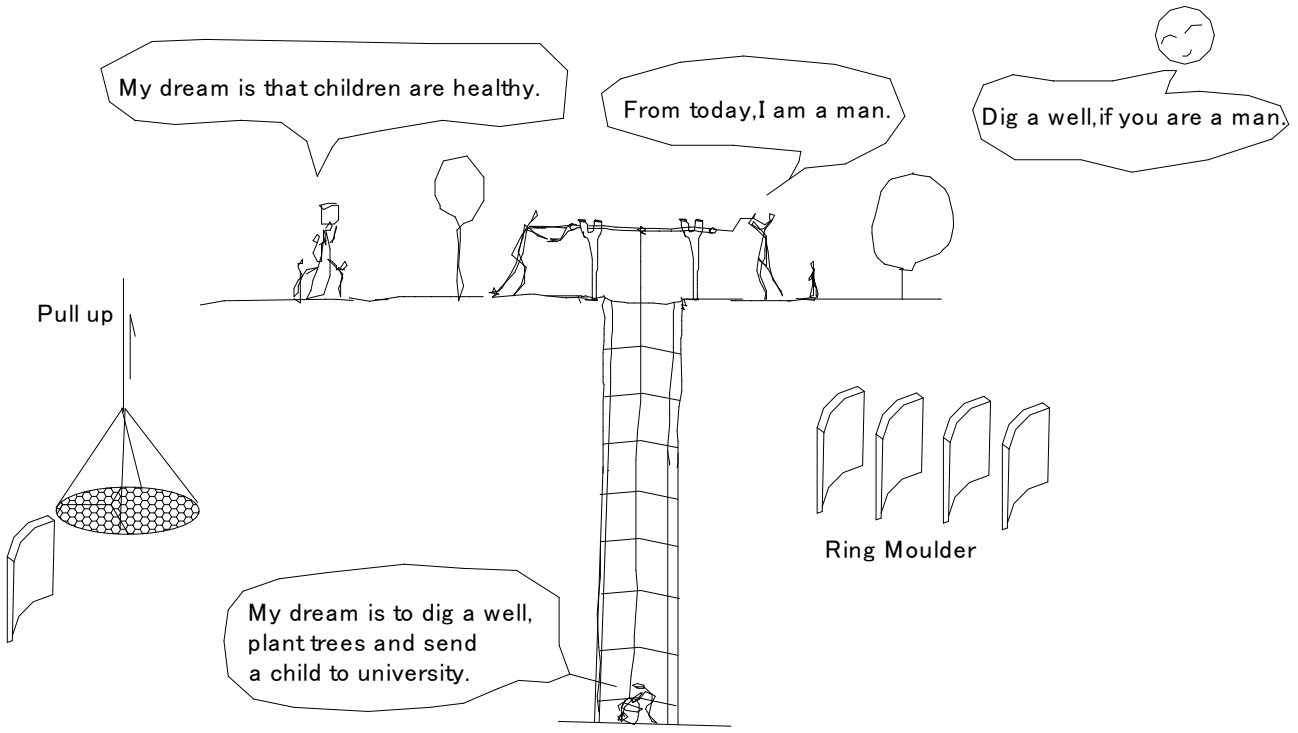
(156) D-WASHE Sanitation Program (Itezhi-Tezhi) (2)



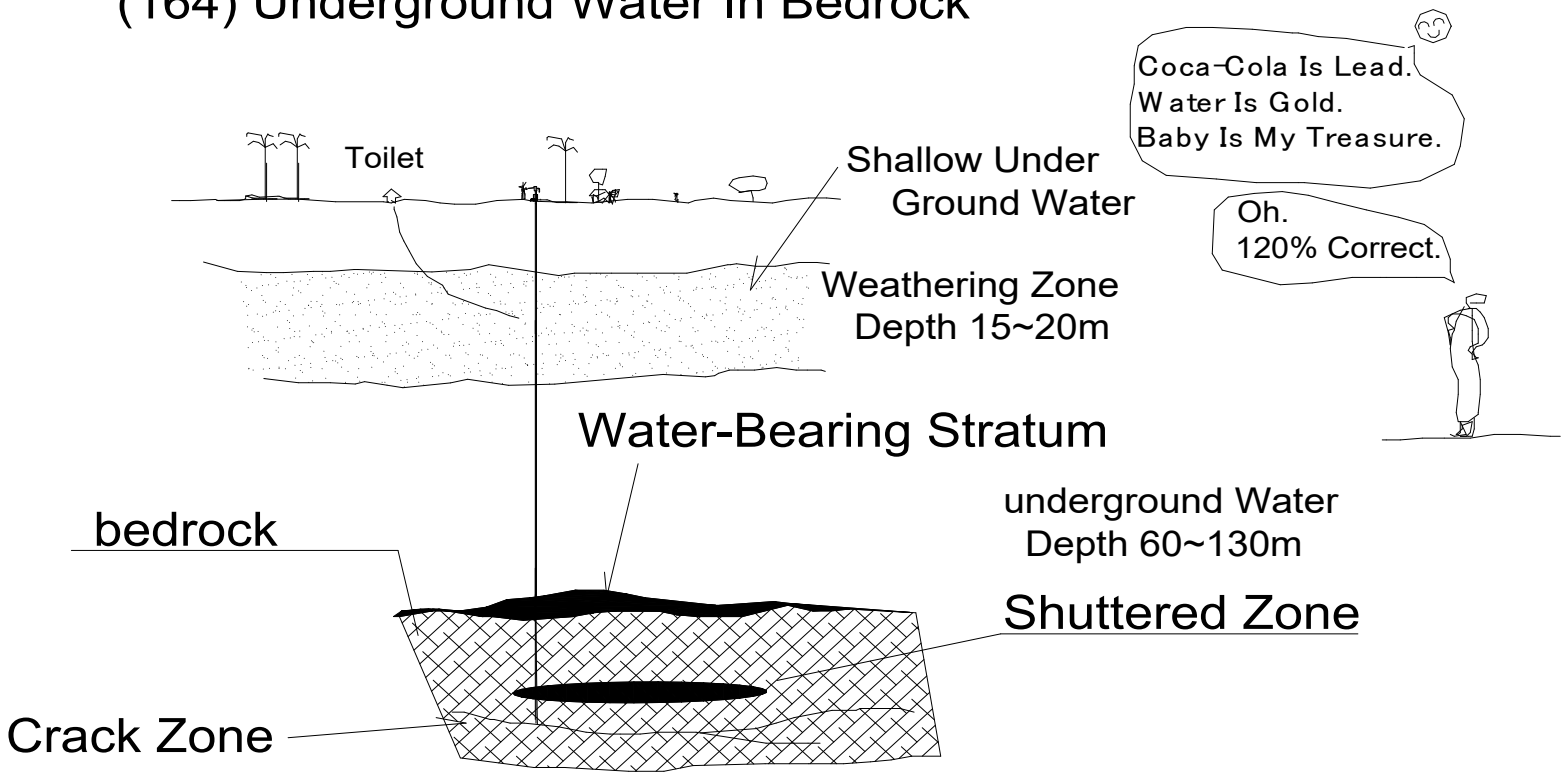

(157) Traditional Shallow Well (Mumbwa)
My grandfather told me that
Groundwater is under Fig Tree.
A good woman is near.
Fig Tree
One Family pay
K 600,000/One well
My dream is to marry
a good woman.
Specialist


(159) Shallow Well ,D-WASHE(Itezhi-Tezhi) (1)
You dig a well
and I will plant trees.
You build a school
and I will cultivate the ground.
Pull up
Ring Moulder
Expert(Excavation,Shuttering,Concreting)
D-WASHE Supply Cement And Ring Moulders.

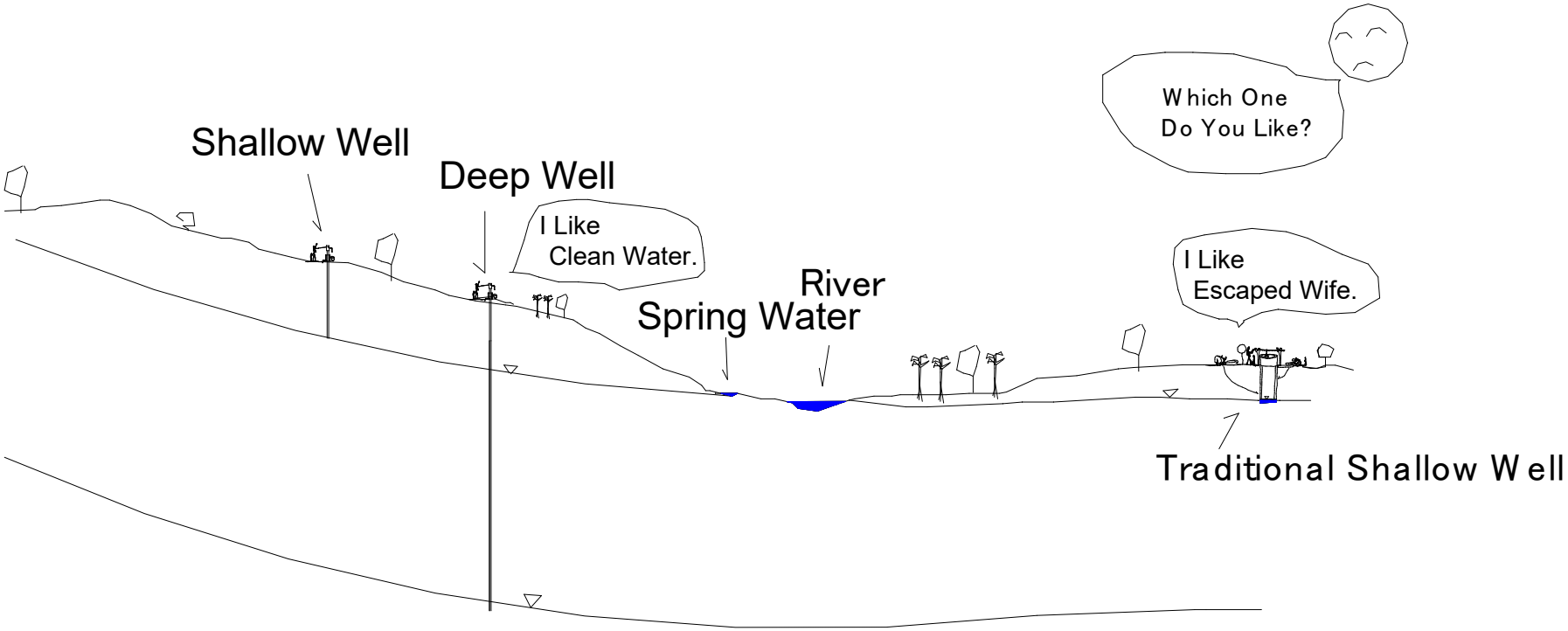
(160) Shallow Well ,D-WASHE(Itezhi-Tezhi) (2)



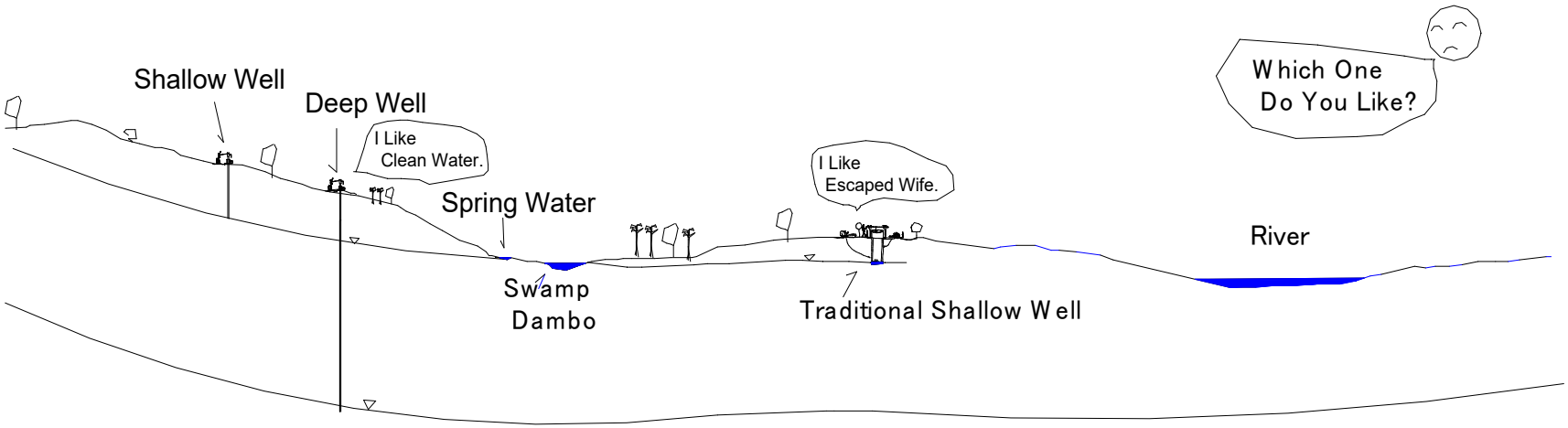
(164) Underground Water In Bedrock



(174)HeadWaters:Water Resources

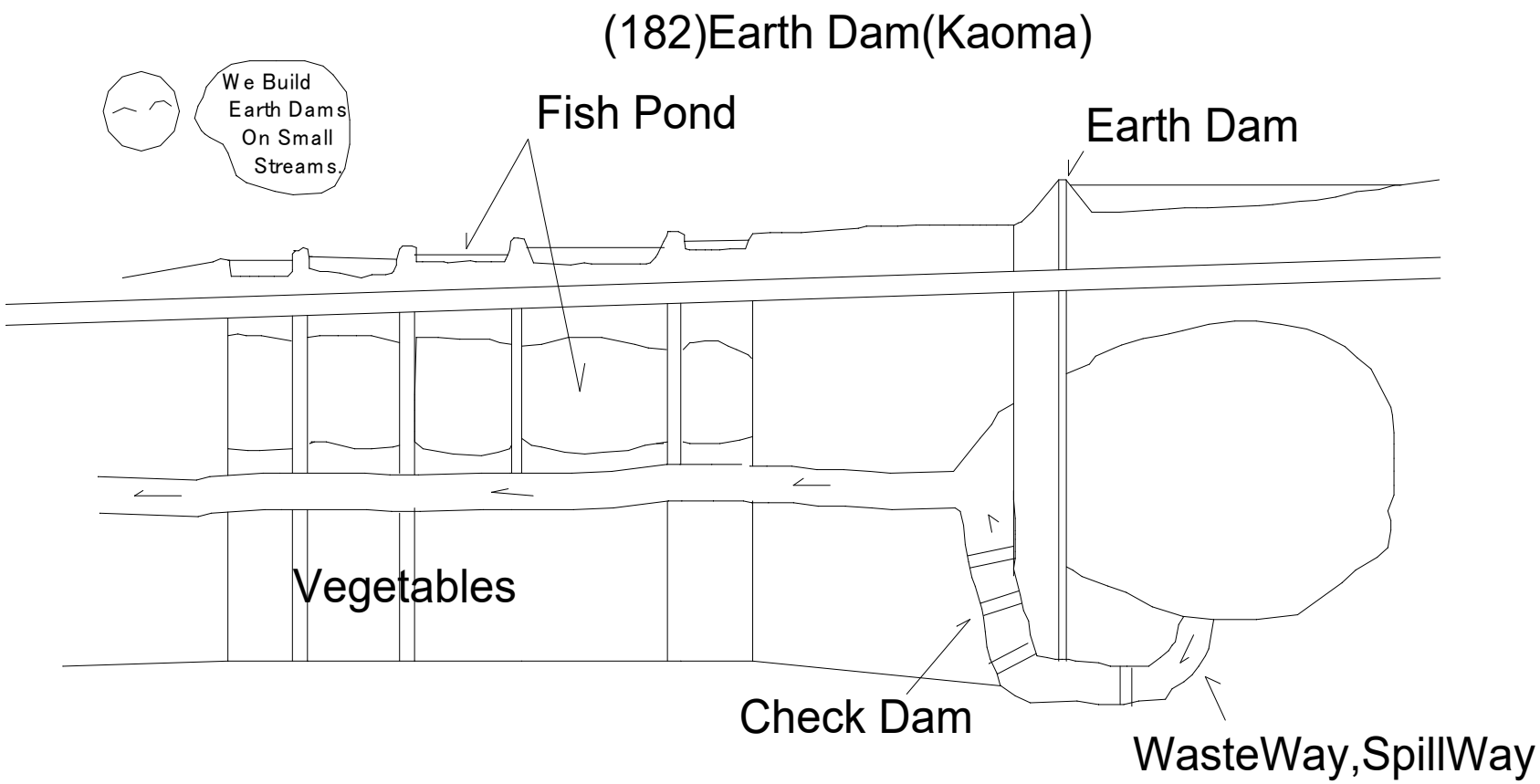


(175)Water sources

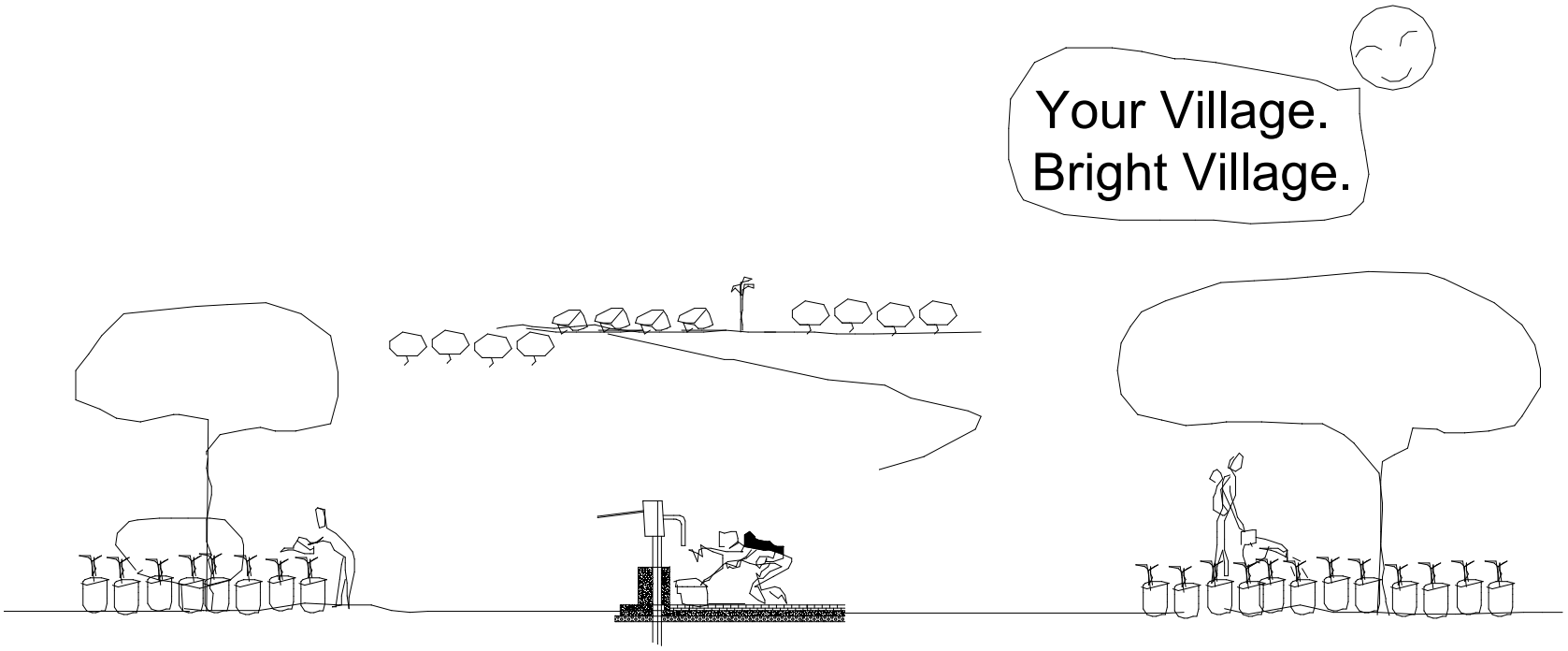


(181)Mumbwa Traditional Shallow Well

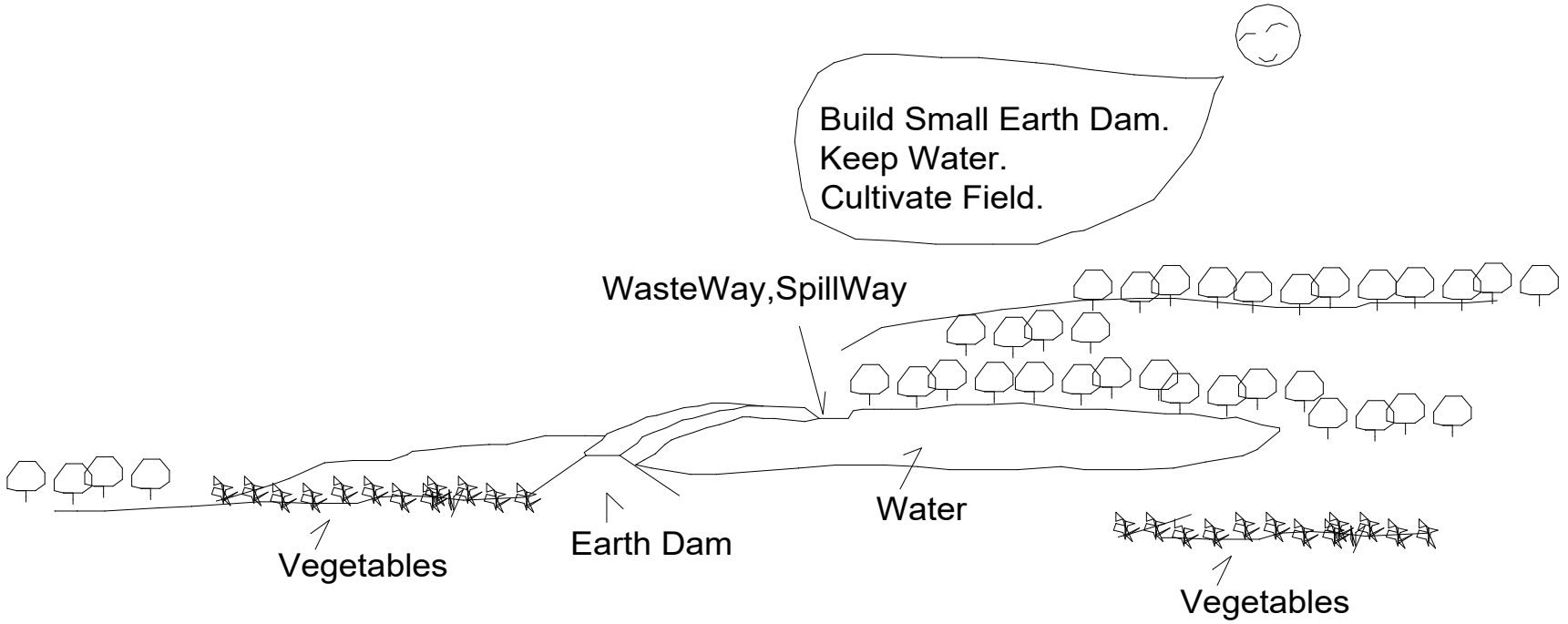
Private Contractor
One Well
K600,000


(182)Earth Dam(Kaoma)
We Build
Earth Dams
On Small
Streams.
Fish Pond
Earth Dam
Vegetables
Check Dam
WasteWay,SpillWay

(198)Planting Trees(Kaoma)

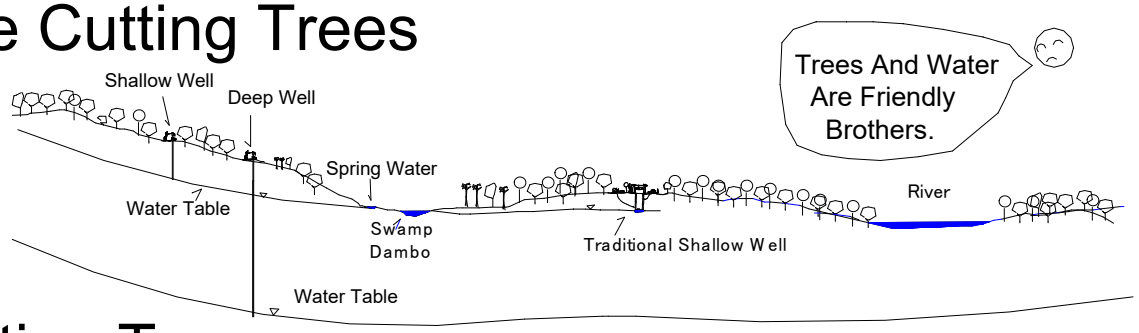


(199) Earth Dam On Dambo(Kaoma)

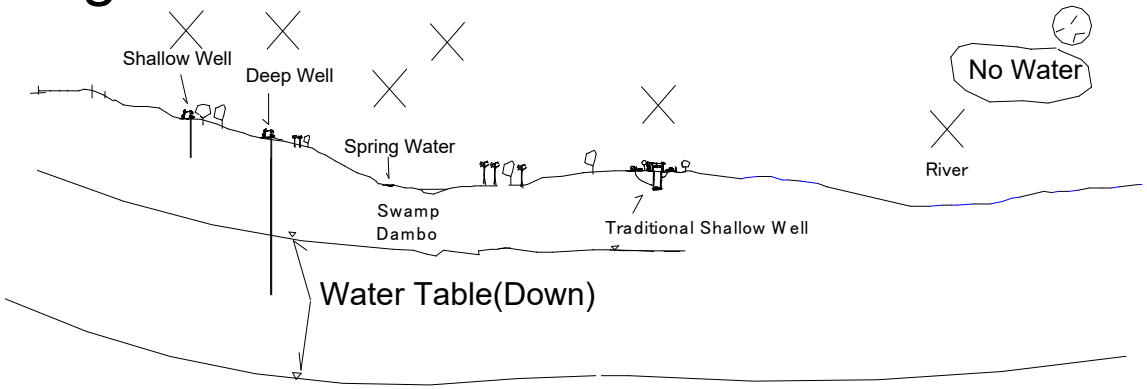


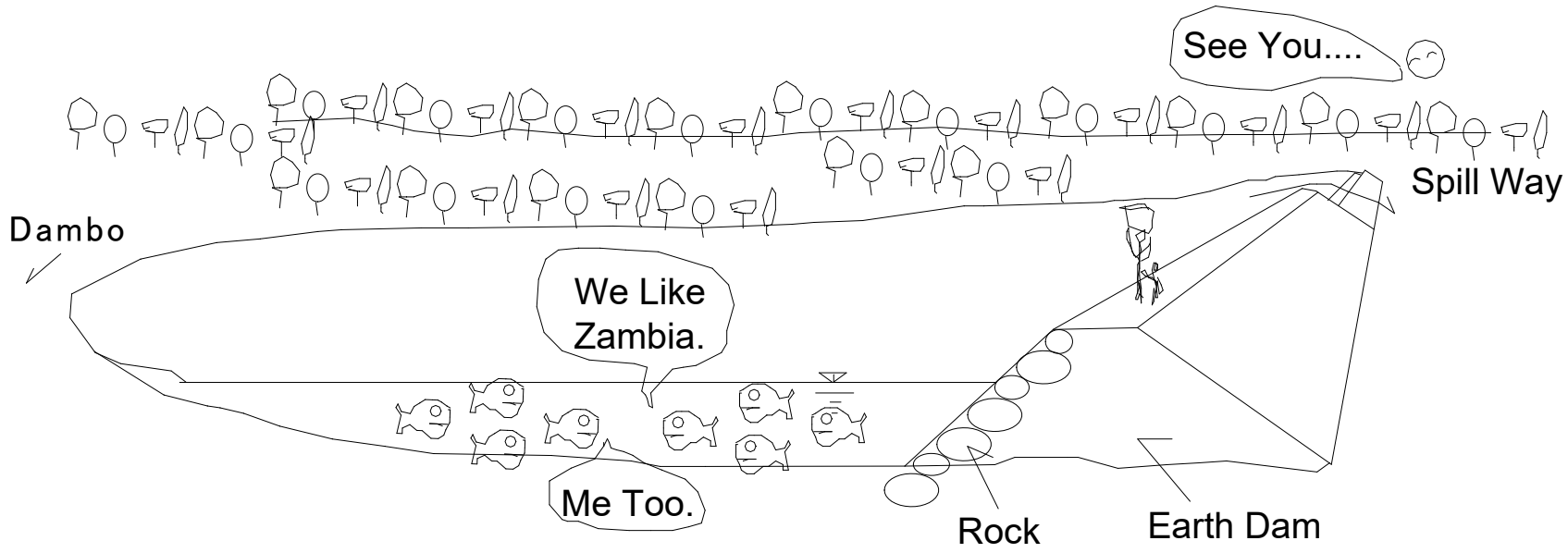
(200)After Cutting Trees

Before Cutting Trees

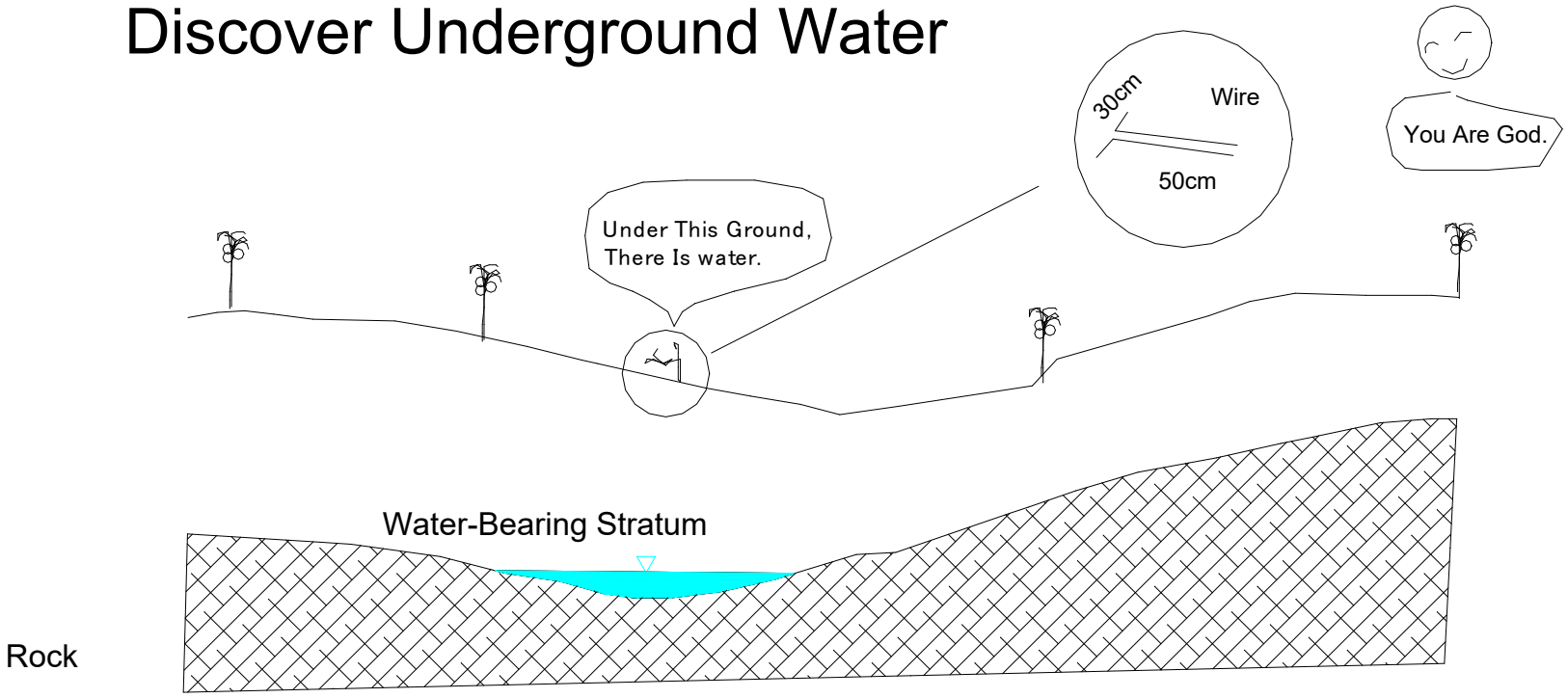


After Cutting Trees

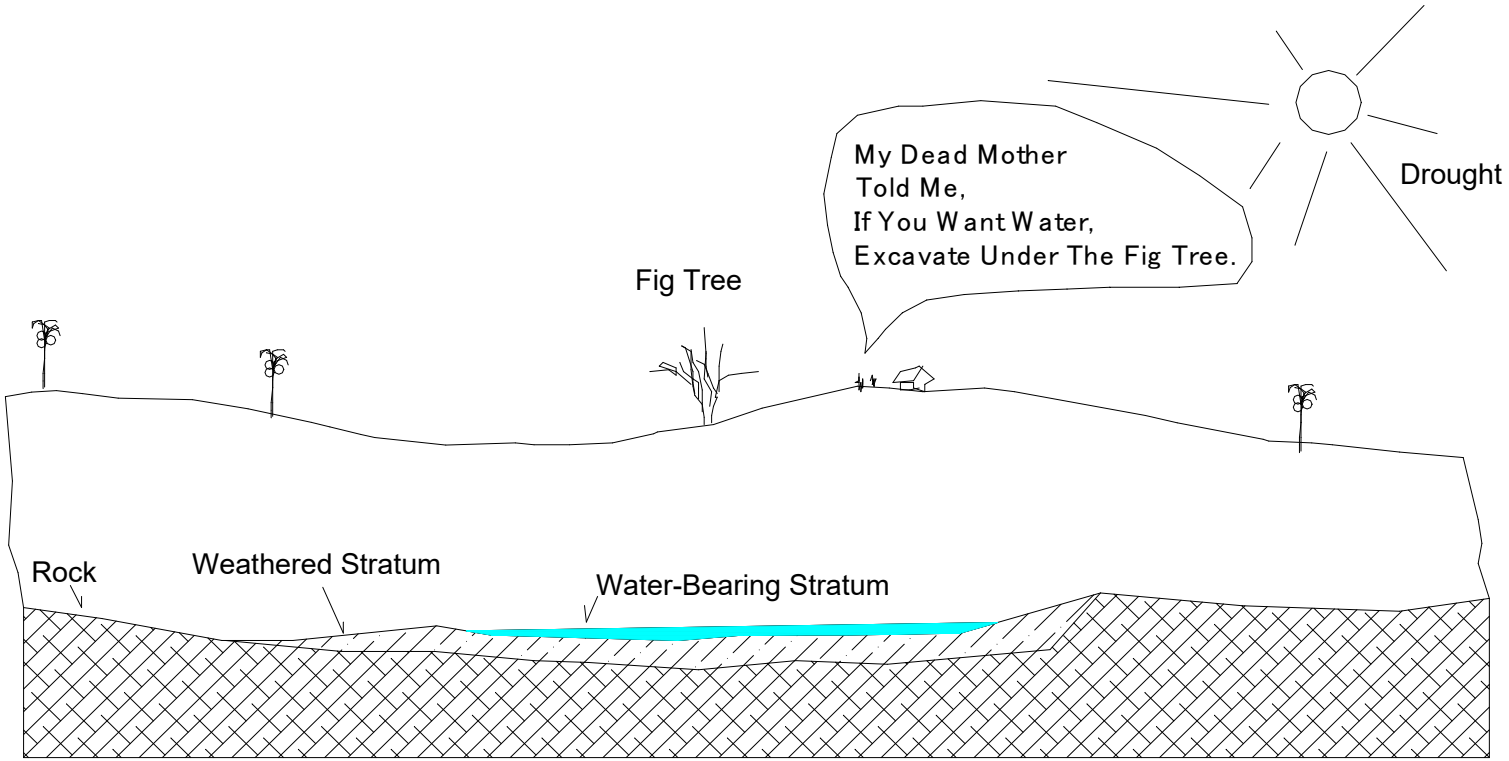



(203)Earth Dam+Rock Fill Dam(Mumbwa)
See You....
Spill Way
Dambo
We Like
Zambia.
Me Too.
Rock
Earth Dam

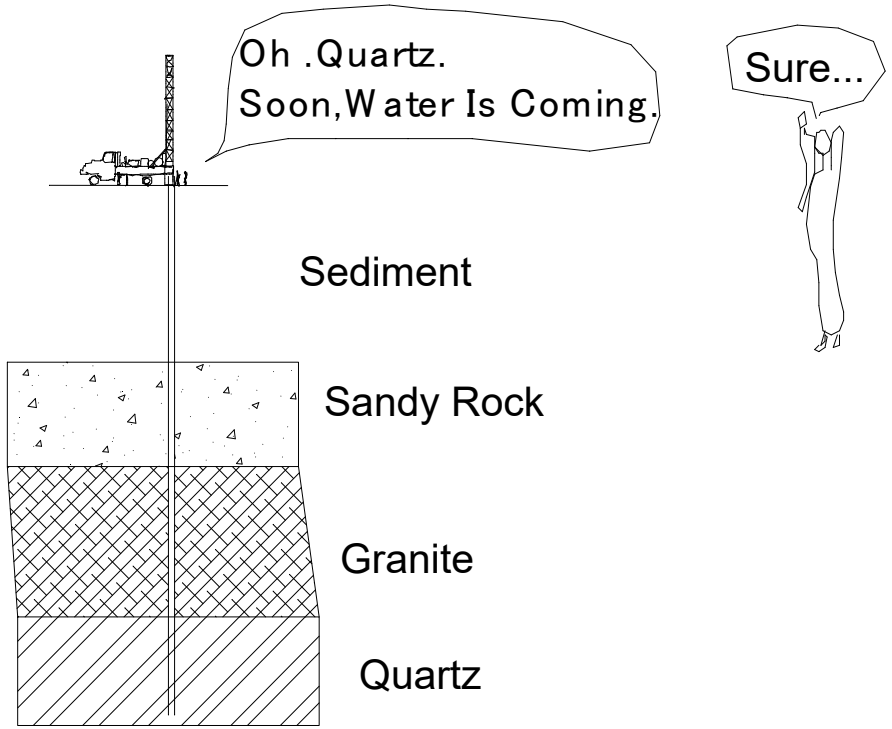
(245)Traditional.
Discover Underground Water



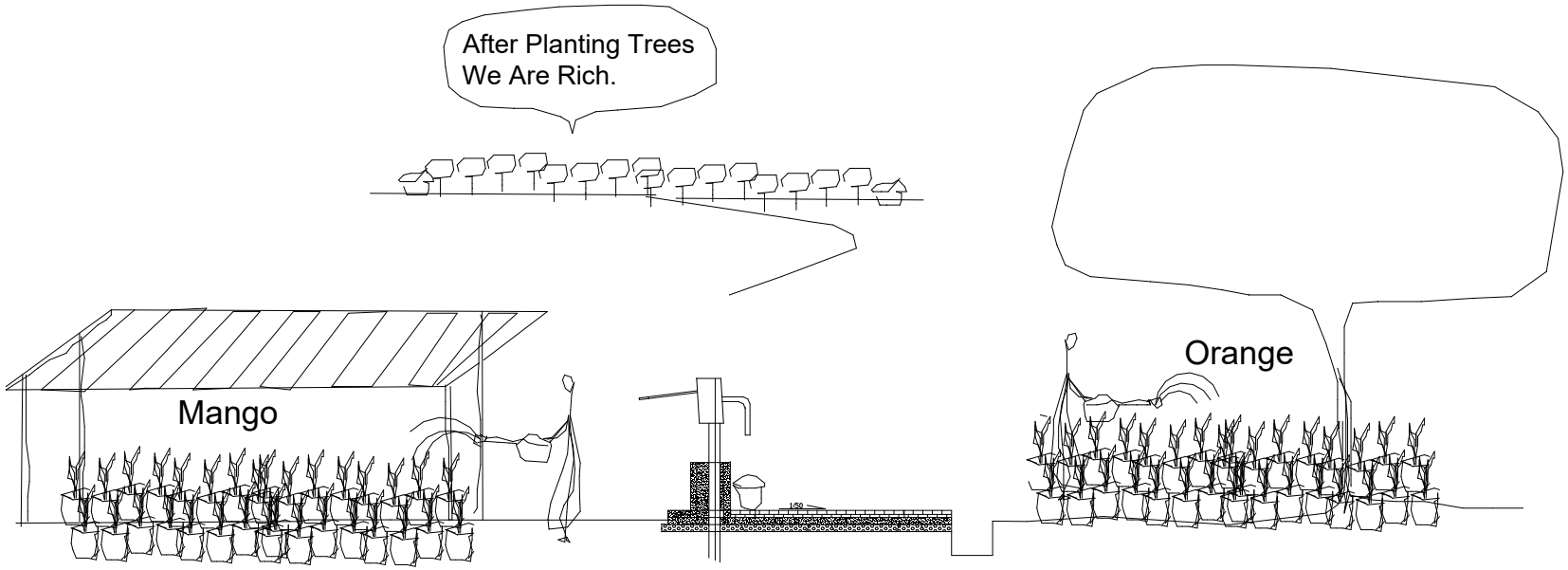
(246) Traditional Discovery of Underground Water



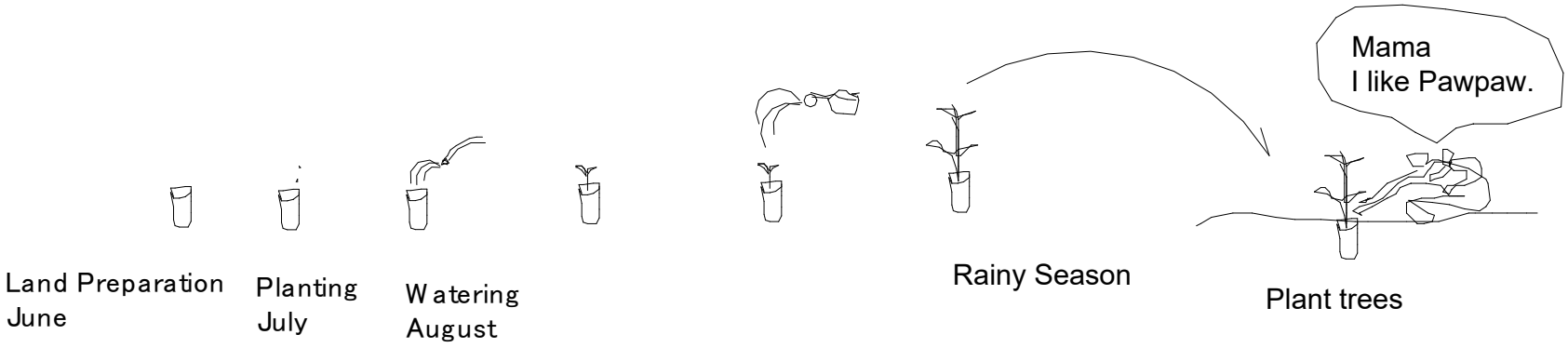
(247)Quartz


Oh .Quartz.
Soon,Water Is Coming.
Sure...
Sediment
Sandy Rock
Granite
Quartz

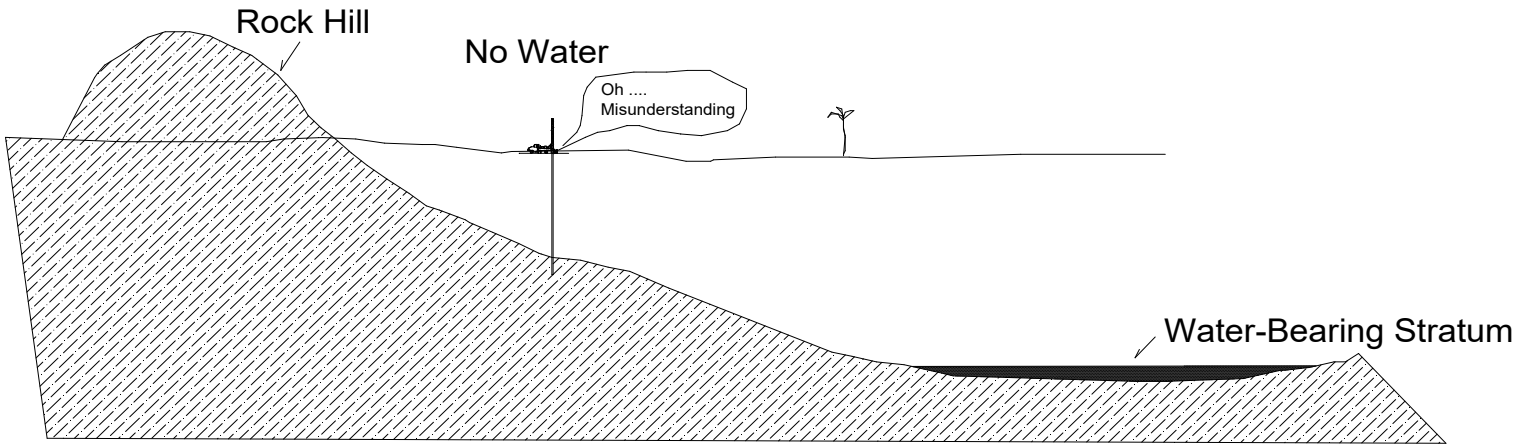
(248)Plant Trees



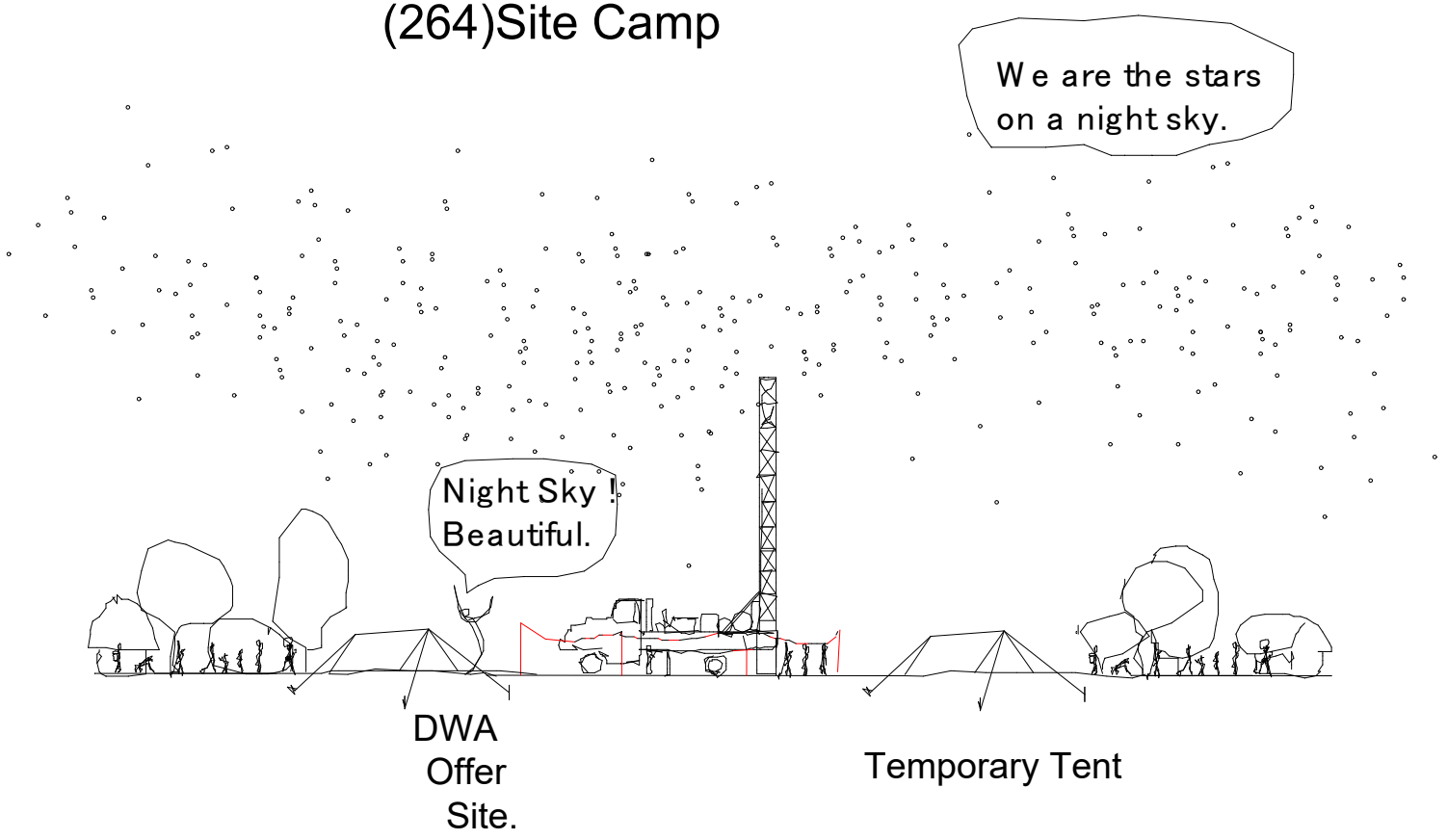
(249)Plant Trees



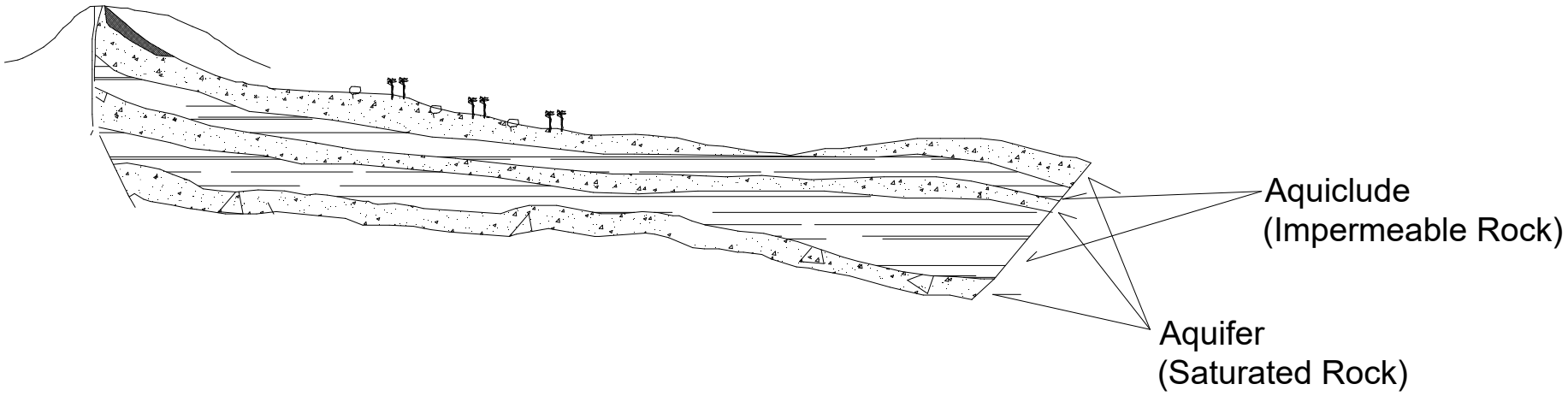
(250)Topography



(264)Site Camp



(274)Ground Water



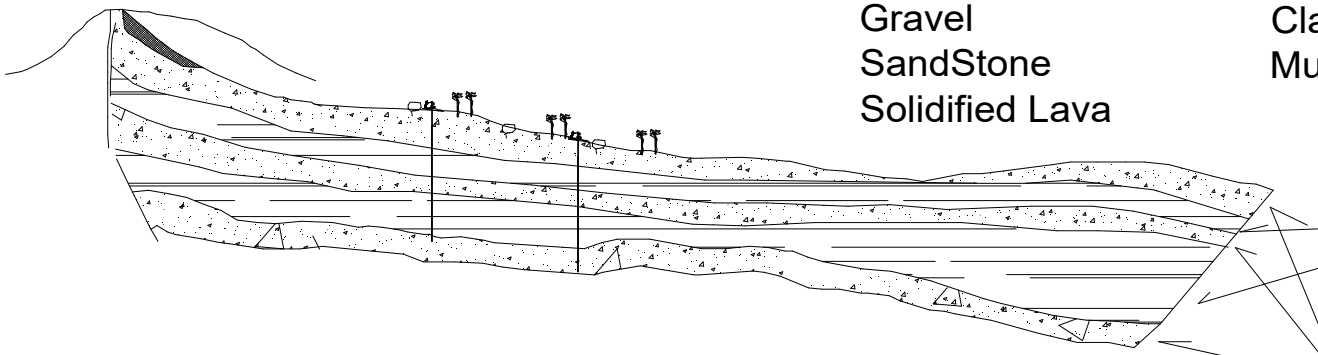
(275)Ground Water

Aquifer
(Saturated Rock)
(Permeable Rock)

Limestone
Gravel
SandStone
Solidified Lava

Aquiclude
(Impermeable Rock)

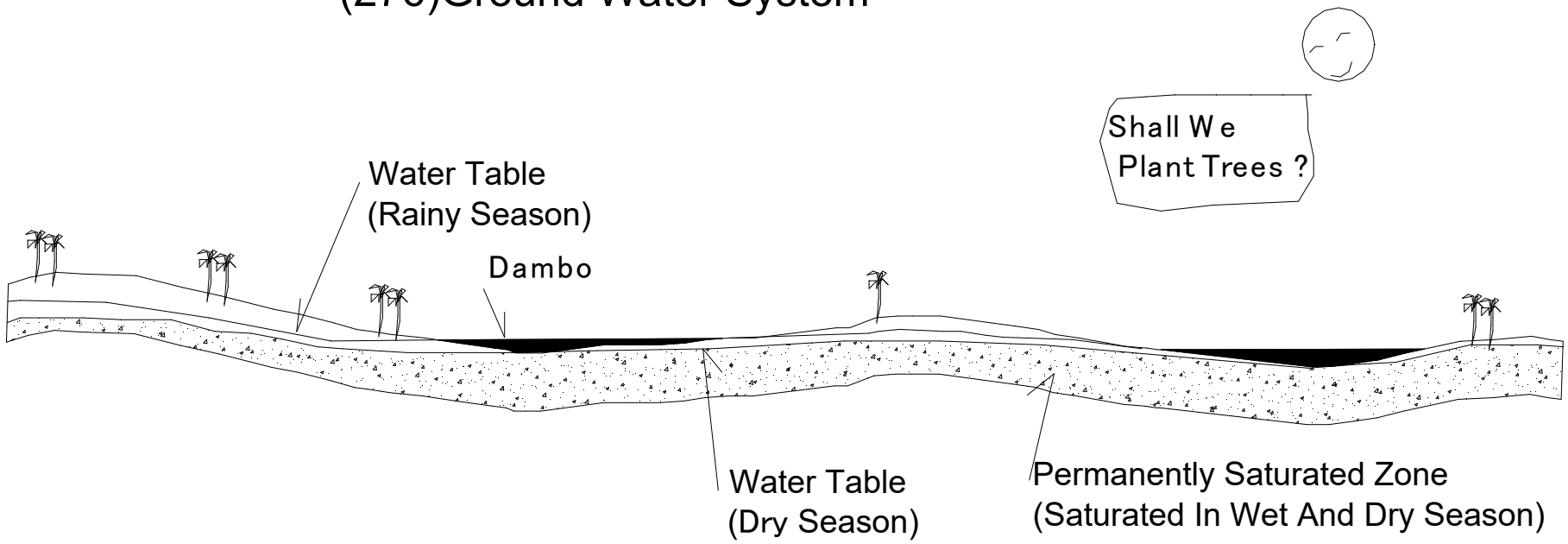
Shale
Clay
Mudstone



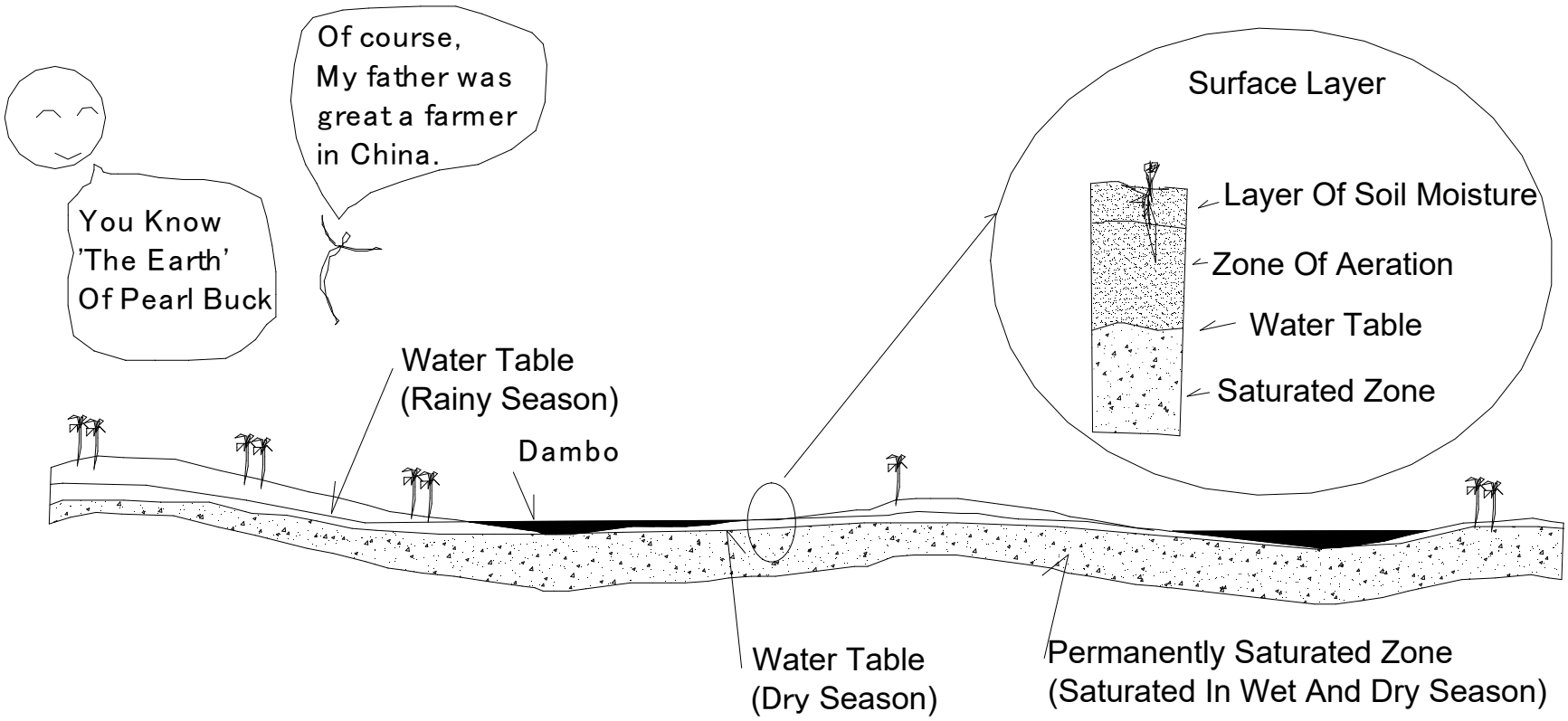
Aquiclude
(Impermeable Rock)

Aquifer
(Saturated Rock)

(276)Ground Water System

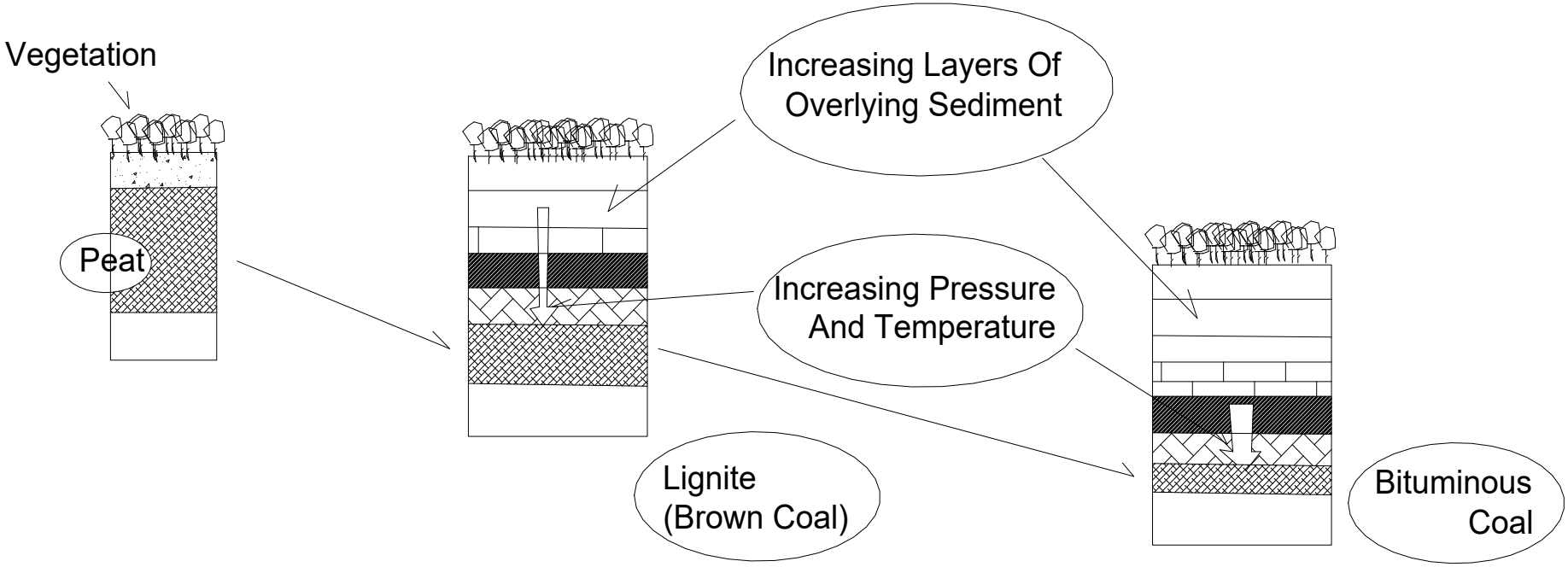


(277)Surface Layer

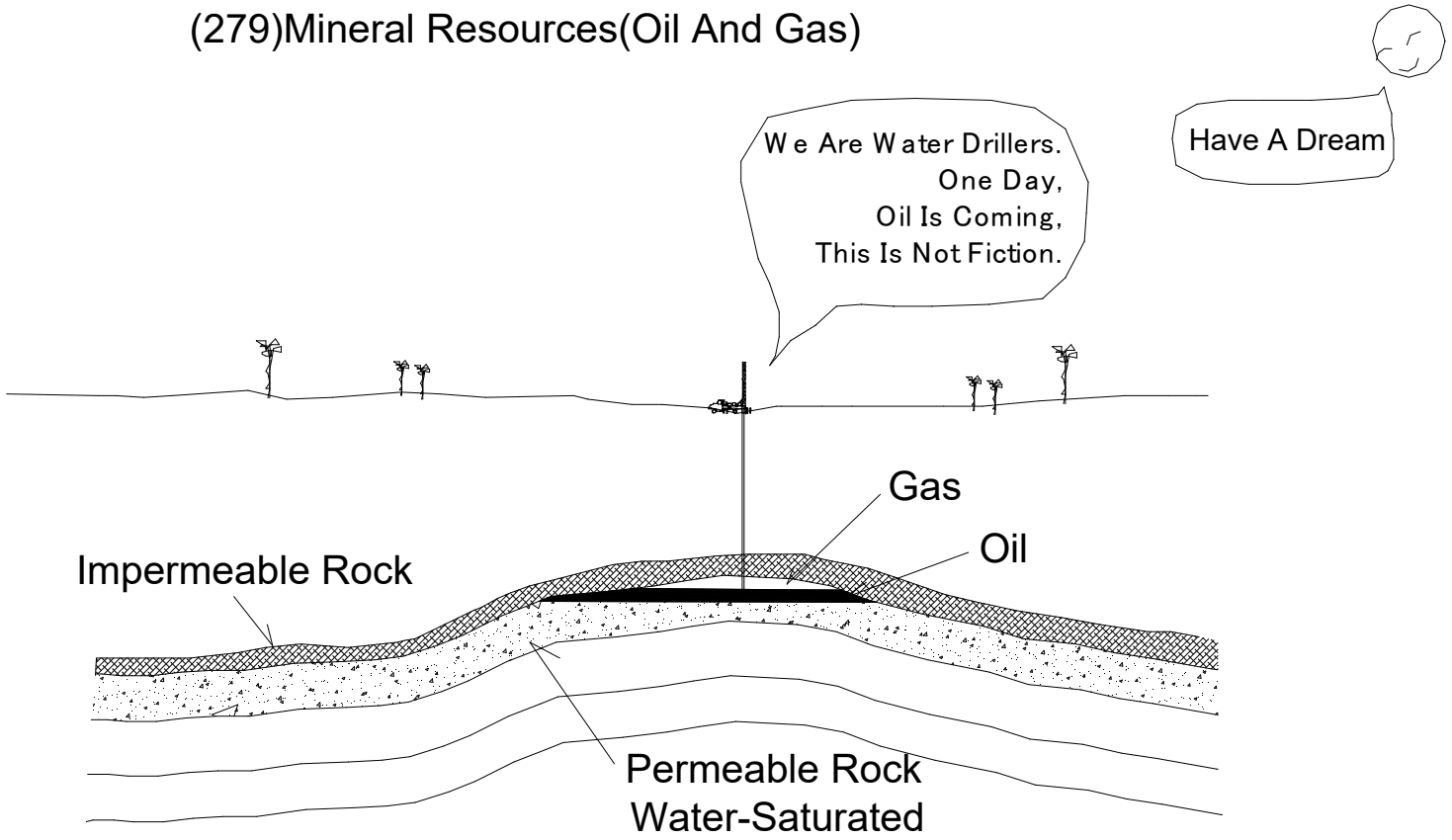


(278)Mineral Resources

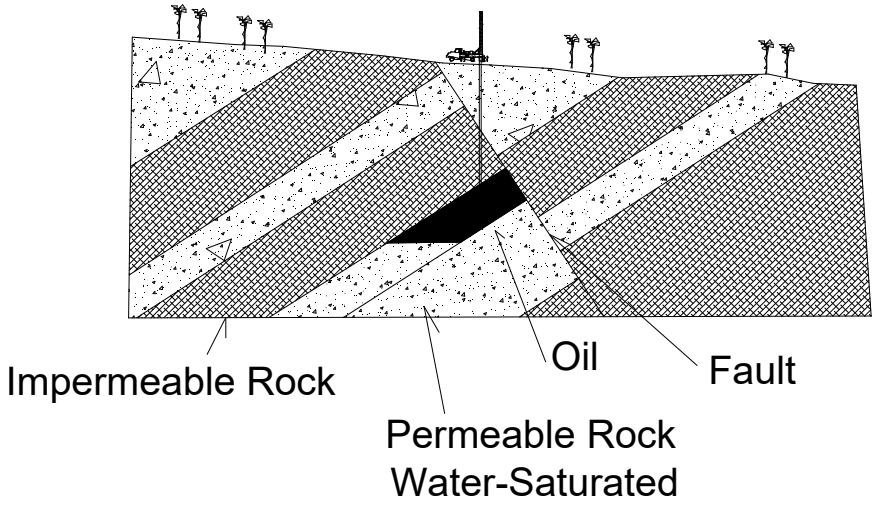
Coal



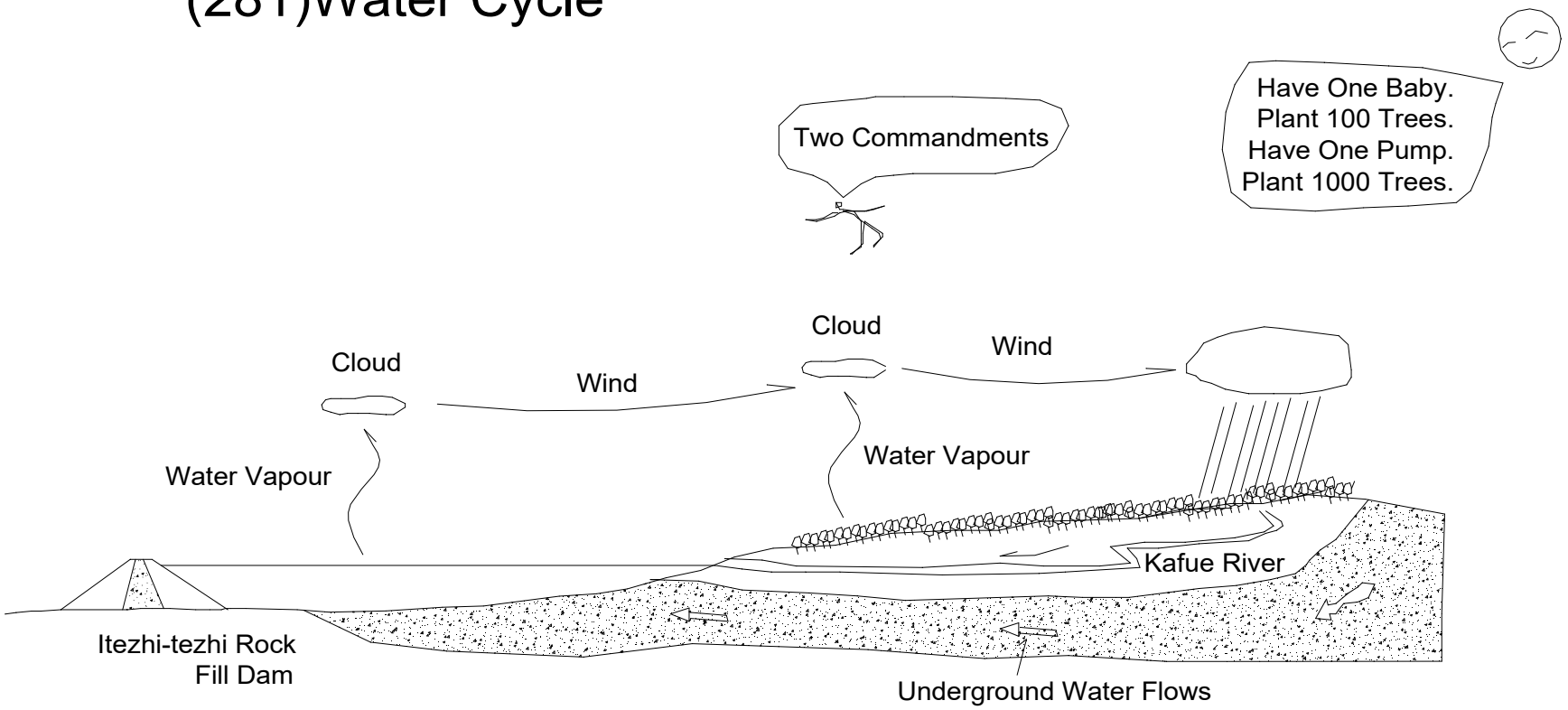
(279)Mineral Resources(Oil And Gas)



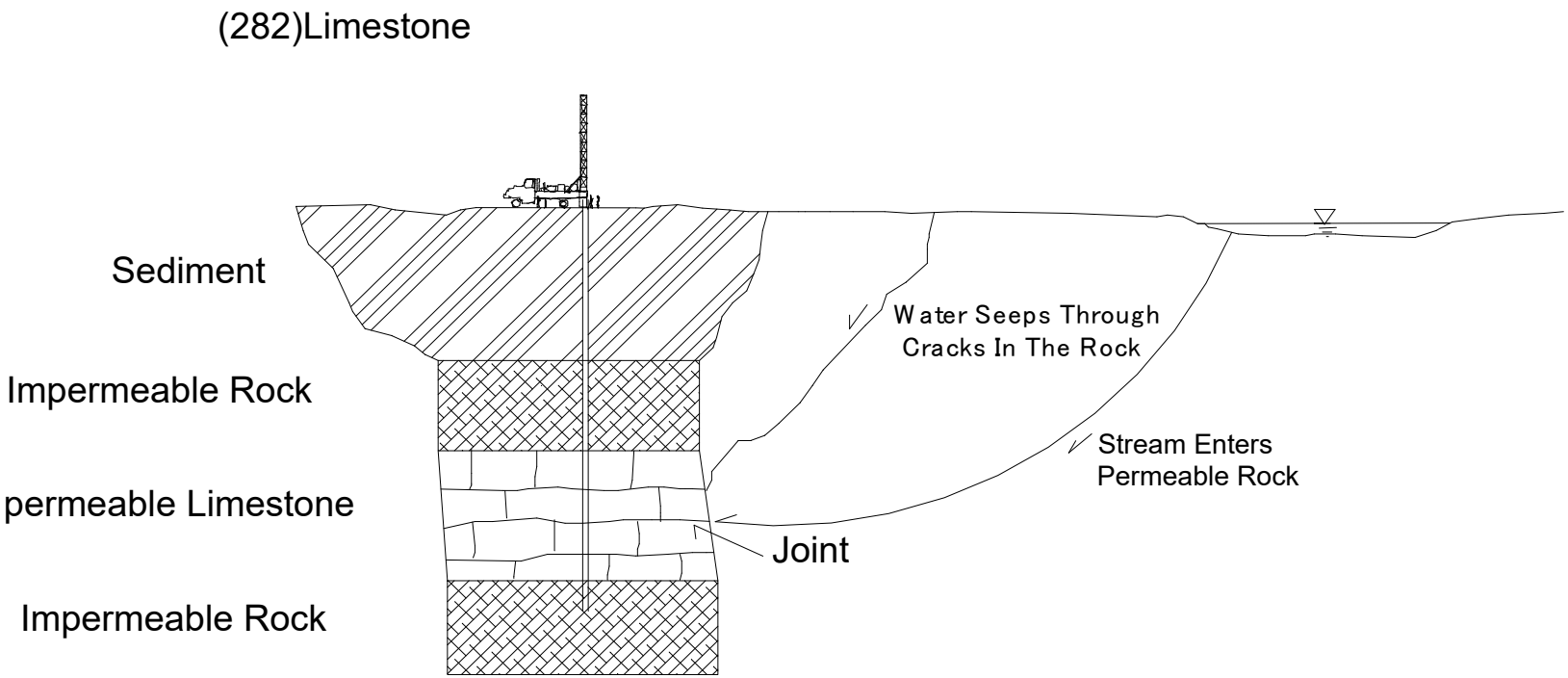
(280)Mineral Resources(Oil And Gas)



(281)Water Cycle

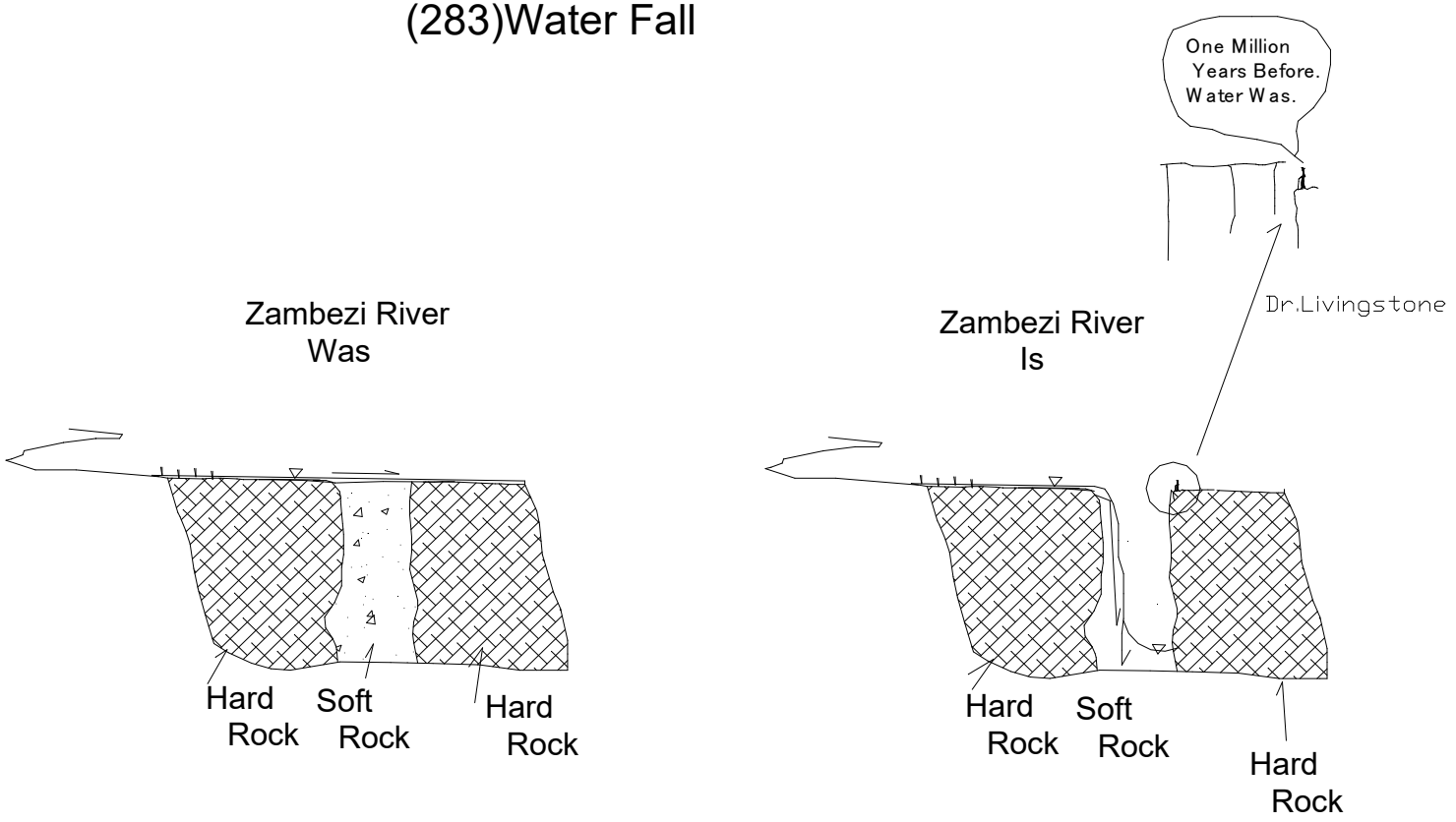


(282) Limestone

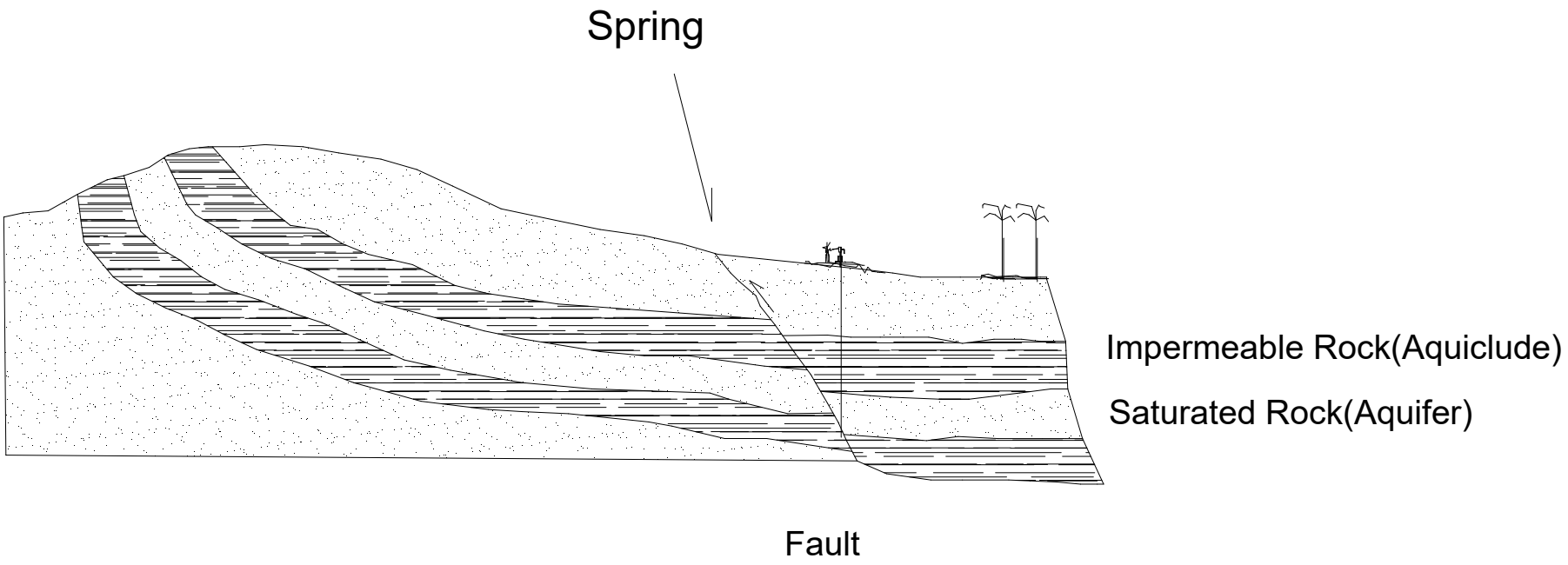


(283) Water Fall

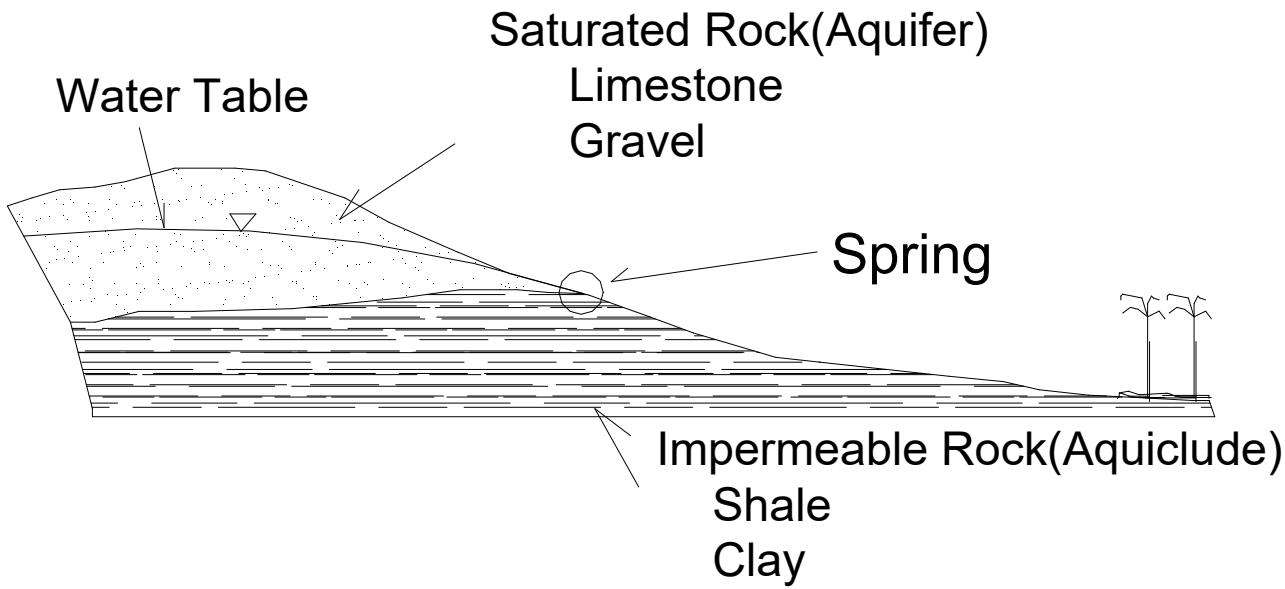
(283)Water Fall



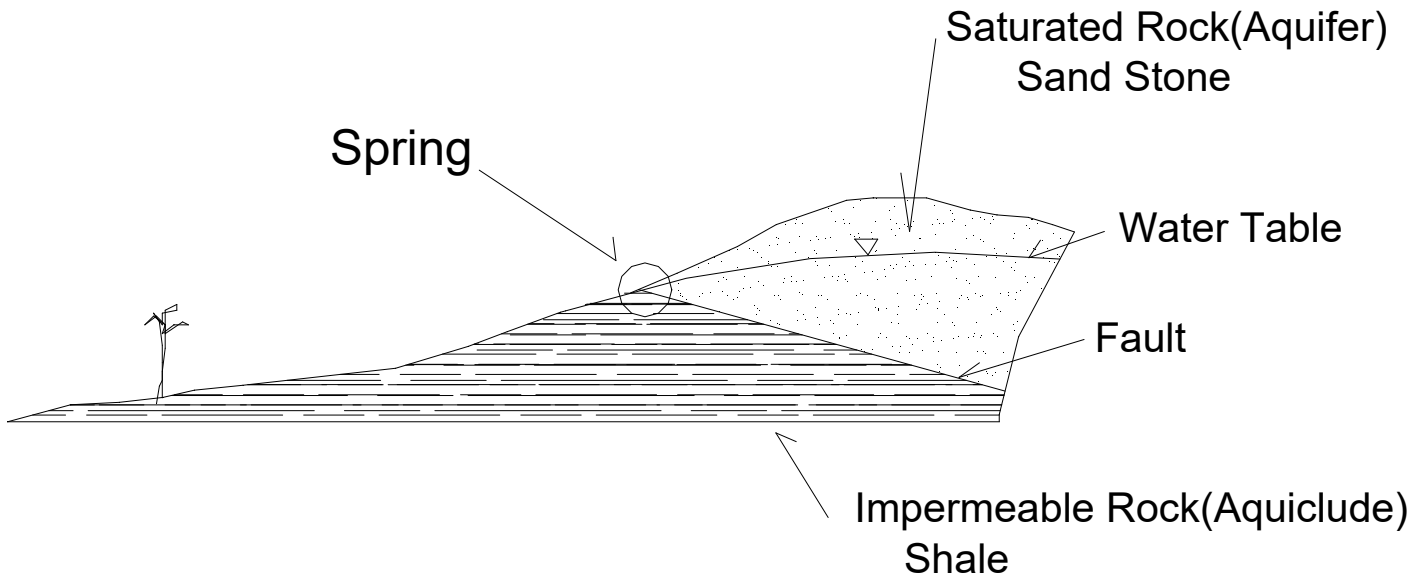
(284) Spring


Spring
Impermeable Rock(Aquiclude)
Saturated Rock(Aquifer)
Fault

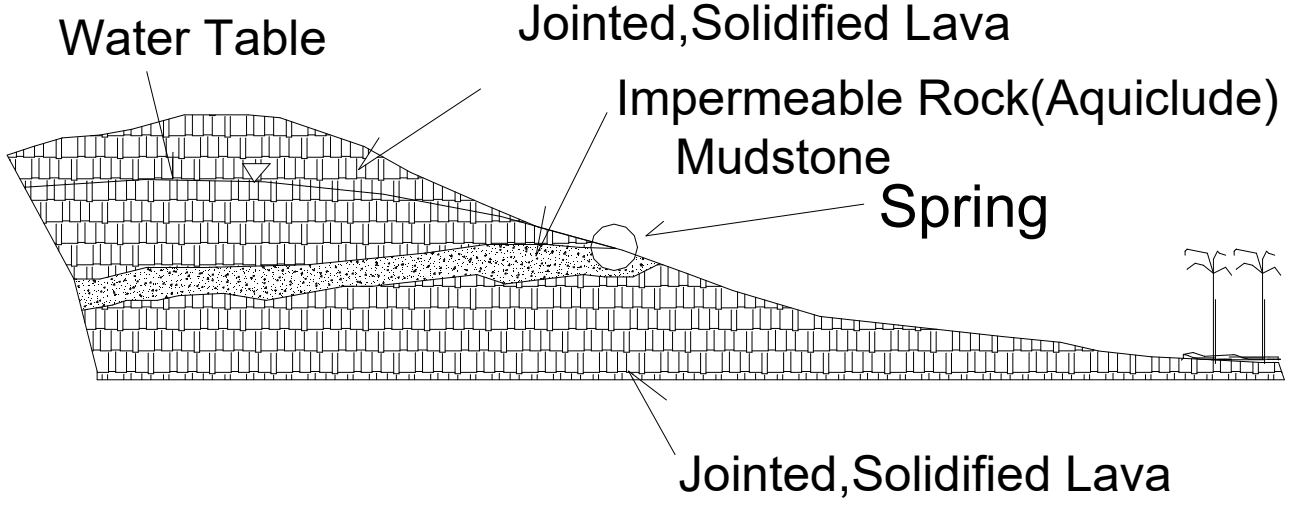
(285) Spring


Saturated Rock(Aquifer)
Limestone
Gravel
Water Table
Spring
Impermeable Rock(Aquiclude)
Shale
Clay

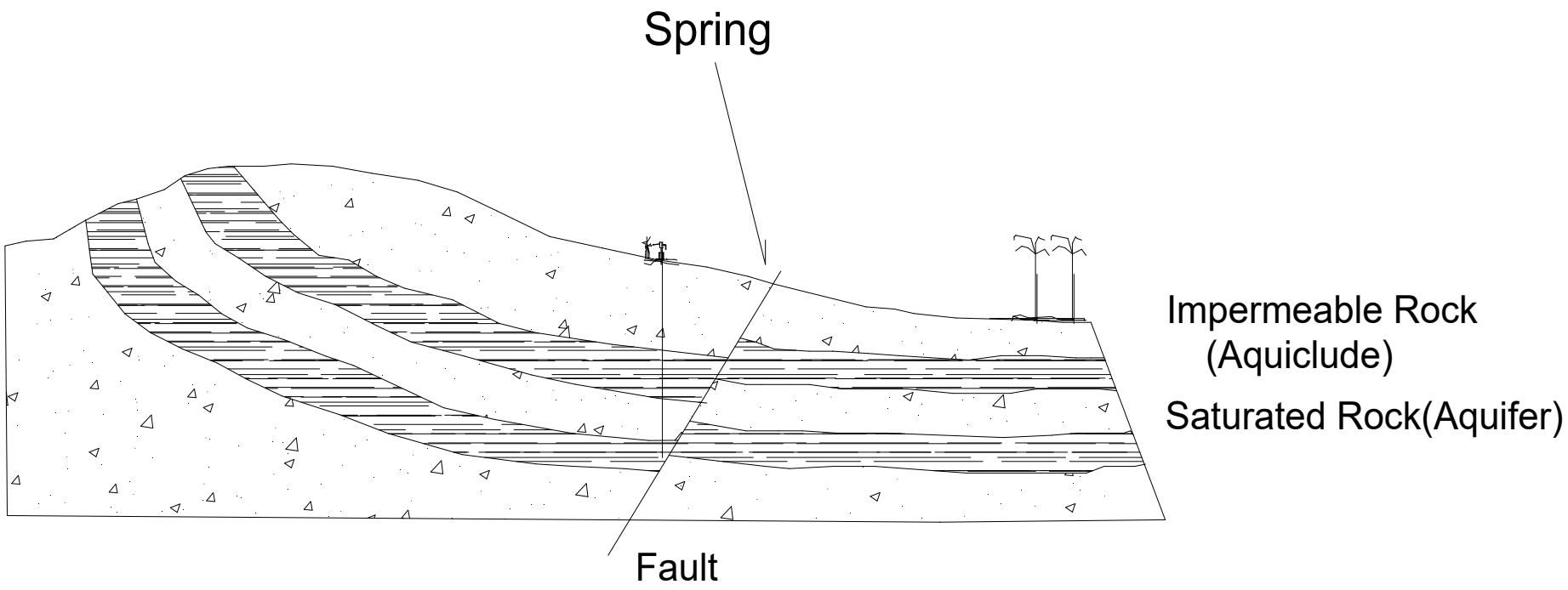
(286) Spring


Saturated Rock(Aquifer)
Sand Stone
Spring
Water Table
Fault
Impermeable Rock(Aquiclude)
Shale

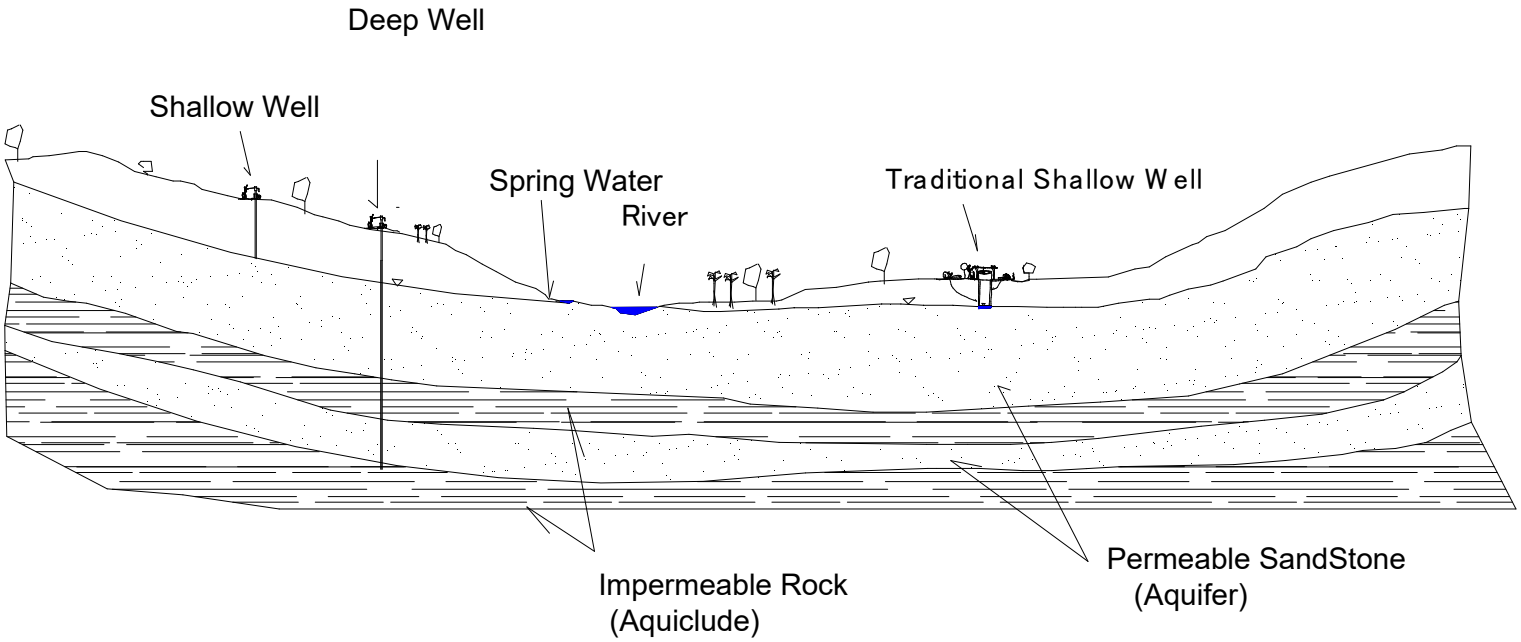
(287) Spring


Water Table
Jointed,Solidified Lava
Impermeable Rock(Aquiclude)
Mudstone
Spring
Jointed,Solidified Lava

(288) Spring


Spring
Impermeable Rock
(Aquiclude)
Saturated Rock(Aquifer)
Fault

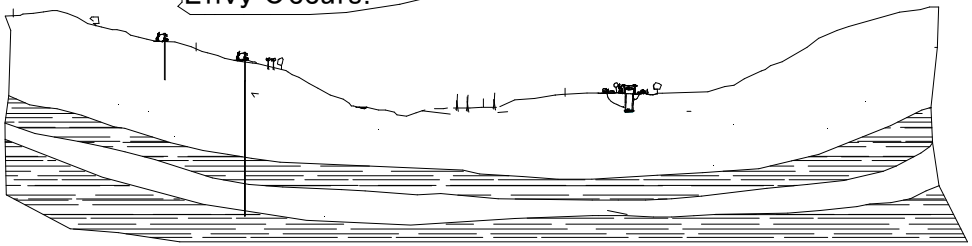
(290)Groundwater



(291)After Cutting Trees,After Planting Trees

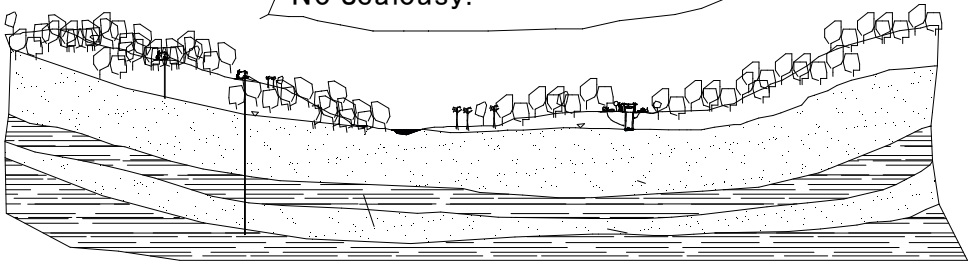
After Cutting Trees

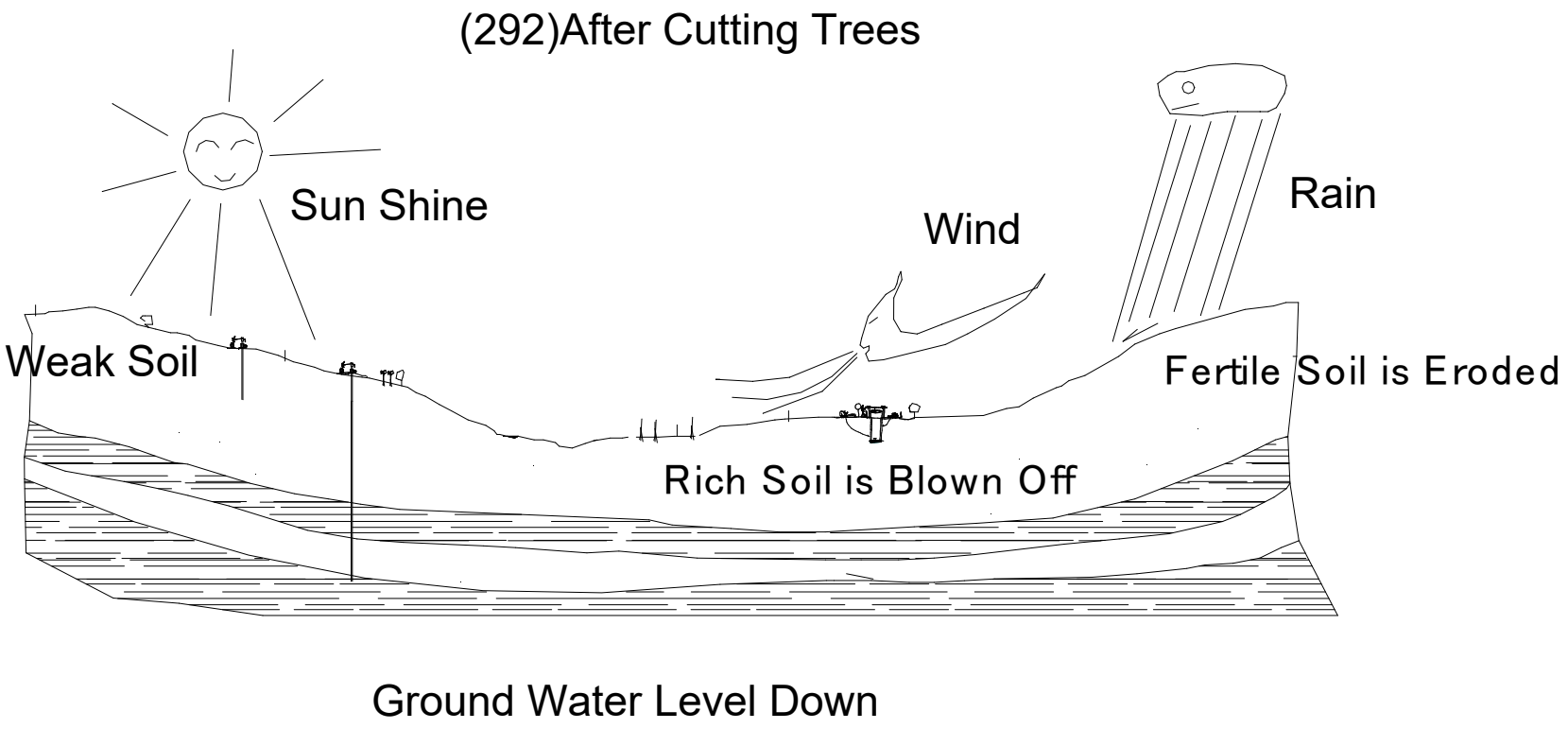
No Water,No Cattle
No Maize,No Wife
Envy Occurs.



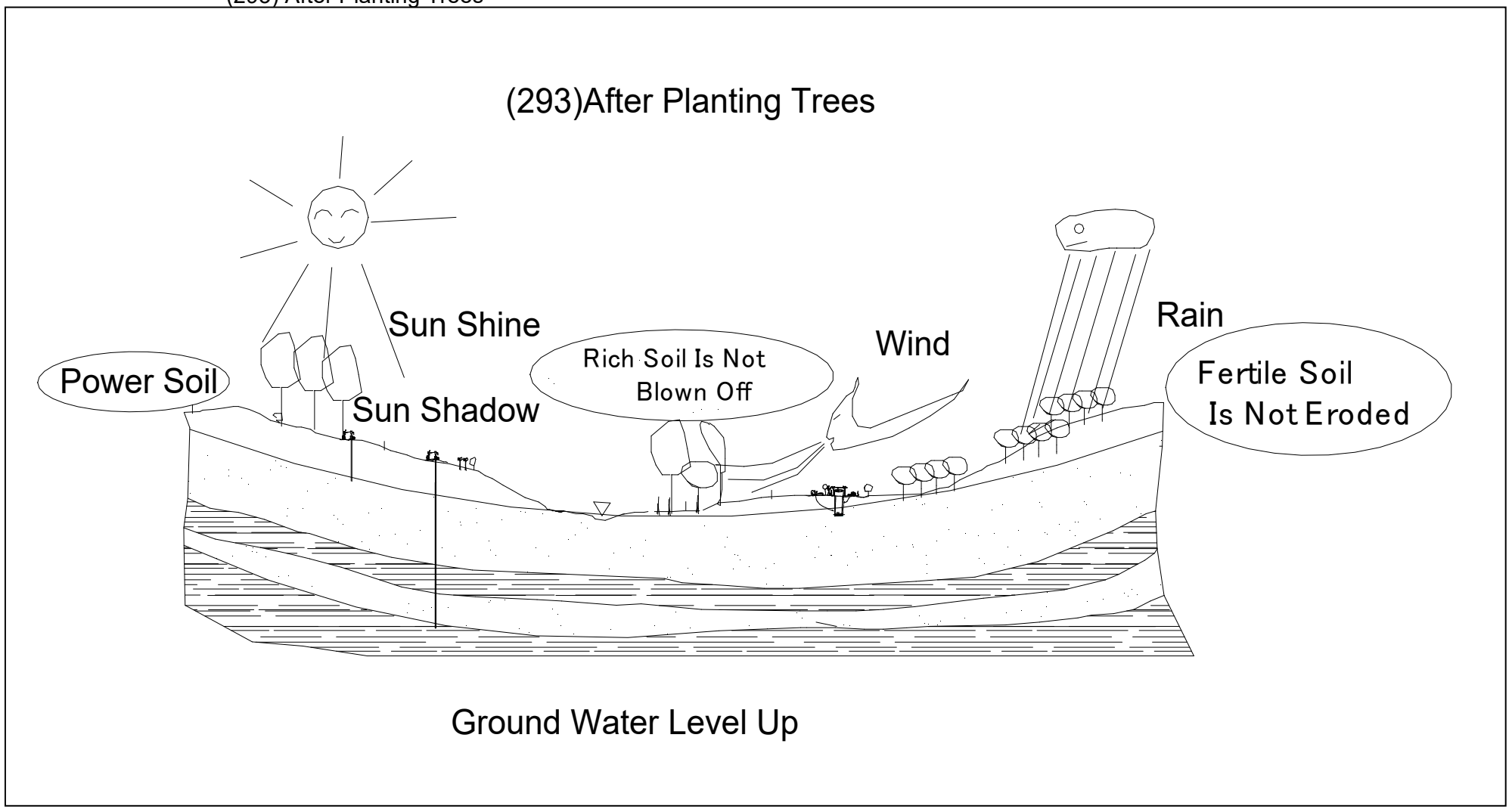
After Planting Trees

Plenty Water,Many Cattle.
Plenty Maize,Wife Comes back.
No Jealousy.

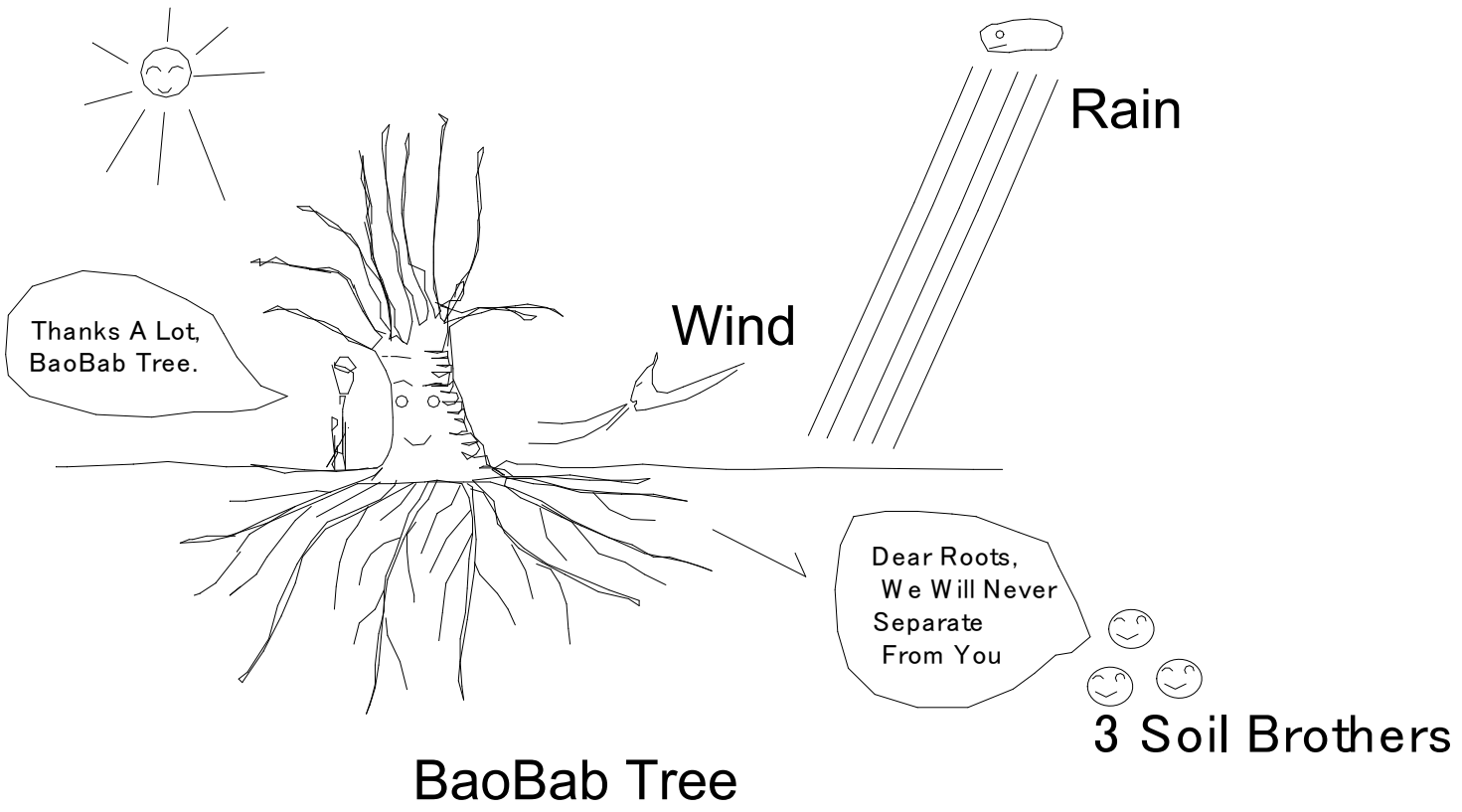



(292)After Cutting Trees
Sun Shine
Wind
Rain
Weak Soil
Fertile Soil is Eroded
Rich Soil is Blown Off
Ground Water Level Down

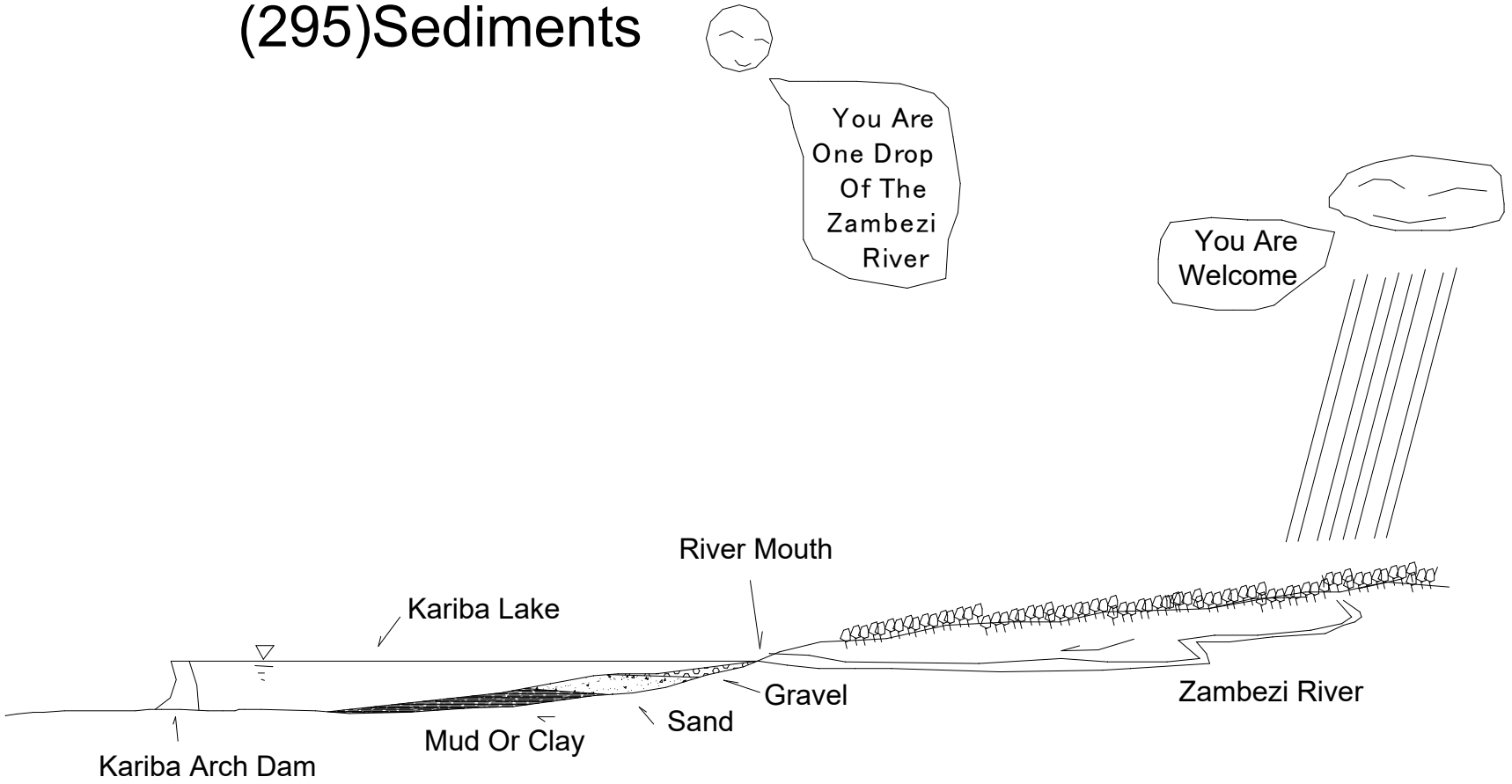
(293) After Planting Trees



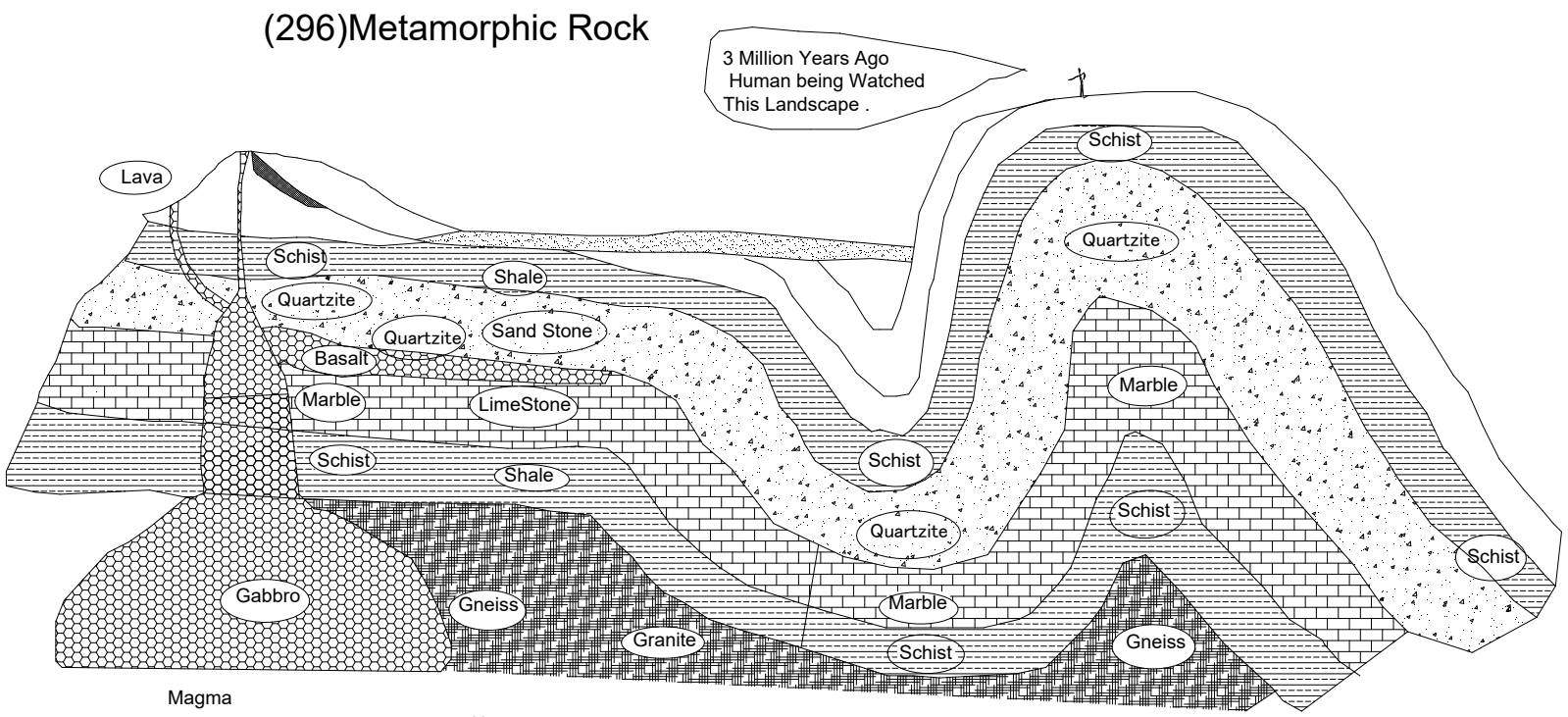
(294) Roots and Soil



(295)Sediments

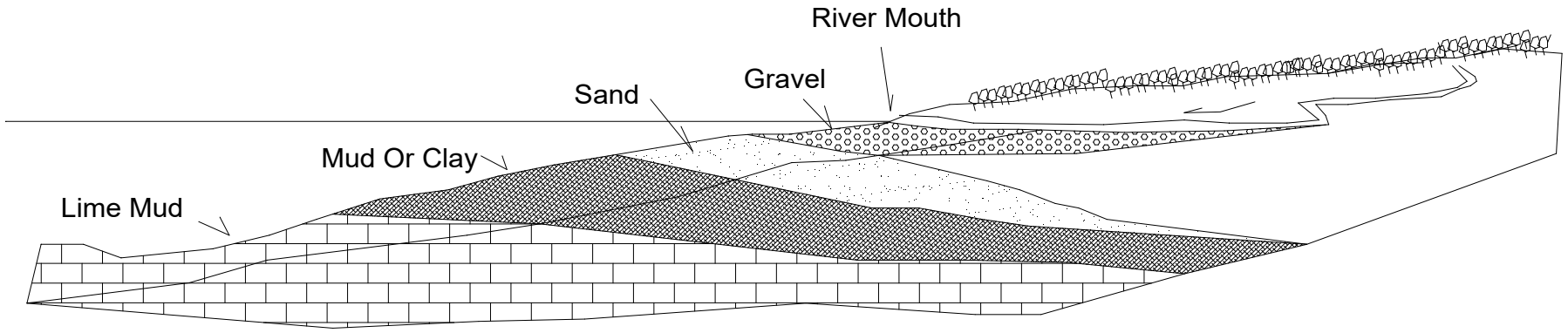


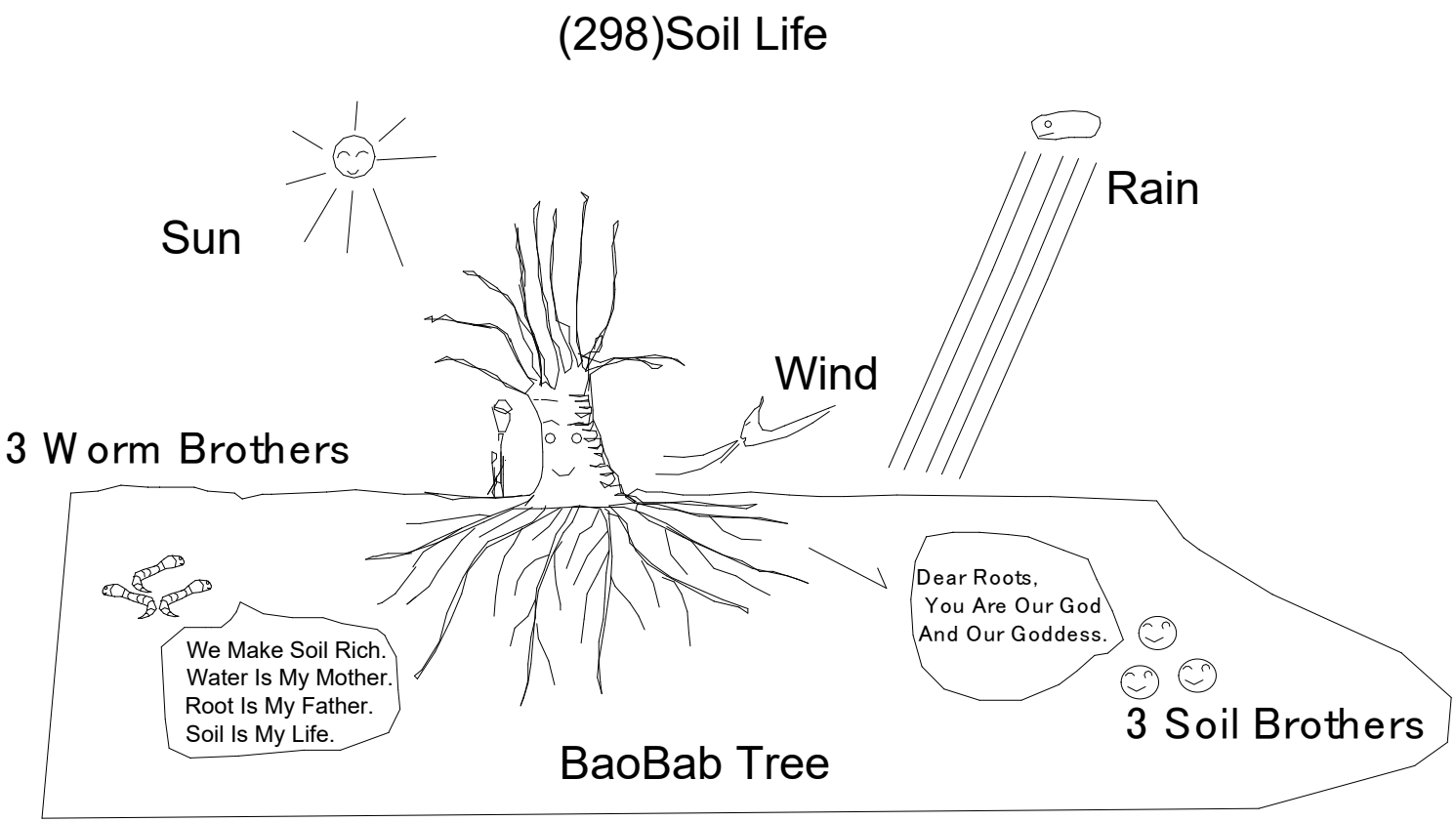
(296) Metamorphic Rock



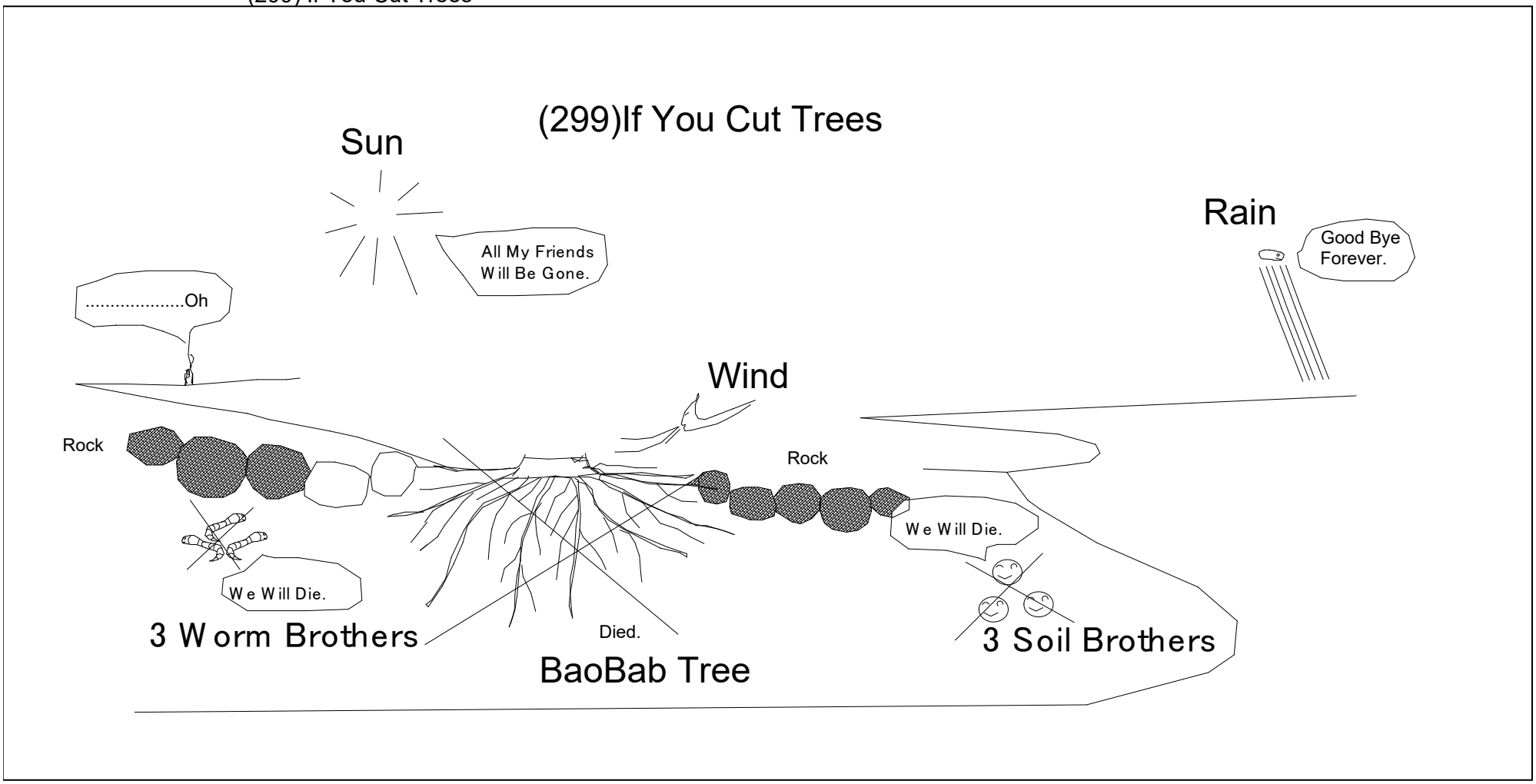
(297) Sediments

(297)Sediments

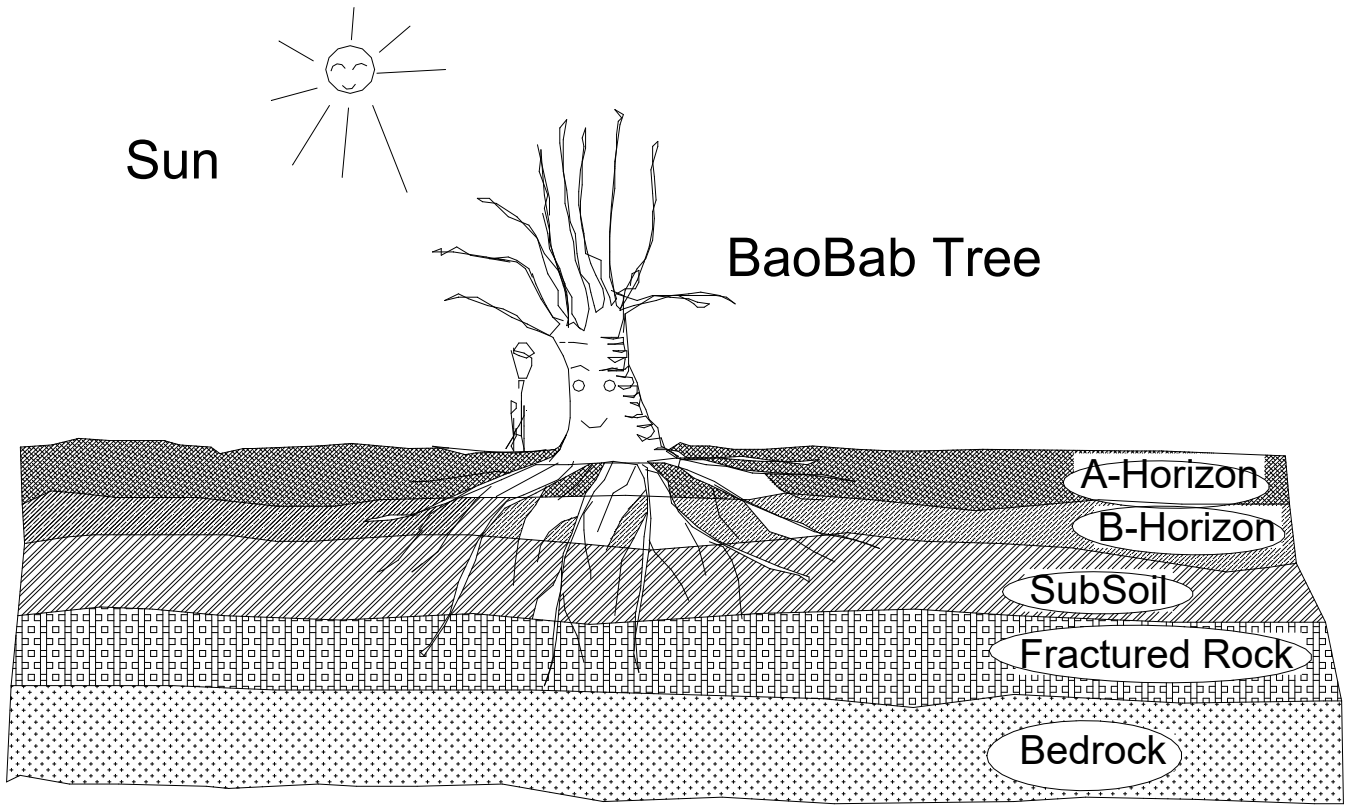



(298)Soil Life
Sun
Rain
Wind
3 Worm Brothers
We Make Soil Rich.
Water Is My Mother.
Root Is My Father.
Soil Is My Life.
Dear Roots,
You Are Our God
And Our Goddess.
3 Soil Brothers
BaoBab Tree

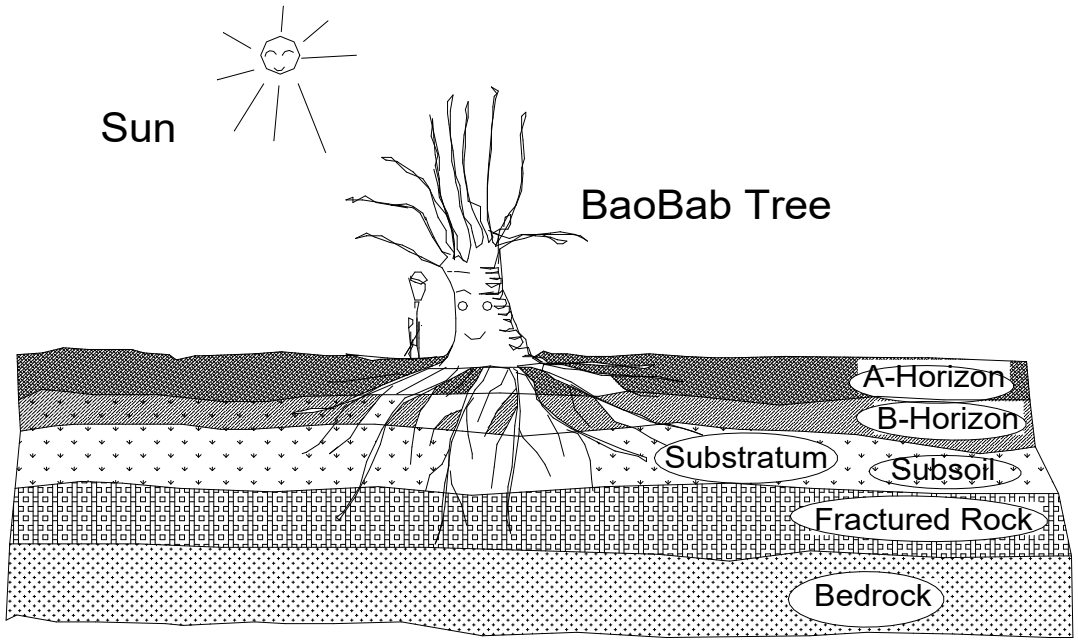
(299) If You Cut Trees



(300)Soil Profiles



（ 301） Parts Of Soil Profiles



Top Soil(Minerals, Decayed Plant,Leaf Material)

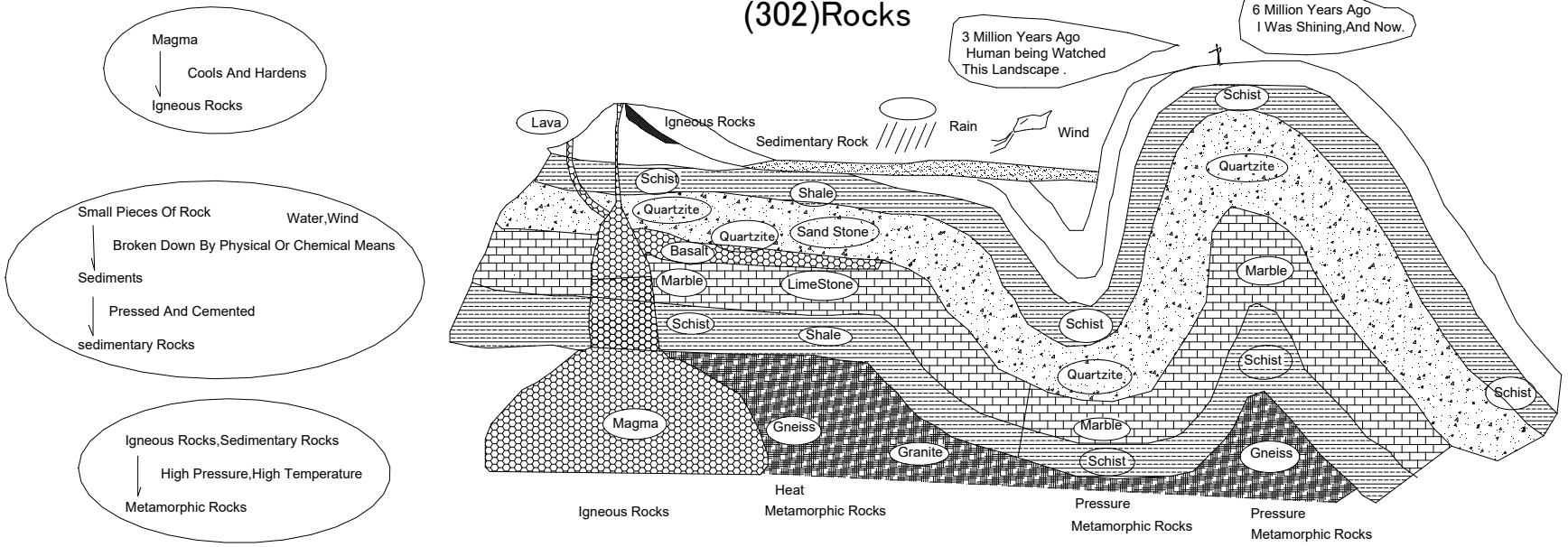
Subsoil Clay And Minerals

Weathered Bedrock Material

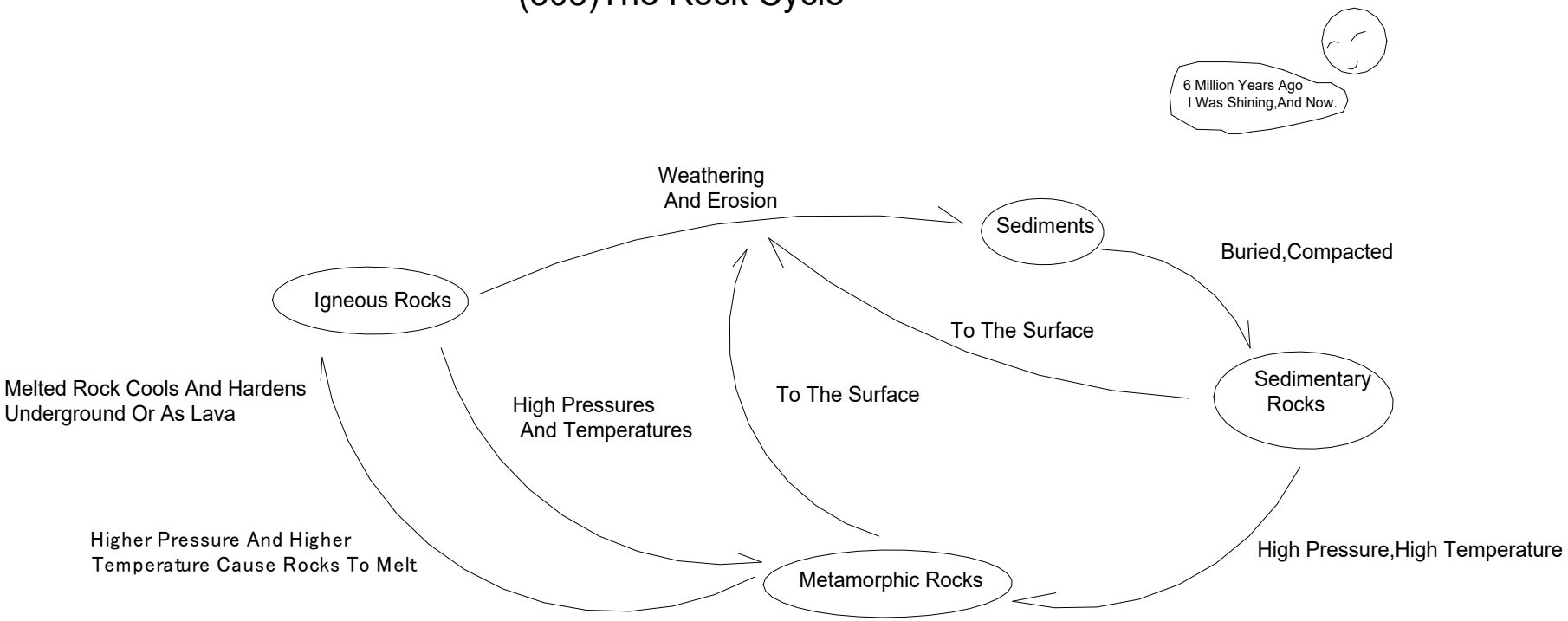
Top Soil Erode Away

Subsoil

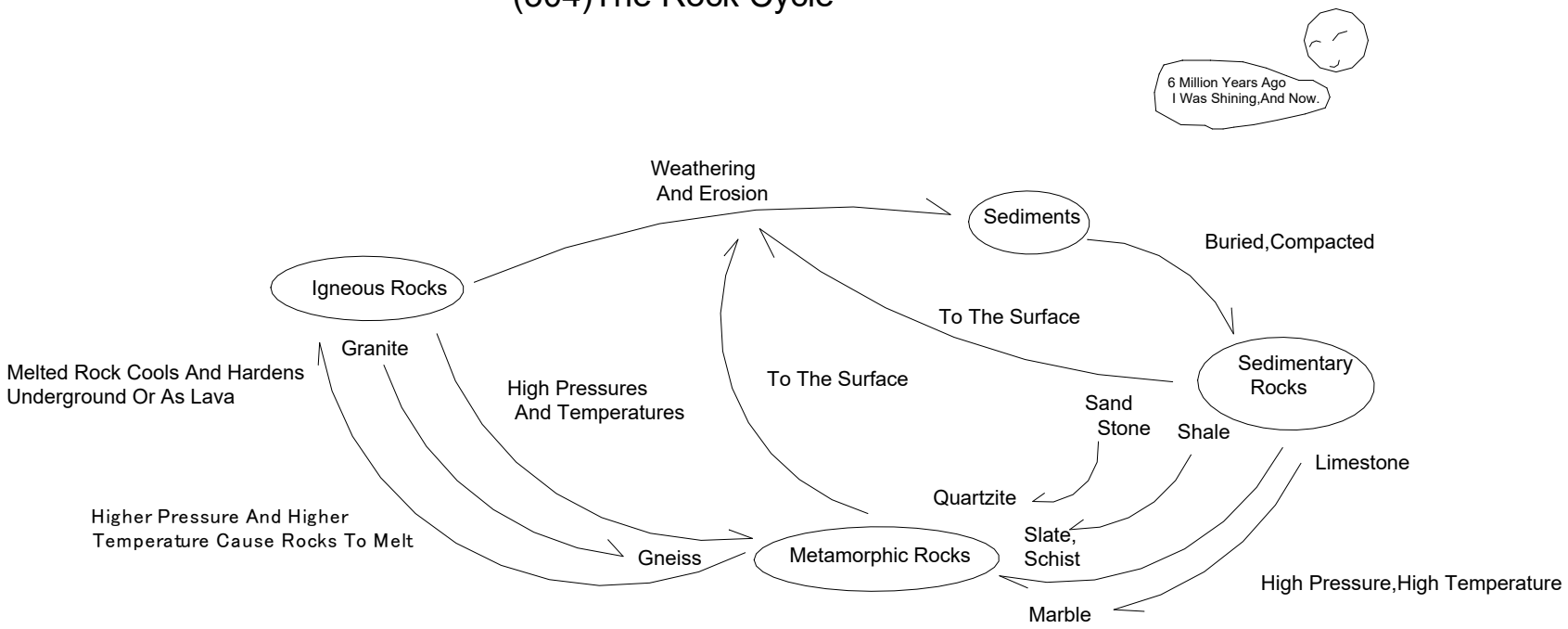
Substratum

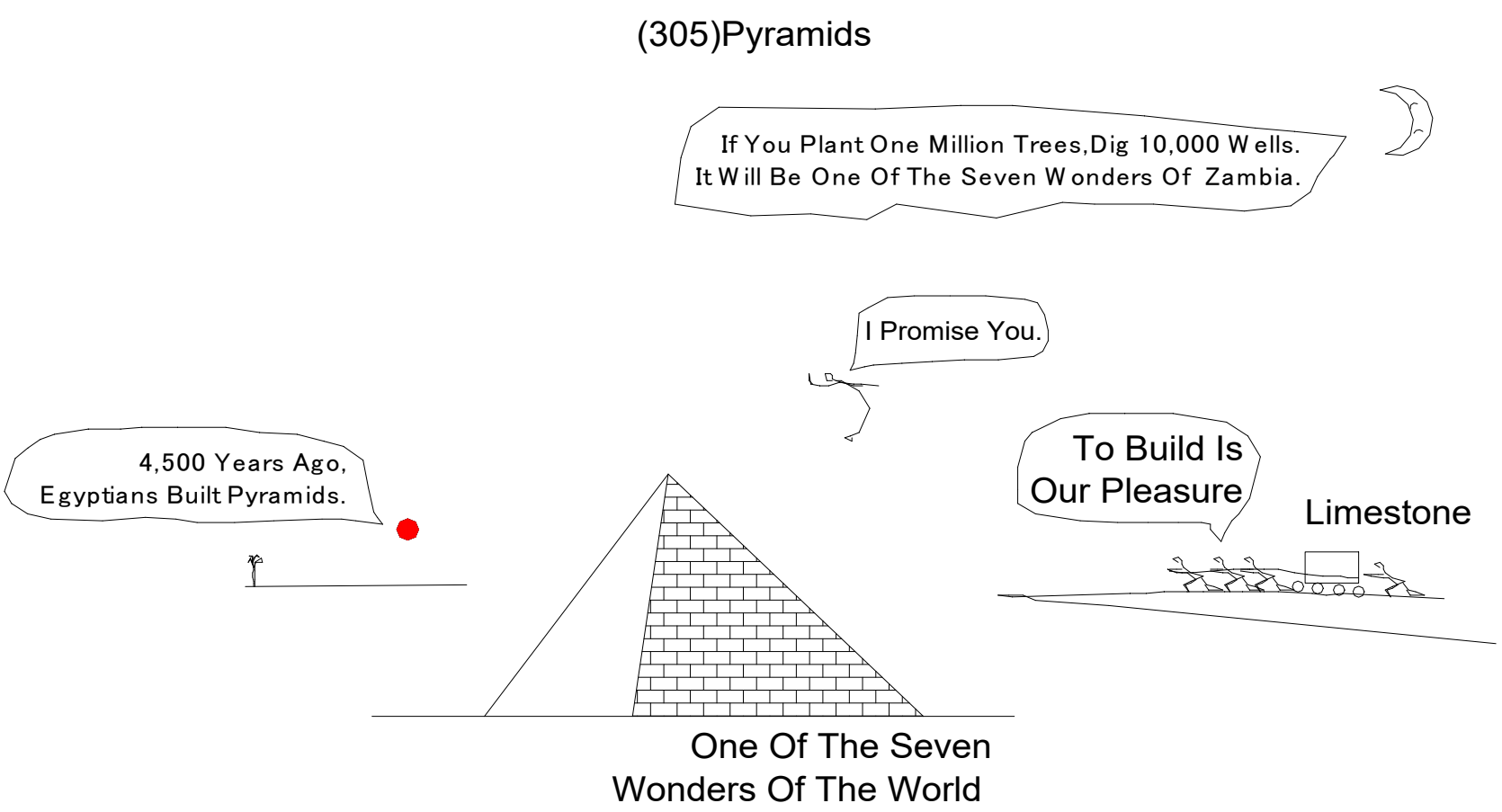

Magma
Cools And Hardens
Igneous Rocks
Small Pieces Of Rock
Water,Wind
Broken Down By Physical Or Chemical Means
Sediments
Pressed And Cemented
sedimentary Rocks
Igneous Rocks,Sedimentary Rocks
High Pressure,High Temperature
Metamorphic Rocks
(302)Rocks
3 Million Years Ago
Human being Watched
This Landscape .
6 Million Years Ago
I Was Shining,And Now.
Lava
Igneous Rocks
Sedimentary Rock
Rain
Wind
Schist
Quartzite
Shale
Sand Stone
Basalt
Marble
LimeStone
Magma
Gneiss
Granite
Heat
Igneous Rocks
Metamorphic Rocks
Pressure
Metamorphic Rocks
Pressure
Metamorphic Rocks

(303)The Rock Cycle

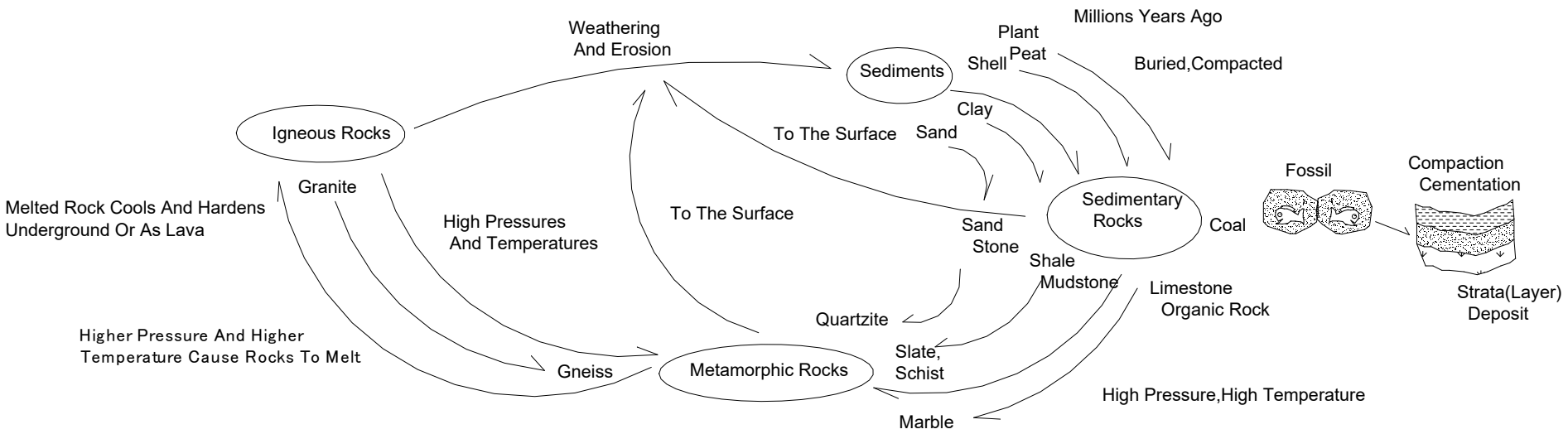


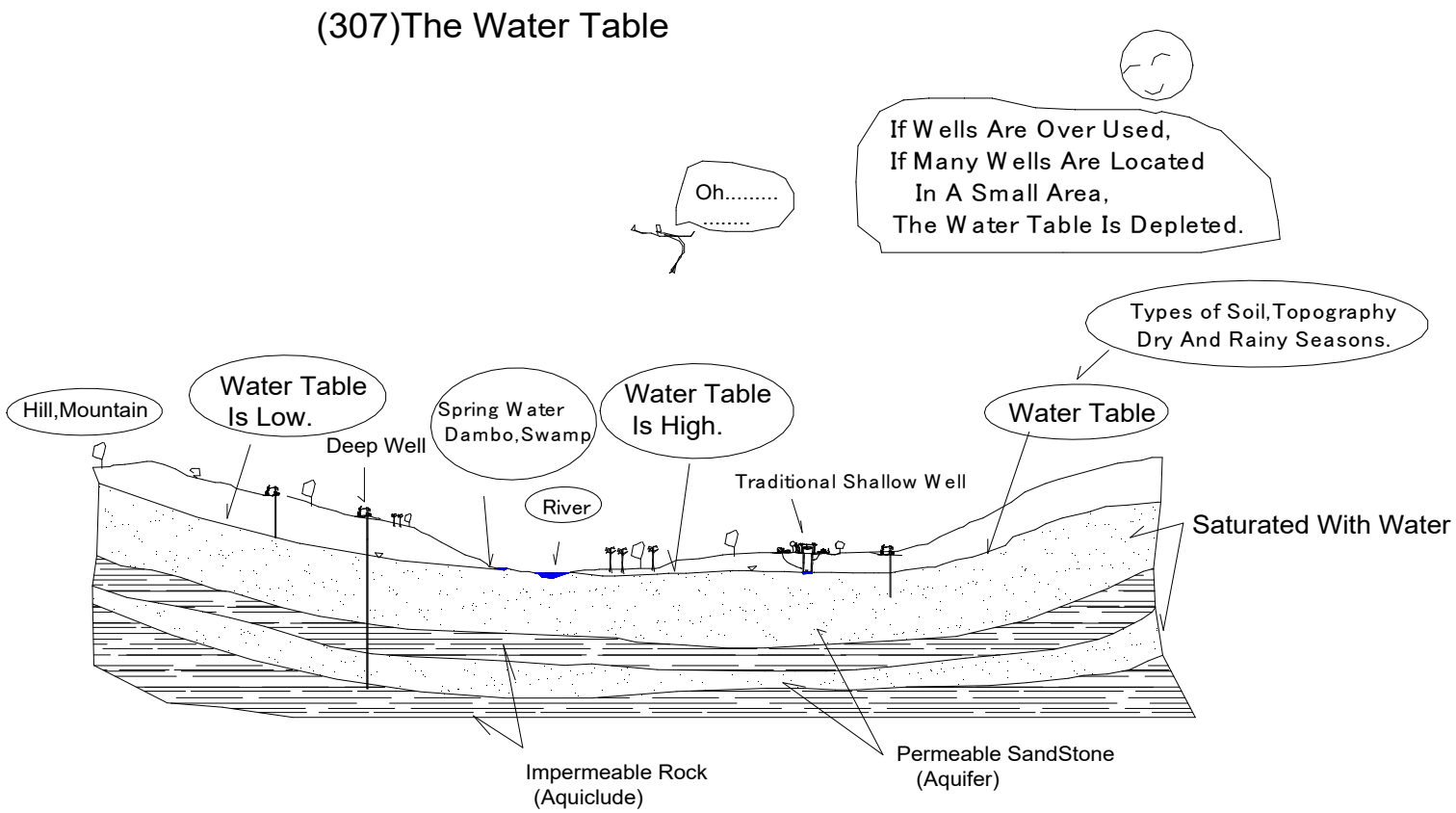
(304)The Rock Cycle



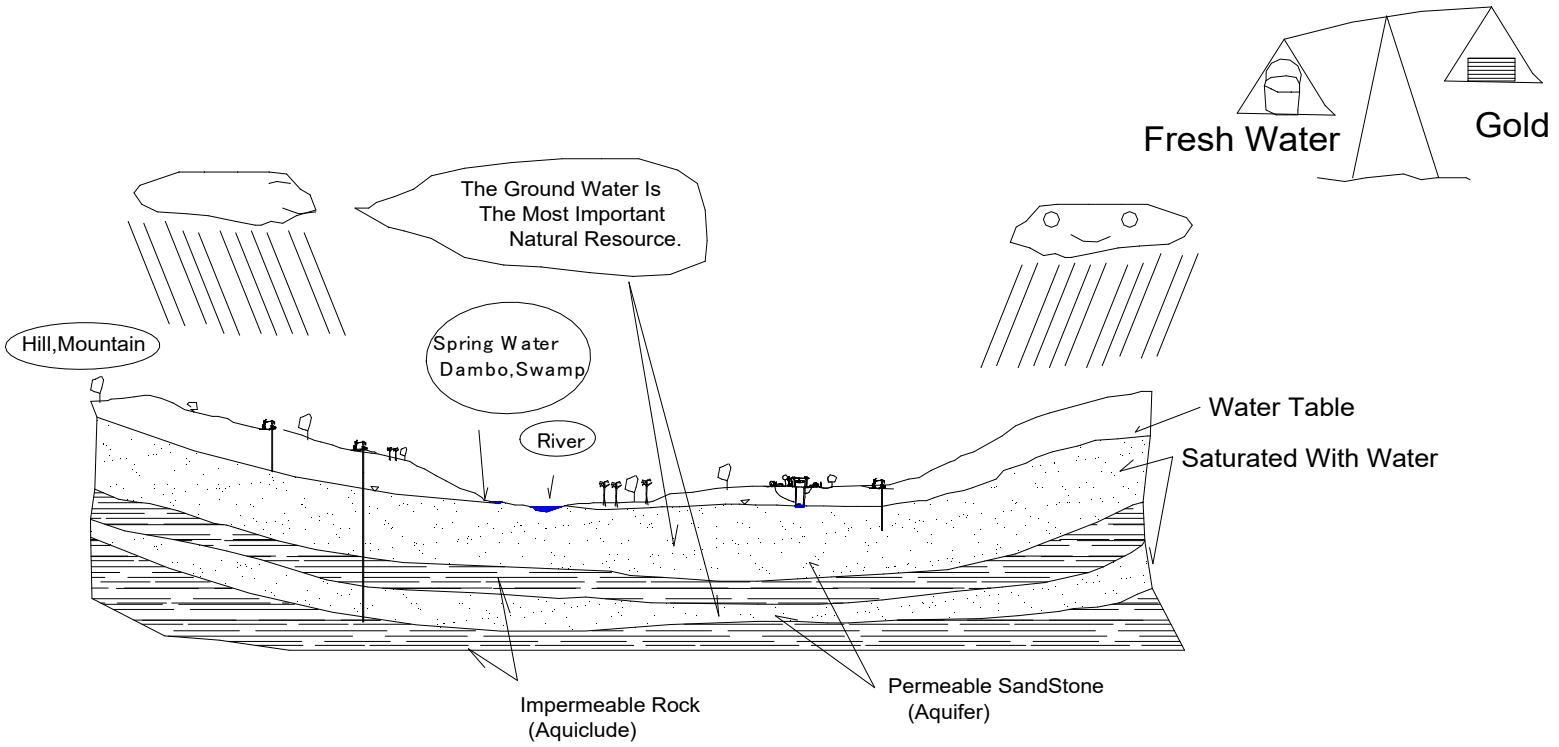

(305)Pyramids
If You Plant One Million Trees,Dig 10,000 Wells.
It Will Be One Of The Seven Wonders Of Zambia.
I Promise You.
4,500 Years Ago,
Egyptians Built Pyramids.
To Build Is
Our Pleasure
Limestone
One Of The Seven
Wonders Of The World

(306)Sedimentary Rock

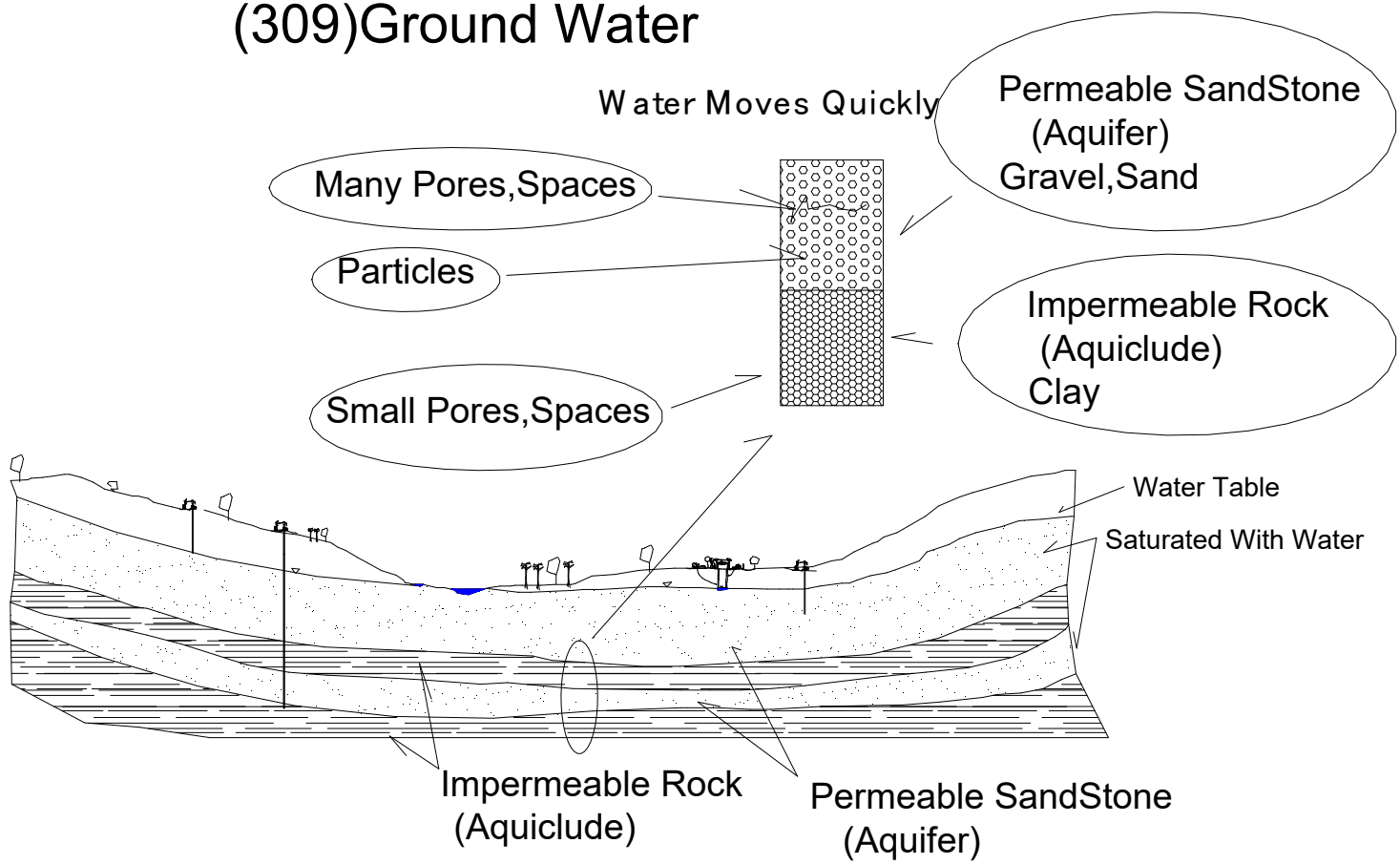



(307)The Water Table
If Wells Are Over Used,
If Many Wells Are Located
In A Small Area,
The Water Table Is Depleted.
Oh.....
.....
Types of Soil,Topography
Dry And Rainy Seasons.
Hill,Mountain
Water Table
Is Low.
Deep Well
Spring Water
Dambo,Swamp
River
Water Table
Is High.
Traditional Shallow Well
Water Table
Saturated With Water
Impermeable Rock
(Aquiclude)
Permeable SandStone
(Aquifer)

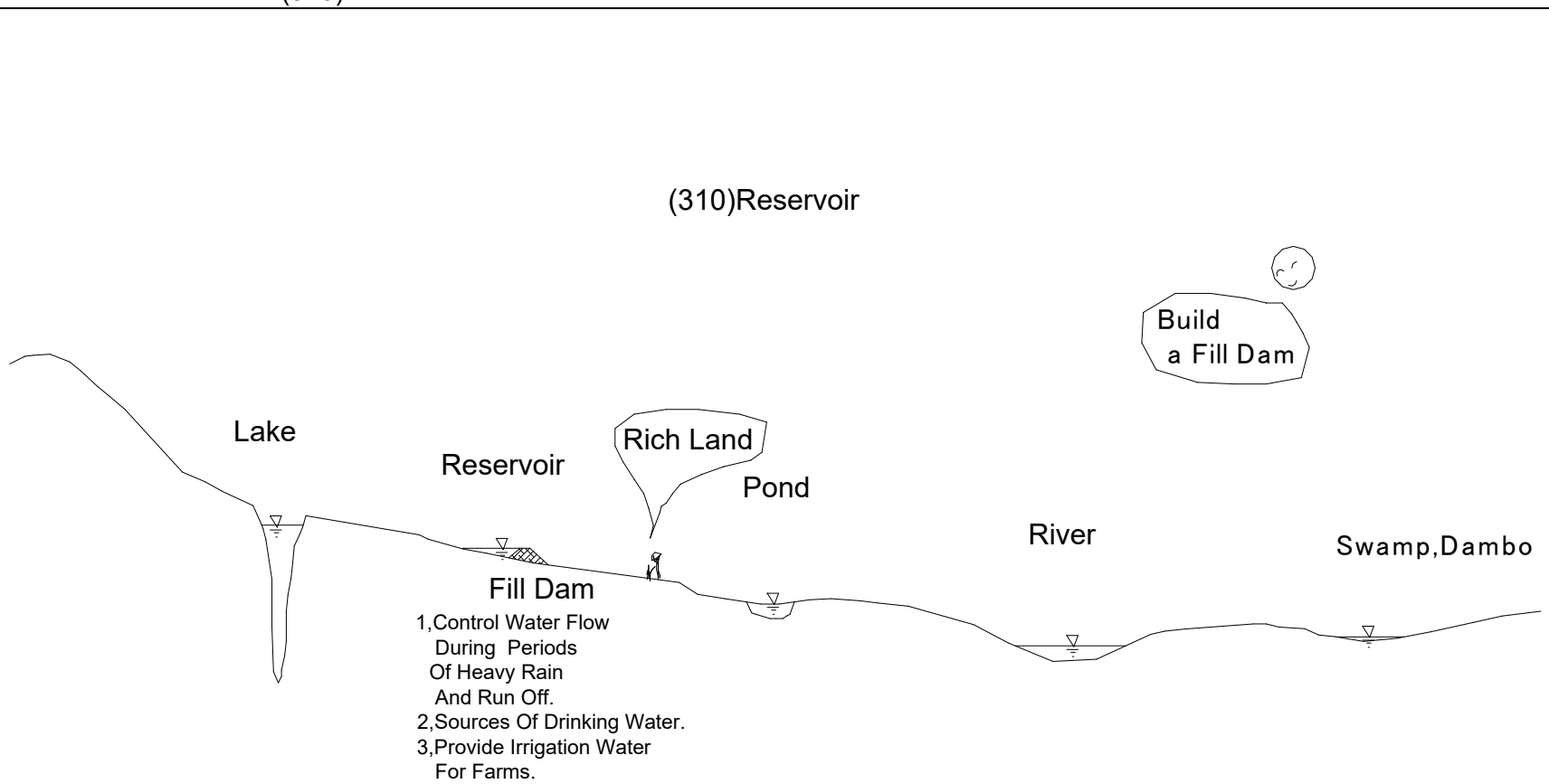
(308)Fresh Water
Below The Earth's Surface



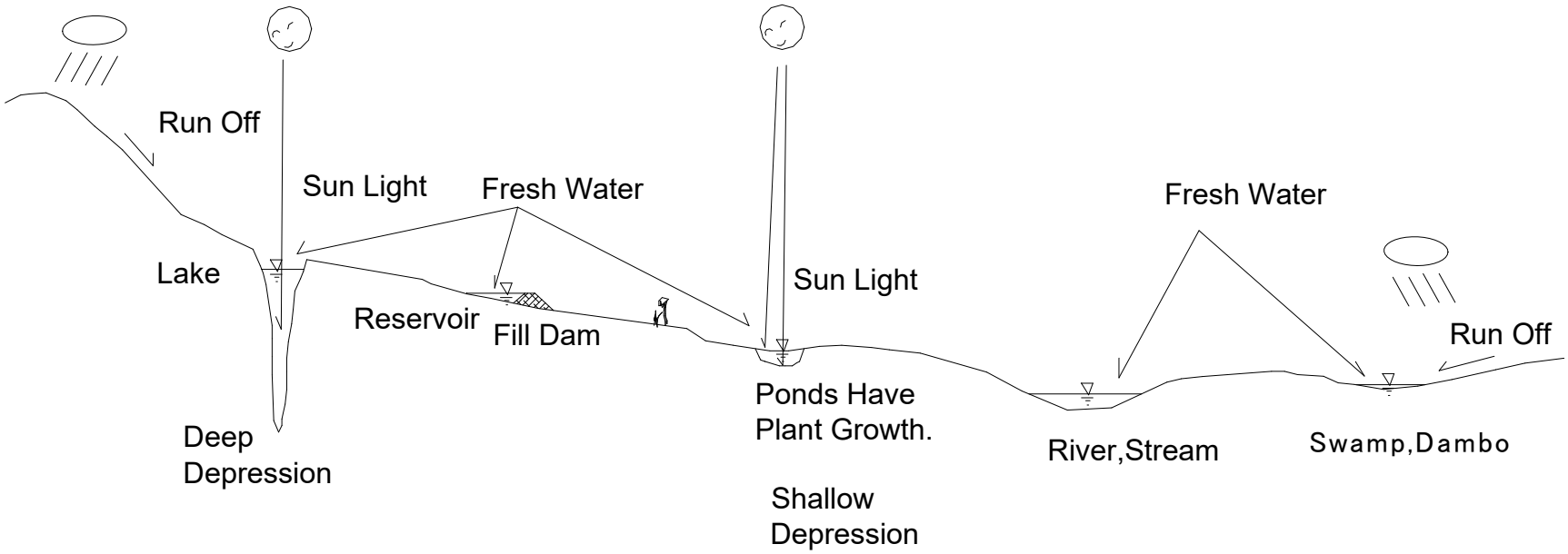
(309)Ground Water

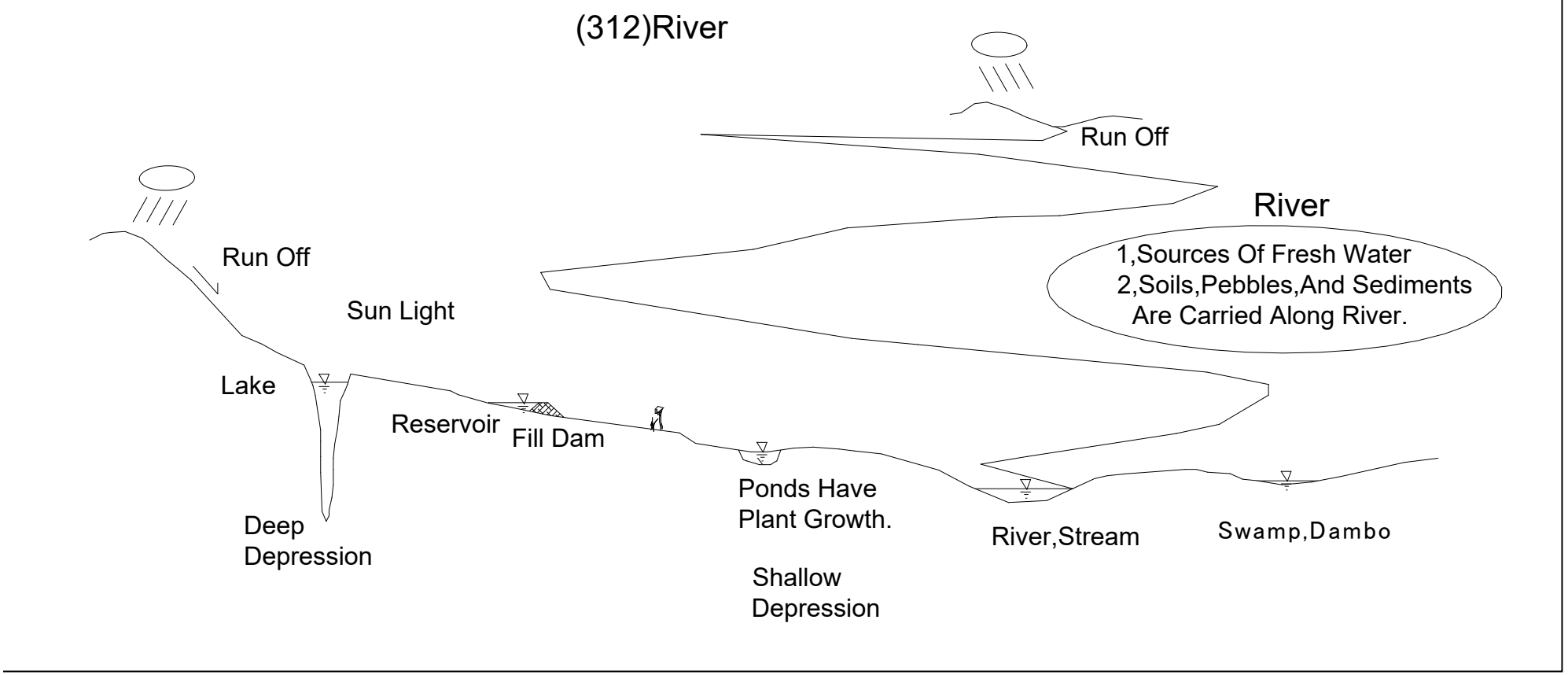


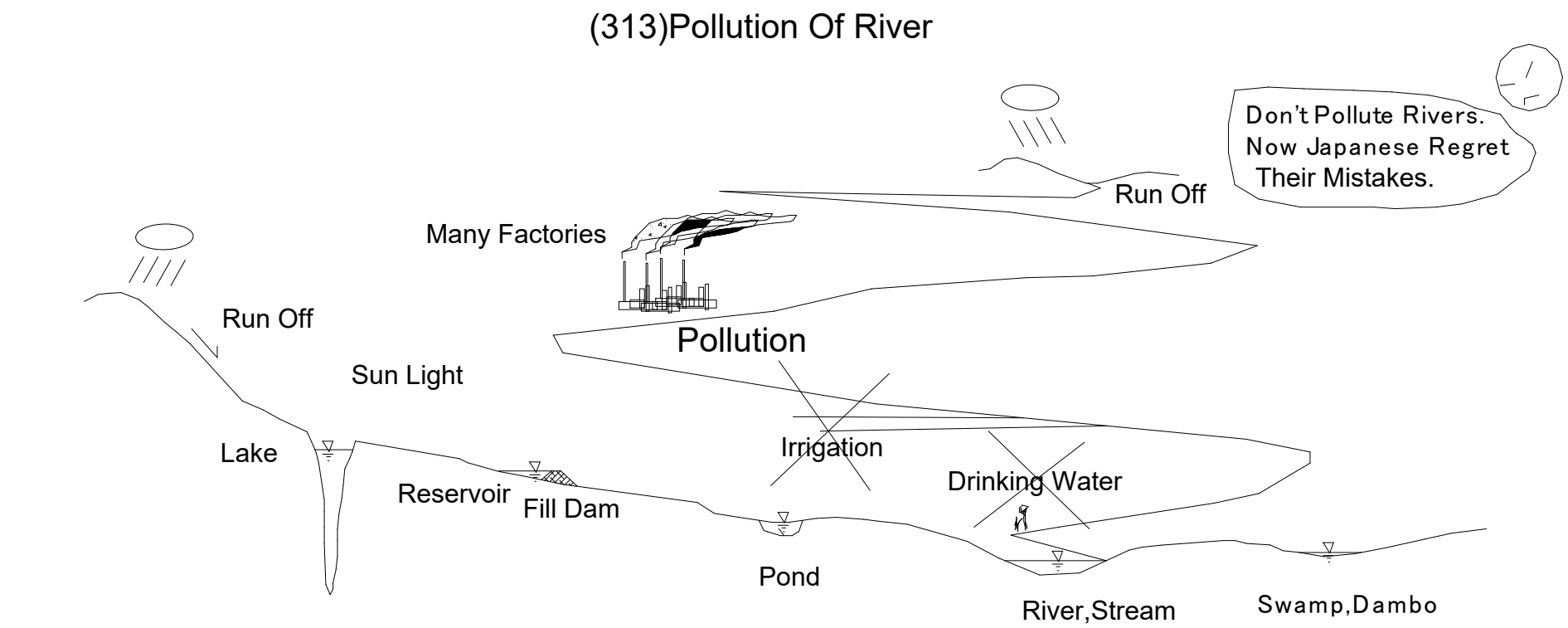
(310) Reservoir



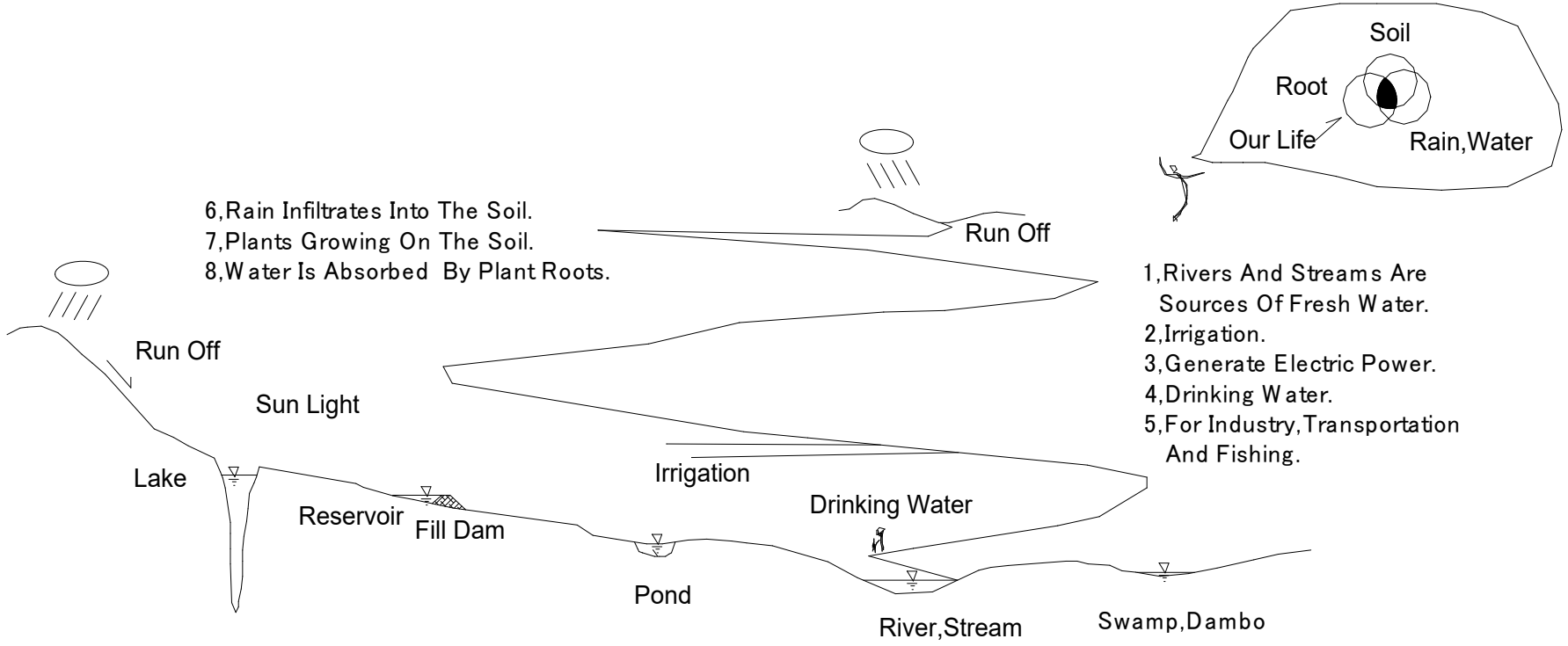
(311)Lake And Pond

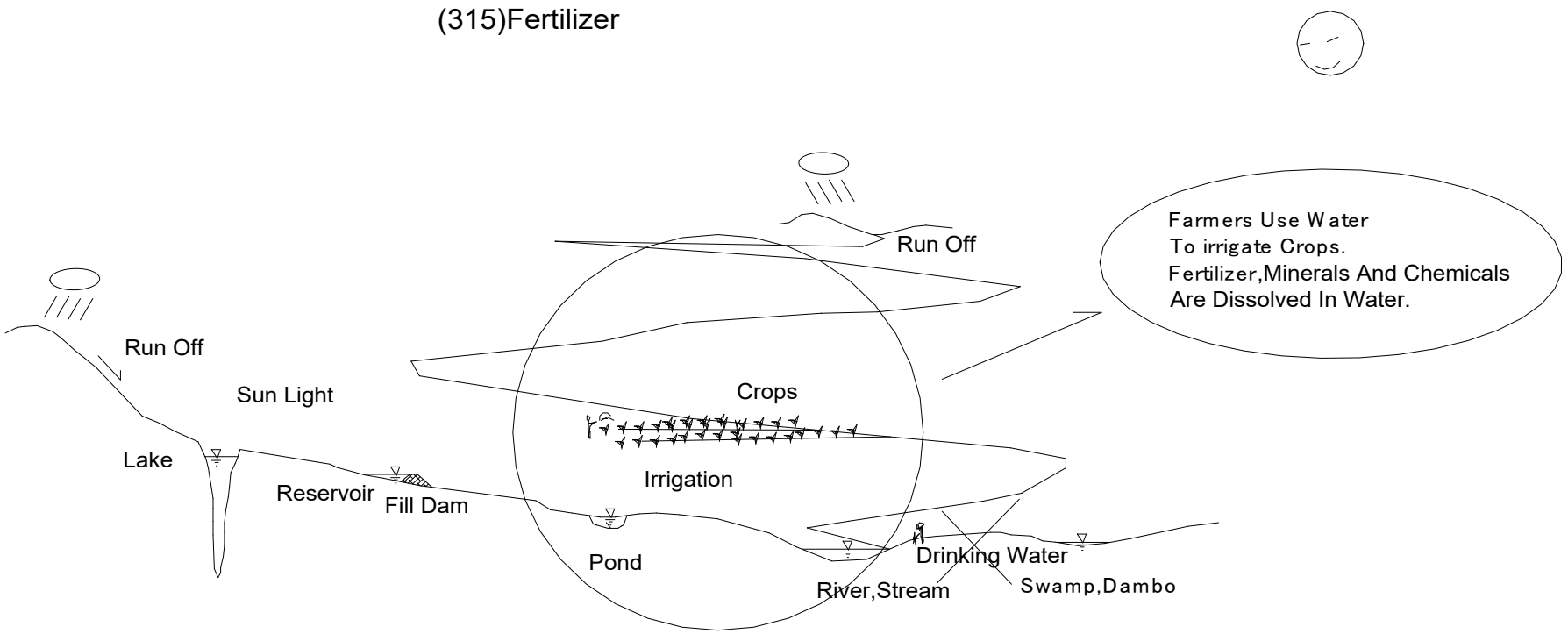


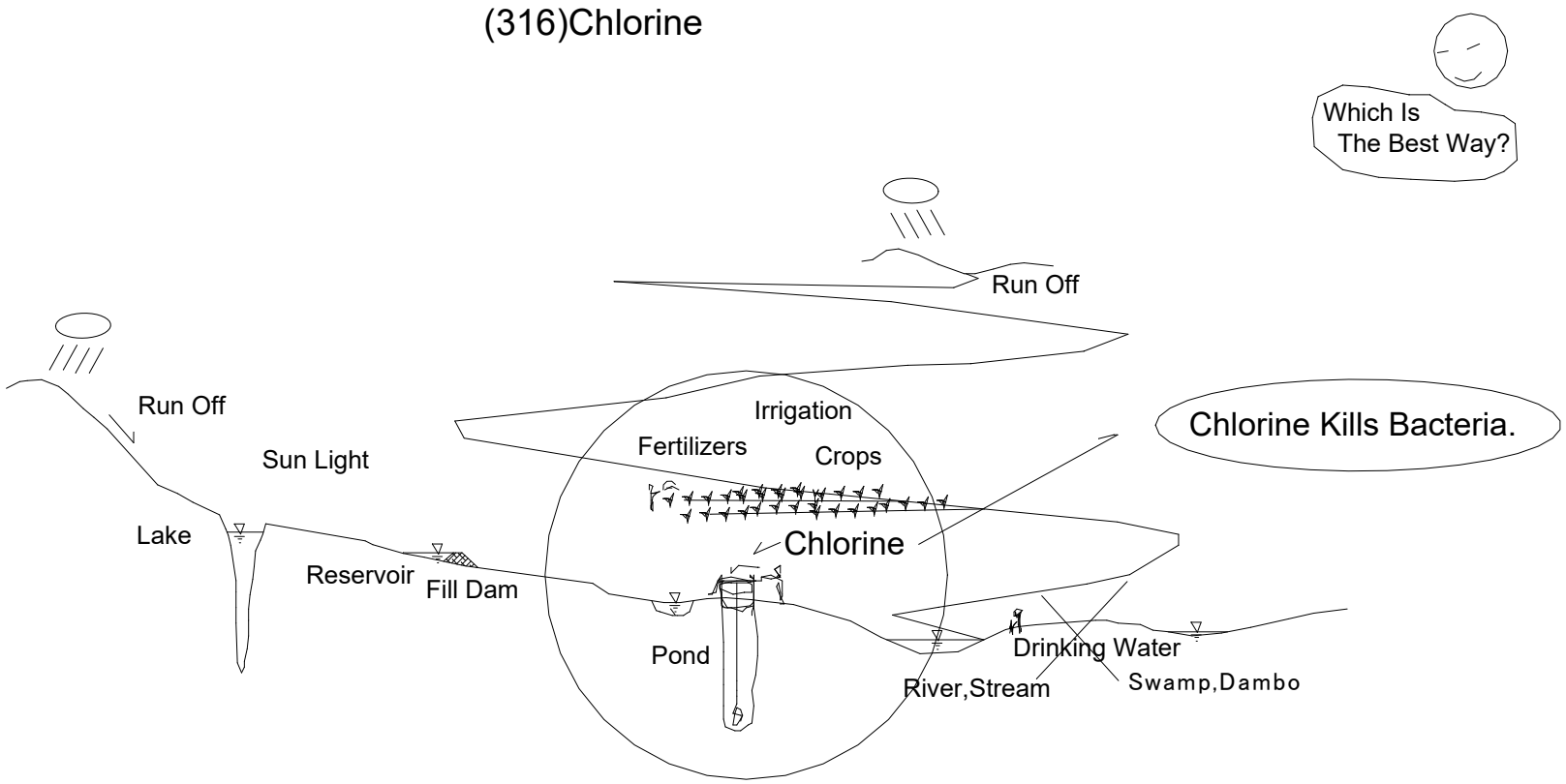

(312)River
Run Off
River
1,Sources Of Fresh Water
2,Soils,Pebbles,And Sediments
Are Carried Along River.
Run Off
Sun Light
Lake
Reservoir
Fill Dam
Ponds Have
Plant Growth.
Deep
Depression
Shallow
Depression
River,Stream
Swamp,Dambo


(313)Pollution Of River
Don't Pollute Rivers.
Now Japanese Regret
Their Mistakes.
Run Off
Many Factories
Run Off
Pollution
Sun Light
Lake
Irrigation
Drinking Water
Reservoir
Fill Dam
Pond
River,Stream
Swamp,Dambo

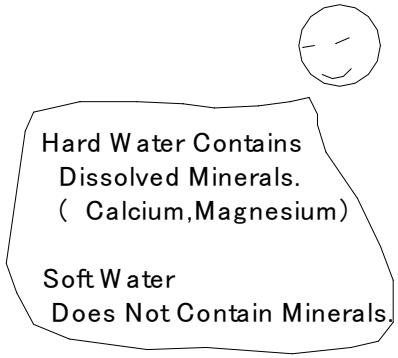
(314)River And Stream

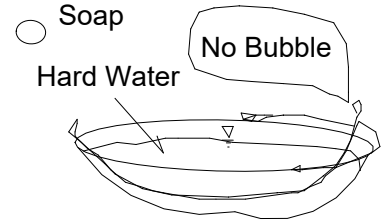


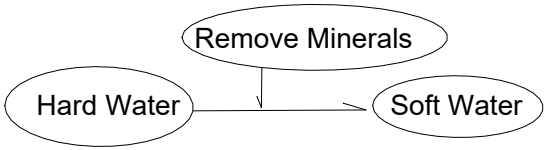

(315)Fertilizer
Run Off
Farmers Use Water
To irrigate Crops.
Fertilizer,Minerals And Chemicals
Are Dissolved In Water.
Run Off
Sun Light
Crops
Lake
Irrigation
Reservoir
Fill Dam
Pond
Drinking Water
River,Stream
Swamp,Dambo

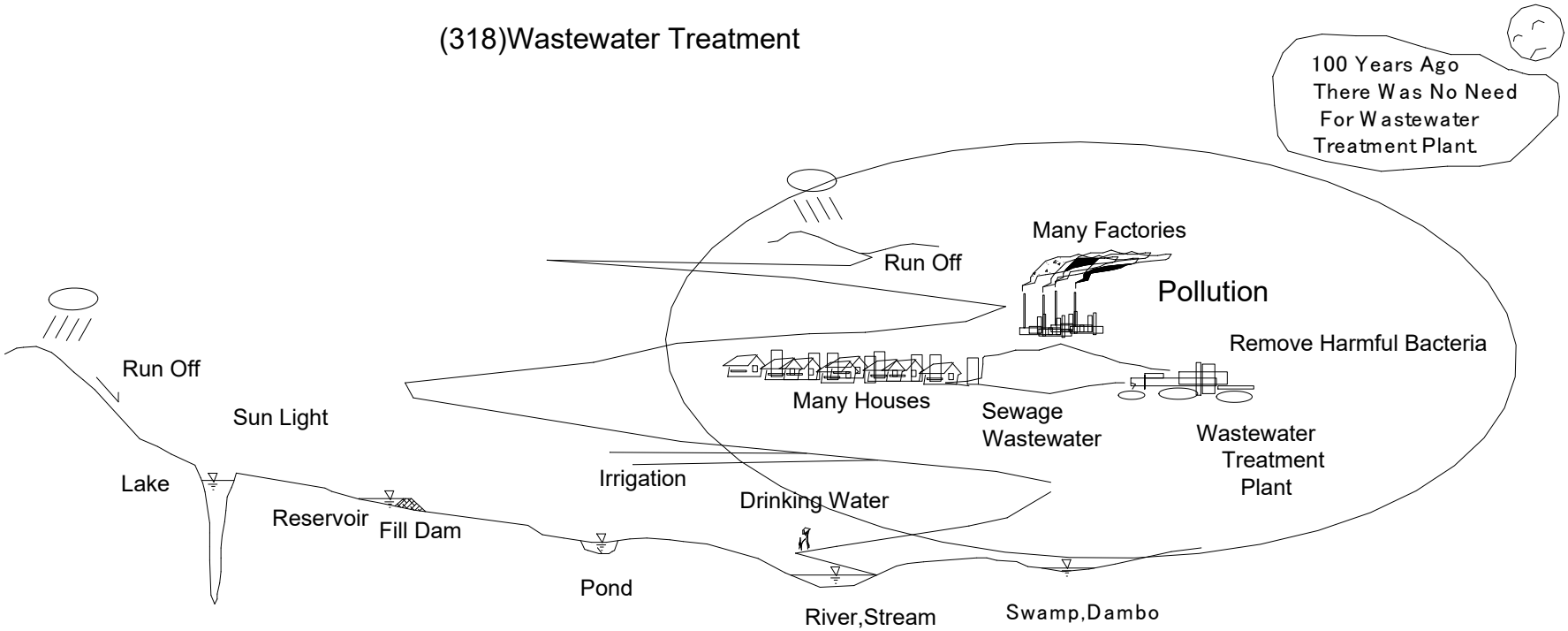

(316)Chlorine
Which Is
The Best Way?
Run Off
Run Off
Sun Light
Irrigation
Fertilizers
Crops
Chlorine Kills Bacteria.
Lake
Chlorine
Reservoir
Fill Dam
Pond
Drinking Water
River,Stream
Swamp,Dambo

(317)Hardness Of Water

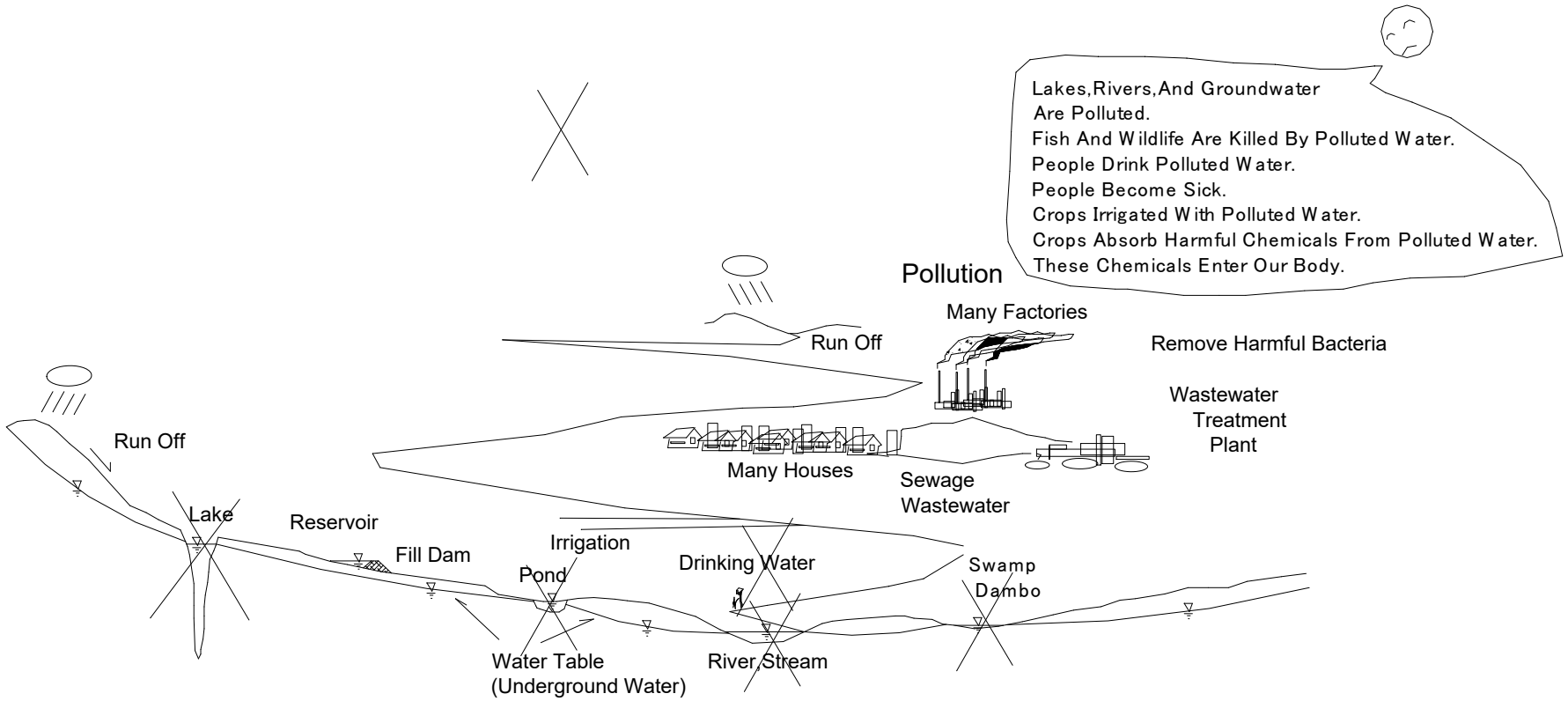




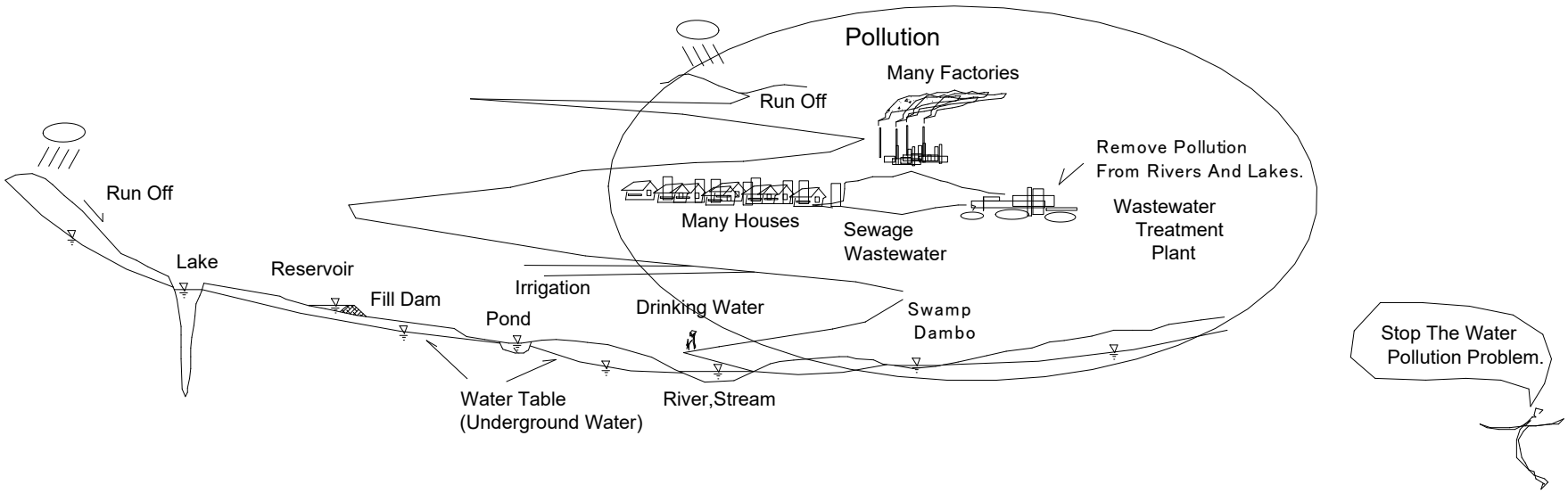



(318)Wastewater Treatment
100 Years Ago
There Was No Need
For Wastewater
Treatment Plant.
Many Factories
Run Off
Pollution
Remove Harmful Bacteria
Run Off
Sun Light
Many Houses
Sewage
Wastewater
Wastewater
Treatment
Plant
Irrigation
Drinking Water
Lake
Reservoir
Fill Dam
Pond
River,Stream
Swamp,Dambo

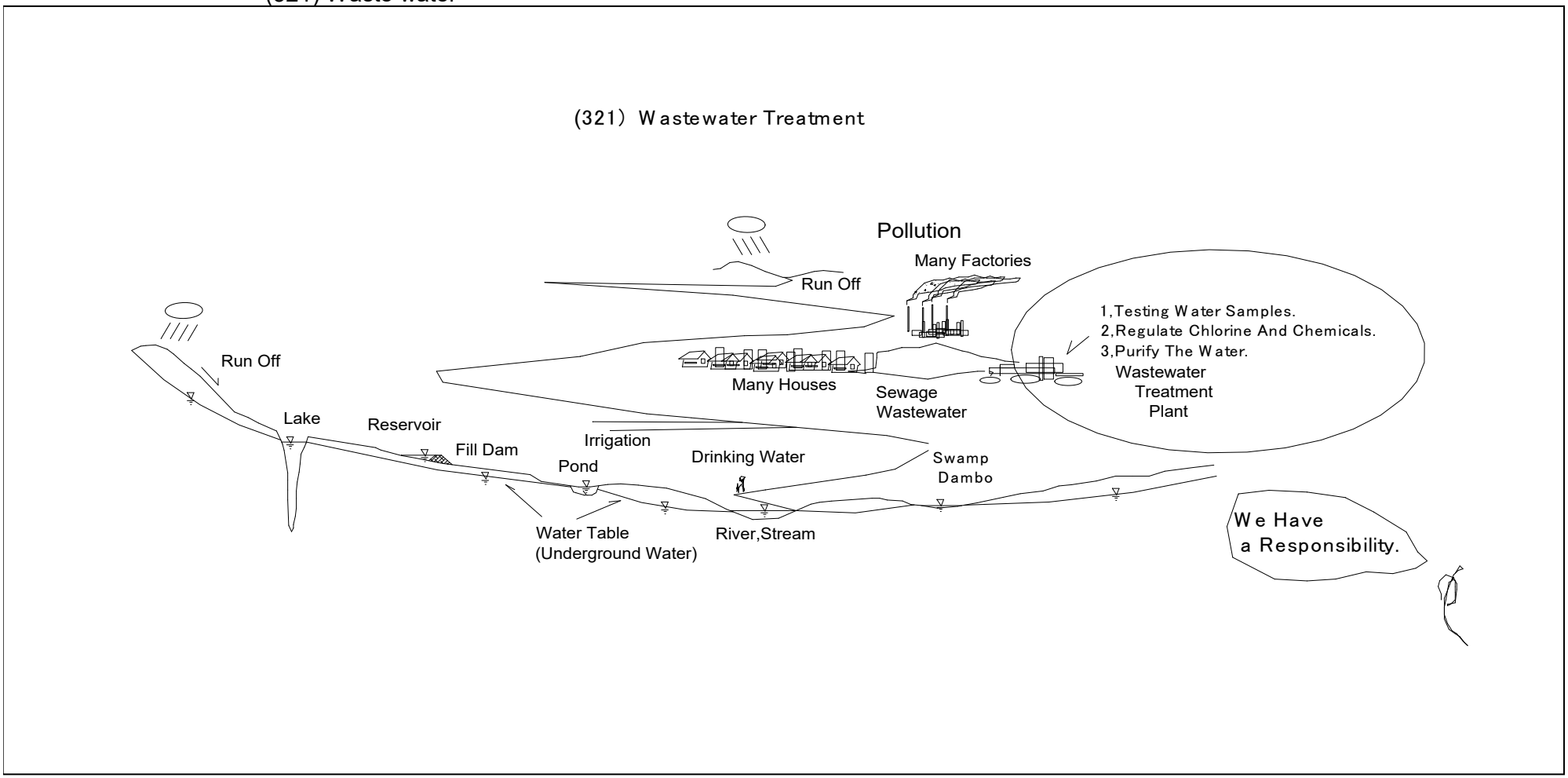
(319)Water Pollution



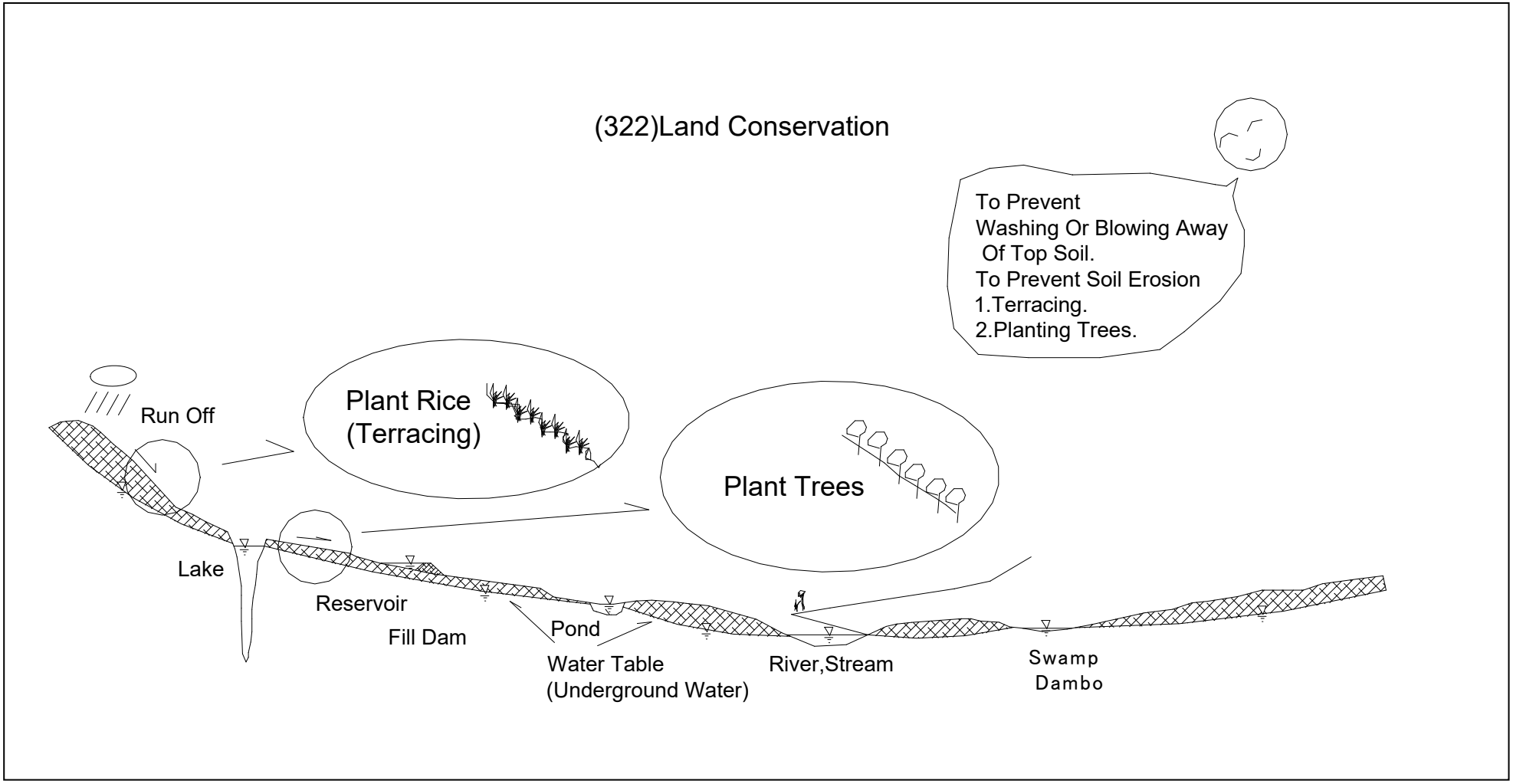
(320)Water Quality

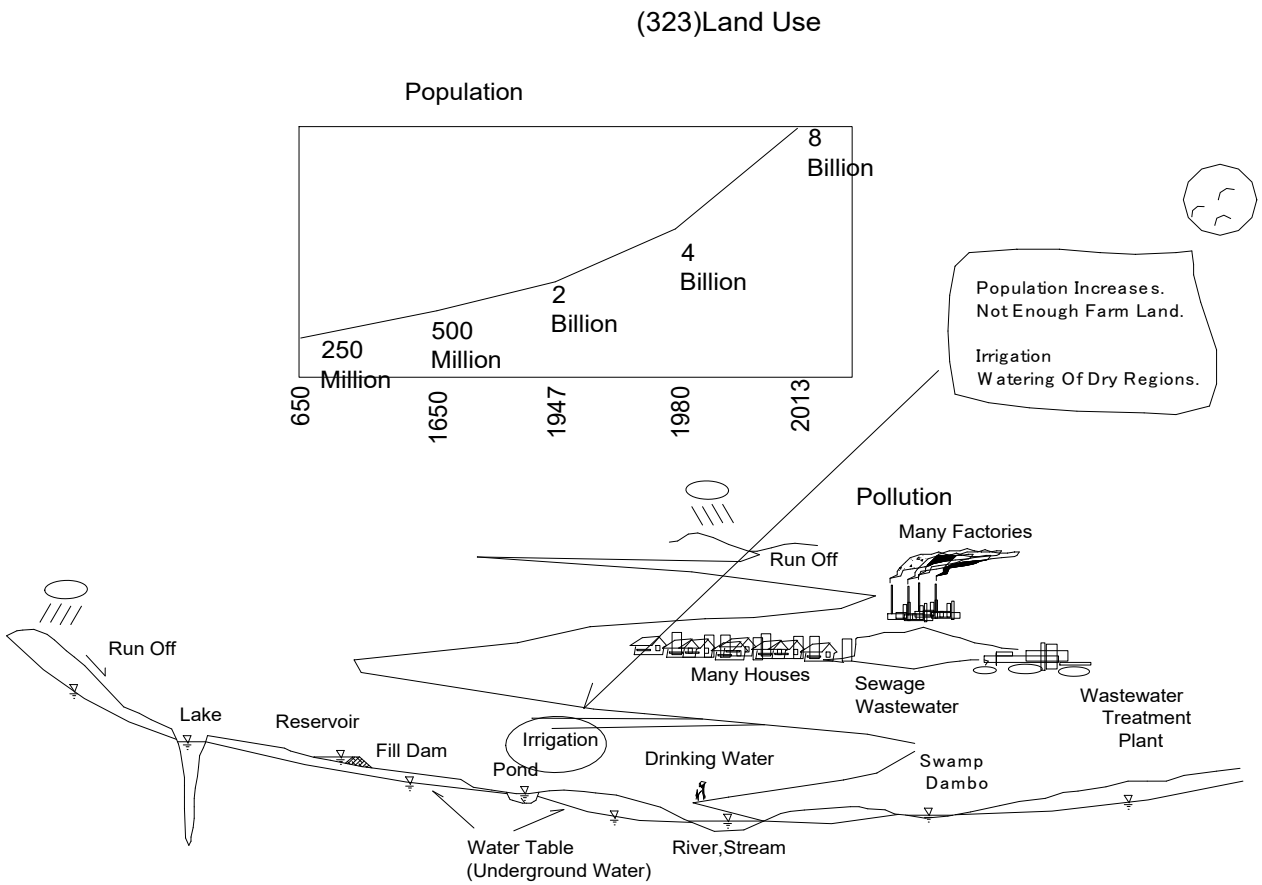


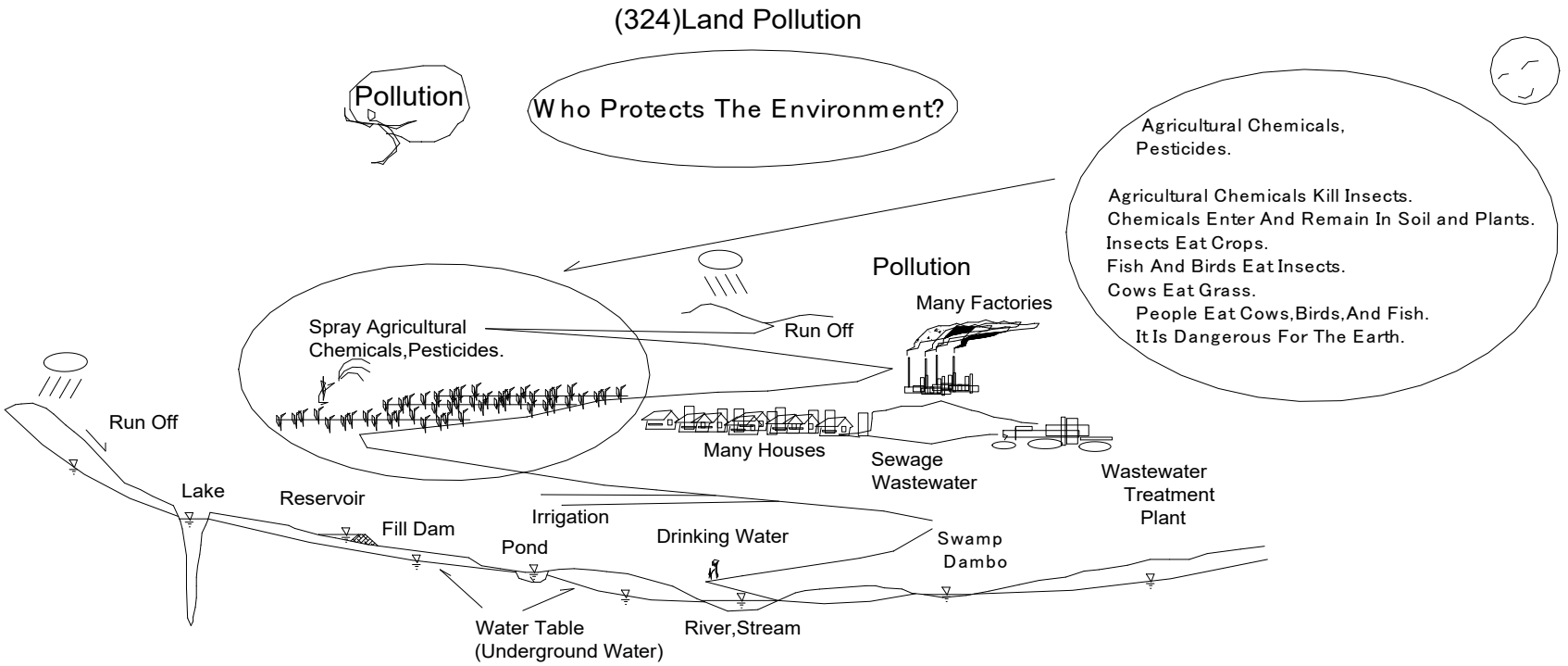
(321) Waste water

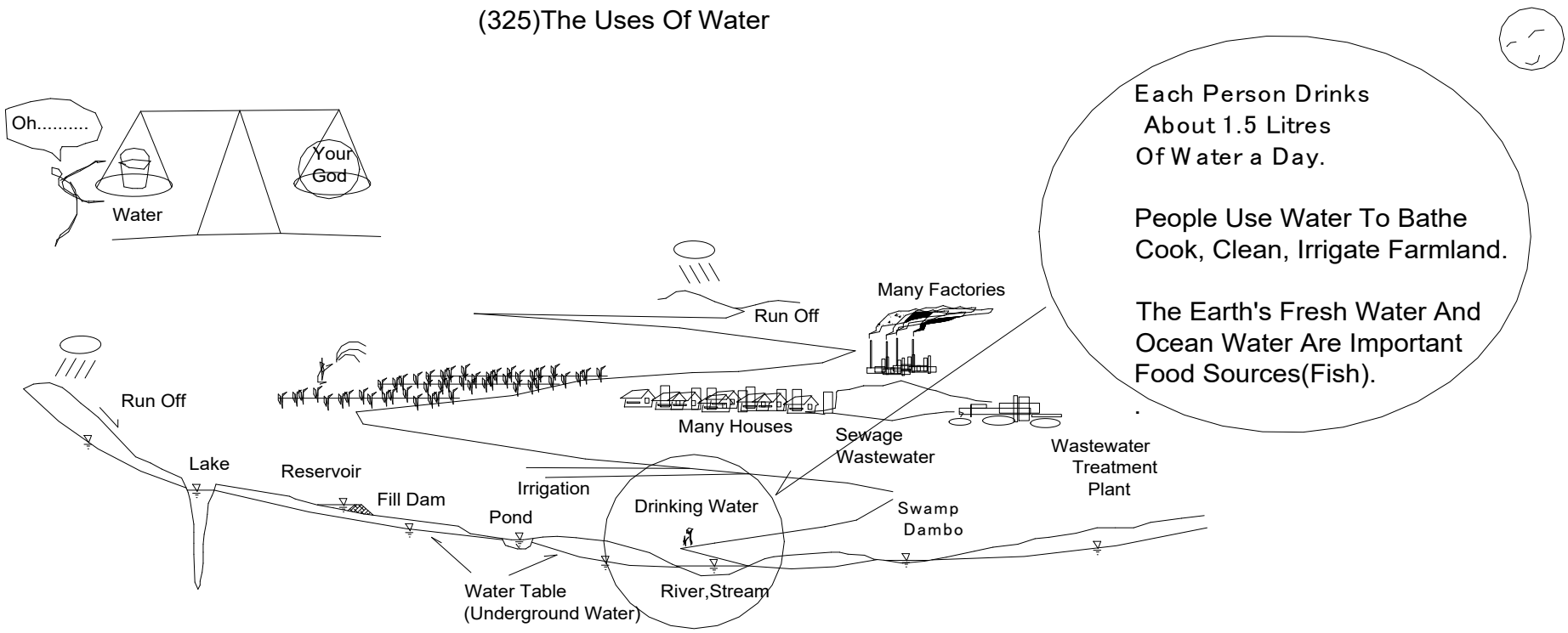


(322) Land Conservation




(323)Land Use
Population
8
Billion
4
Billion
2
Billion
500
Million
250
Million
650
1650
1947
1980
2013
Population Increases.
Not Enough Farm Land.
Irrigation
Watering Of Dry Regions.
Pollution
Many Factories
Run Off
Run Off
Many Houses
Sewage
Wastewater
Wastewater
Treatment
Plant
Lake
Reservoir
Fill Dam
Irrigation
Pond
Drinking Water
Swamp
Dambo
Water Table
(Underground Water)
River,Stream


(324)Land Pollution
Pollution
Who Protects The Environment?
Agricultural Chemicals,
Pesticides.
Agricultural Chemicals Kill Insects.
Chemicals Enter And Remain In Soil and Plants.
Insects Eat Crops.
Fish And Birds Eat Insects.
Cows Eat Grass.
People Eat Cows,Birds,And Fish.
It Is Dangerous For The Earth.
Pollution
Many Factories
Spray Agricultural
Chemicals,Pesticides.
Run Off
Run Off
Many Houses
Sewage
Wastewater
Wastewater
Treatment
Plant
Lake
Reservoir
Irrigation
Fill Dam
Pond
Drinking Water
Swamp
Dambo
Water Table
(Underground Water)
River,Stream


(325)The Uses Of Water
Oh.....
Your God
Water
Each Person Drinks
About 1.5 Litres
Of Water a Day.
People Use Water To Bathe
Cook, Clean, Irrigate Farmland.
The Earth's Fresh Water And
Ocean Water Are Important
Food Sources(Fish).
.
Run Off
Many Factories
Run Off
Many Houses
Sewage
Wastewater
Wastewater
Treatment
Plant
Lake
Reservoir
Fill Dam
Irrigation
Pond
Drinking Water
Swamp
Dambo
Water Table
(Underground Water)
River,Stream

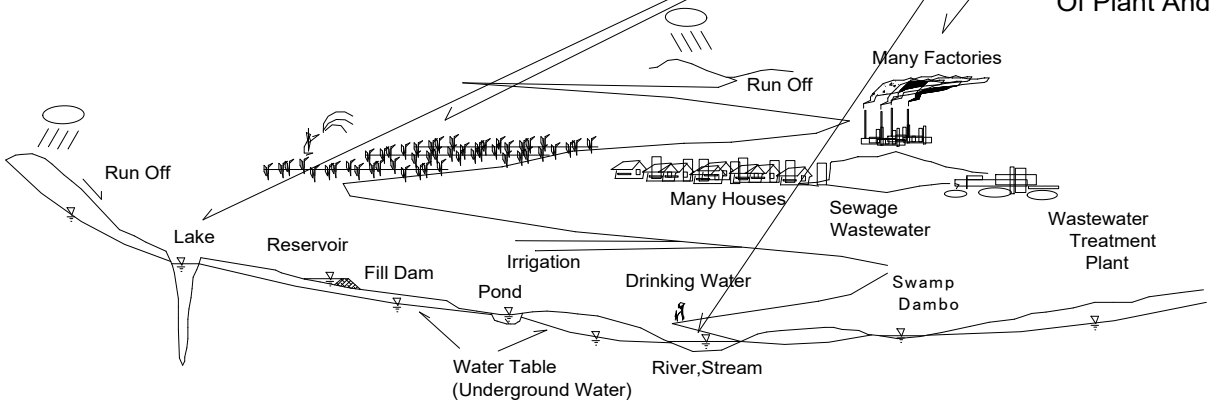
(326)Water Pollution

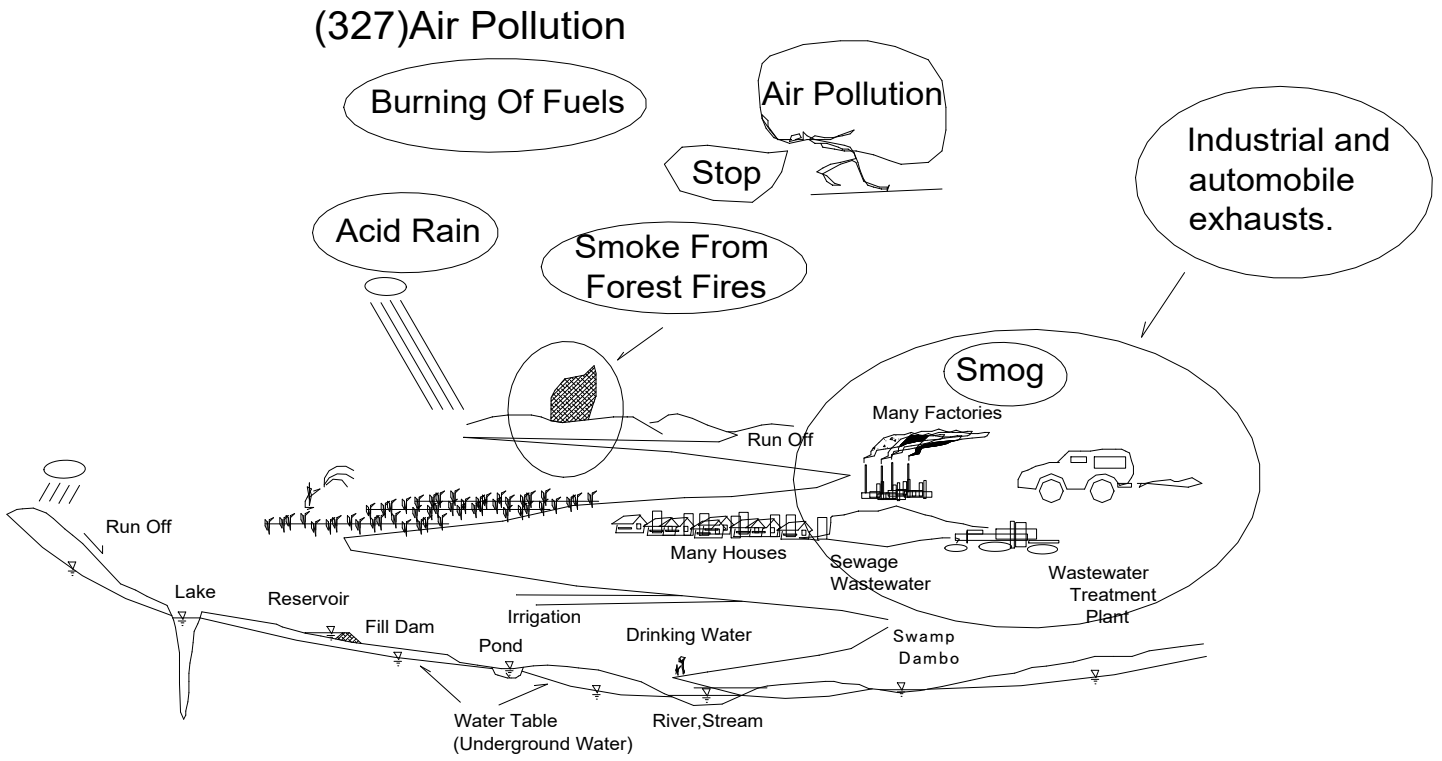
Industrial Chemicals,Raw Sewage.

These Pollutants make People Ill And Die.
Phosphates ,Green Plants In Lakes,
Use Up Oxygen In Water,Many Fish die.

Heated Water From Industries.
Thermal Pollution.
Upsets The Natural Balance
Of Plant And Animal Life.

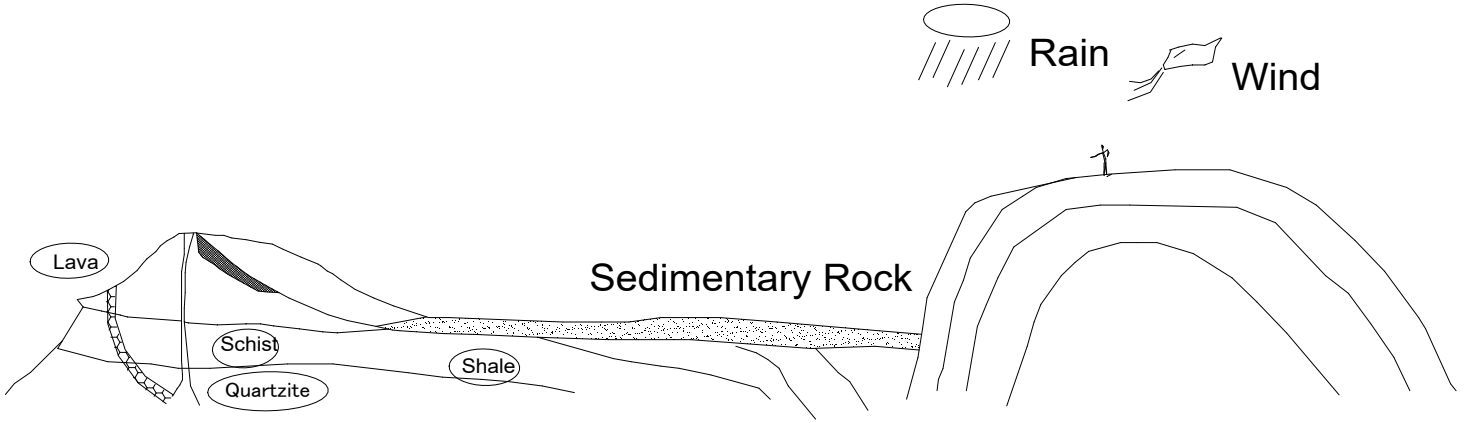
Pollution Destroys Many Organisms In Rivers,Lakes And Streams.




(327)Air Pollution
Burning Of Fuels
Air Pollution
Stop
Industrial and automobile exhausts.
Acid Rain
Smoke From Forest Fires
Smog
Many Factories
Run Off
Run Off
Many Houses
Sewage Wastewater
Wastewater Treatment Plant
Lake
Reservoir
Fill Dam
Irrigation
Pond
Drinking Water
Swamp Dambo
Water Table (Underground Water)
River,Stream

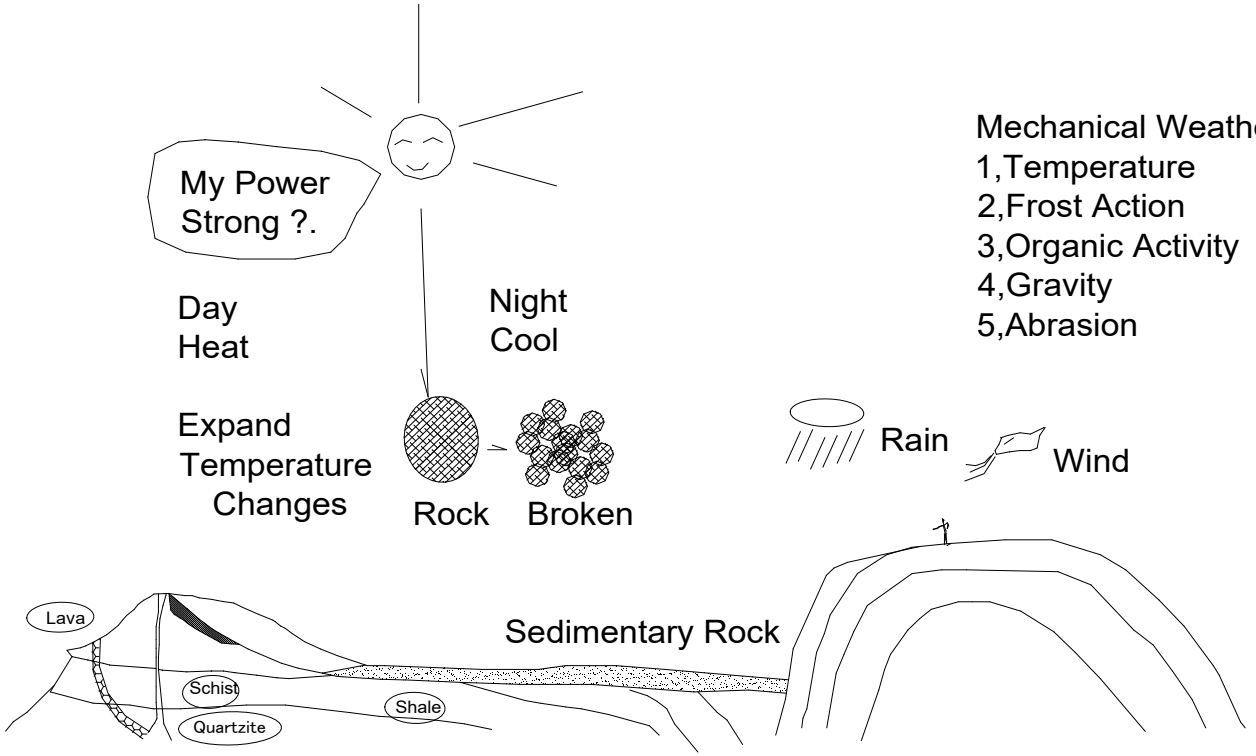
(328) Weathering

The Earth's Surface -Weathering
1,Mechanical Weathering.
2,Chemical Weathering.

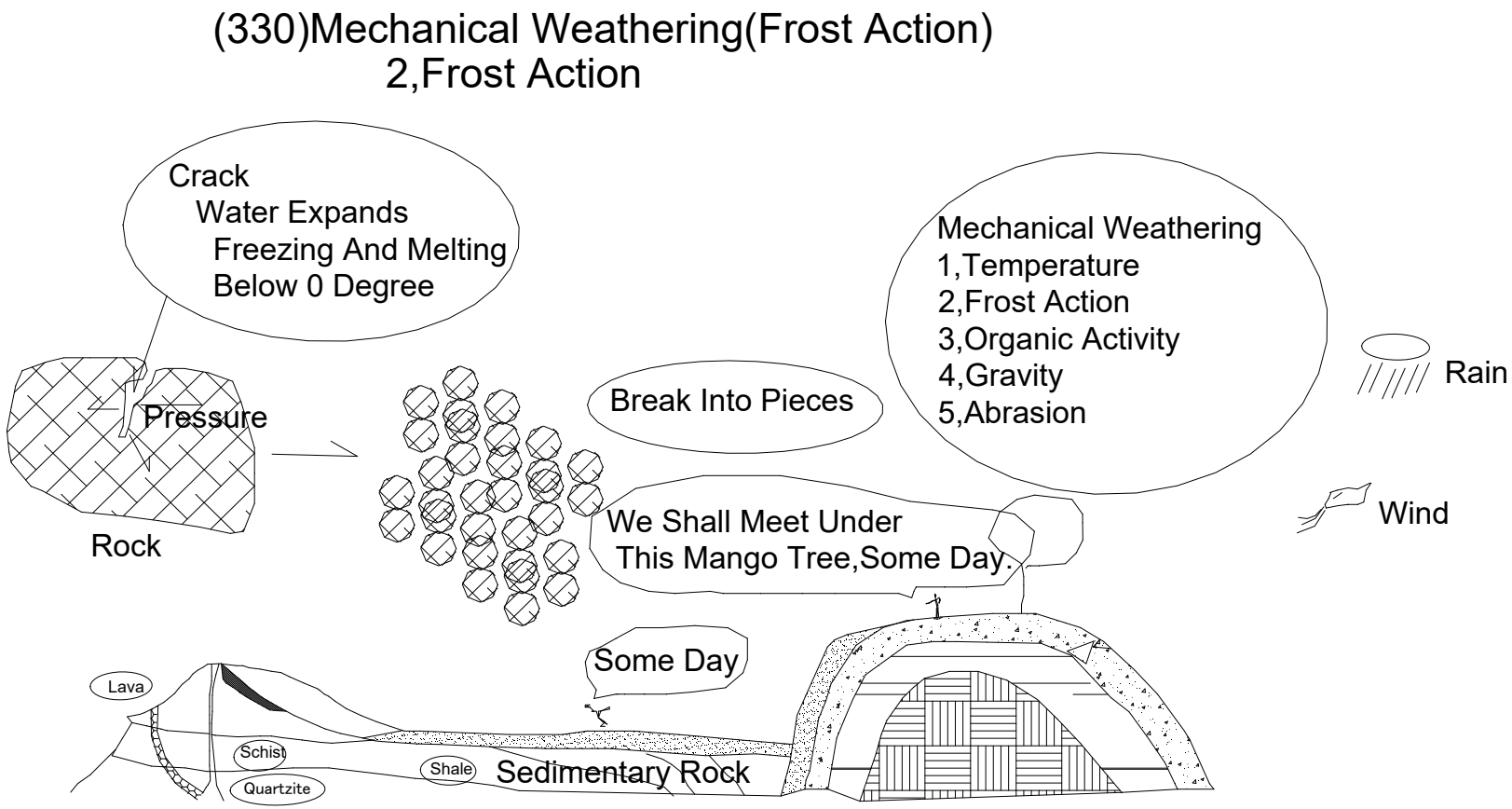


(329) Mechanical Weathering(Temperature)

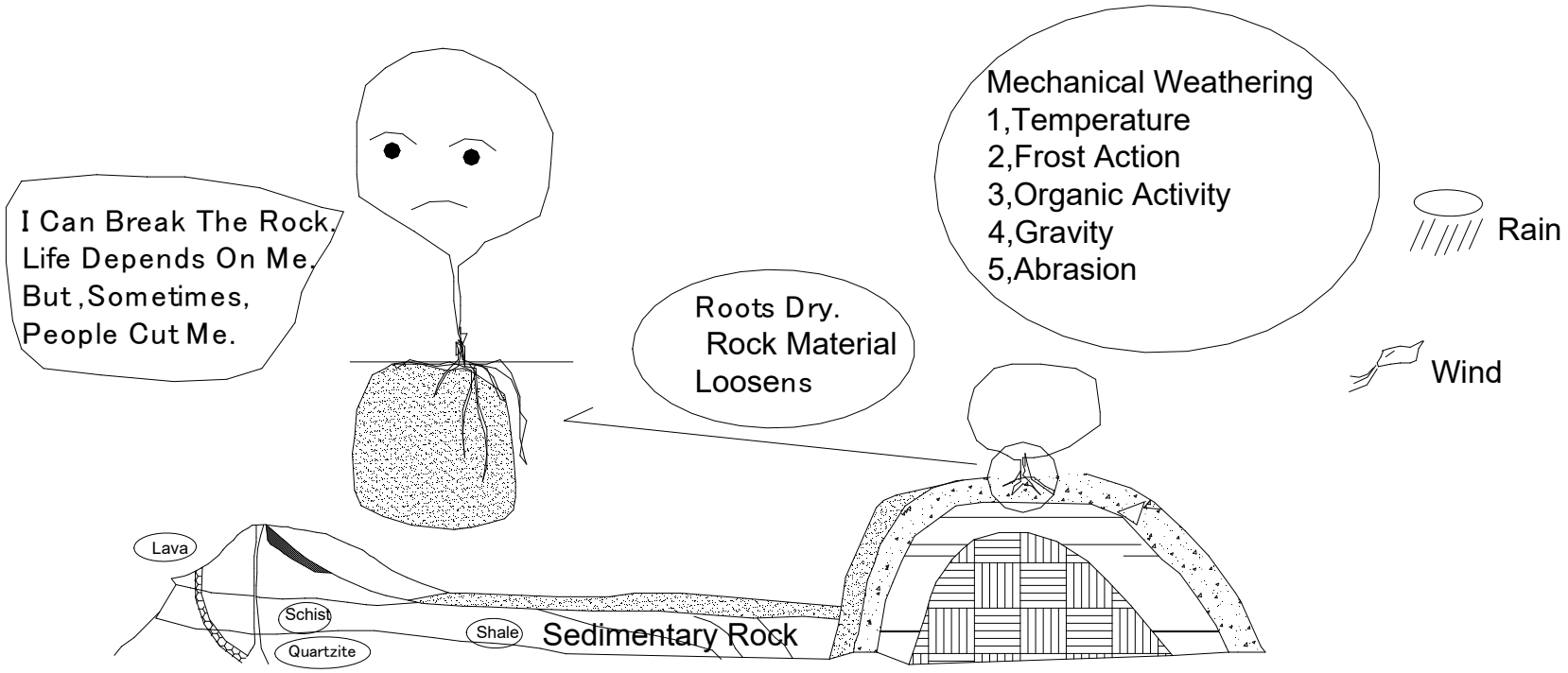
1,Temperature



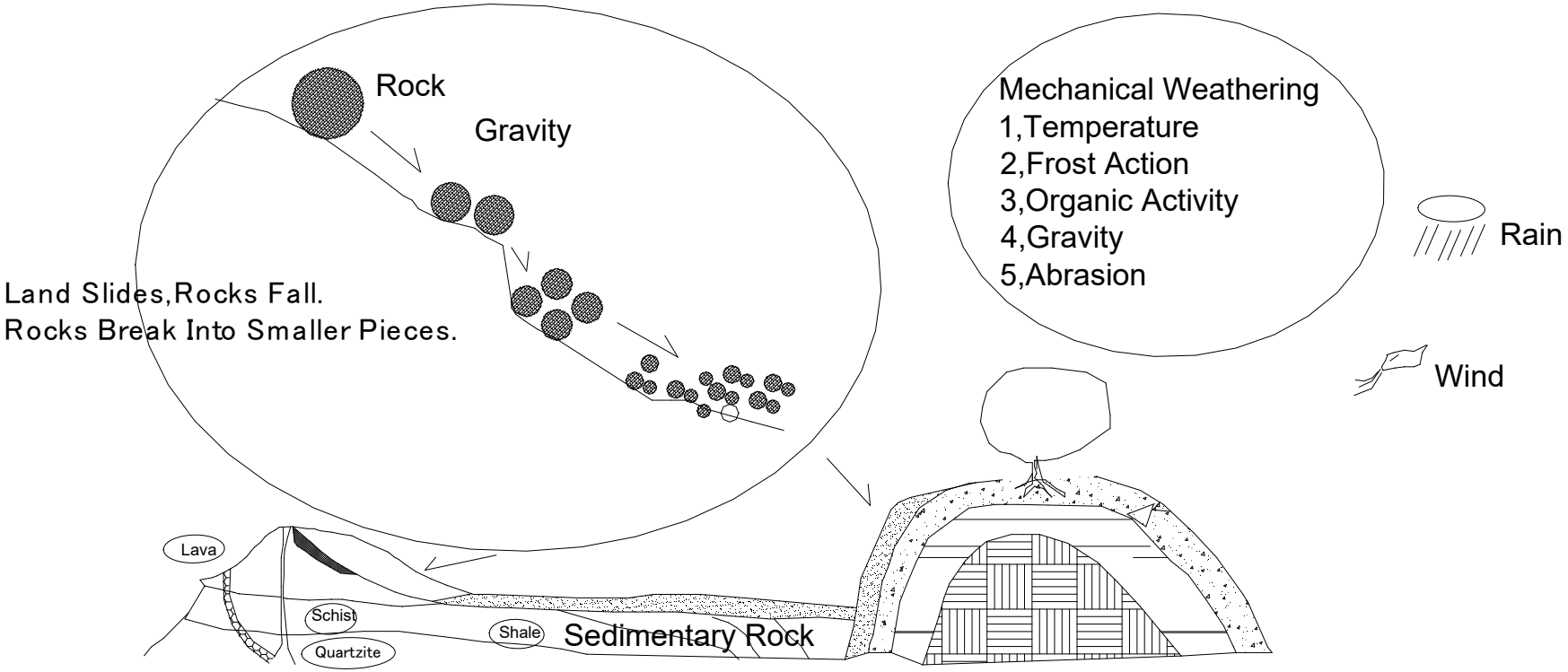
Mechanical Weathering
1,Temperature
2,Frost Action
3,Organic Activity
4,Gravity
5,Abrasion


(330)Mechanical Weathering(Frost Action)
2,Frost Action
Crack
Water Expands
Freezing And Melting
Below 0 Degree
Pressure
Rock
Break Into Pieces
Mechanical Weathering
1,Temperature
2,Frost Action
3,Organic Activity
4,Gravity
5,Abrasion
Rain
Wind
We Shall Meet Under
This Mango Tree,Some Day.
Some Day
Lava
Schist
Quartzite
Shale
Sedimentary Rock

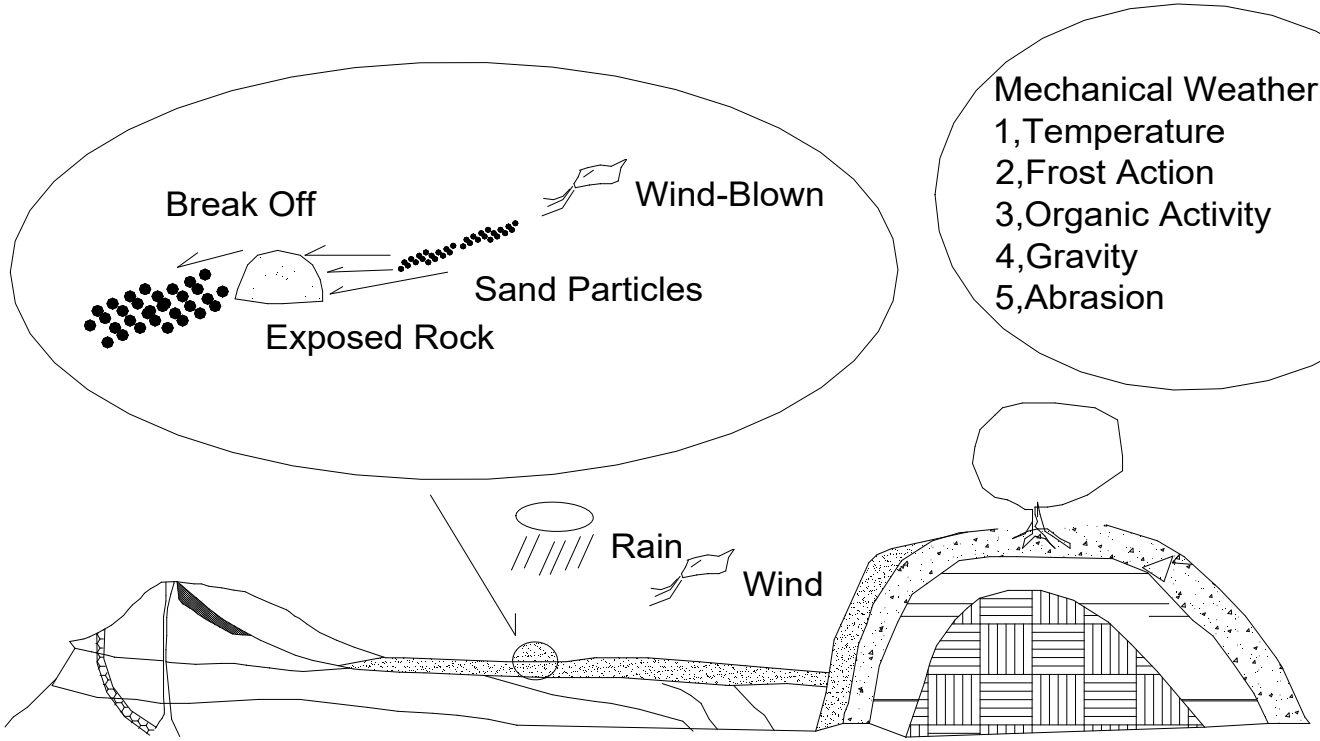
(331)Mechanical Weathering(Organic Activity)
3,Organic Activity



(332)Mechanical Weathering(Gravity)
4,Gravity



(333)Mechanical Weathering(Abrasion)
5,Abrasion

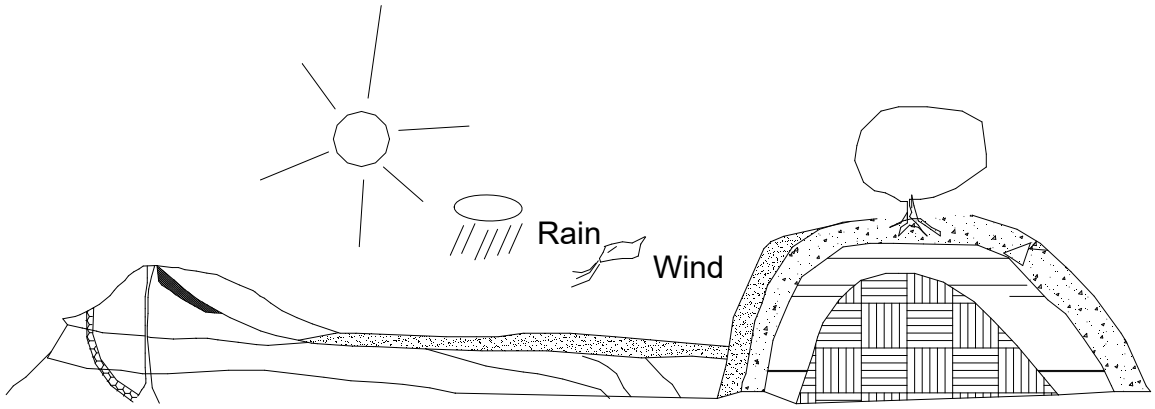


Mechanical Weathering
1,Temperature
2,Frost Action
3,Organic Activity
4,Gravity
5,Abrasion

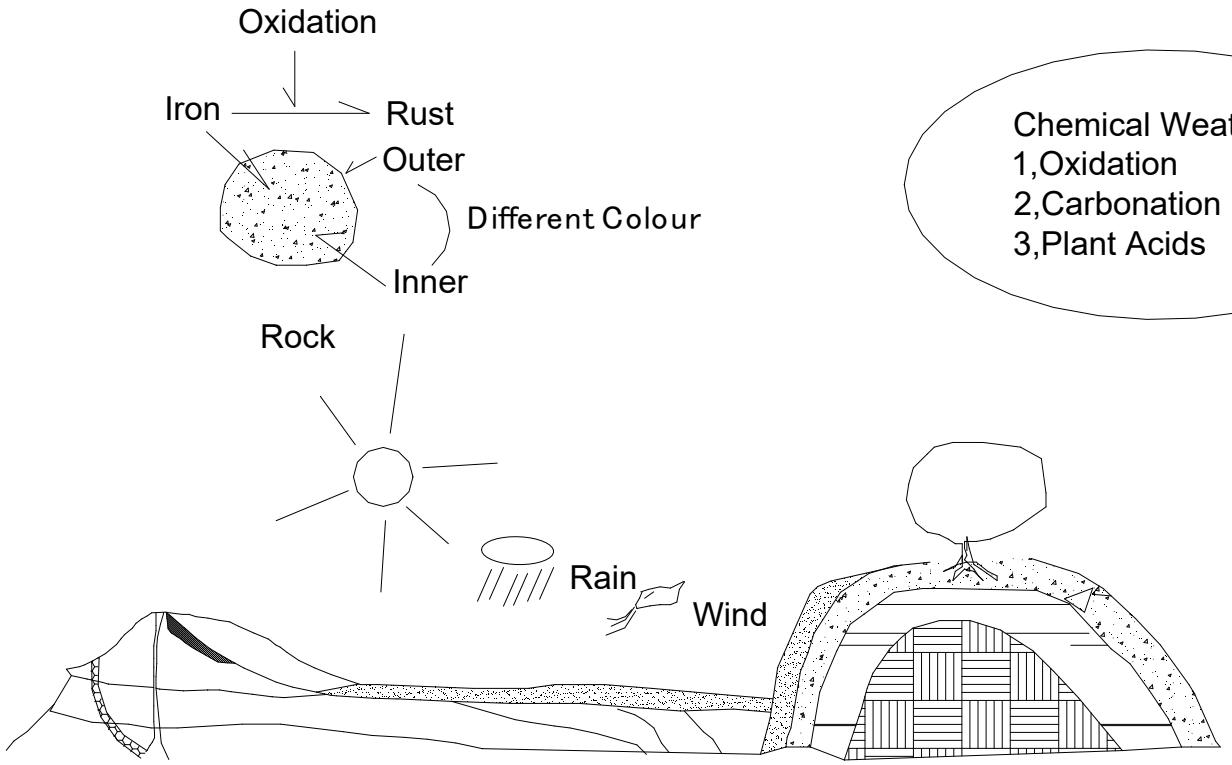
(334) Chemical Weathering

Chemical Weathering Causes
The Decomposition Of Rocks.

Chemical Weathering
1,Oxidation
2,Carbonation
3,Plant Acids

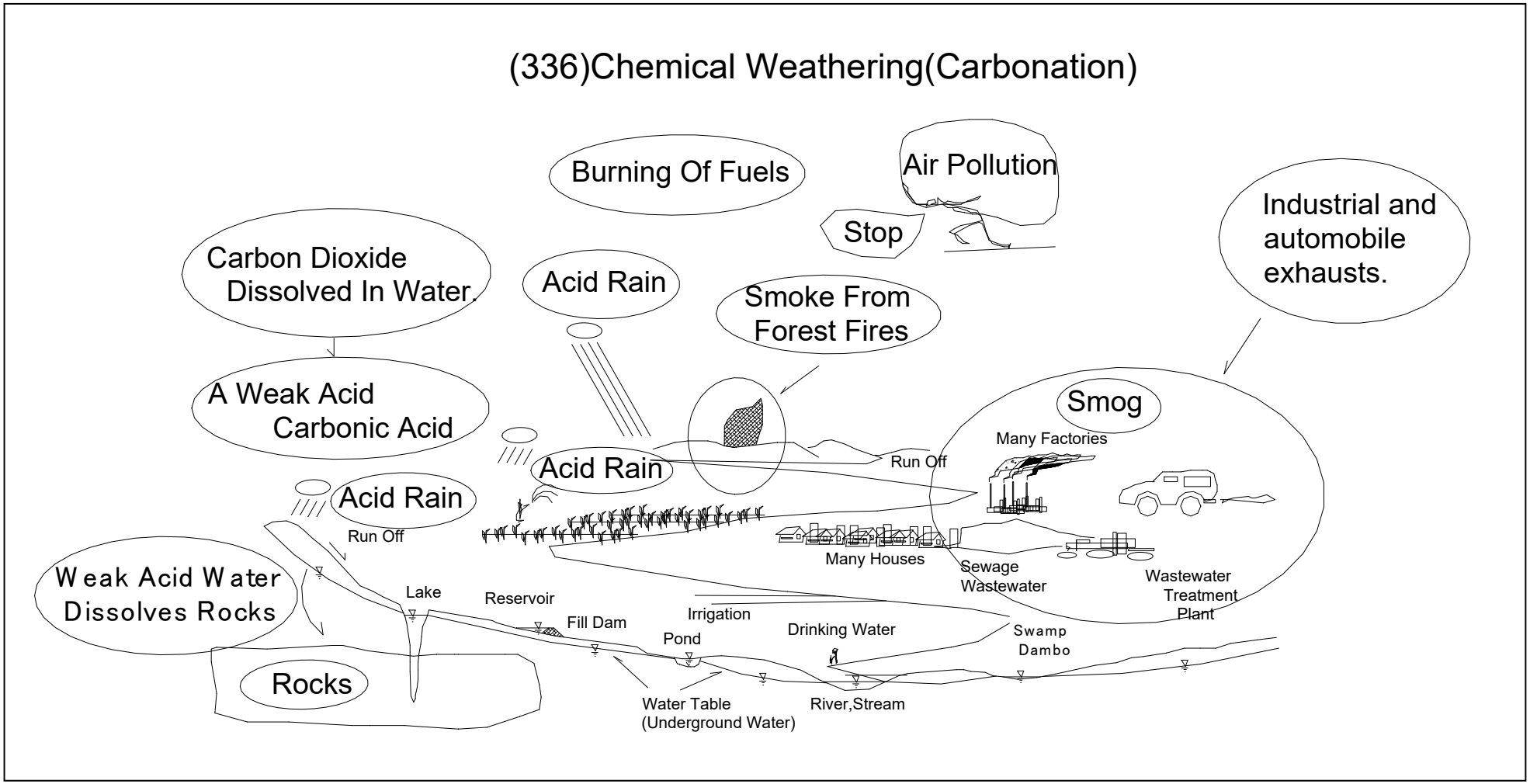


(335) Chemical Weathering(Oxidation)

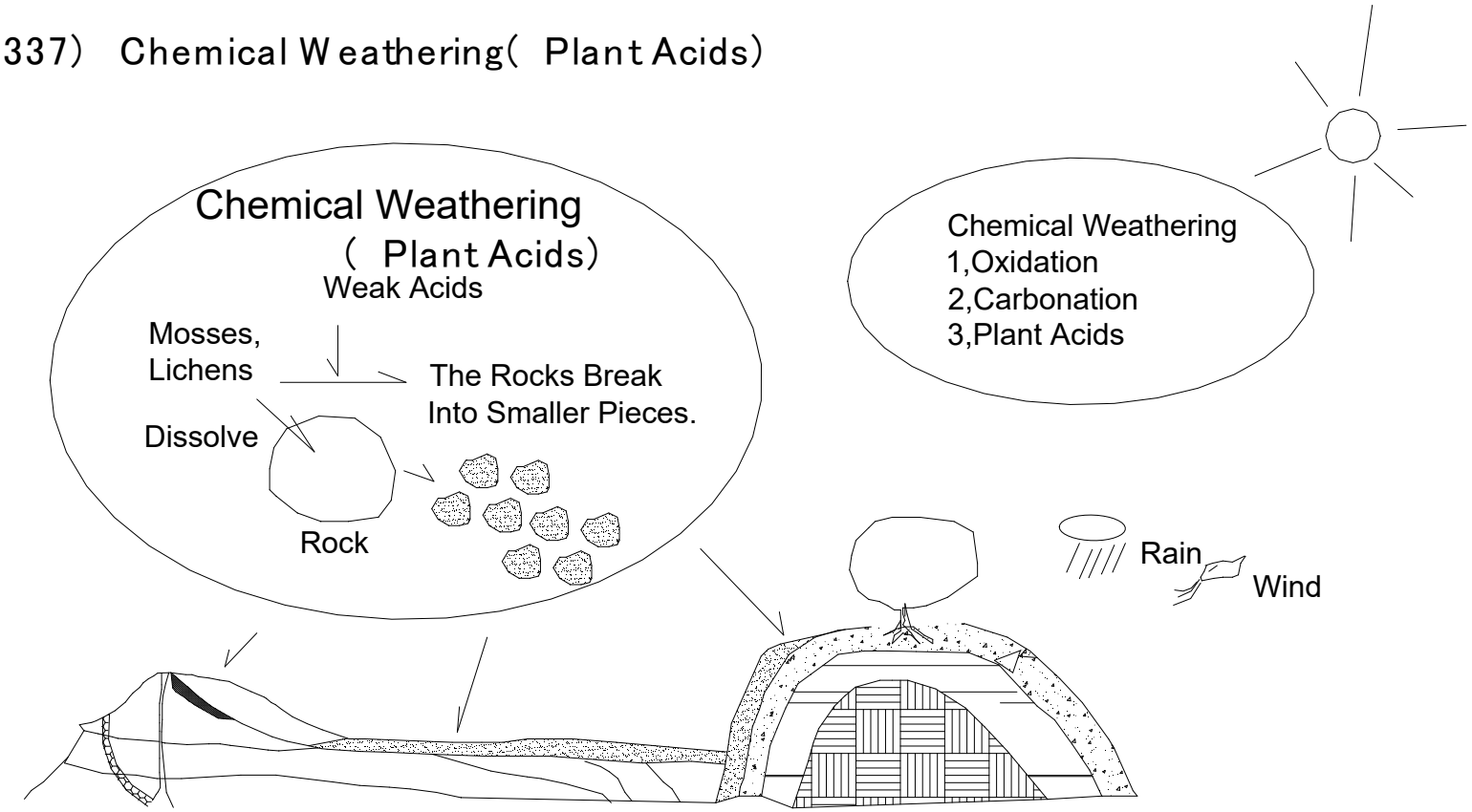


Chemical Weathering
1,Oxidation
2,Carbonation
3,Plant Acids

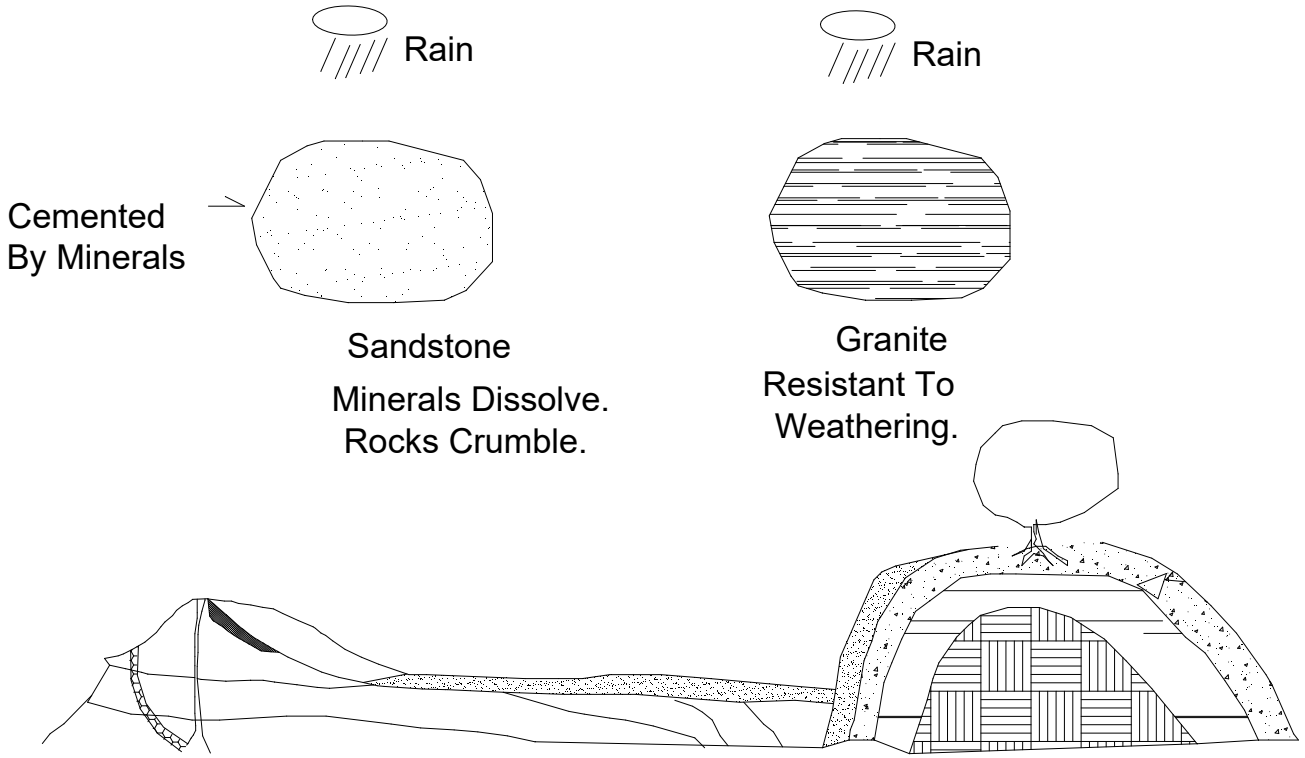
(336) Chemical Weathering(Carbonation)



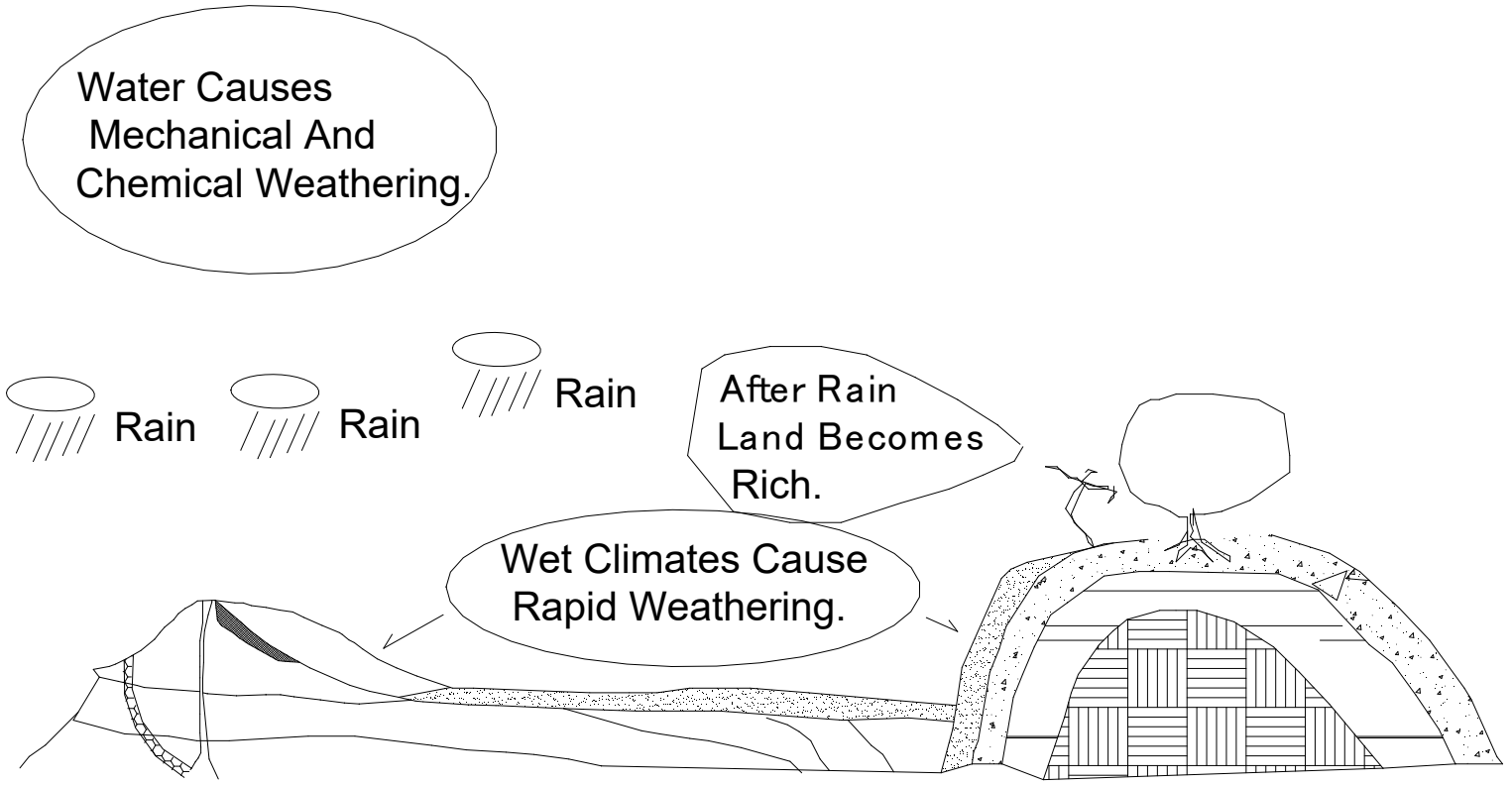
(337) Chemical Weathering(Plant Acids)



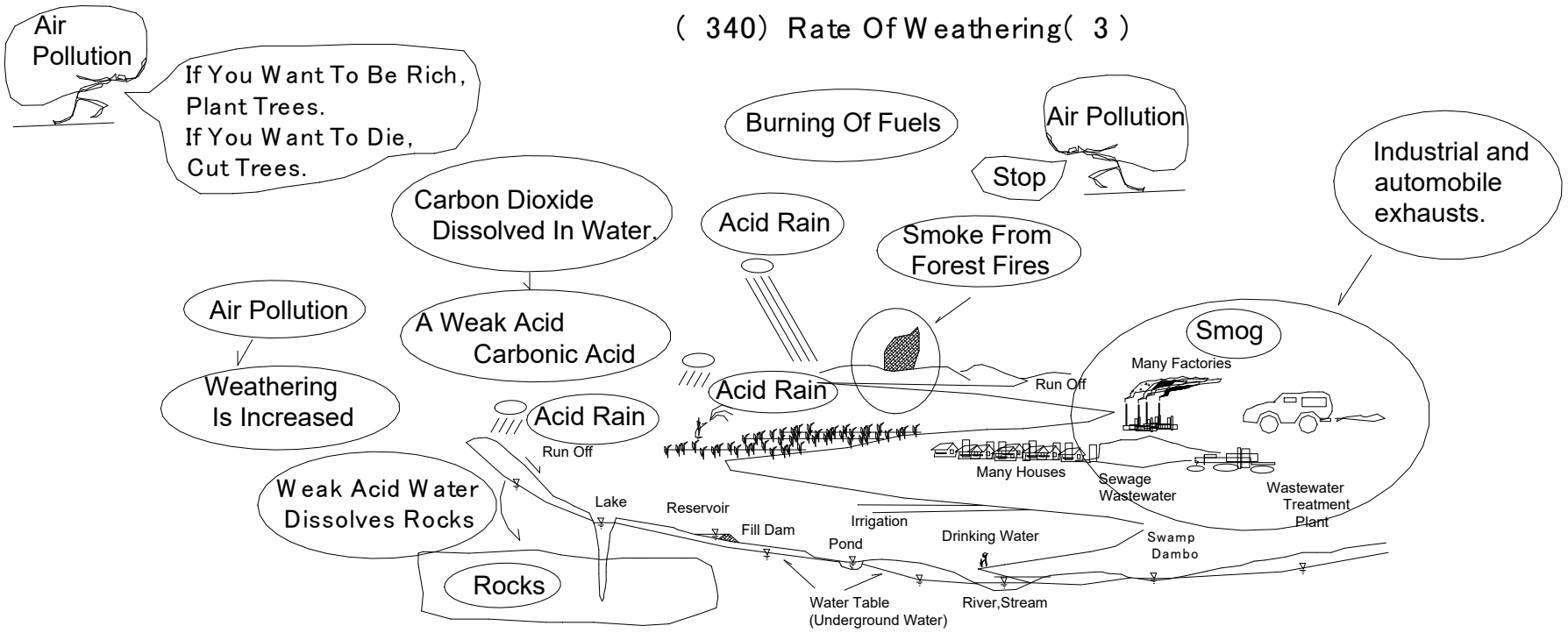
(338) Rate Of Weathering(1)



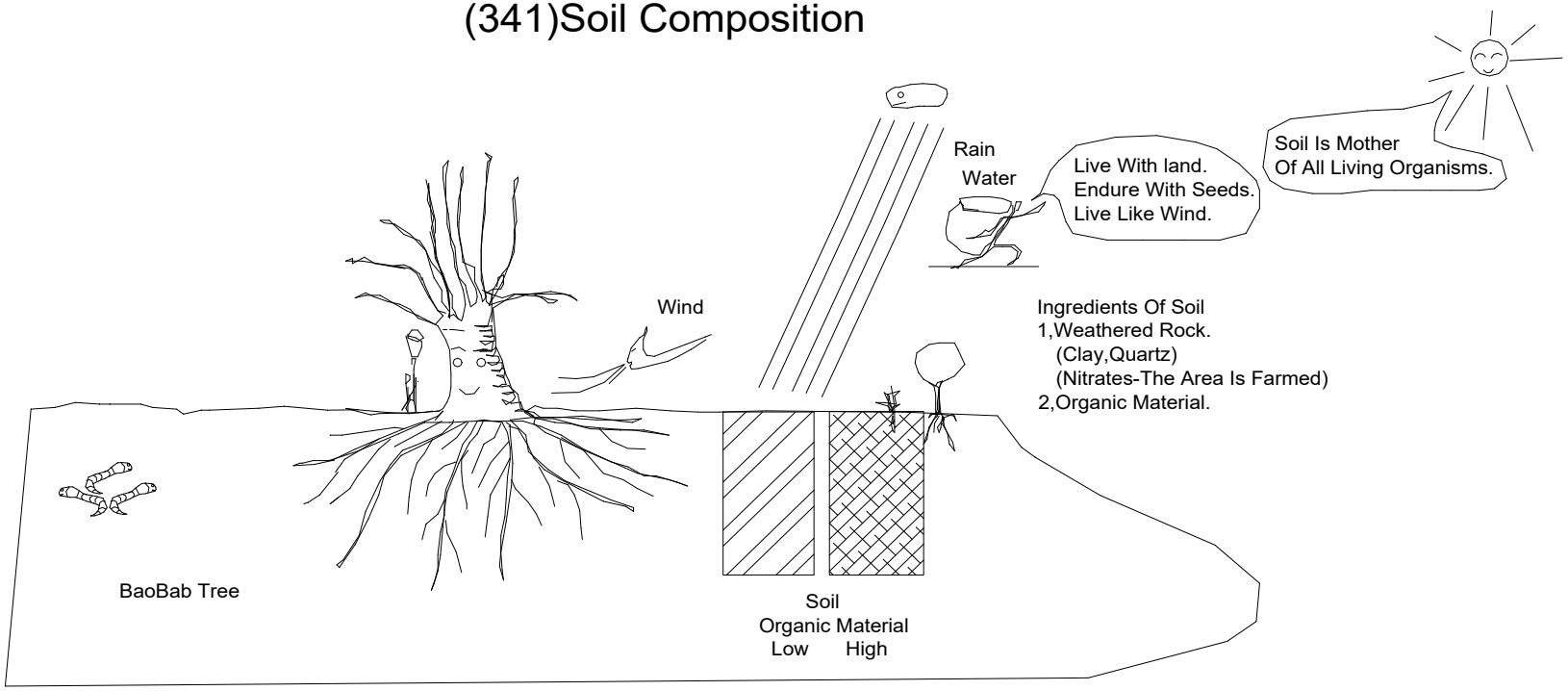
(339) Rate Of Weathering(2)



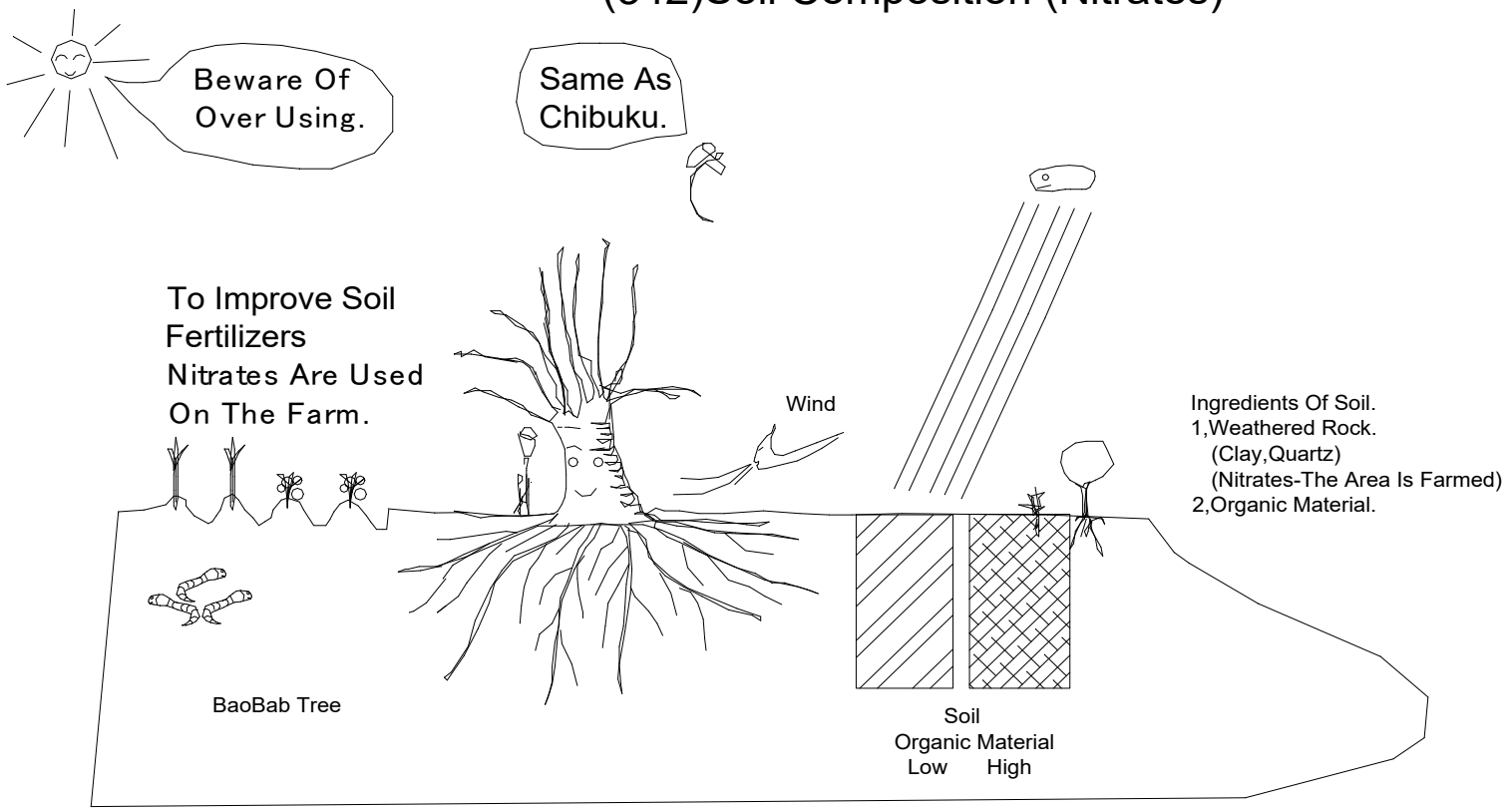
(340) After Cutting Trees



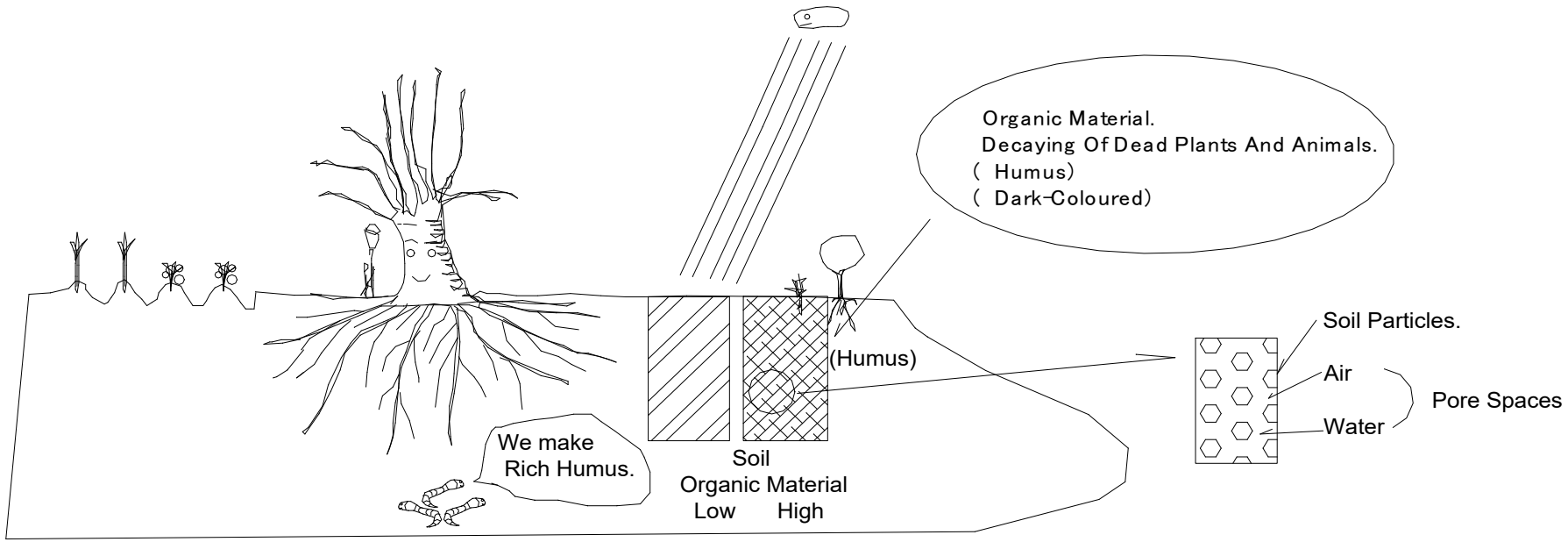
(341)Soil Composition



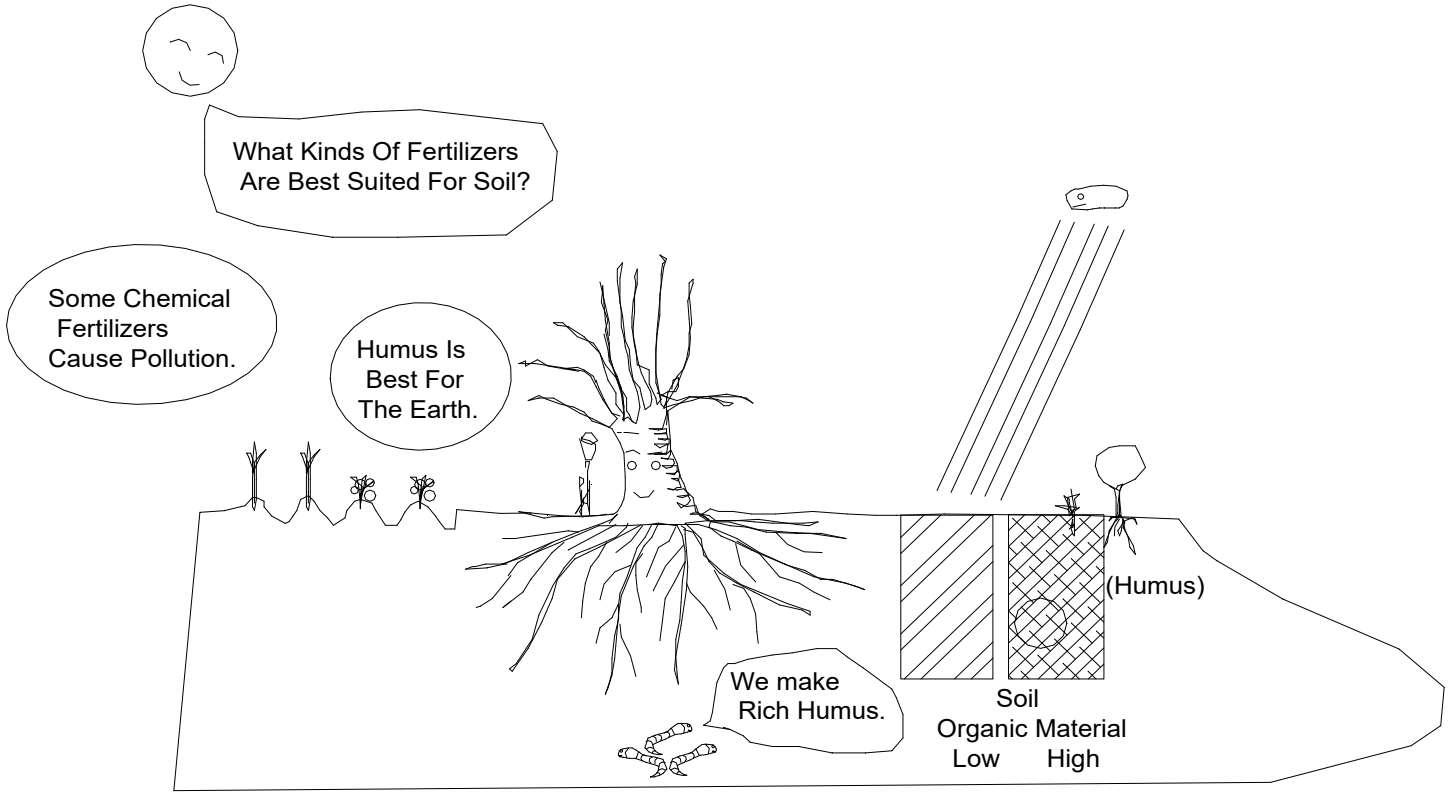
(342)Soil Composition (Nitrates)



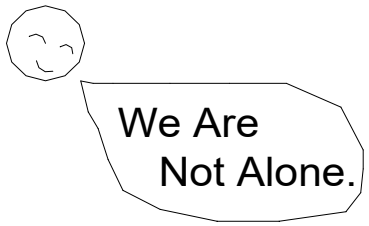
(343)Soil Composition (Organic Material)



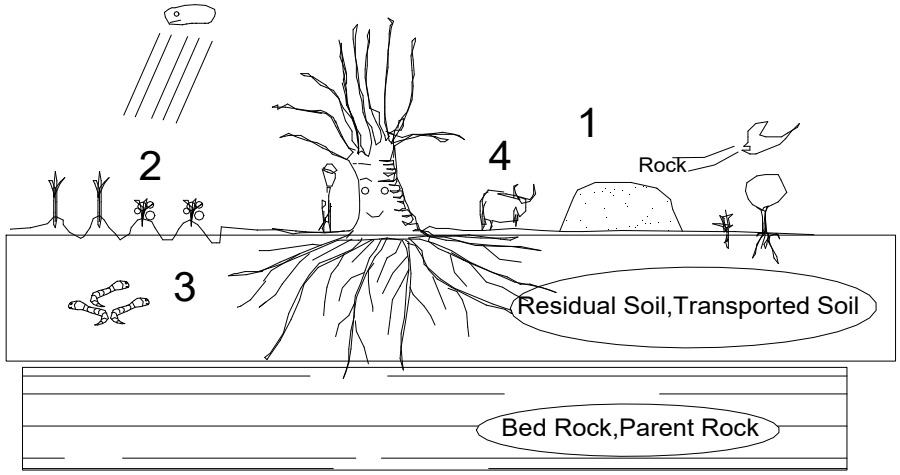
(344)Soil Composition (Fertilizers)



(345)Soil Formation(Weathering)

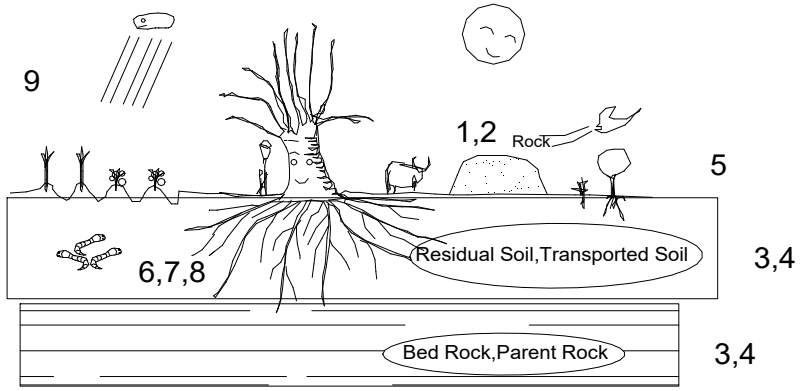


1,The Weathering Of Rocks Forms Soil.
2,Living Organisms Depend On Soil For Food.
3,Soil Supplies Plants With Minerals And Food.
4,Animals Eat Plants.

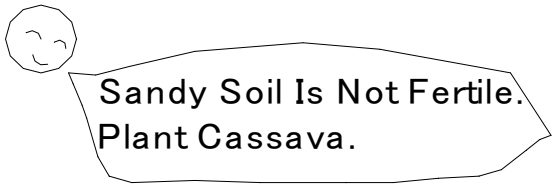


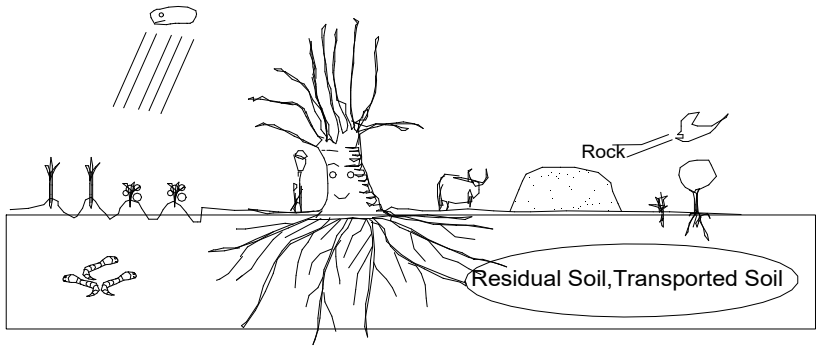
(346)Soil Formation(Weathering)

1,Soil Is Formed When Rock Is Broken Down By Weathering.
2,Rock Breaks Into Small Pieces To Form Soil.
3,Soil Above Bed Rock.(Solid Rock) .
4,Soil(Residual Soil) ,Bed Rock(Parent Rock) .
5,Some Soil Is Moved Away From Its Parent Rock By Water And Wind .
(Transported Soil)
6,Living Organisms(Produce Acids Which Break Down Rock) Help To Form Soil.
7,Bacteria In The Soil cause The decay of dead plants and animals to form humus.
8,Other Living Things(Moles,Earthworms,Ants,Beetles,Etc) Break large pieces of soil.
9,Water Speeds Up Weathering Of Rock.



(347)Soil Science



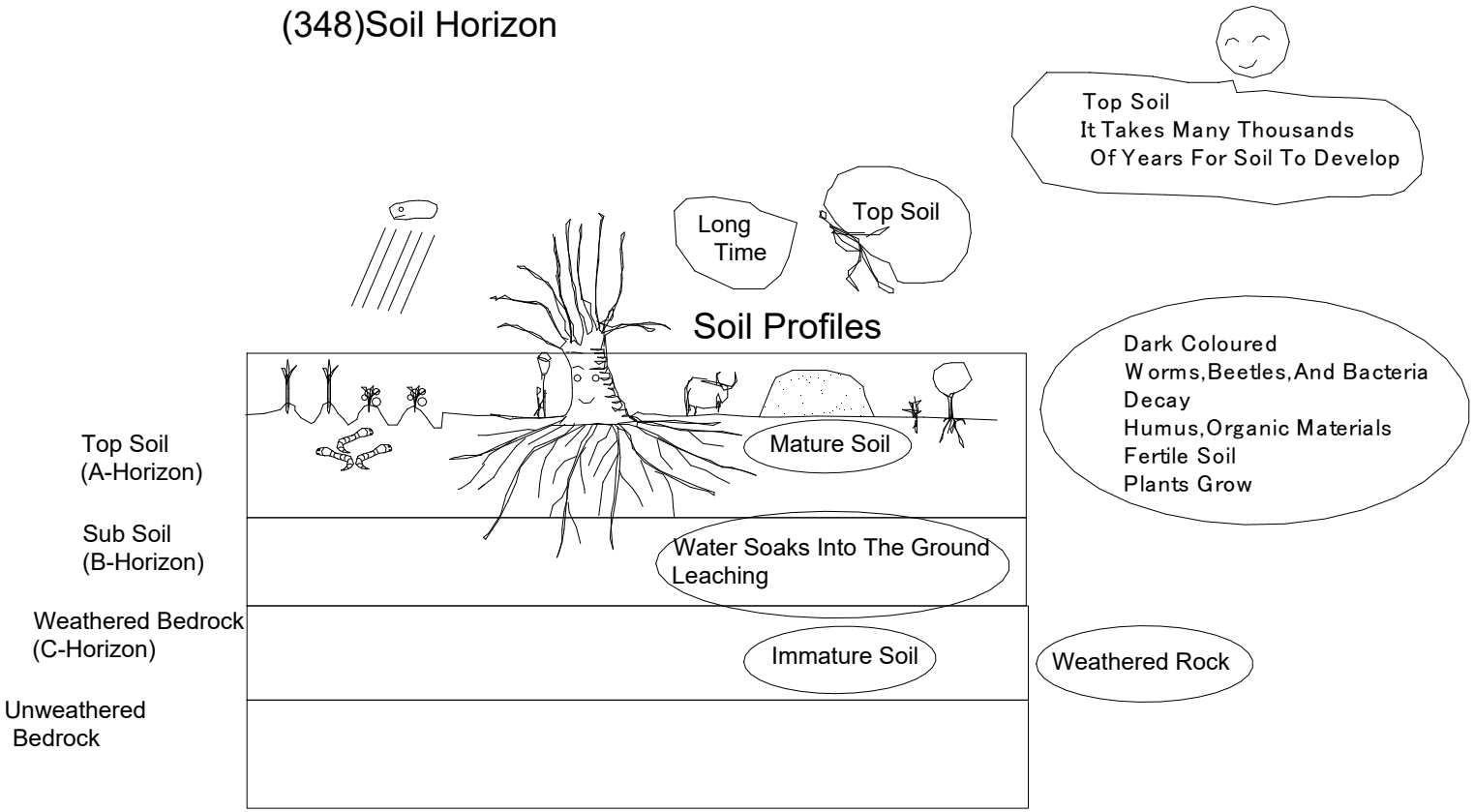


1,Different Types Of Soil.
2,Some Soils Are Good For Growing Crops.
3,Some Soils Support Vast Forests.
4,Some Soils Can Be Improved With Fertilizers.

Soil Scientist.
Classify Soils,Soil Types.
Soil Map.

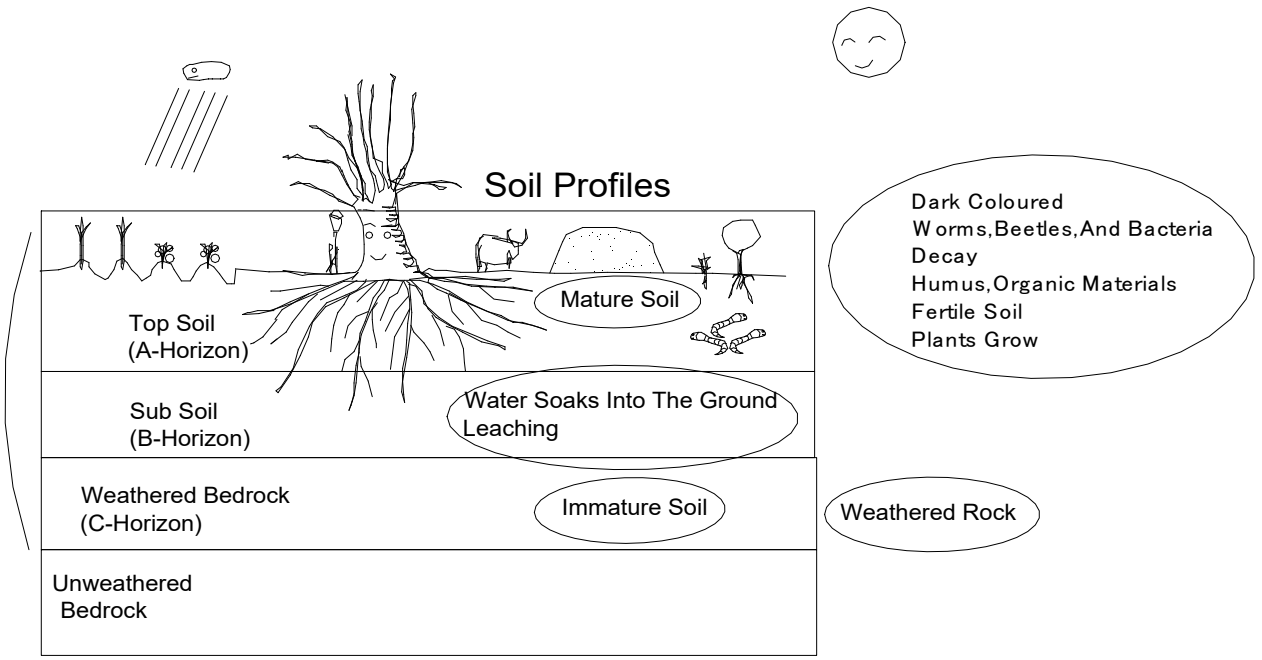
Farmers Determine which crops grow best in The field.

(348)Soil Horizon

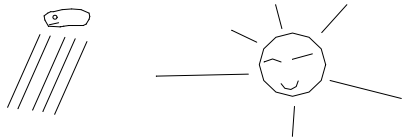
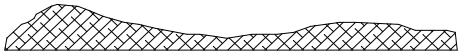
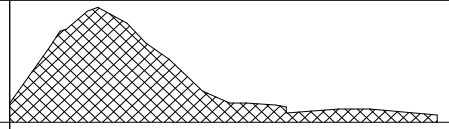


(349) Soil Horizon Development

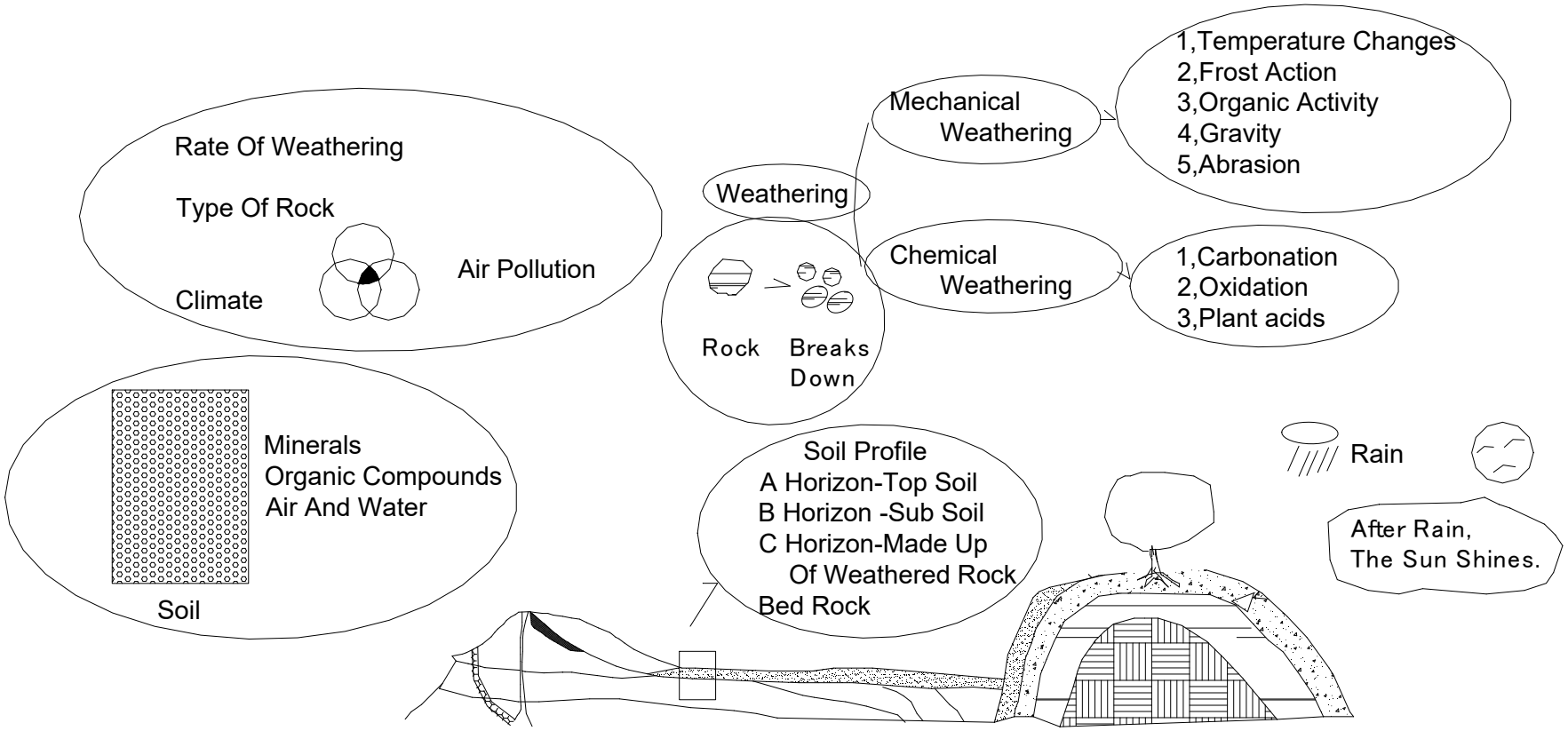
Soil Horizon Develop(Factor)
1,Time.
2,Climate(High Rainfall,High Warm Temperature) .
Organisms,Tropical Regions .
Weathering Takes Place Rapidly.
Dry Area,Cold Area .
Weathering Process Is Slowed Down.
3,Types Of Rock.
Sandstone Breaks Into Sand Quickly.
It Takes A Long Time For Granite To Break Apart.
4,Shape Of The Land's Surface.
On Steep Slope.
Little Weathering Takes Place.
5,Amount And Type Of Soil.

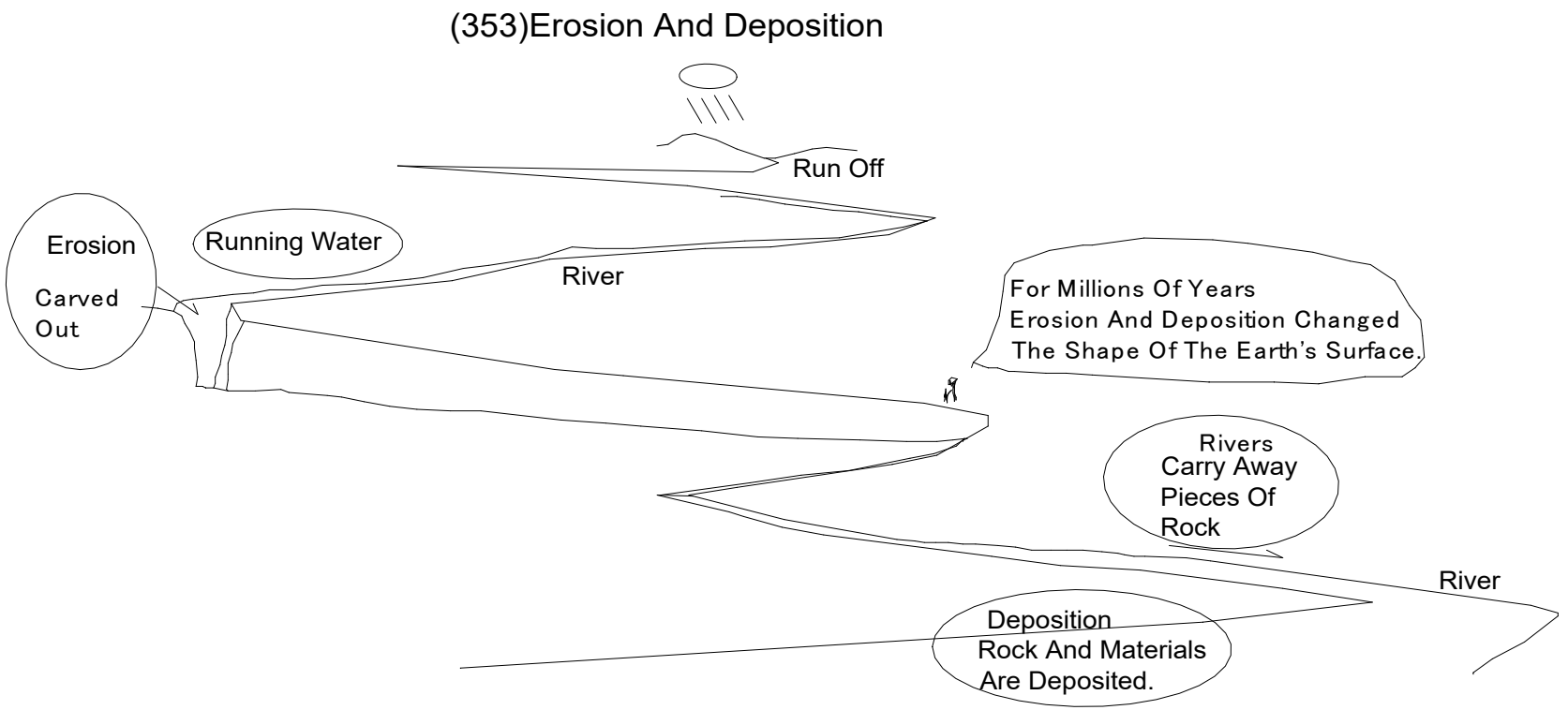


（ 350） Soil Horizon Development

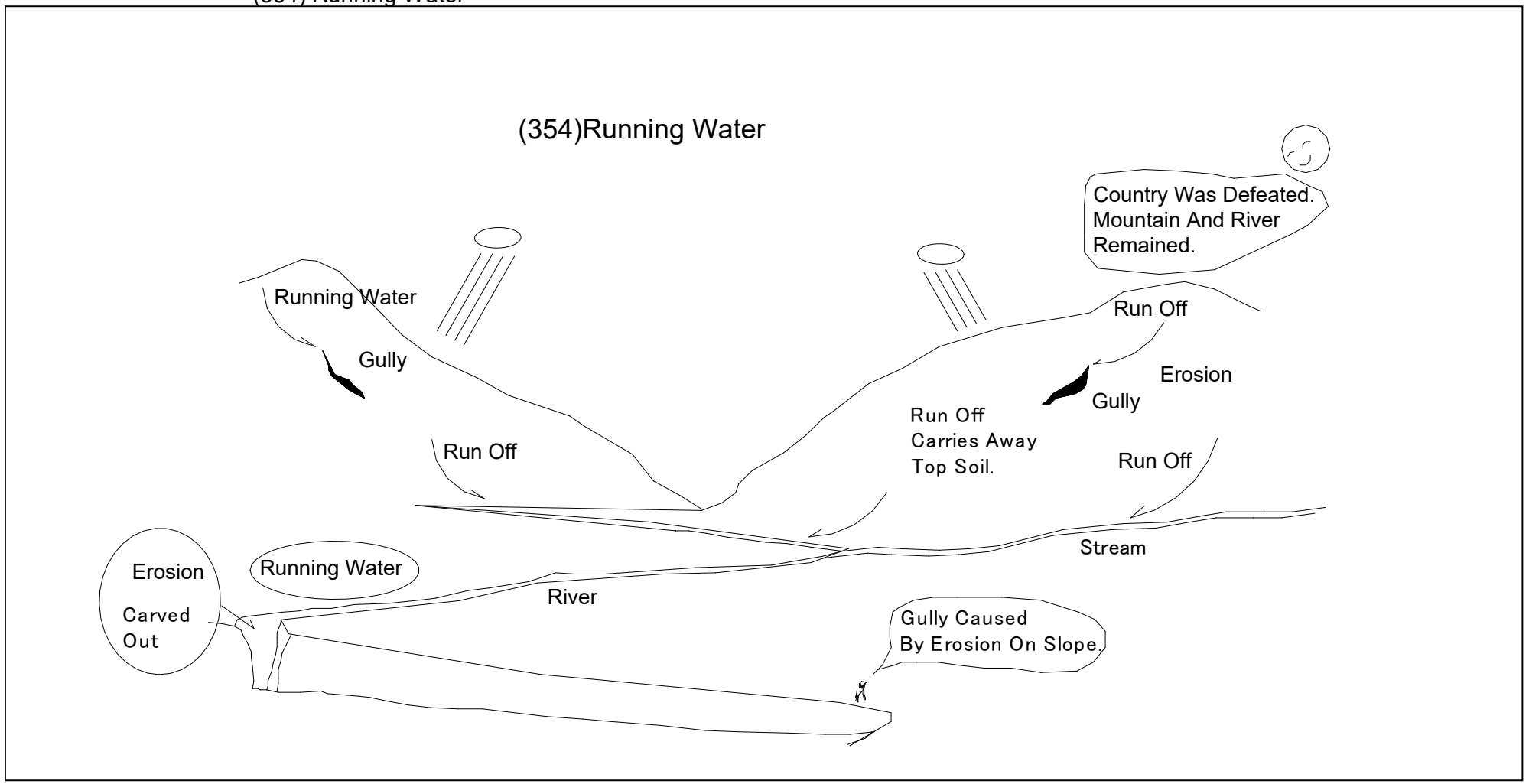
Soil Horizon Develop(Factor)	Weathering Rapidly	Weathering Slowly
1,Time.		Glacial Erosion
2,Climate(High Rainfall,High Warm Temperature). Organisms,Tropical Regions . Weathering Takes Place Rapidly. Dry Area,Cold Area . Weathering Process Is Slowed Down.		
3,Types Of Rock. Sandstone Breaks Into Sand Quickly. It Takes A Long Time For Granite To Break Apart.		
4,Shape Of The Land's Surface. On Steep Slope. Little Weathering Takes Place.		
5,Amount And Type Of Soil.		

(352) Soil Summary

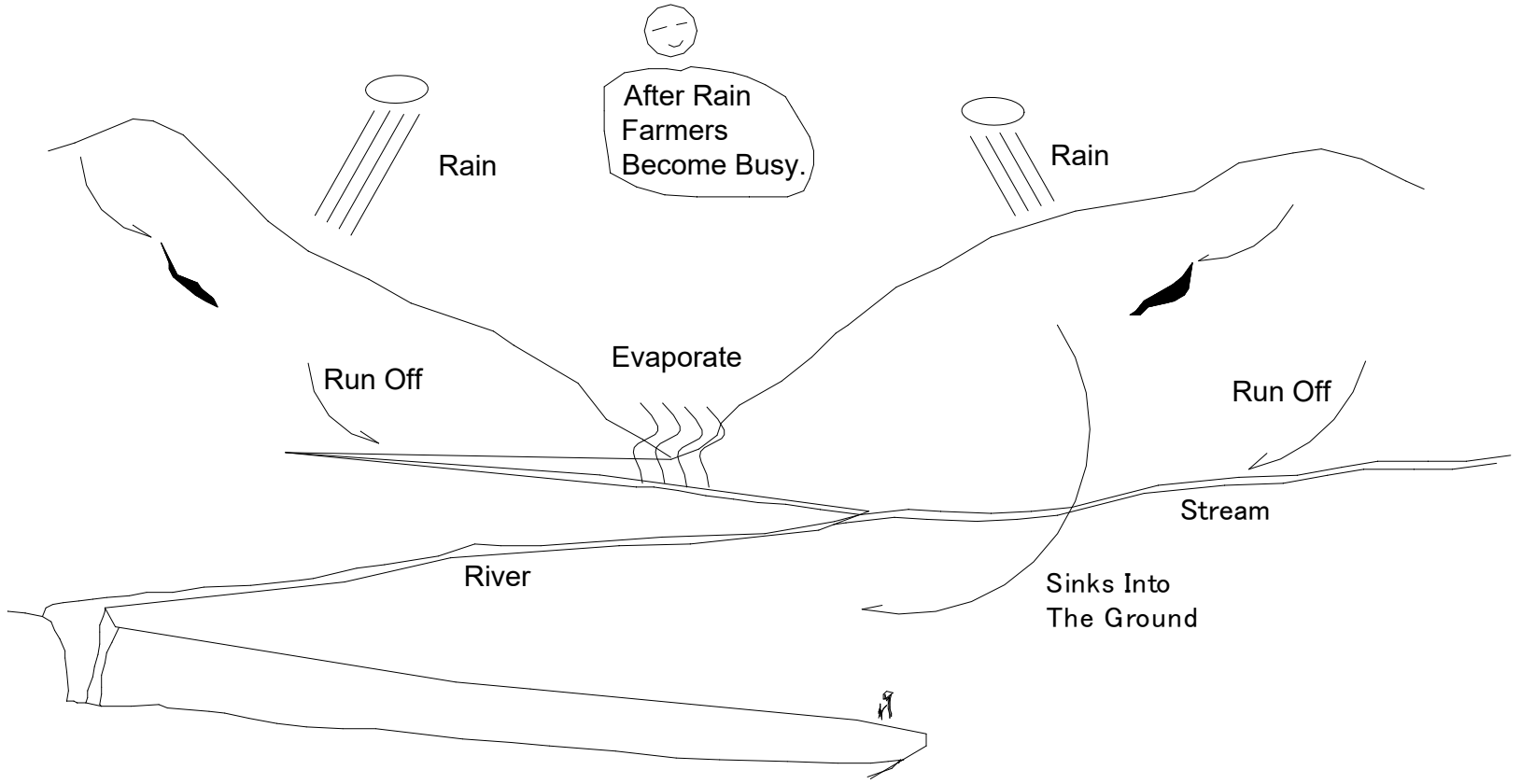


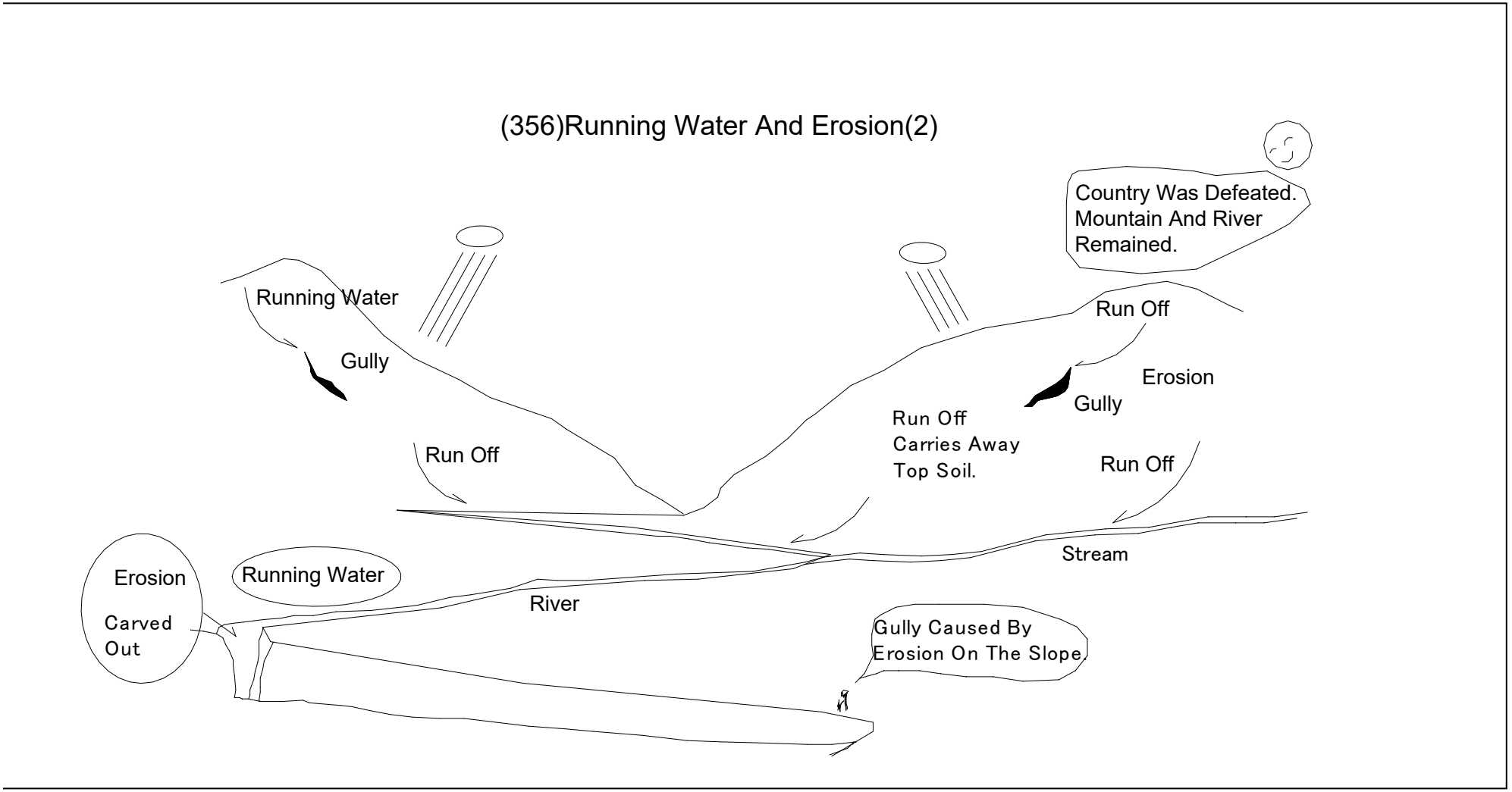

(353)Erosion And Deposition
Run Off
Erosion
Carved
Out
Running Water
River
For Millions Of Years
Erosion And Deposition Changed
The Shape Of The Earth's Surface.
Rivers
Carry Away
Pieces Of
Rock
River
Deposition
Rock And Materials
Are Deposited.

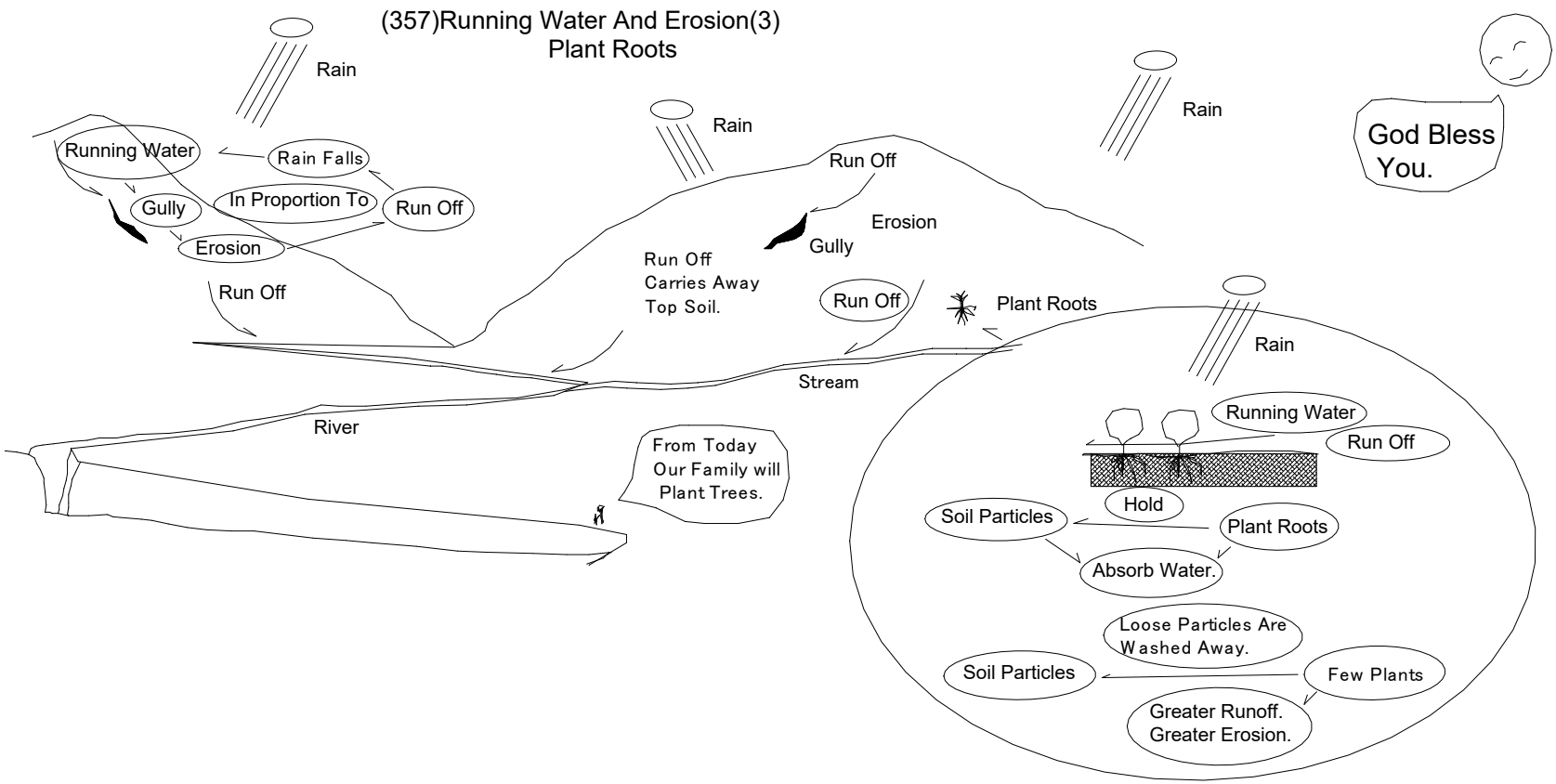
(354) Running Water



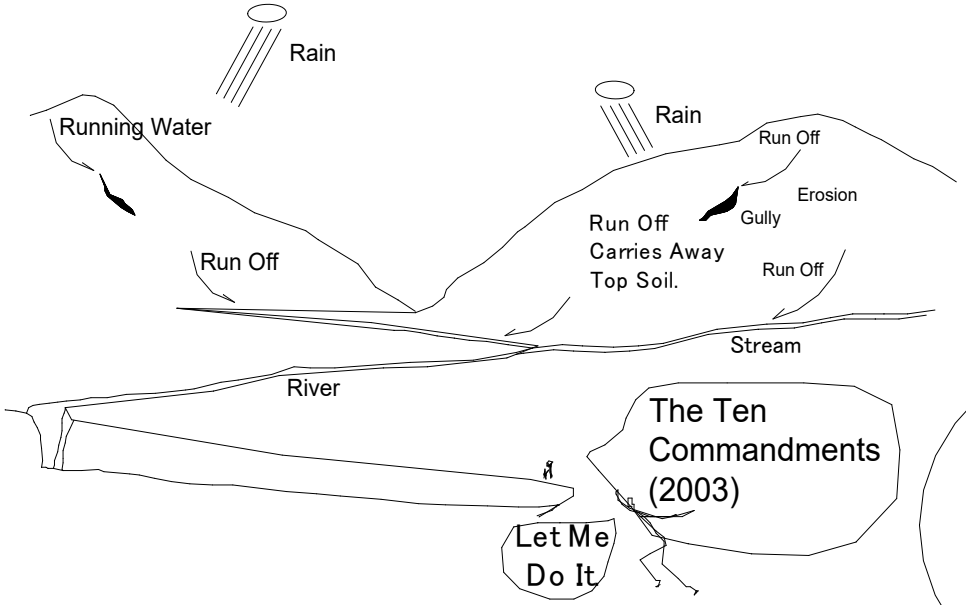
(355)Running Water And Erosion(1)




(356)Running Water And Erosion(2)
Country Was Defeated. Mountain And River Remained.
Running Water
Gully
Run Off
Erosion
Gully
Run Off Carries Away Top Soil.
Run Off
Run Off
Stream
Erosion
Carved Out
Running Water
River
Gully Caused By Erosion On The Slope.

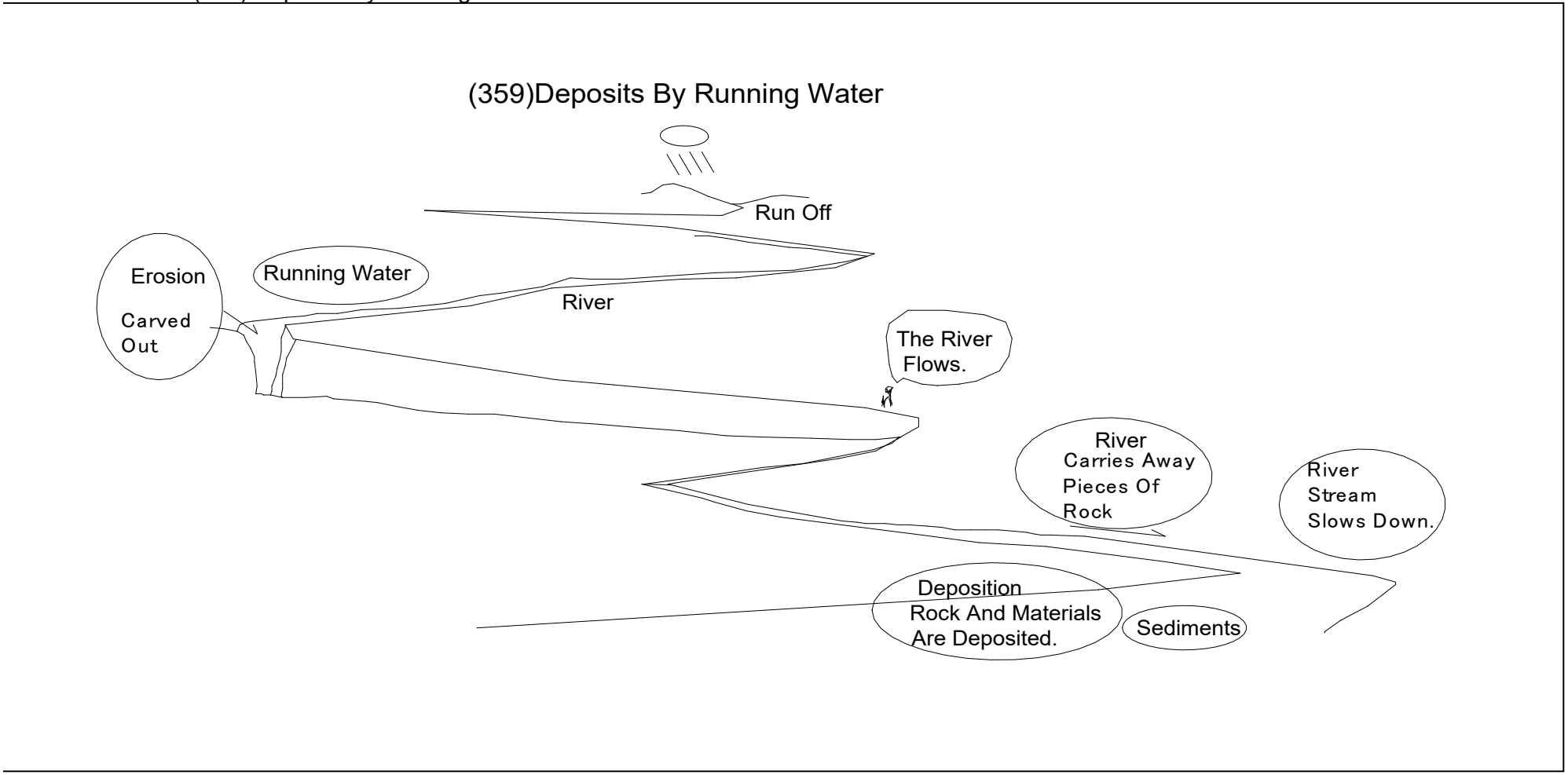

(357)Running Water And Erosion(3)
Plant Roots
Rain
Rain
Rain
Running Water
Rain Falls
In Proportion To
Run Off
Gully
Erosion
Run Off
Run Off
Carries Away
Top Soil.
Run Off
Erosion
Gully
Plant Roots
Stream
River
From Today
Our Family will
Plant Trees.
God Bless
You.
Rain
Running Water
Run Off
Hold
Soil Particles
Plant Roots
Absorb Water.
Loose Particles Are
Washed Away.
Soil Particles
Few Plants
Greater Runoff.
Greater Erosion.

(358)Running Water And Erosion(4)
Land Shape

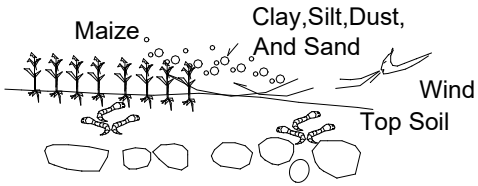


Land Shape	Steep Slope
Amount Of Run Off	Greatest
Water Flow	Rapid
Erosion	Great Deal Of
Remarks	Need Proper Cares

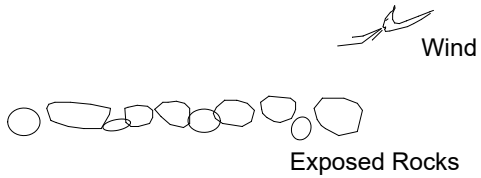
1. Plant Trees.
2. Do Not Cut Trees.
3. Build Rock Wall.
4. Earth Dam,Fill Dam(Small) .
5. Do Not Release Goat.
6. Do Not Make Charcoal.
7. Do Not Destroy Nature.
8. Environmental Protection.
9. Do Not Forget Mountain God.
10. People Love Not Only Family But Also Nature.


(359)Deposits By Running Water
Run Off
Erosion
Carved Out
Running Water
River
The River Flows.
River Carries Away Pieces Of Rock
River Stream Slows Down.
Deposition
Rock And Materials Are Deposited.
Sediments

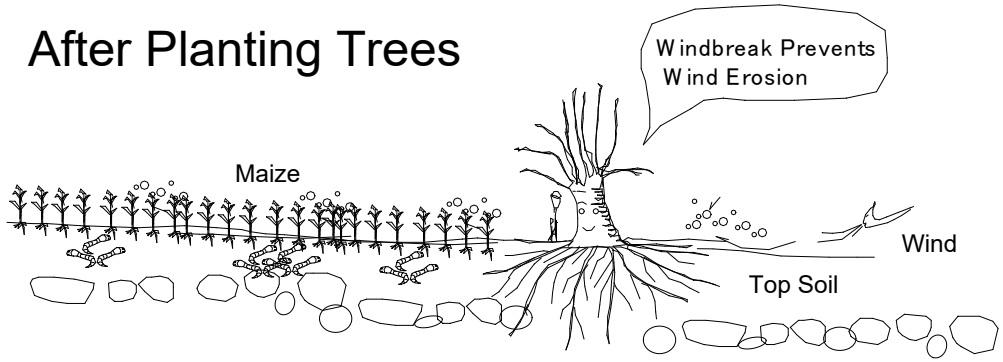
(360)Wind And Erosion(1)



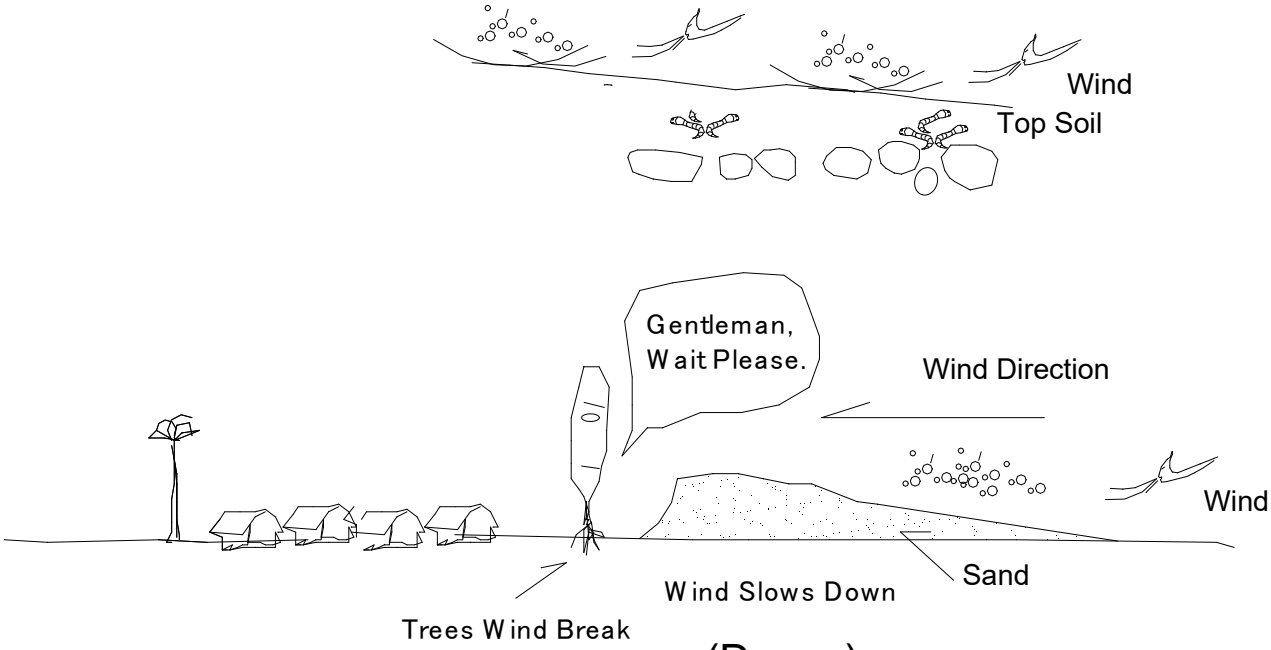
Before Planting Trees



After Planting Trees

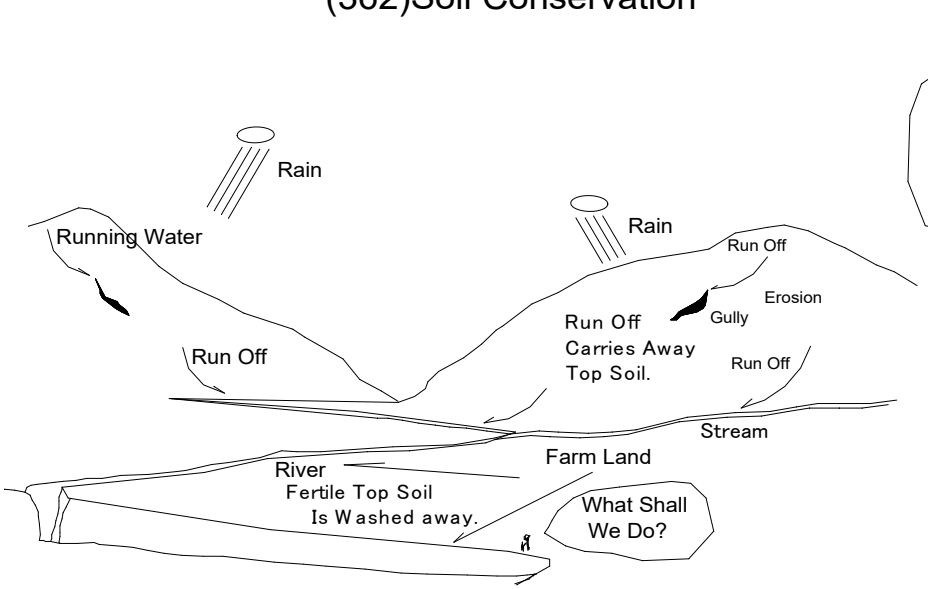


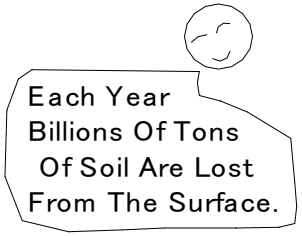
(361)Deposits By Wind(Dunes)

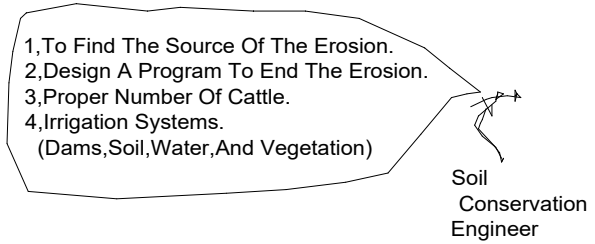


(Dunes)

(362)Soil Conservation



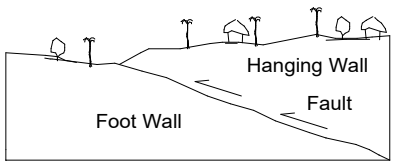




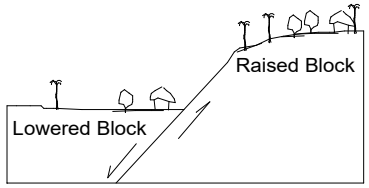
The Best Way To End The Erosion.

To Plant Trees.

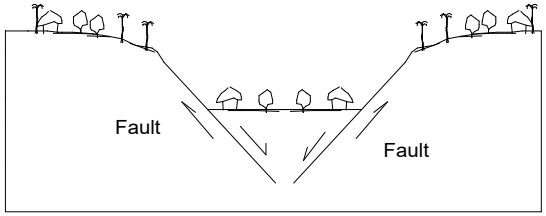
(363)Thrust Fault And Normal Fault



Thrust Fault
Compression

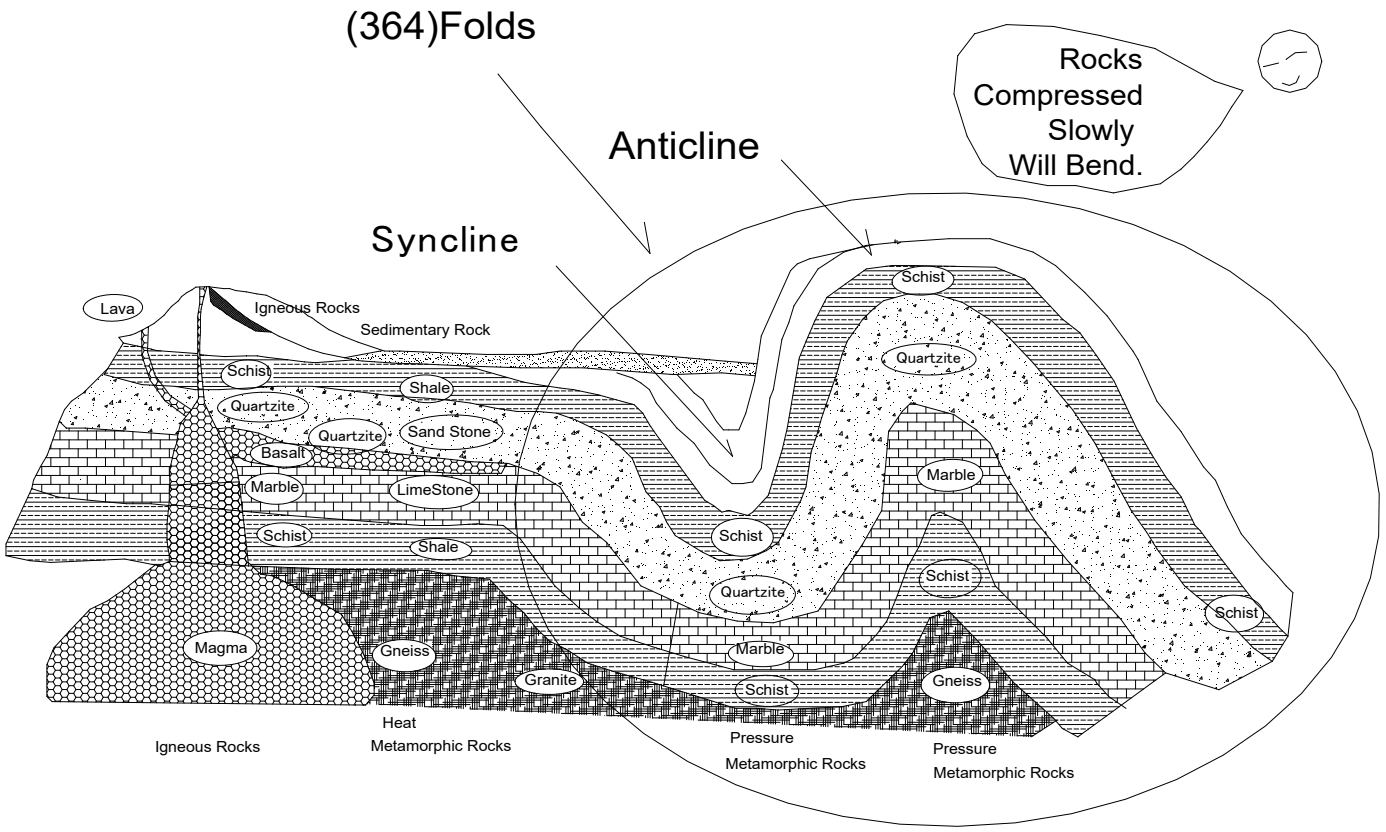


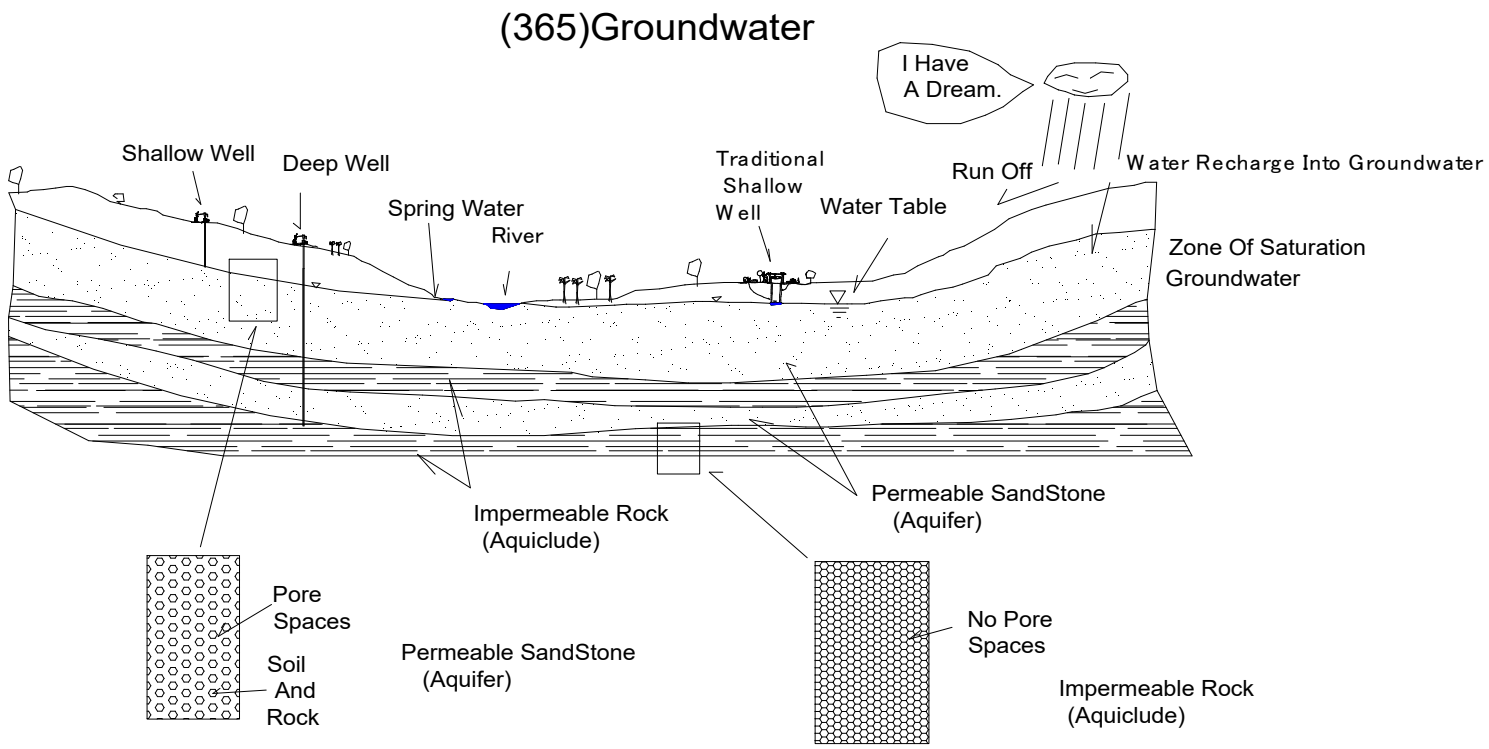
Normal Fault
Tension



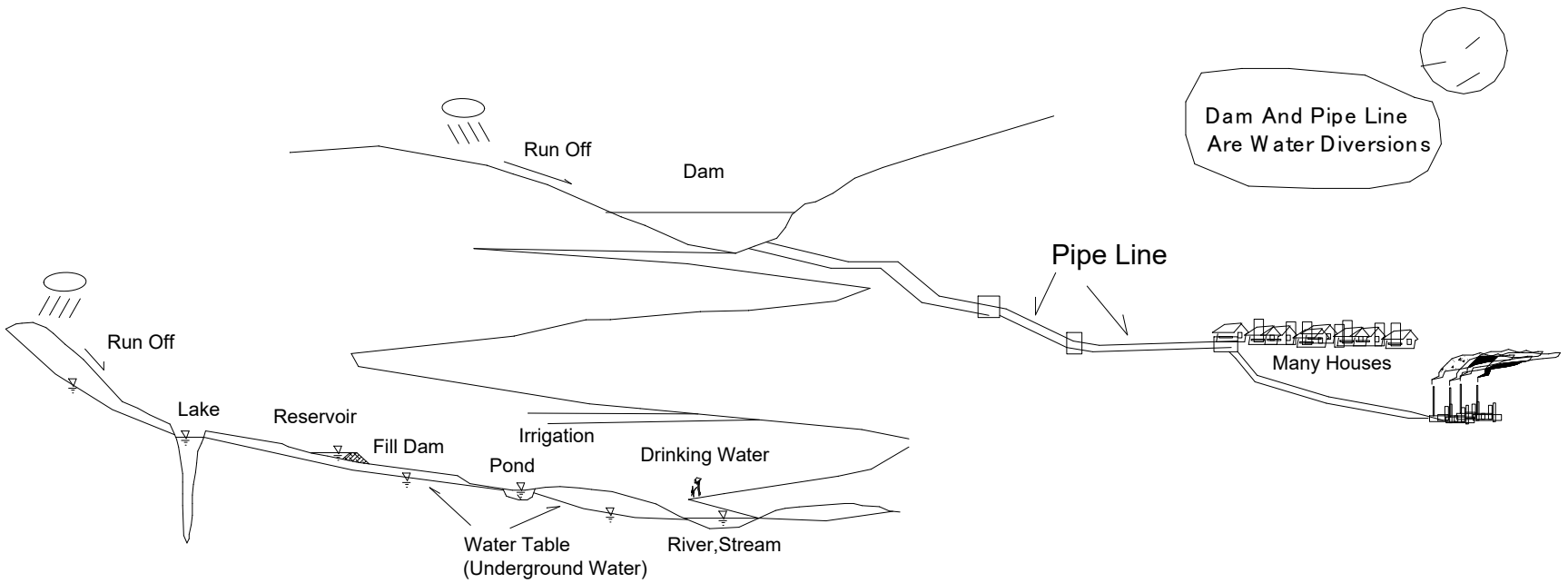
Rift Valley

(364) Folds

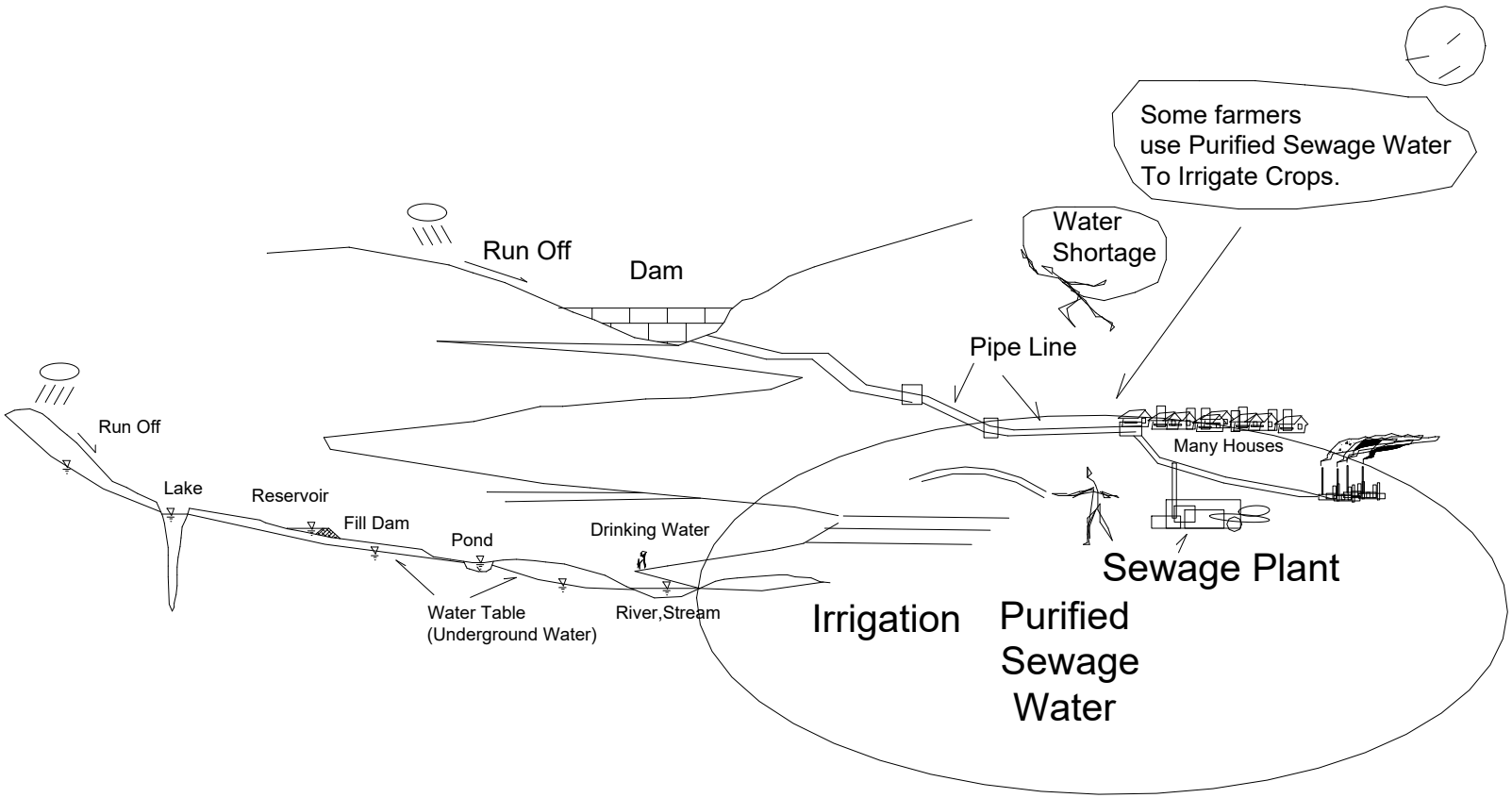

(364)Folds
Rocks
Compressed
Slowly
Will Bend.
Anticline
Syncline
Lava
Igneous Rocks
Sedimentary Rock
Schist
Shale
Quartzite
Quartzite
Sand Stone
Basalt
Marble
LimeStone
Schist
Shale
Magma
Gneiss
Granite
Igneous Rocks
Heat
Metamorphic Rocks
Schist
Quartzite
Marble
Schist
Pressure
Metamorphic Rocks
Schist
Quartzite
Marble
Schist
Gneiss
Schist
Pressure
Metamorphic Rocks


(365)Groundwater
I Have
A Dream.
Shallow Well
Deep Well
Spring Water
River
Traditional
Shallow
Well
Water Table
Run Off
Water Recharge Into Groundwater
Zone Of Saturation
Groundwater
Impermeable Rock
(Aquiclude)
Permeable SandStone
(Aquifer)
Pore
Spaces
Soil
And
Rock
Permeable SandStone
(Aquifer)
No Pore
Spaces
Impermeable Rock
(Aquiclude)

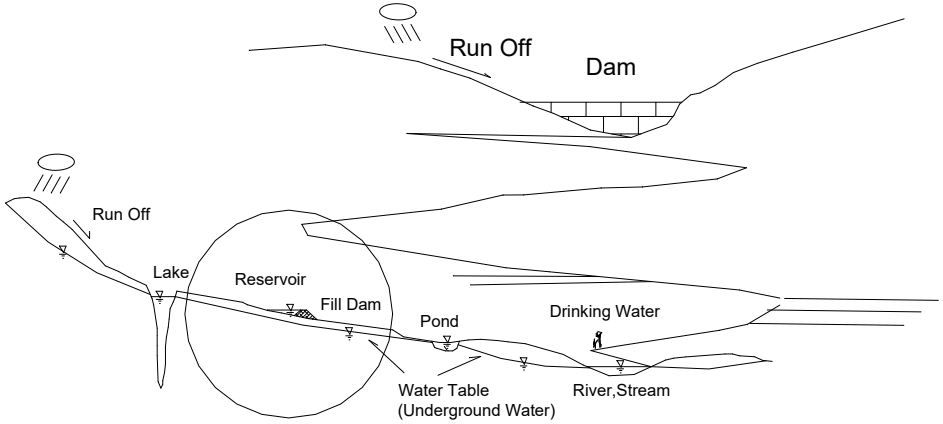
(366)Water Diversion

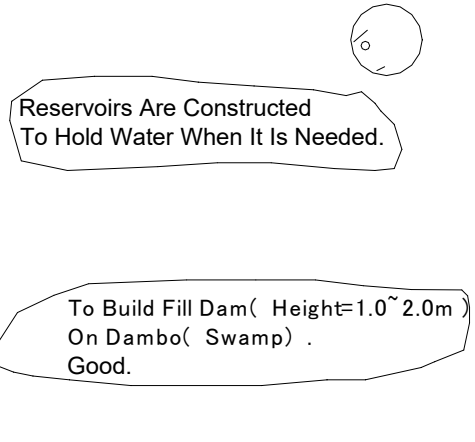


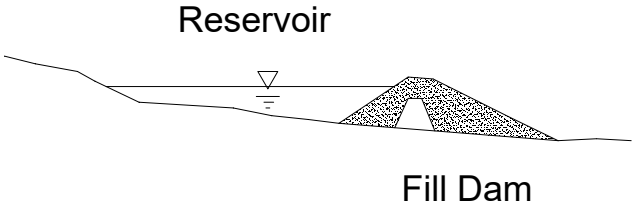
(367)Purified Sewage Water



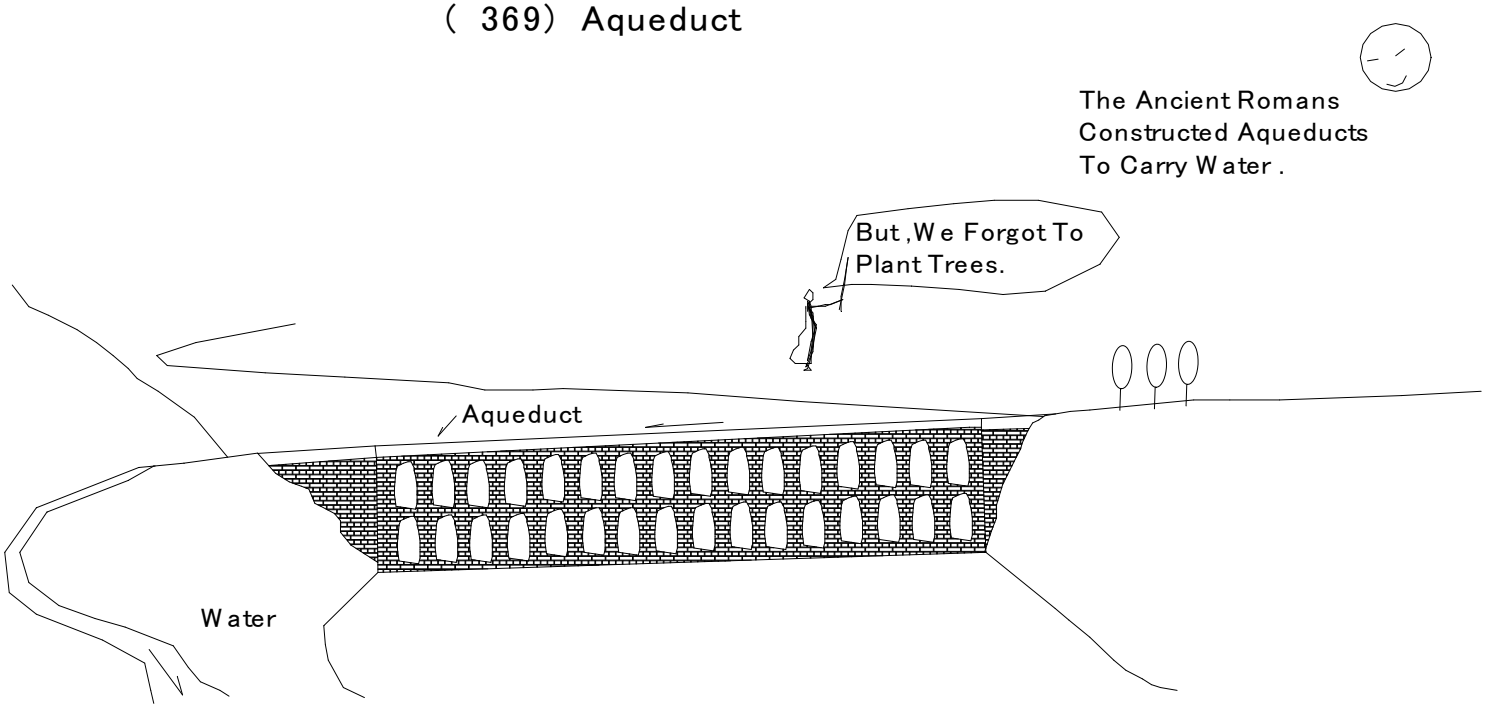
(368)Reservoirs

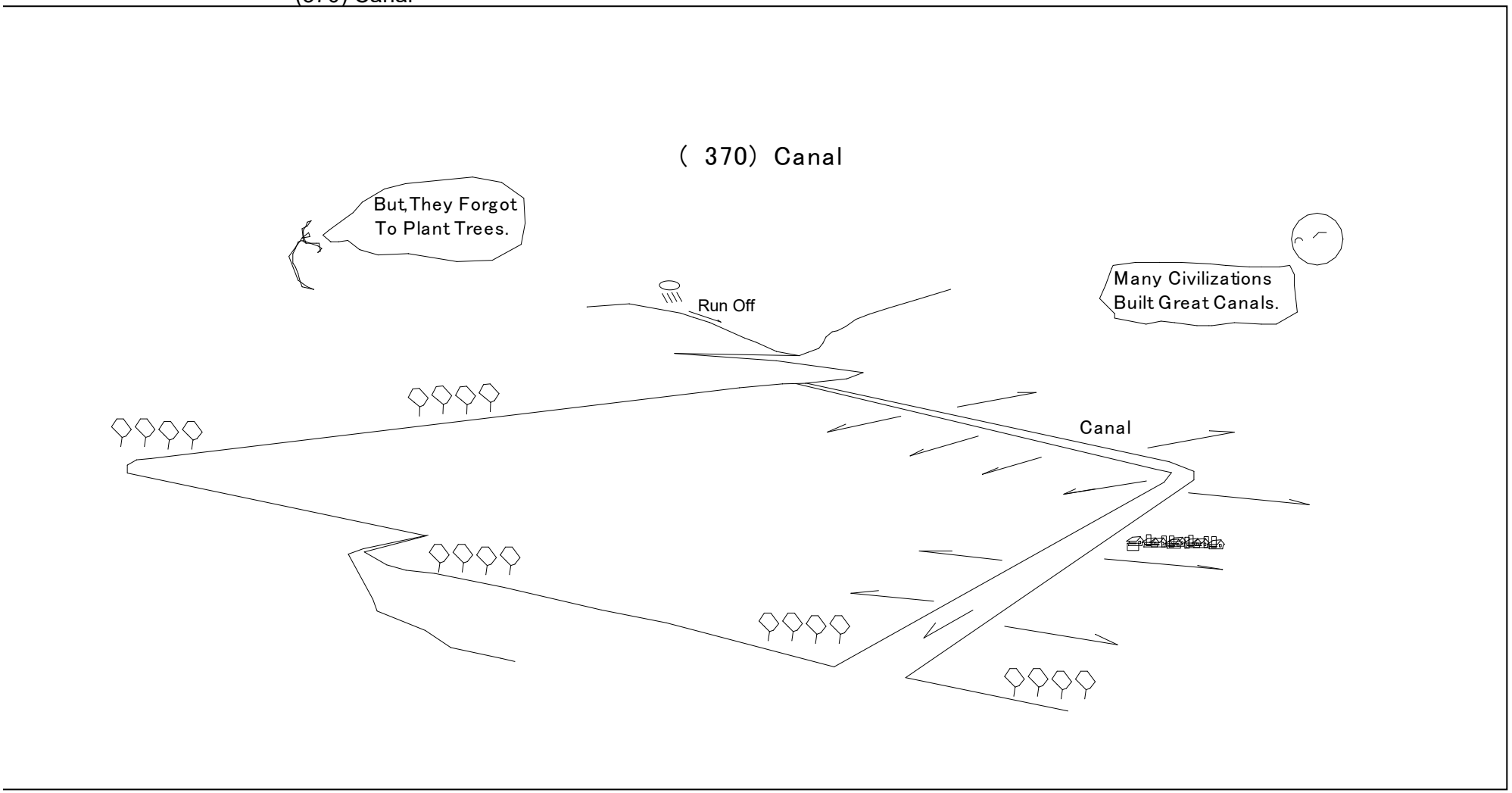




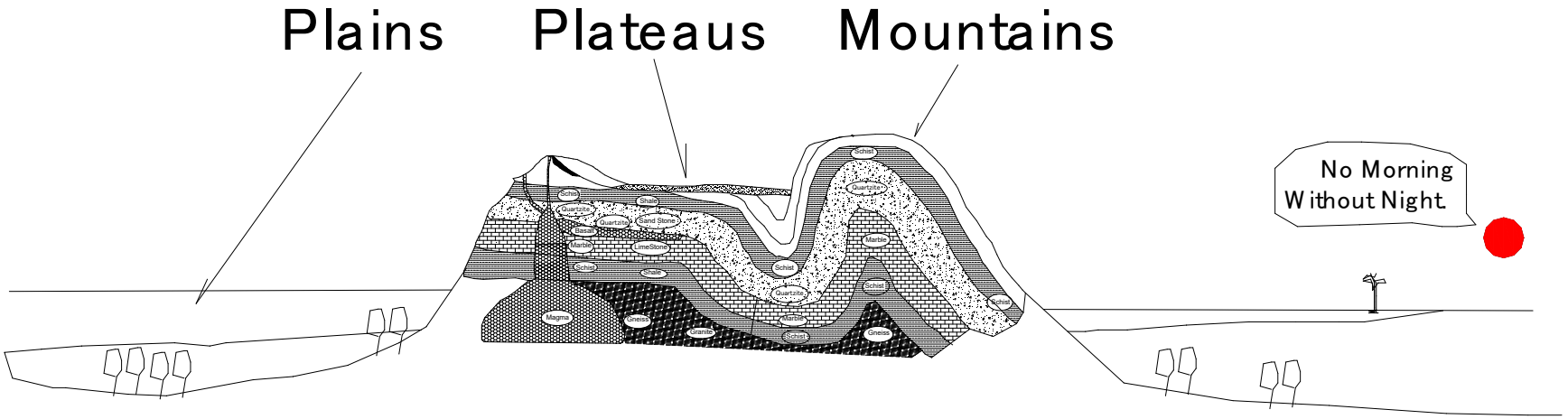


(369) Aqueduct



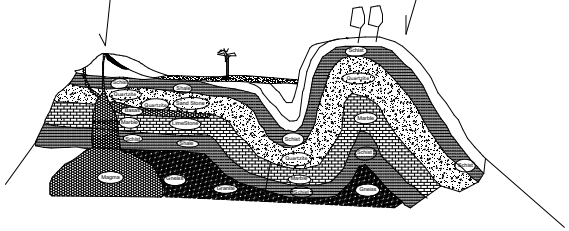

(370) Canal
But,They Forgot
To Plant Trees.
Run Off
Many Civilizations
Built Great Canals.
Canal

(371) LandForms



(372) Mountains

Volcanic Mountains

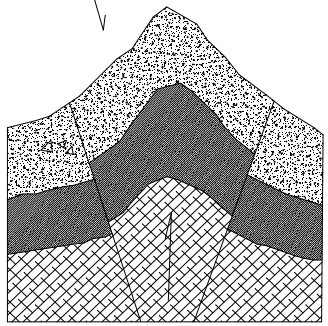


Molten Material Reaches The Surface

Folded Mountains

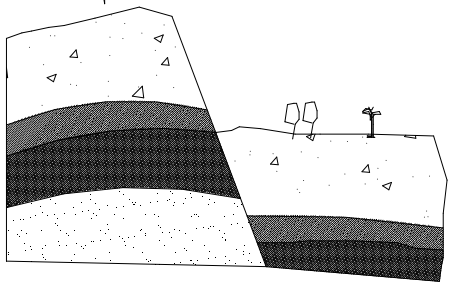
Rock Layers Are Squeezed From Opposite Sides By Forces Inside Earth

Upwarped Mountains



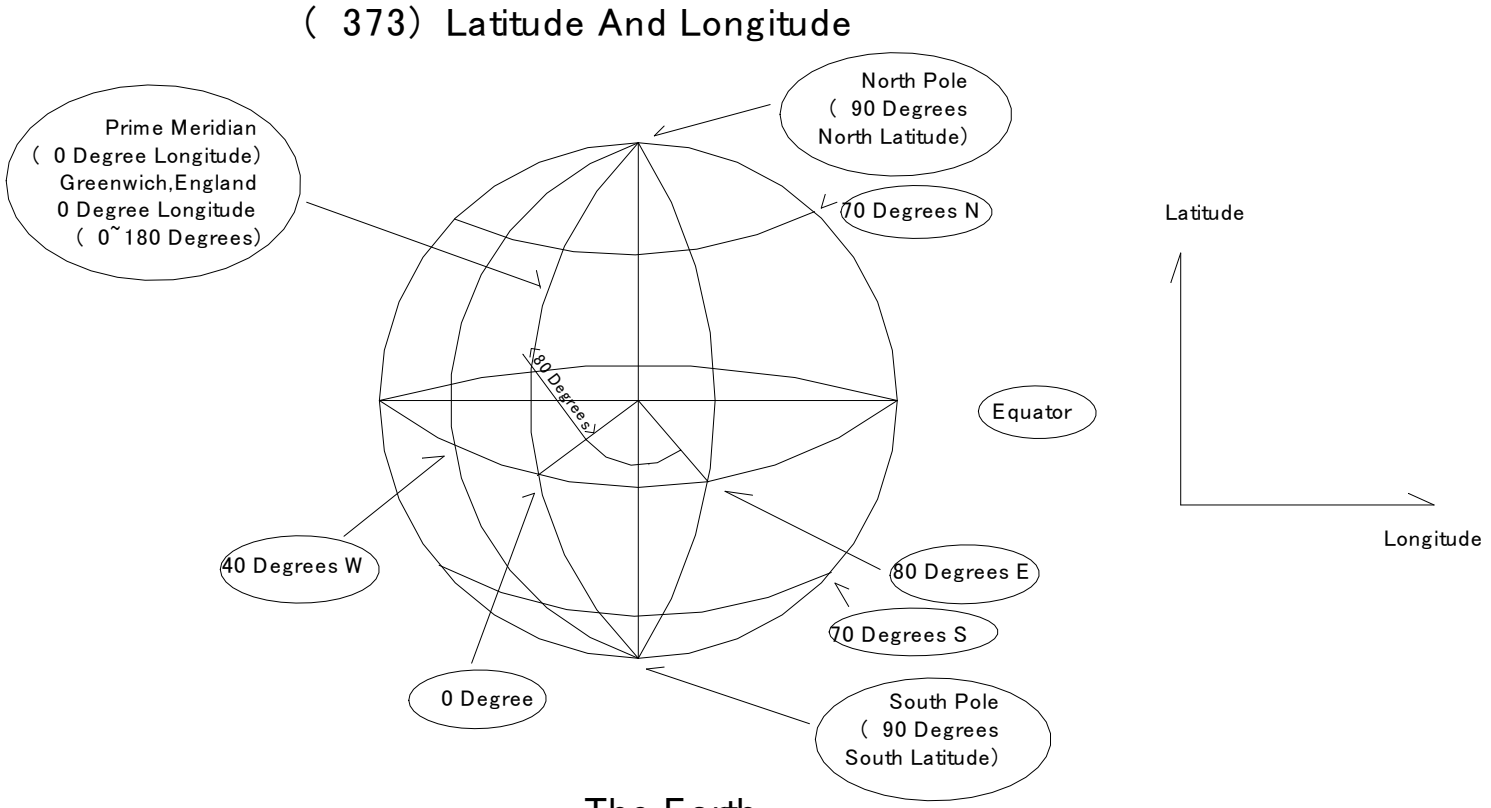
Pushed Up By Forces Inside Earth

Fault-Block Mountains

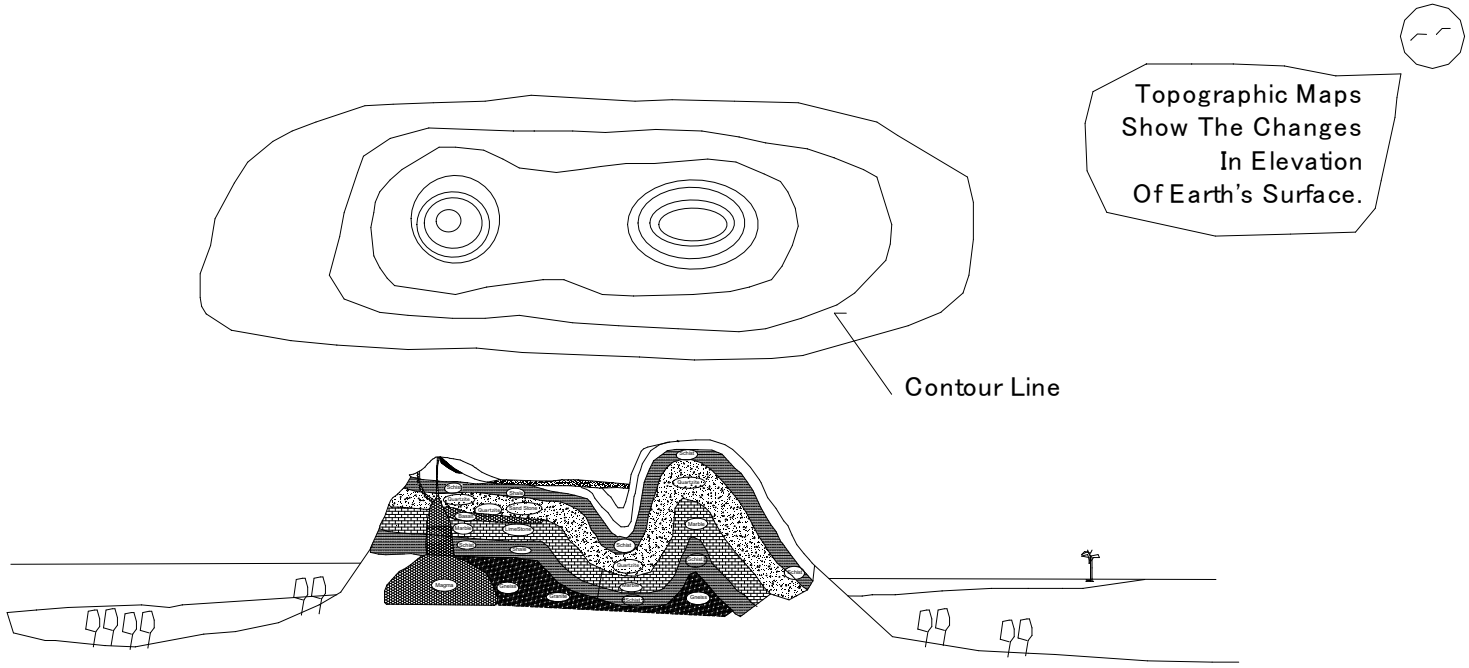


A Large Crack In Rock

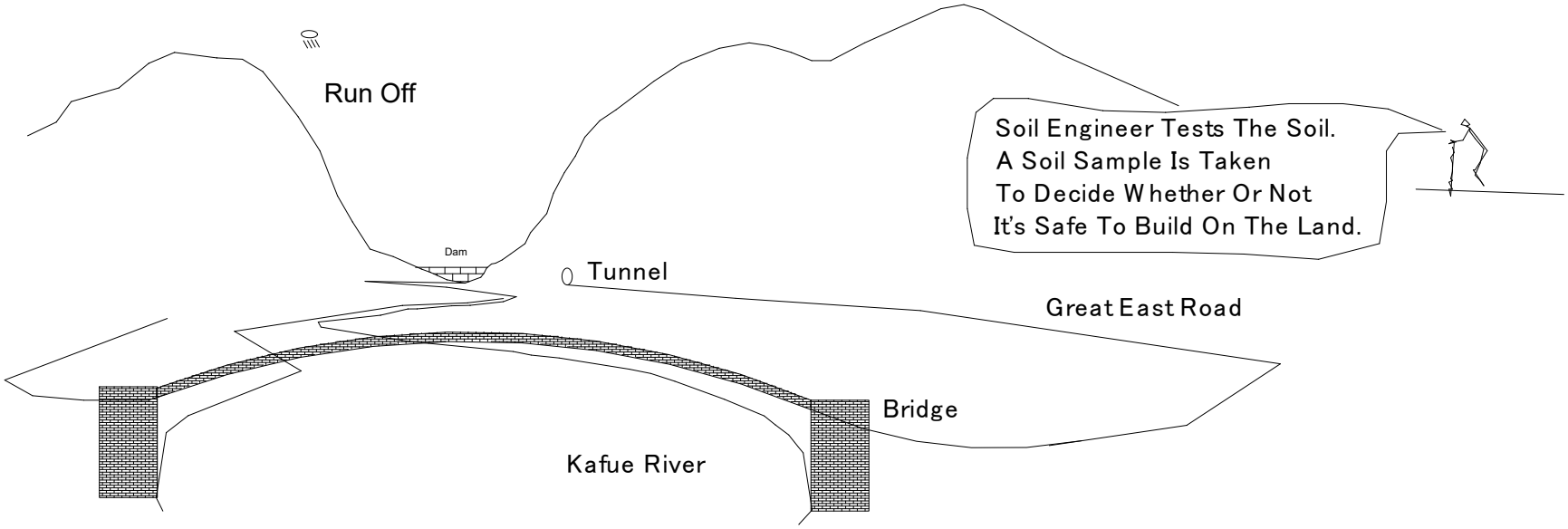
(373) Latitude And Longitude



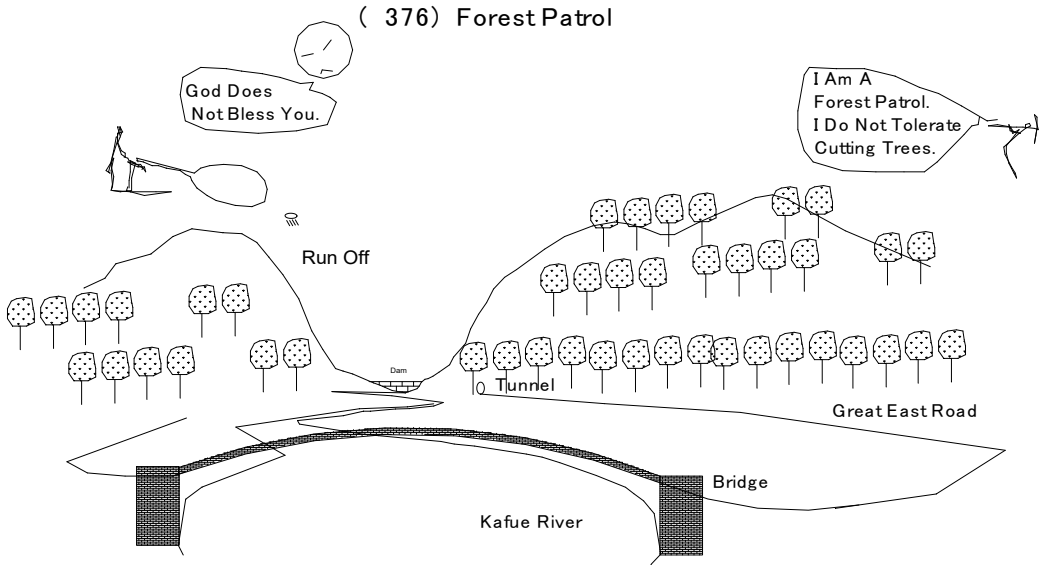
(374) Topographic Maps



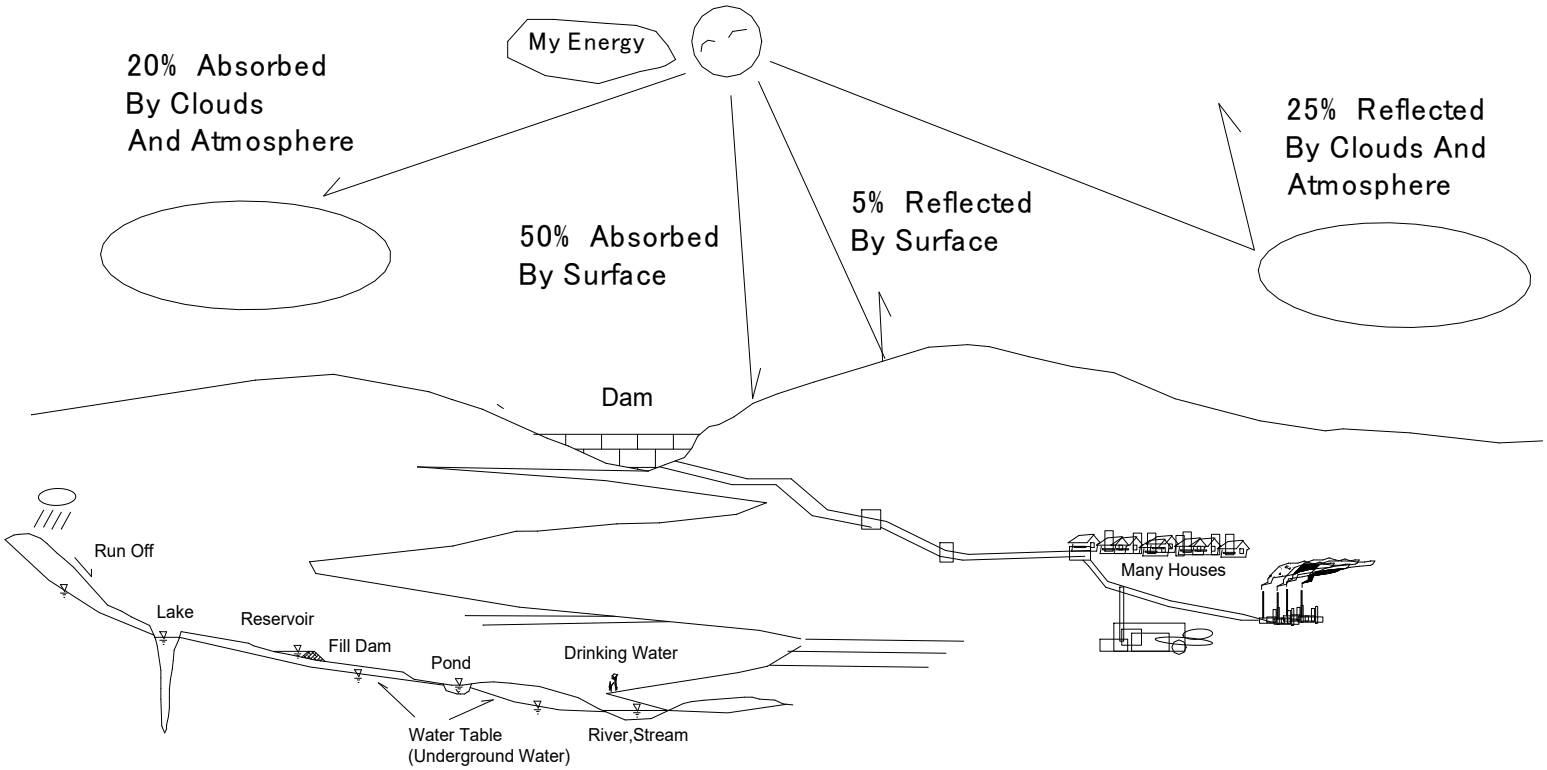
(375)Soil Engineer



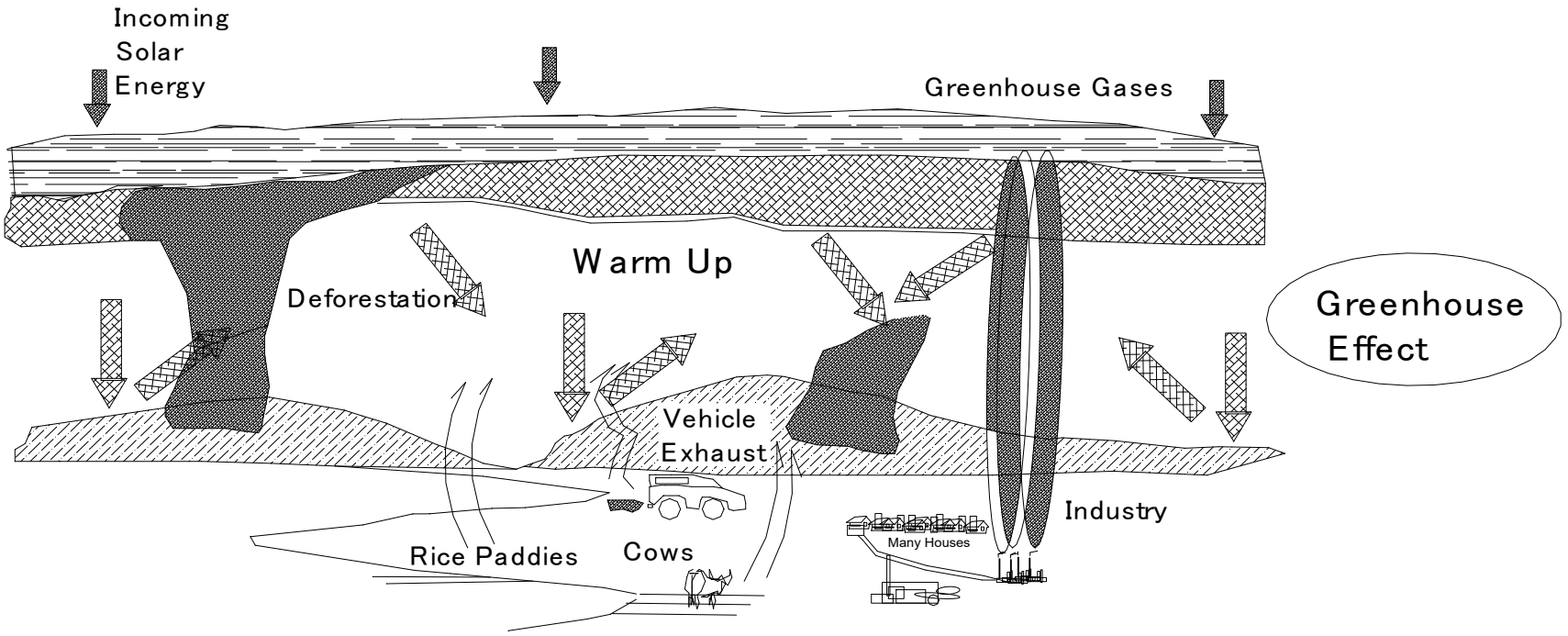
(376) Forest Patrol



(377) Energy Transfer In The Atmosphere



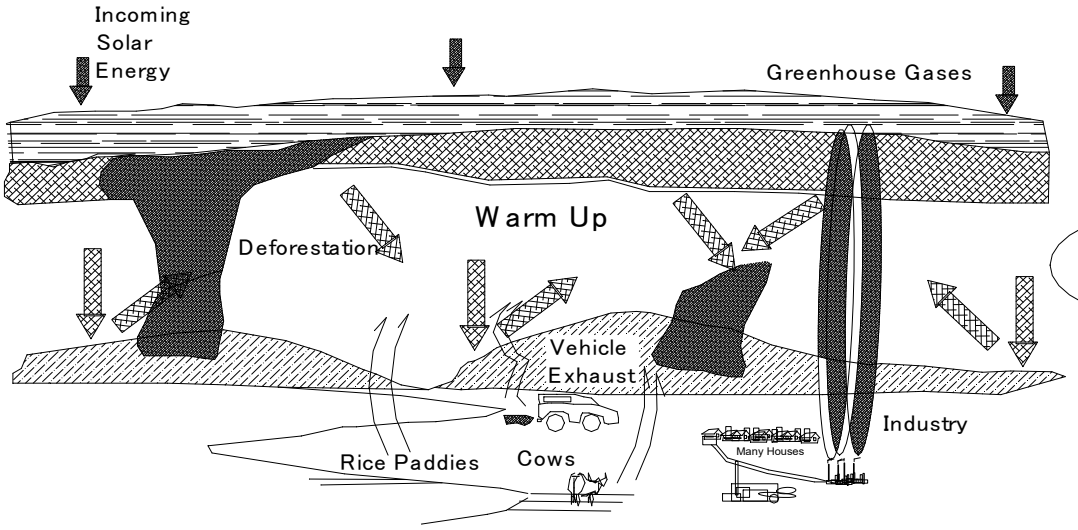
(378) Greenhouse Effect



(379) Global Warming

(379) Global Warming

1,(The Burning Of Natural Gas,Petroleum,Coal)
↓ Burning
Carbon Dioxide
↓ Increase
Green House Effect

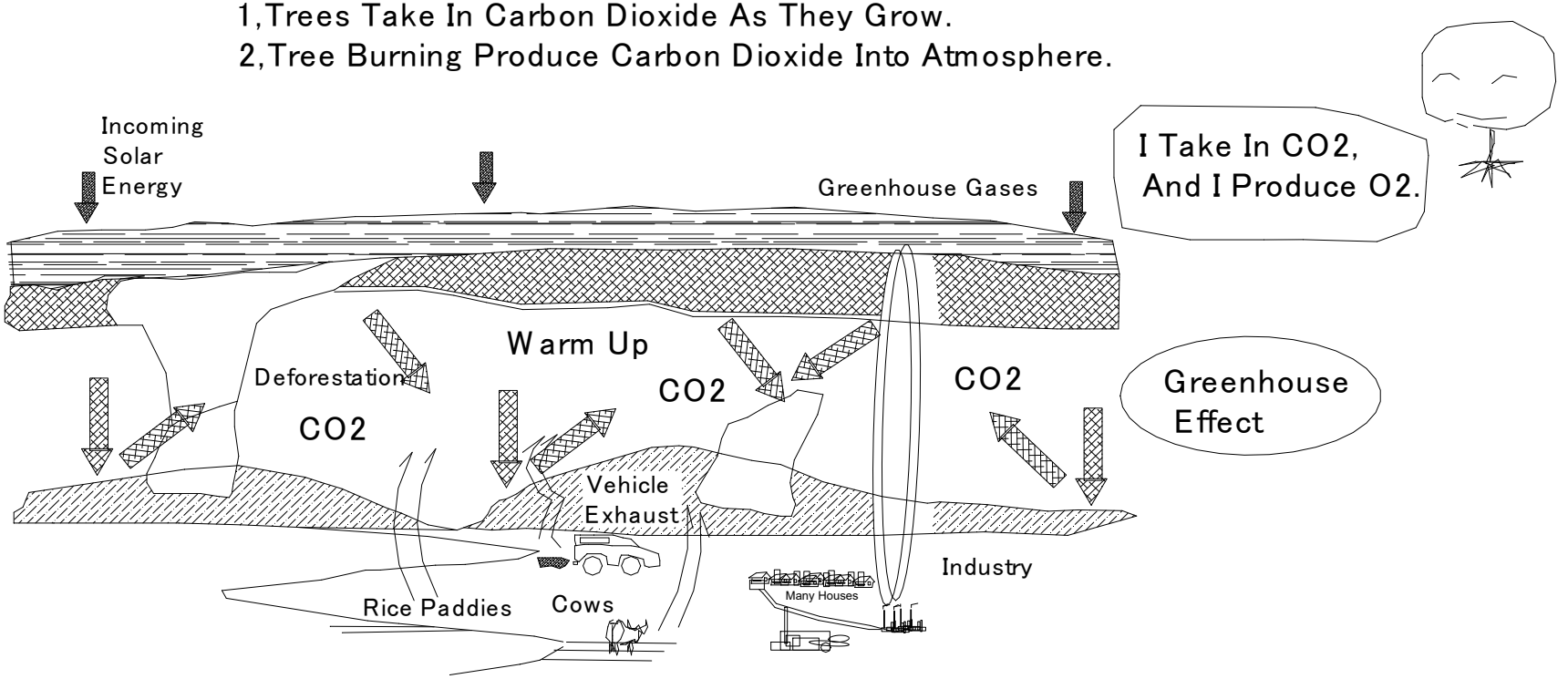


Greenhouse
Effect

2,Deforestation

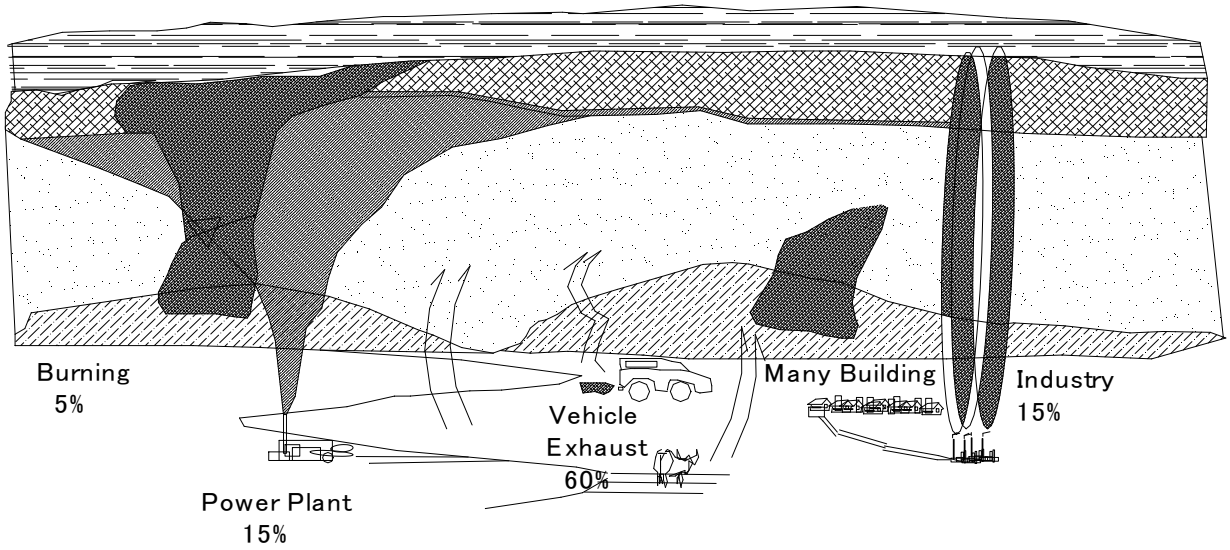
(380) Deforestation

Deforestation(Global Warming)
1,Trees Take In Carbon Dioxide As They Grow.
2,Tree Burning Produce Carbon Dioxide Into Atmosphere.



(381) Air Pollution

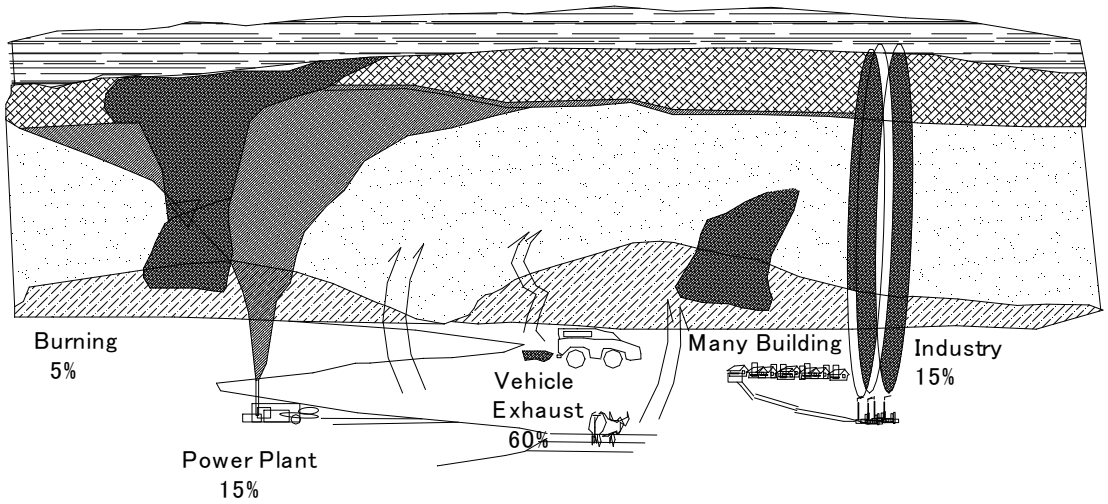
1,Smog(Polluted Air)
2,Holes In The Ozone Layers.
3,Acid Rain.



(382) Smog

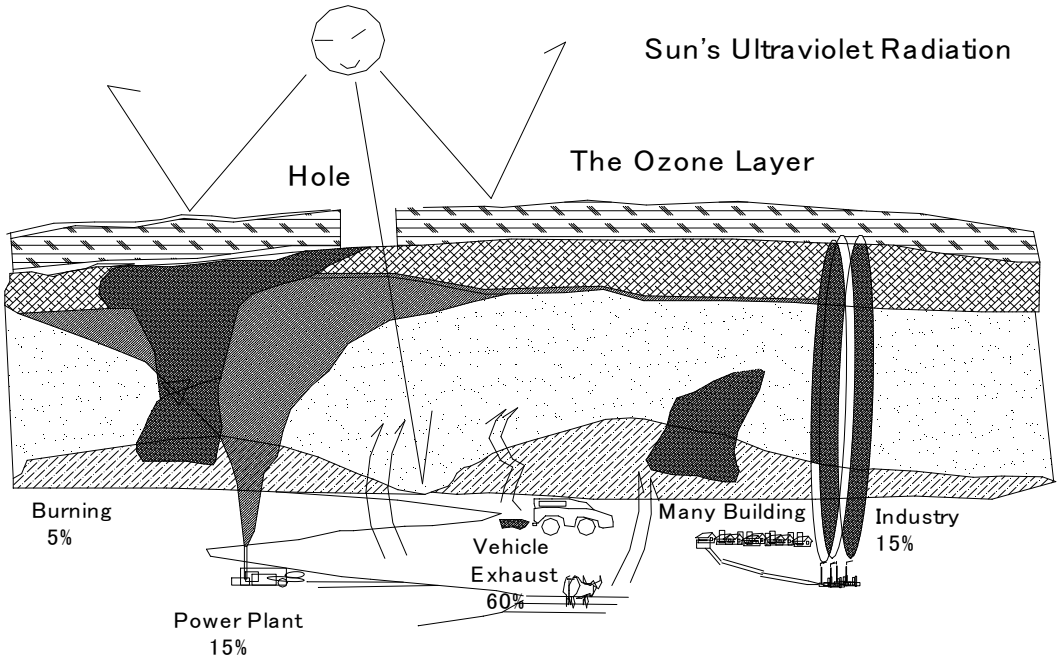
1,Smog(Polluted Air)
2,Holes In The Ozone Layers.
3,Acid Rain.

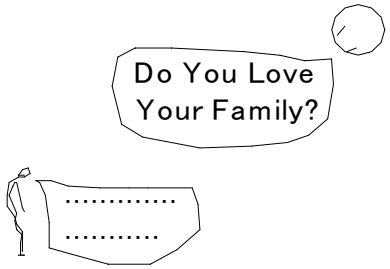
Smog(Polluted Air)
Fossil Fuels are burned.
Nitrogen And Oxygen Combine To Form Nitrogen Compounds.
These Compounds React With Sunlight To
Produce Other Substances.
1,Holes In The Ozone Layers.
2,Health Problems.
3,Acid Rain.



(383) Ozone Layer

(383) Ozone Layer



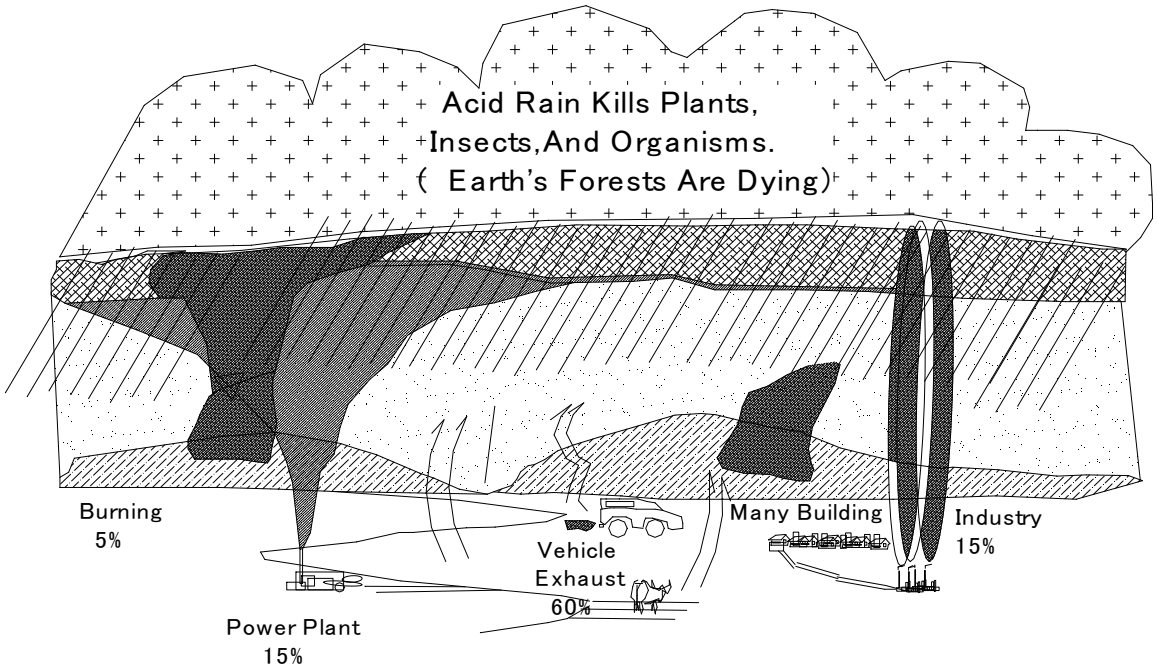


The Ozone Layer
Protects Us From
The Sun's Ultraviolet Radiation.

Chlorofluorocarbons From
Air Conditioners, Refrigerators,
And Spray Cans Are
Destroying The Ozone Layer.

(384) Acid Rain(pH=5.6)

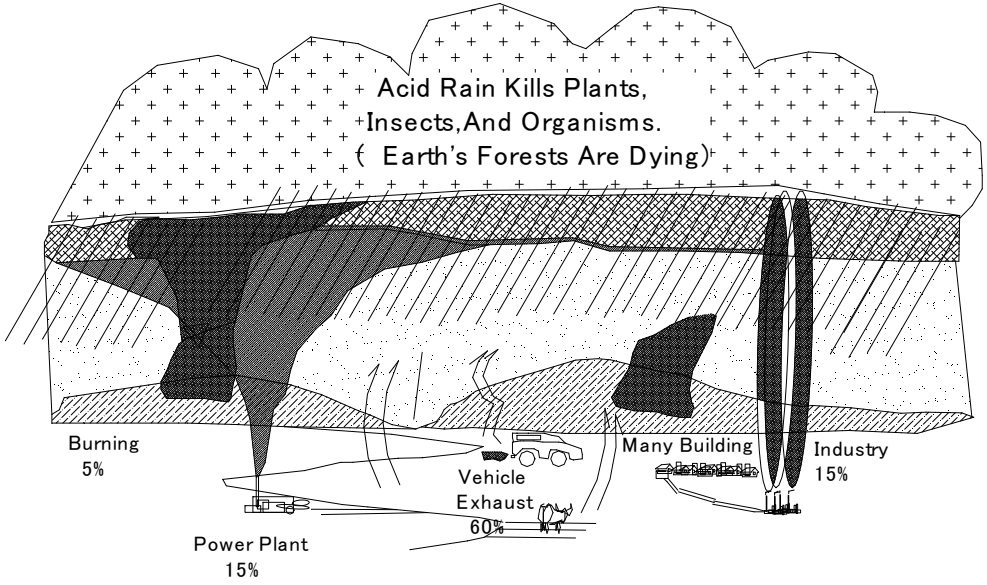
(384) Acid Rain(pH=5.6)

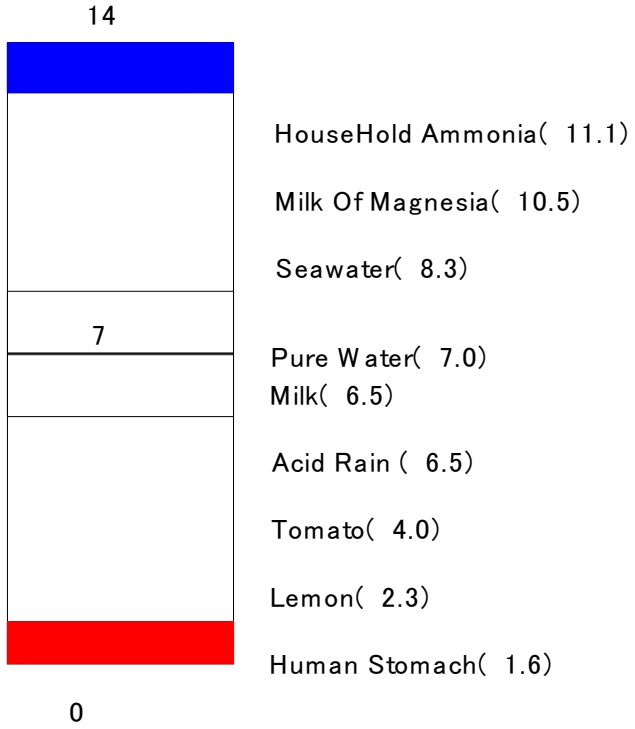


Sulphur Dioxide
From Coal-Burning
Combines With
Moisture To Form
Sulphuric Acid.

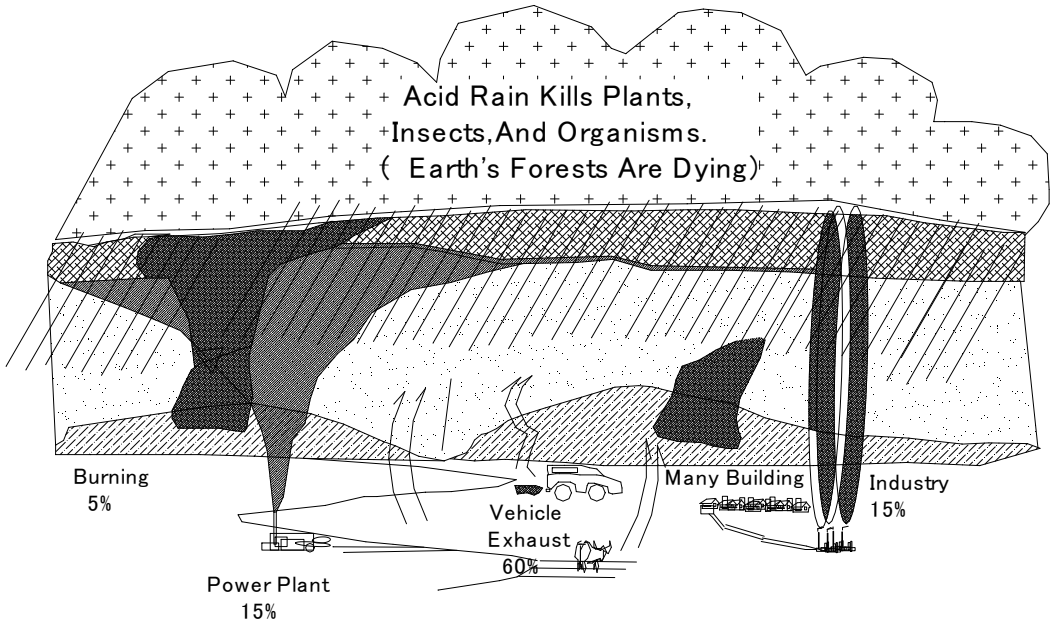
Nitrogen Oxide From Car Exhausts
Combines With
Moisture To Form
Nitric Acid.

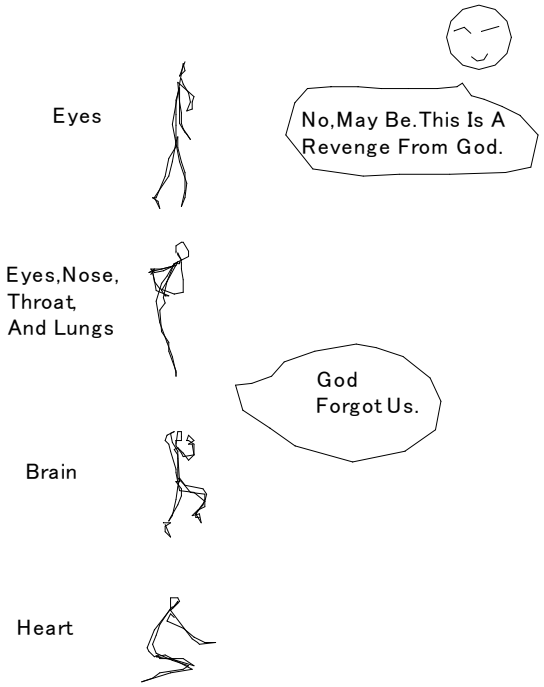
(385) Acid Rain(pH=5.6)



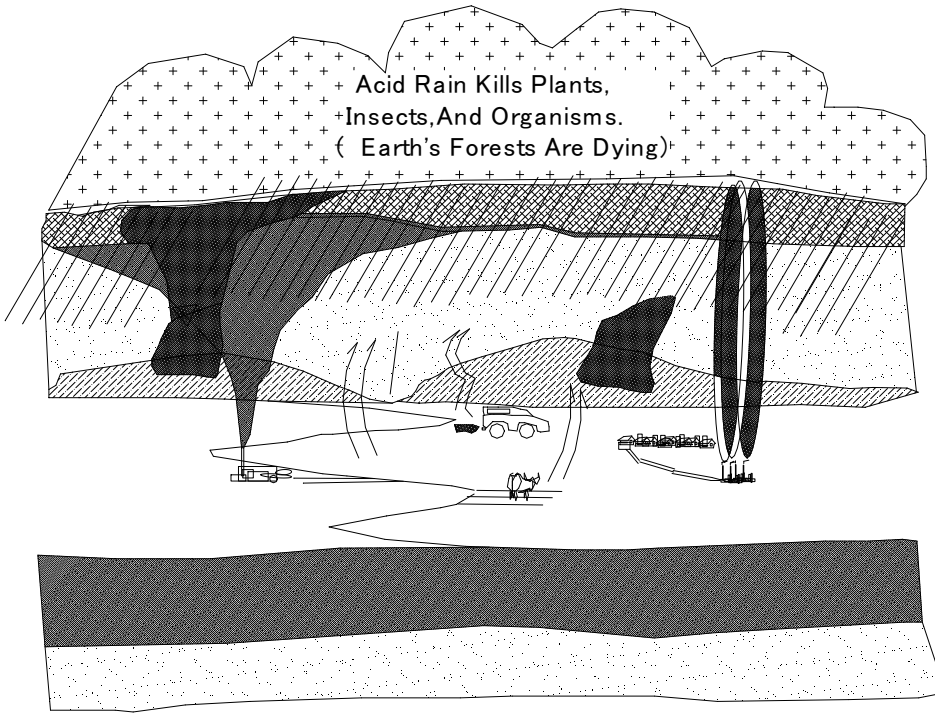


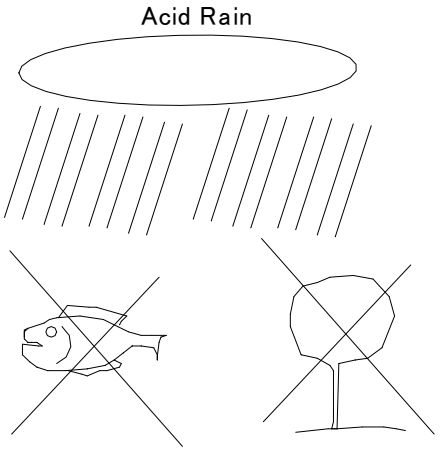
(386) Effects Of Air Pollution On The Body





(387) Acid Rain

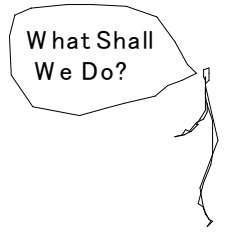




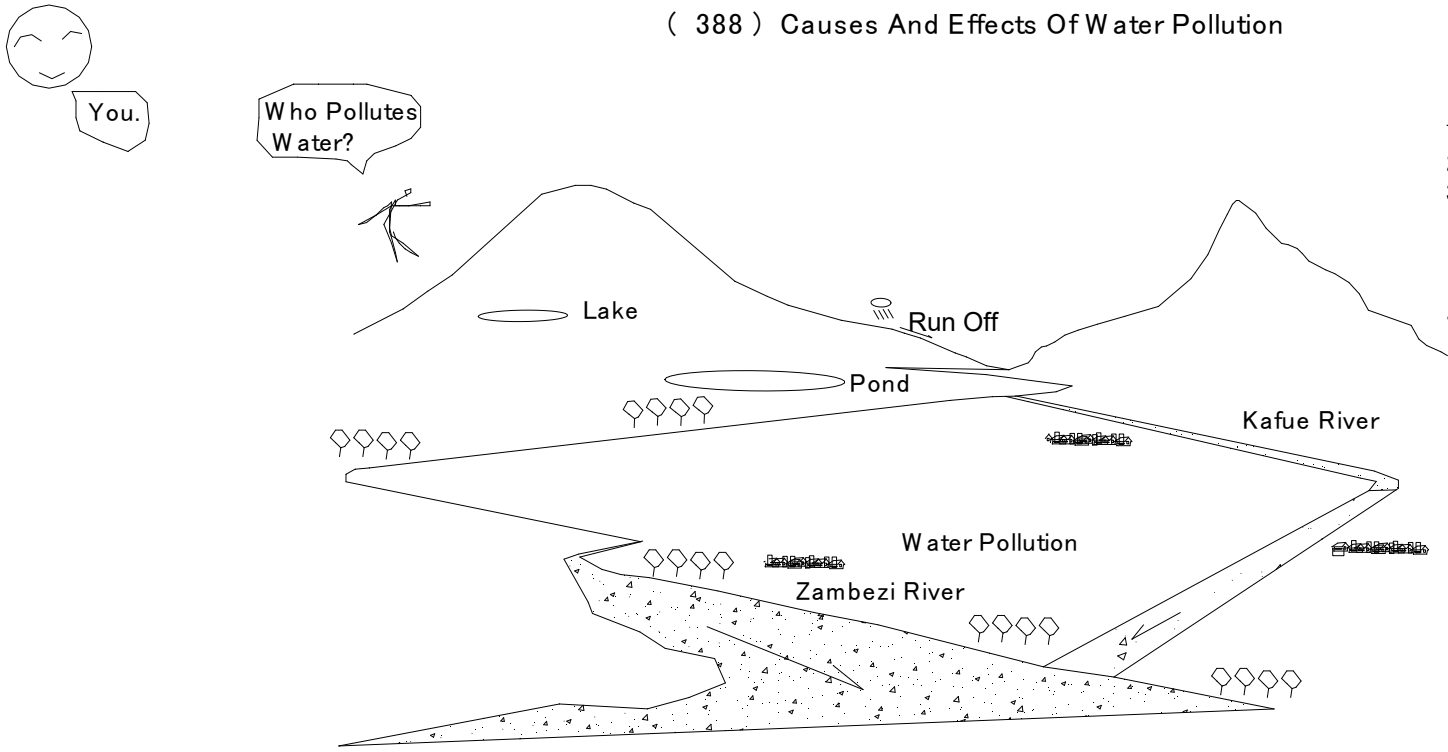
Acid Rain

Soil → Acid

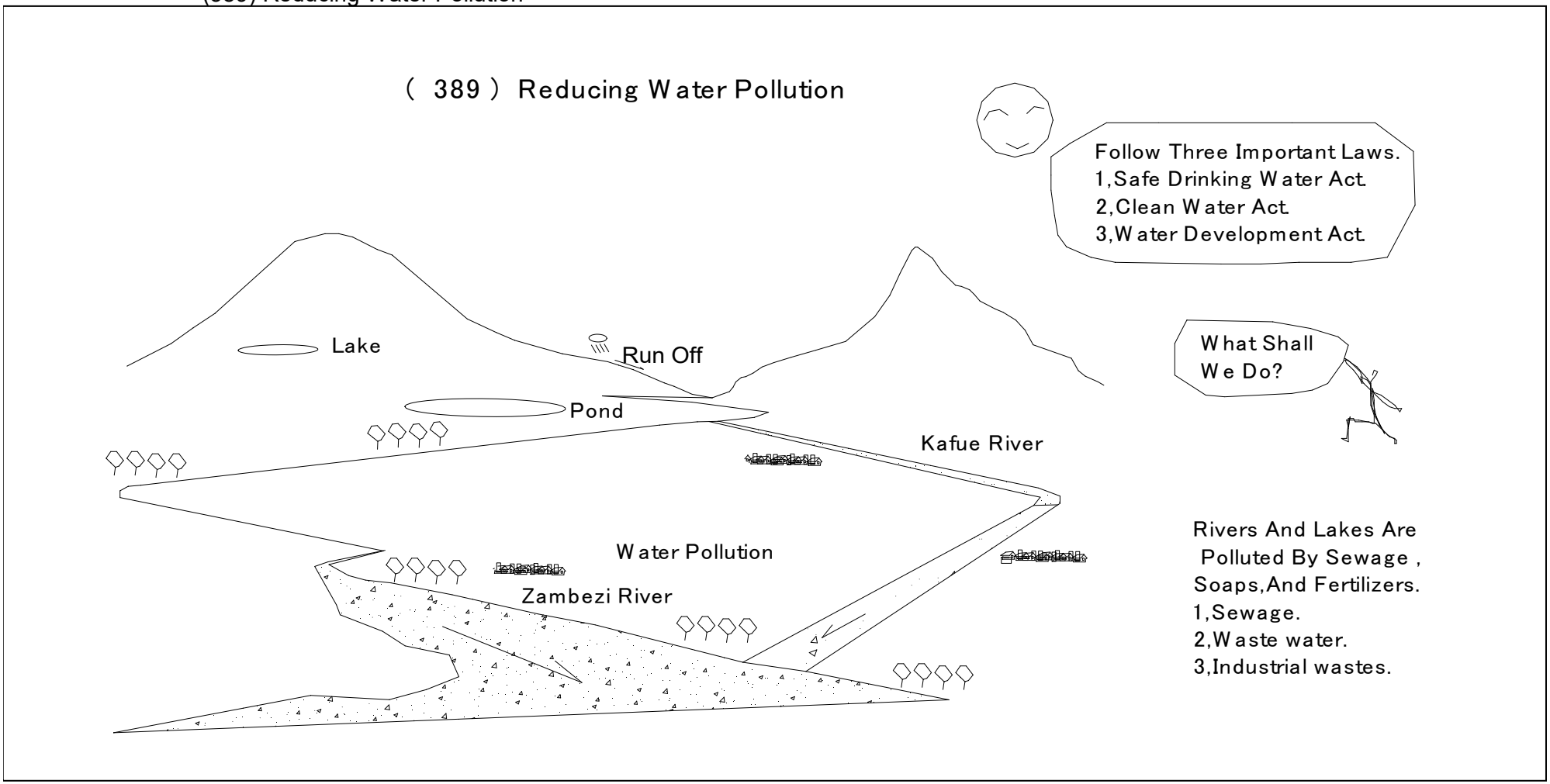
Groundwater → Acid



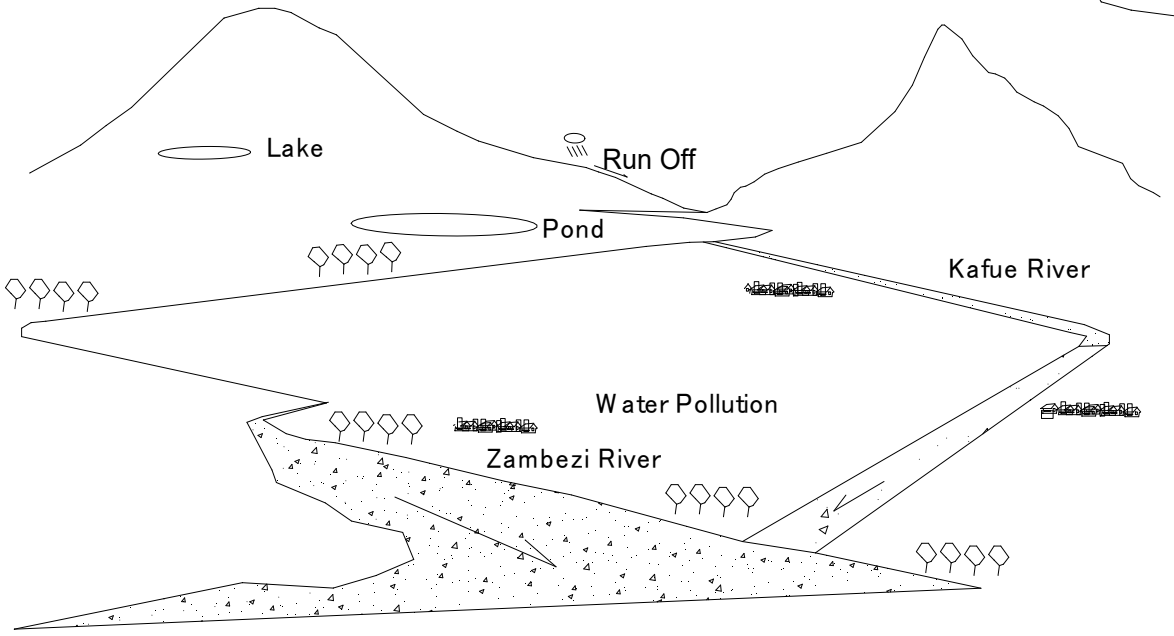
(388) Causes And Effects Of Water Pollution

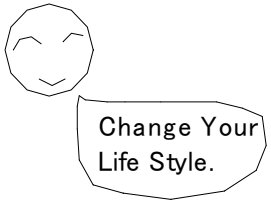


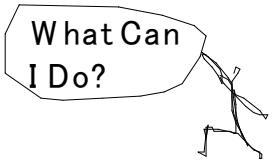
(389) Reducing Water Pollution



（ 390 ） What Can I Do?

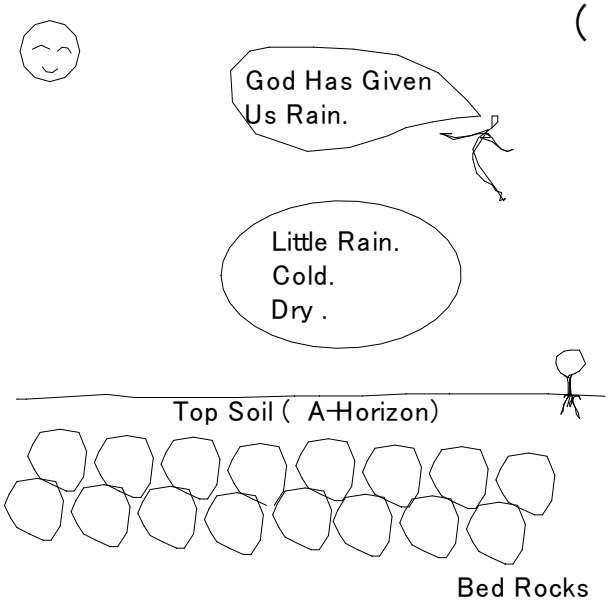


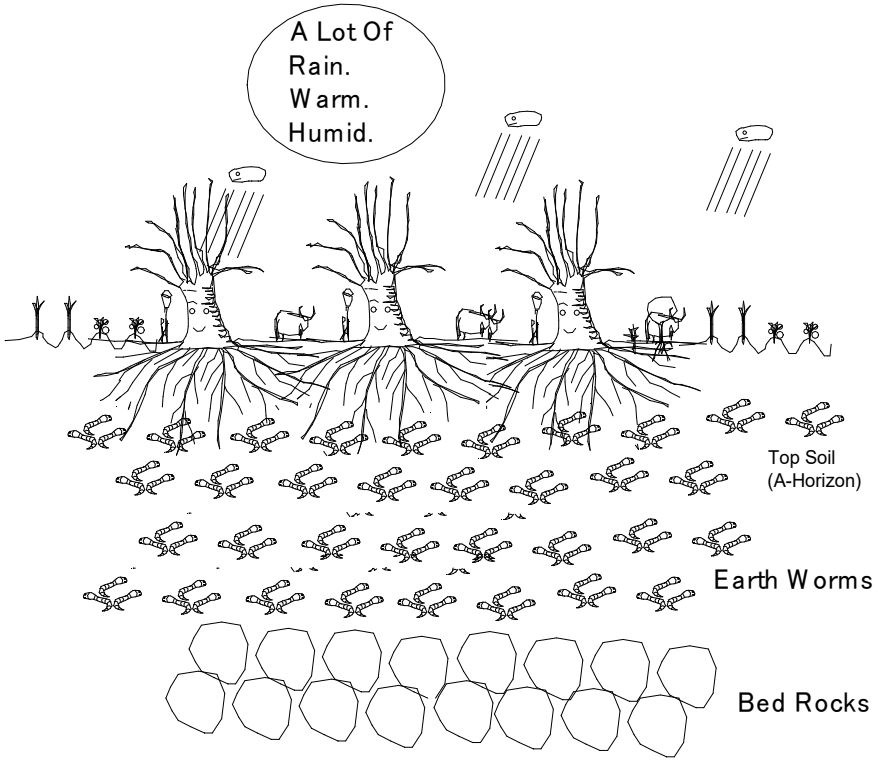




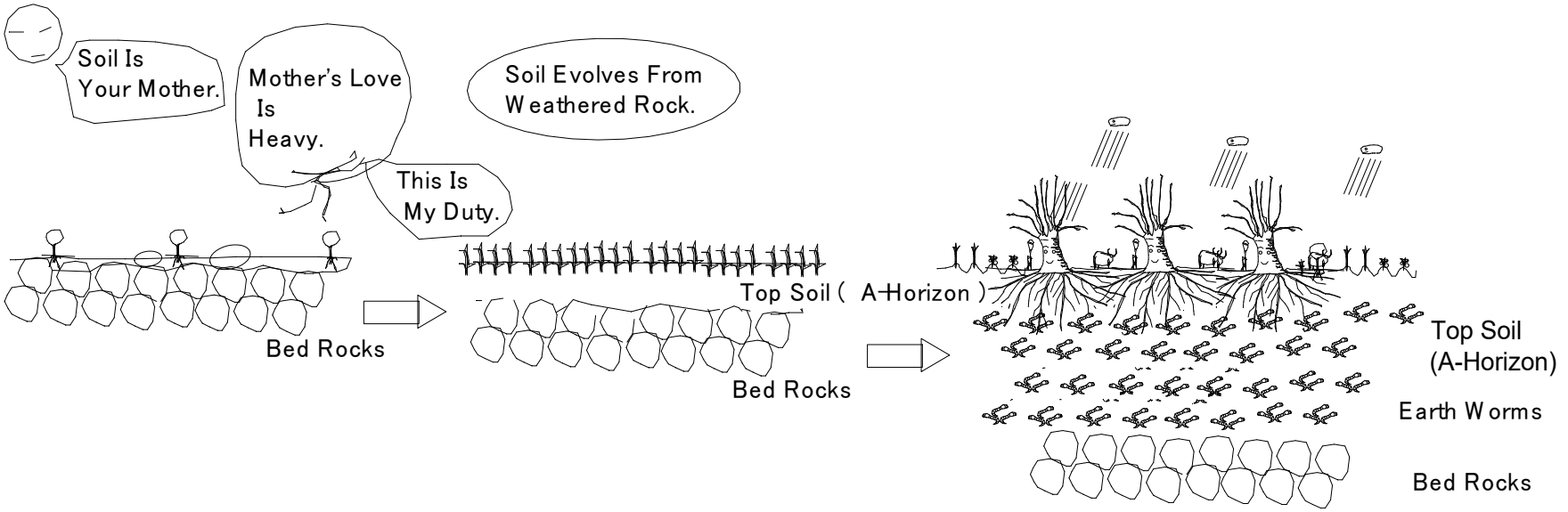
1,Reduce The Amount Of Water Used.
2,Conserve Energy.
3,Recycle If You Can.
4,Don't Dispose Chemical Wastes.

(392) Types Of Soil



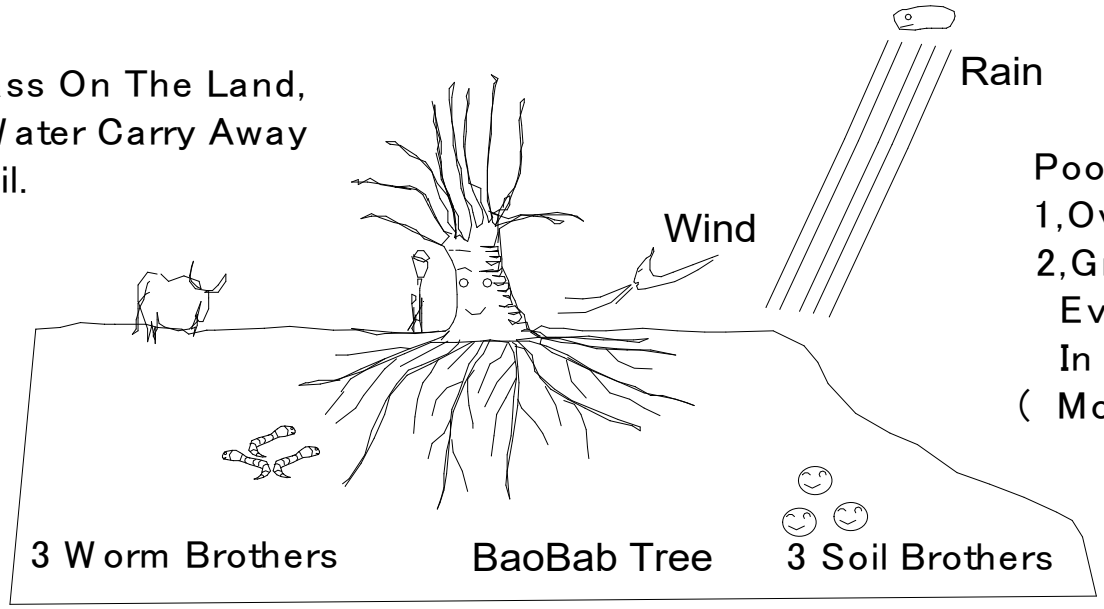


(393) Formation Of Soil



(394) Soil Loss

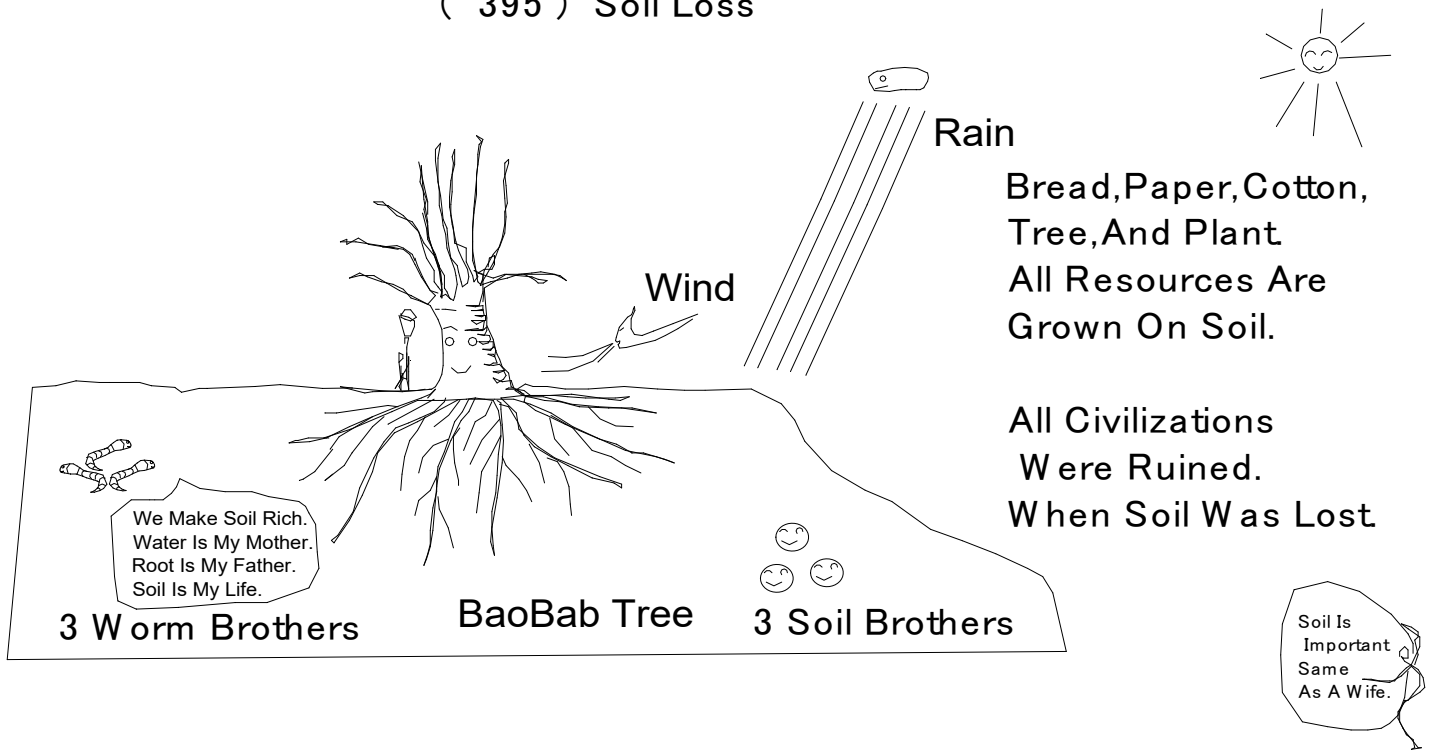
Without Grass On The Land,
Wind And Water Carry Away
The Top Soil.



Poor Farming Practices.
1,Overgrazing.
2,Growing Same Crops
Every Year
In The Same Area.
(Monoculture)

Before Cutting Trees,Soil Was Rich.
After Cutting Trees,Soil Is Poor.

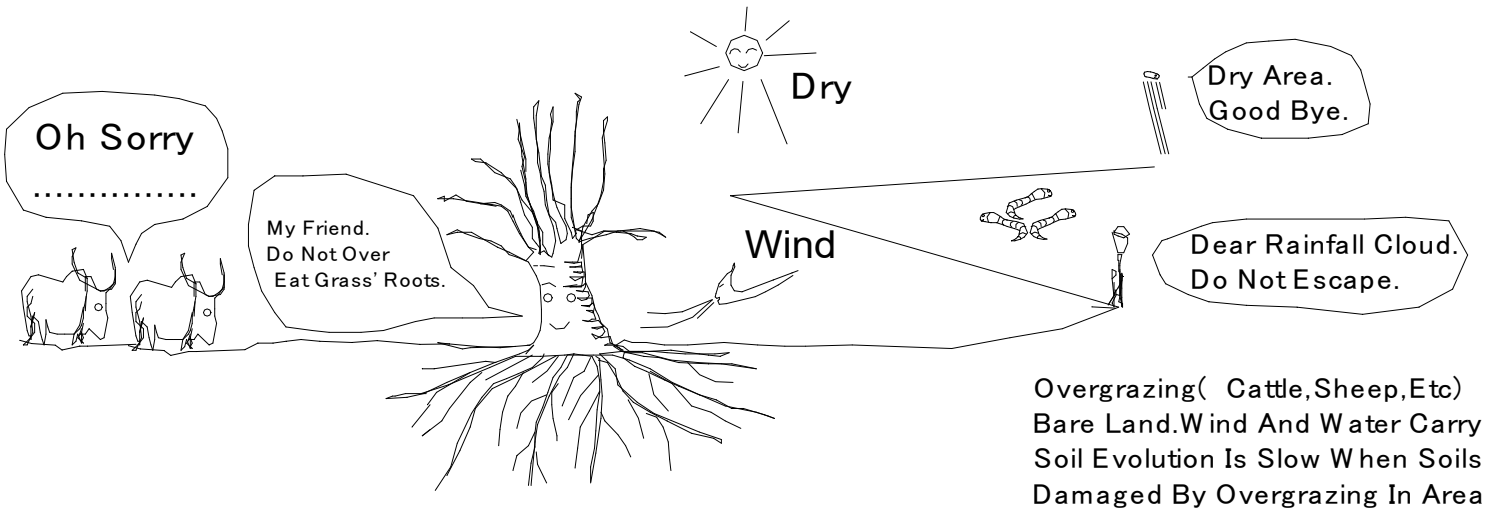
(395) Soil Loss



Bread,Paper,Cotton,
Tree,And Plant.
All Resources Are
Grown On Soil.

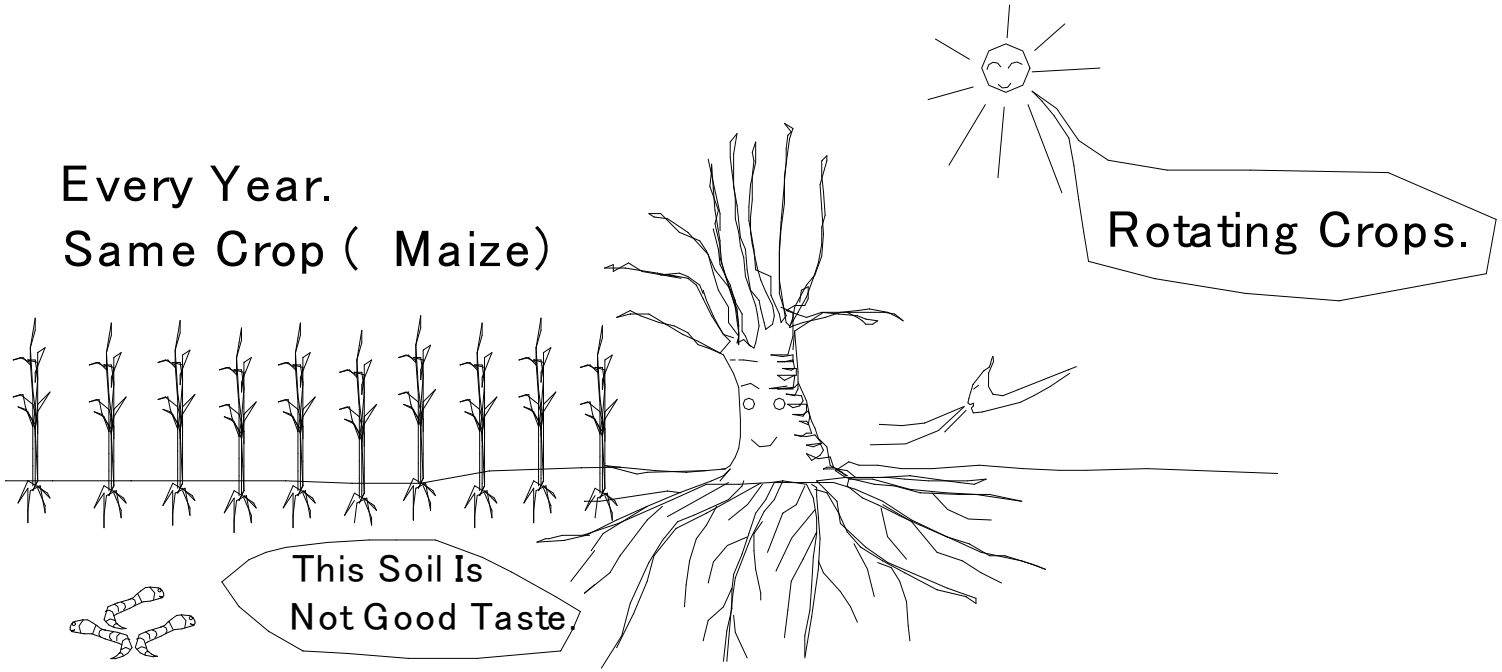
All Civilizations
Were Ruined.
When Soil Was Lost.

（ 396 ） Soil Was Carried Away By The Wind



Overgrazing(Cattle,Sheep,Etc)
Bare Land.Wind And Water Carry Away Top Soil.
Soil Evolution Is Slow When Soils Are
Damaged By Overgrazing In Areas
That Receive Little Rain,
A Desert Is Formed.(Desertification)
Deserts Drive Away Moisture -Laden Clouds.

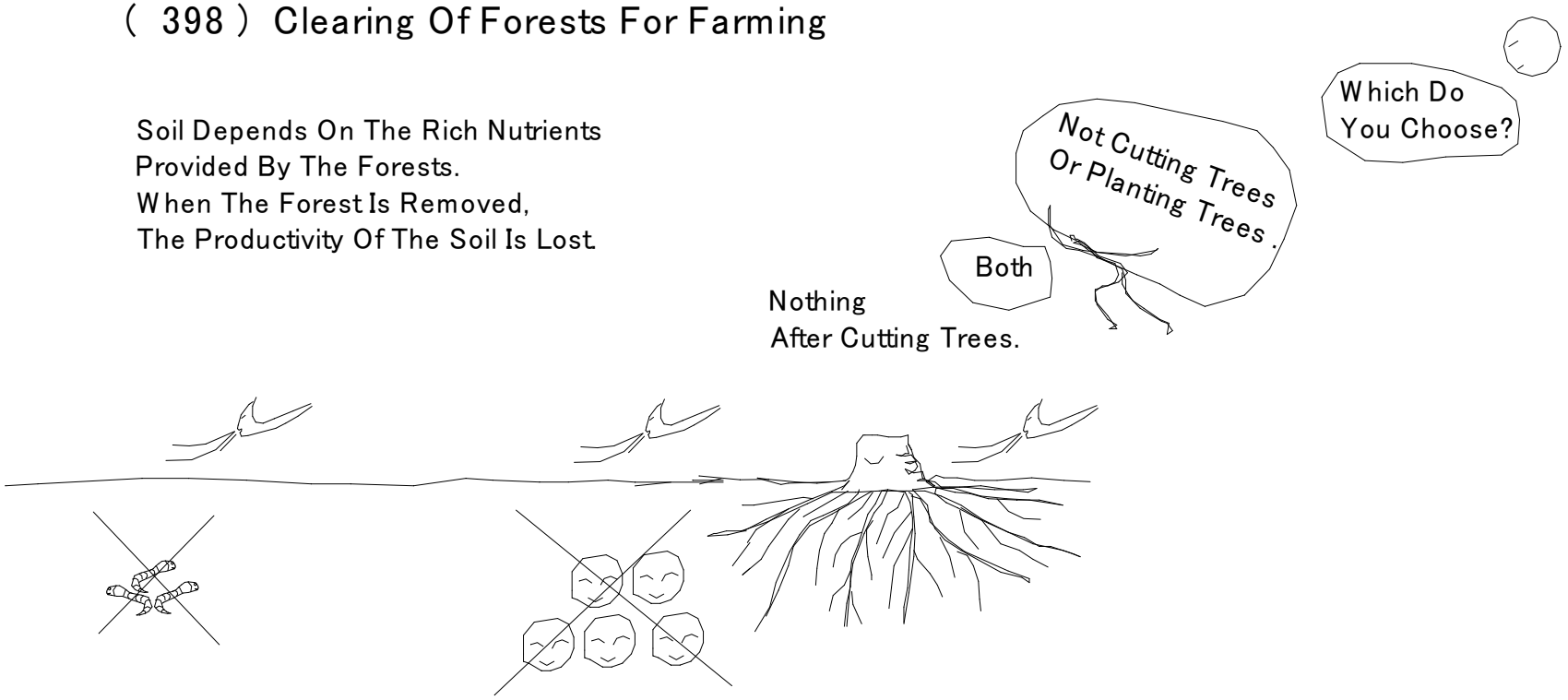
(397) Poor Farming Practice(Rotating Crops)



Growing Crops Every Year In The Same Area.
This Soil Is No Longer Good For Growing Crops.

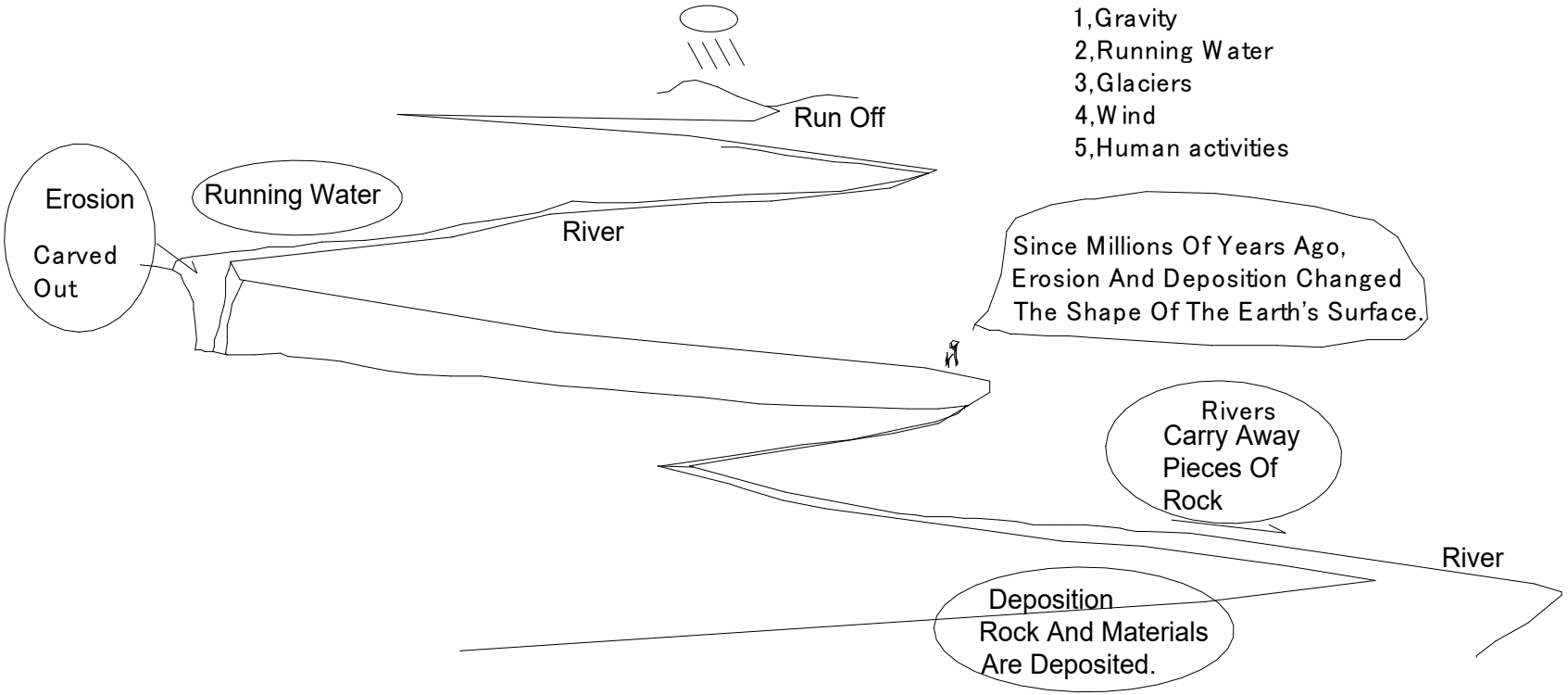
(398) Clearing Of Forests For Farming

Soil Depends On The Rich Nutrients
Provided By The Forests.
When The Forest Is Removed,
The Productivity Of The Soil Is Lost.



Cutting Of Forests
Leads To Soil Loss.

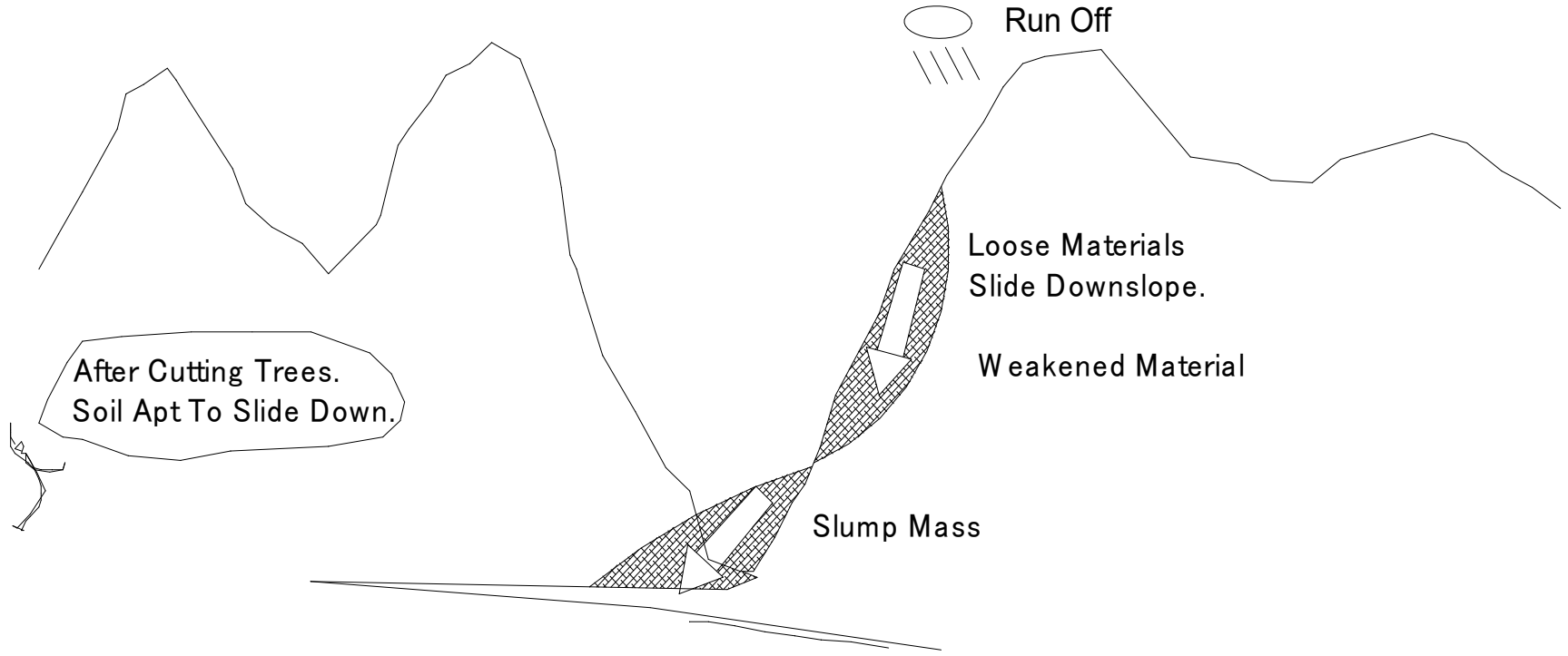
（ 399） The Agents Of Erosion

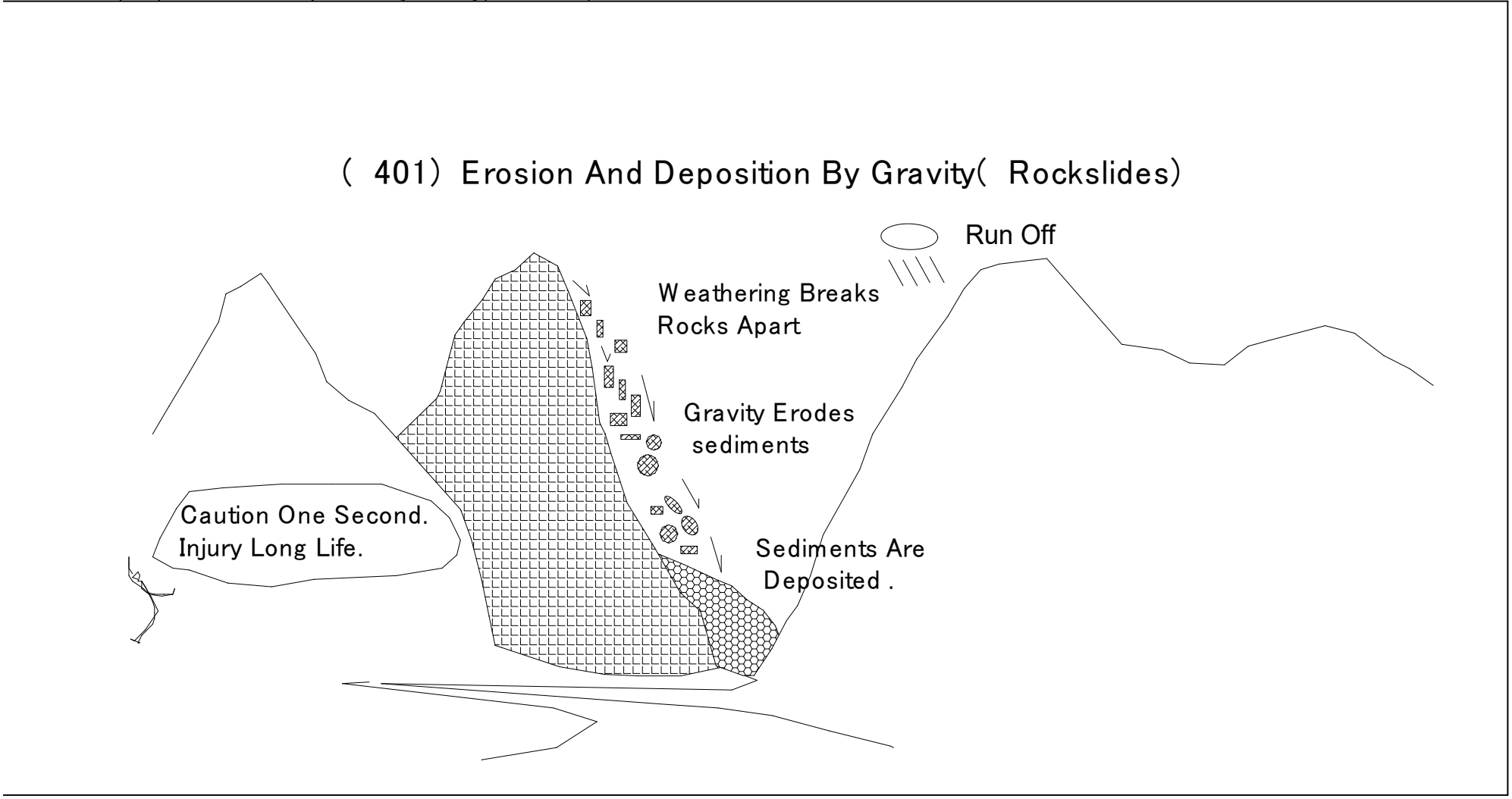


The Five Agents Of Erosion.

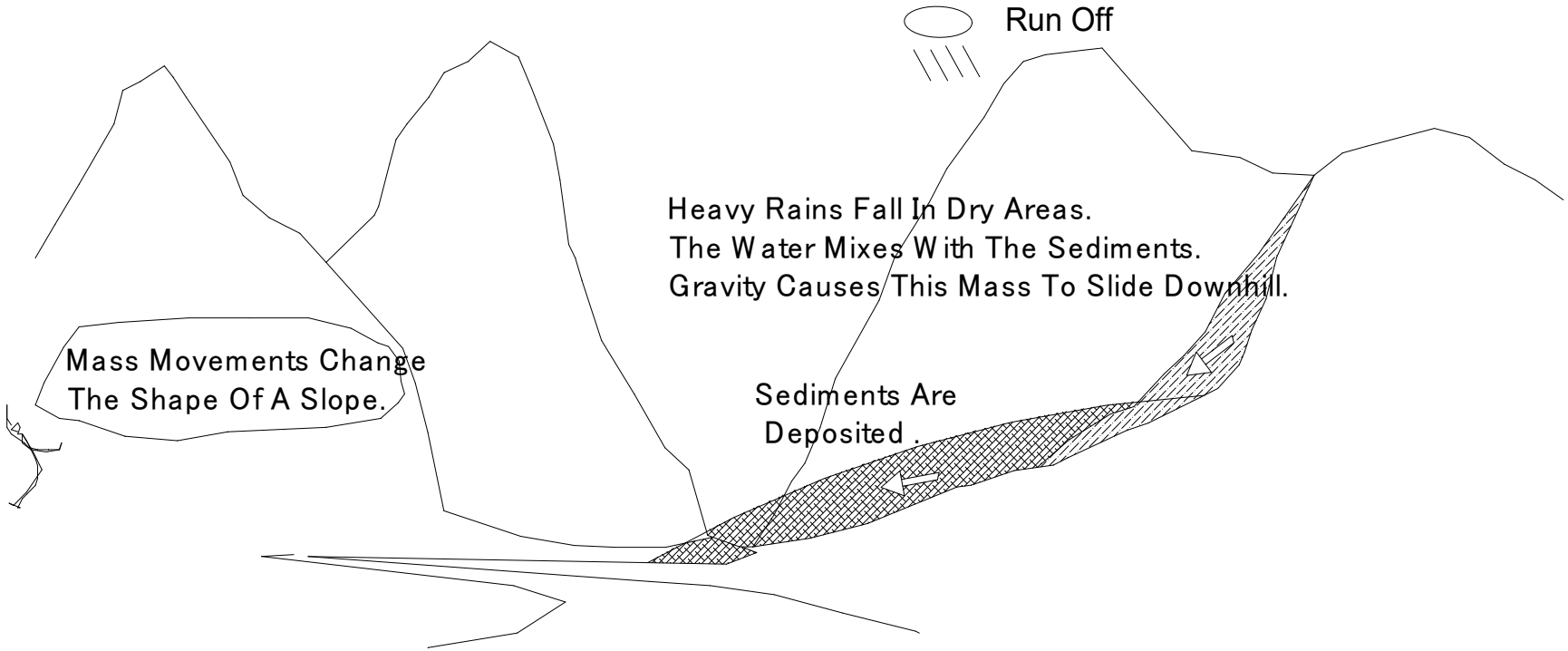
1,Gravity
2,Running Water
3,Glaciers
4,Wind
5,Human activities

(400) Erosion And Deposition By Gravity

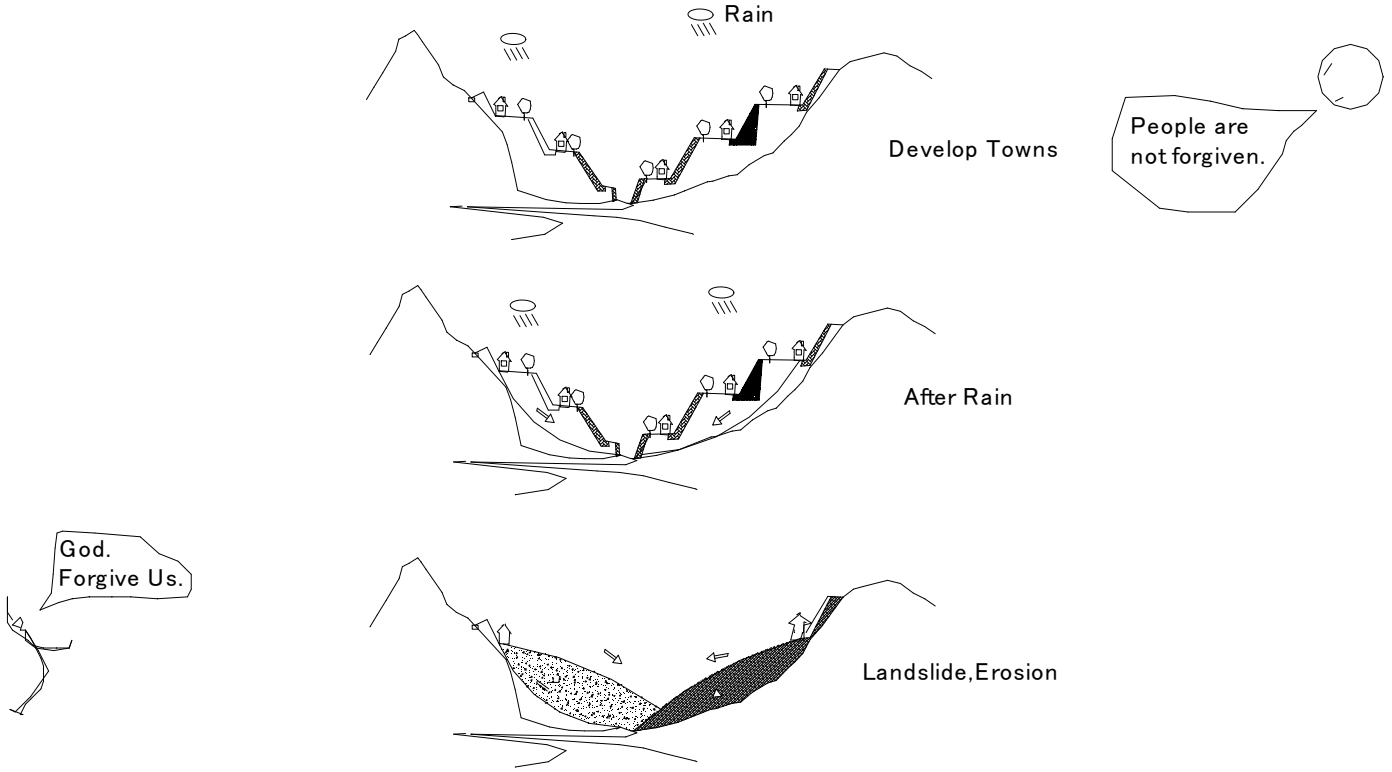



(401) Erosion And Deposition By Gravity(Rockslides)
Run Off
Weathering Breaks
Rocks Apart
Gravity Erodes
sediments
Caution One Second.
Injury Long Life.
Sediments Are
Deposited .

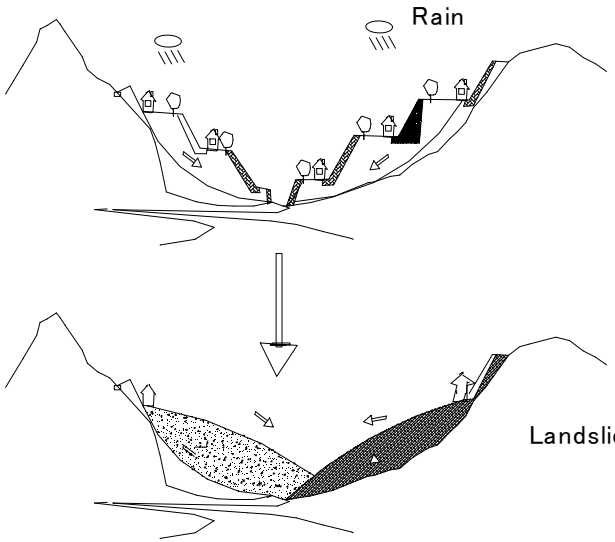
(402) Erosion And Deposition By Gravity(Mudflows)

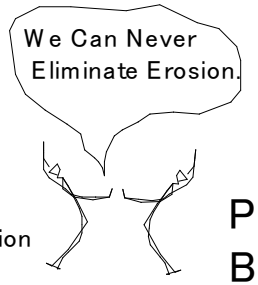


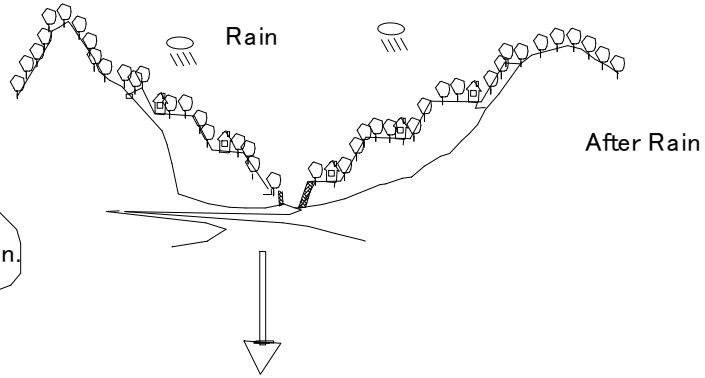
(403) Developing Land Prone To Erosion



(404) Developing Land Prone To Erosion(Reduce Erosion)

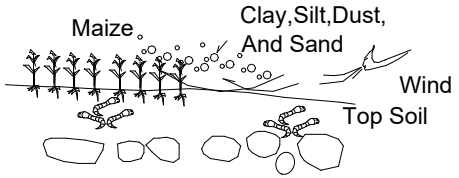






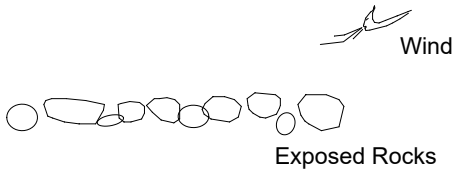
Planting Trees Is The Best Way.
Because Not Only Do Roots Hold Soil,
But Also Plants Absorb A Lot Of Water.

(405) Wind And Erosion(2)



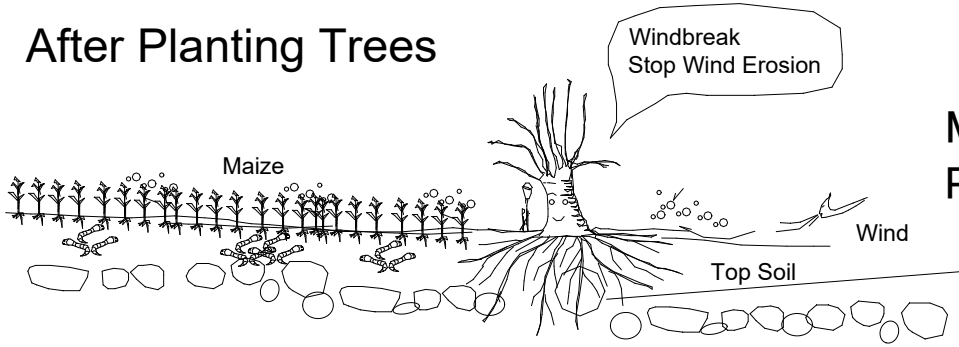
No Trees To Protect.

Before Planting Trees



The Sediments Are
Exposed By Wind.

After Planting Trees



Many Plants
Protect Top Soil.

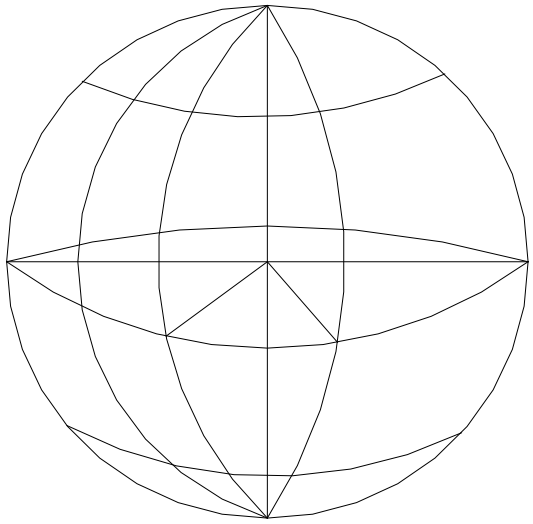
Roots .
I Will Not Loose Soil.

2 Soil Brothers

Soil .
I Will Not Separate
From You.

（406）Water On Earth

The Earth



97% Salt Water

1% Fresh Water

2% Ice

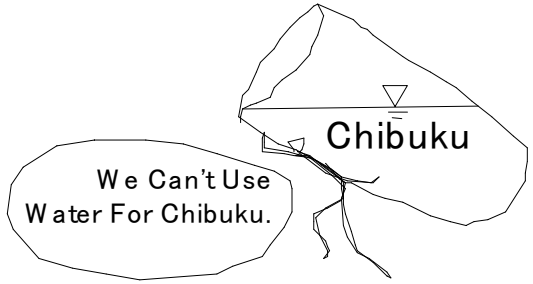
The Earth's Surface Is 70 Percent Covered With Water.

97% Of Water Is Salt Water.

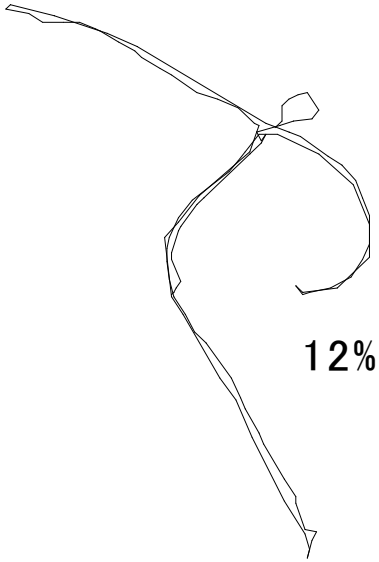
2% Of Water Is Ice.

1% Of Water Is Fresh Water.

（Only 1 % Of Water Can Be Used For Drinking And Growing Food）



(407) Water As Part Of You

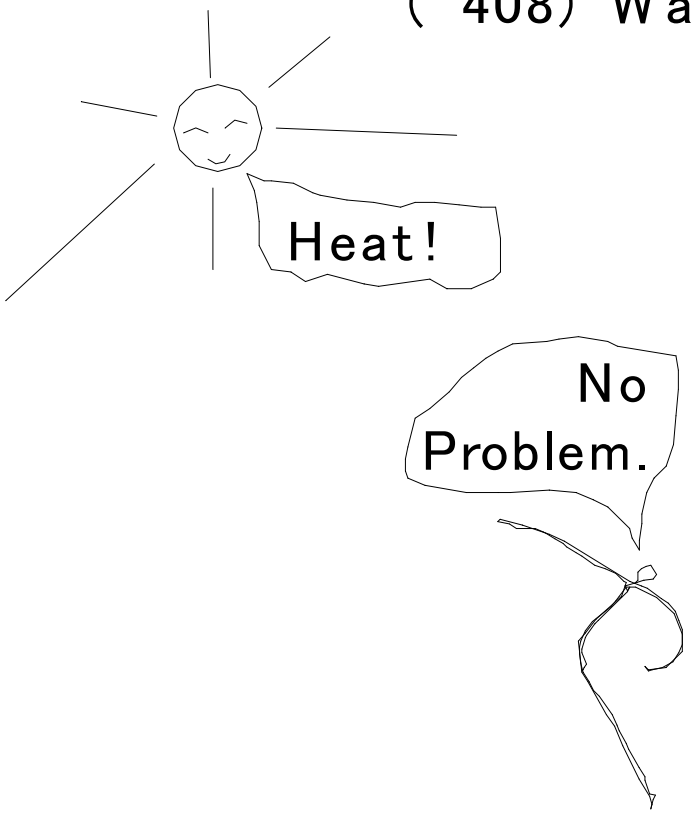


65% Water

12% Water Lost,
You Die.

Almost 65% Of Human Body Is Water.
Teeth Consist Of About 10% Water.
Brain Consists Of About 80% Water.
When We Lose 1 To 2 % Of Water,
We Become Thirsty.
We Would Die If We Lost
Over 12% Of Our Water.

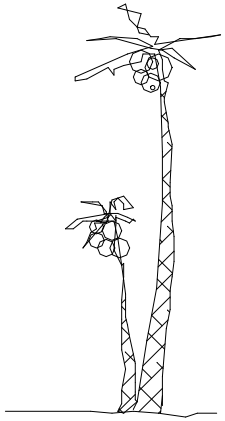
(408) Water In Your Body



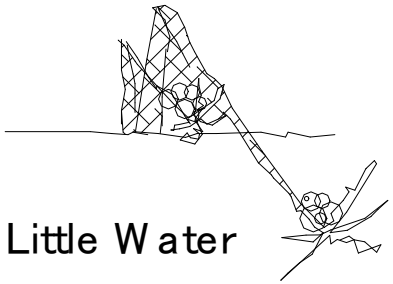
Water In Our Bodies Helps
Control Our Temperature.

Blood In Our Bodies Helps To
Carry Extra Heat To The Skin.

（409）Why Water Is Important To Plants



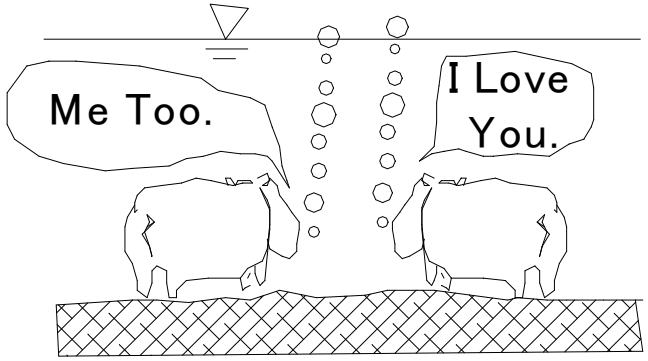
Plenty Water



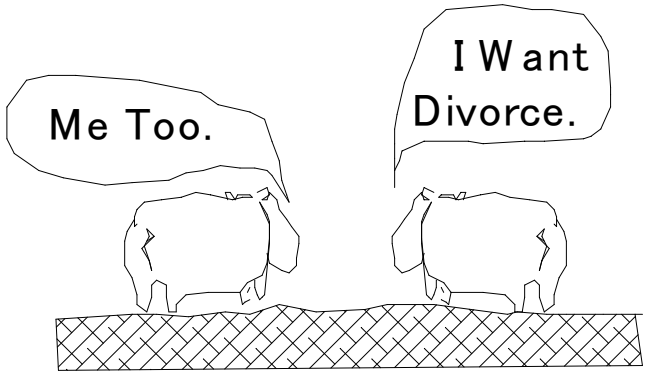
Little Water

Each Plant Cell Contains Living Material.
The Living Material Inside Each Cell Is
Mostly Made Up Of Water.

(410) Water And Animals



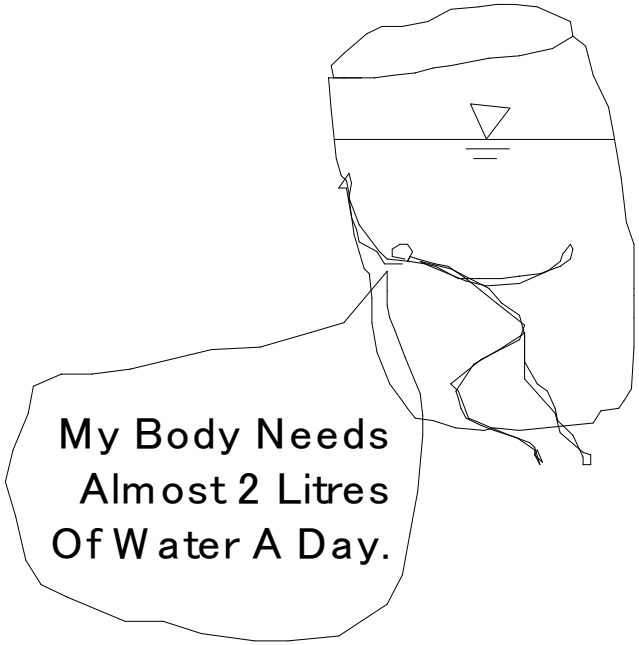
Plenty Water

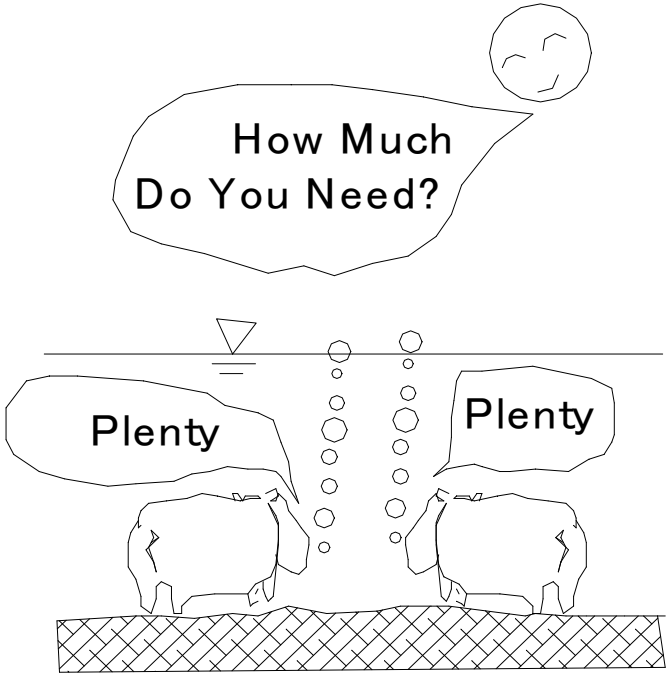


Little Water

Each Animal Cell Contains Living Material.
The Living Material Inside Each Cell Is
Mostly Made Up Of Water.

（ 411） Water Use In Our Life





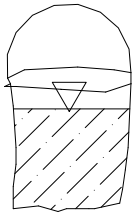
Most People use
19 litres of water
each day.

(412) Water For Irrigation

Maize

1

Water

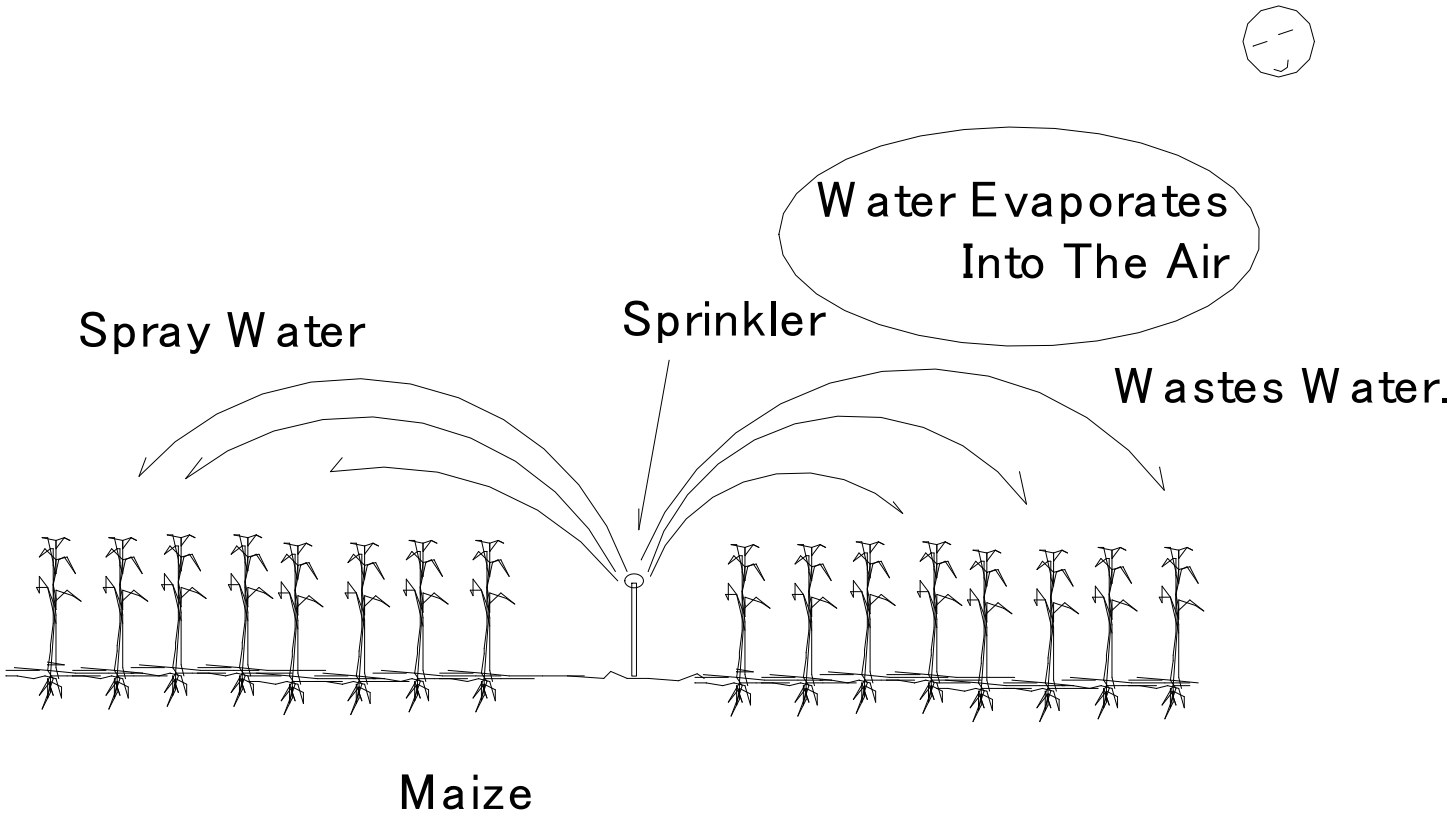


100

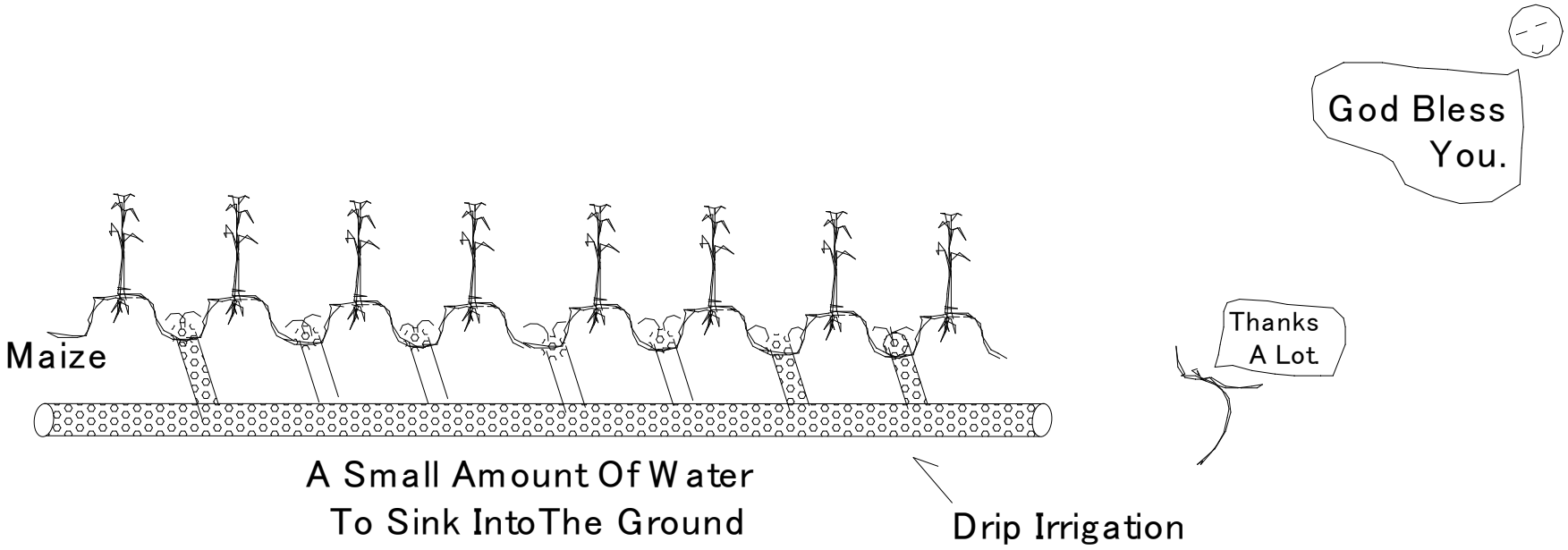
1 Ton
Of Maize

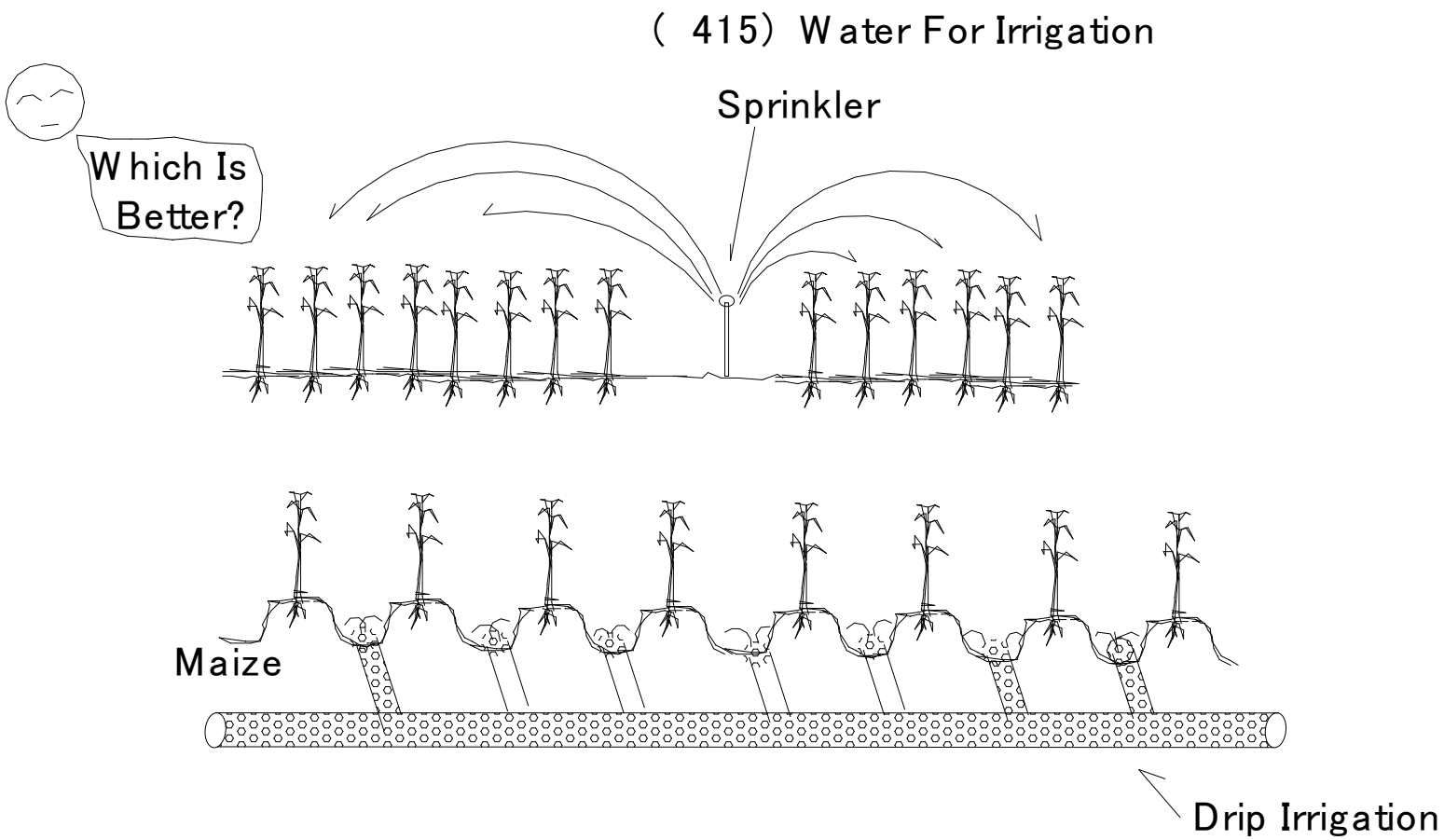
100 Ton
Of Water

(413) Water For Irrigation(Sprinkler)



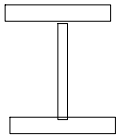
(414) Water For Irrigation(Drip Irrigation)




(415) Water For Irrigation
Which Is Better?
Sprinkler
Maize
Drip Irrigation

(416) Water For Industry

H Steel



1 Ton

Water

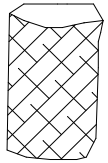
245 Ton

1 Ton
Of Steel

245 Ton
Of Water

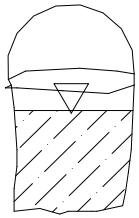
(417) Water For Industry(Chibuku)

Chibuku(Beer)



1 Litre

Water

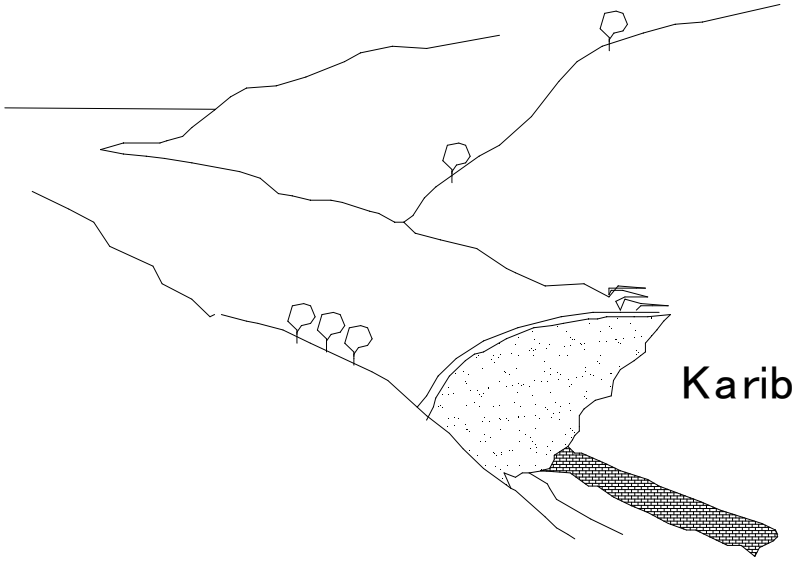


10 Litres

1 Litre Of Chibuku

10 Litres Of Water

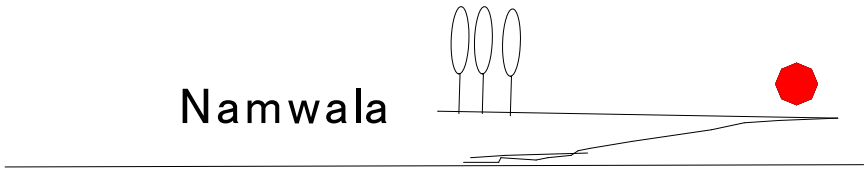
(418) Water For Power



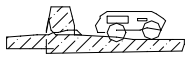
Kariba Dam

Dam Produces Electric Power.

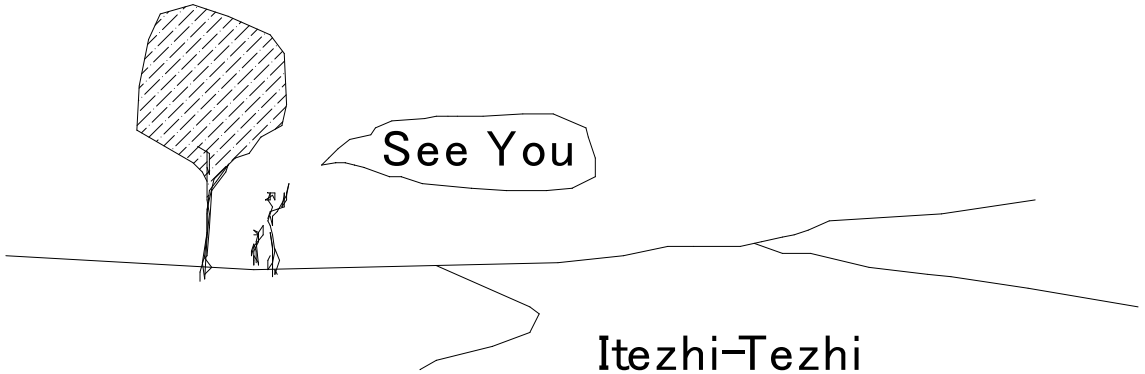
（ 419 ） Water Transportation



Ferry

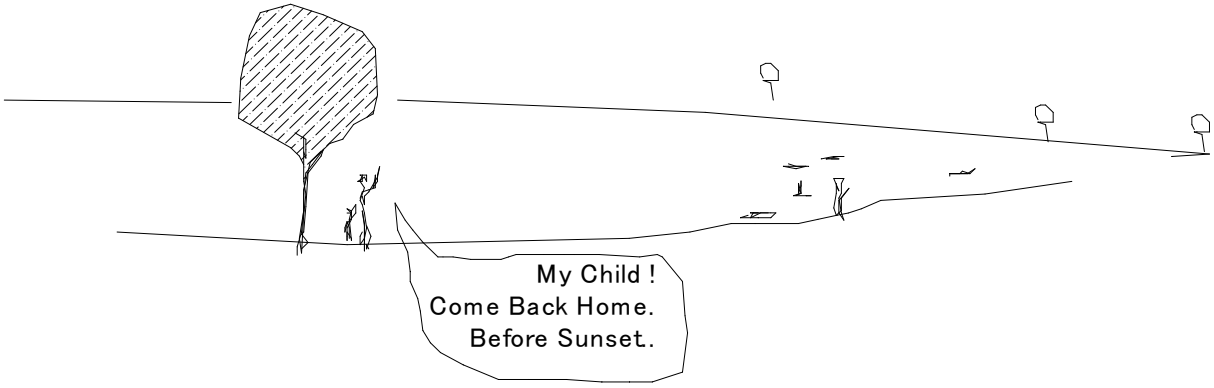


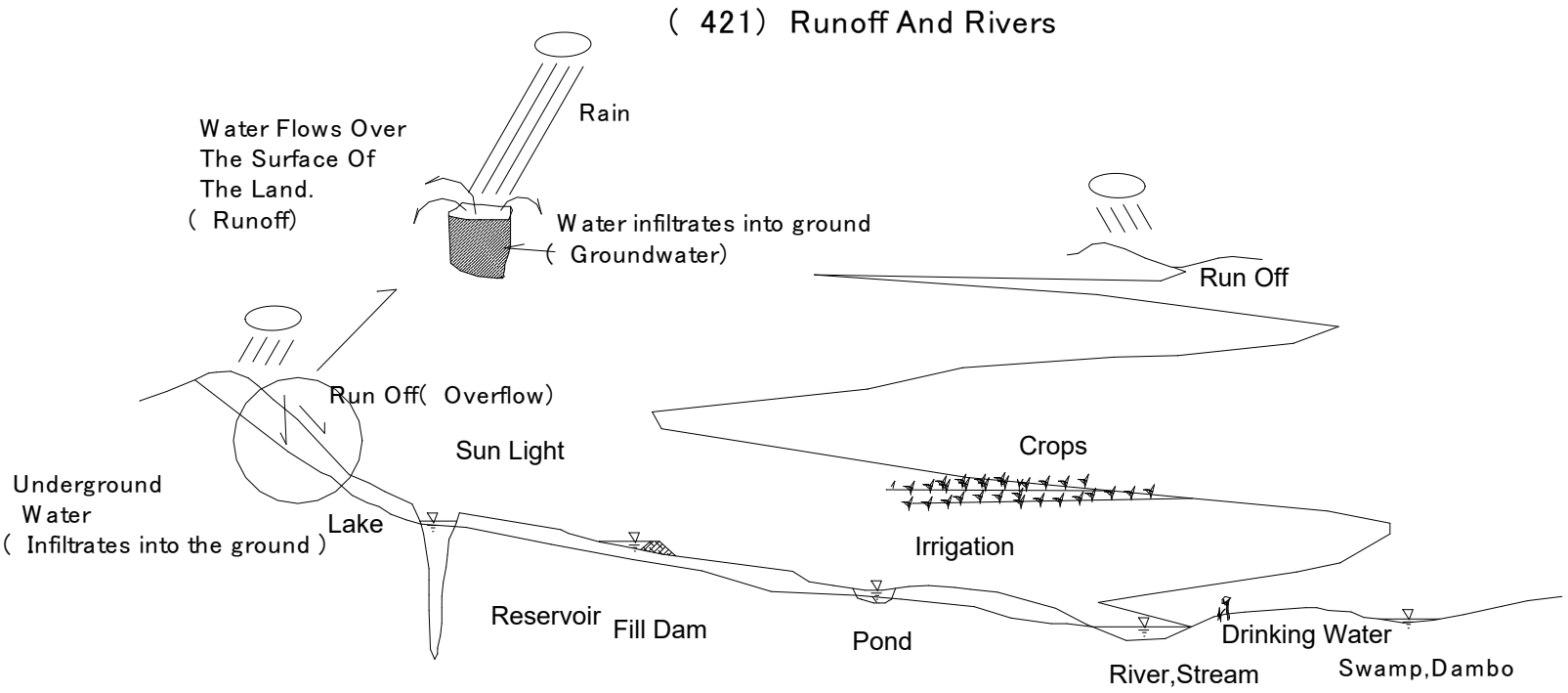
Using boats,canoes or ships.



（420）Water For Recreation

We Used To
Swim In The River
When We Were Children.

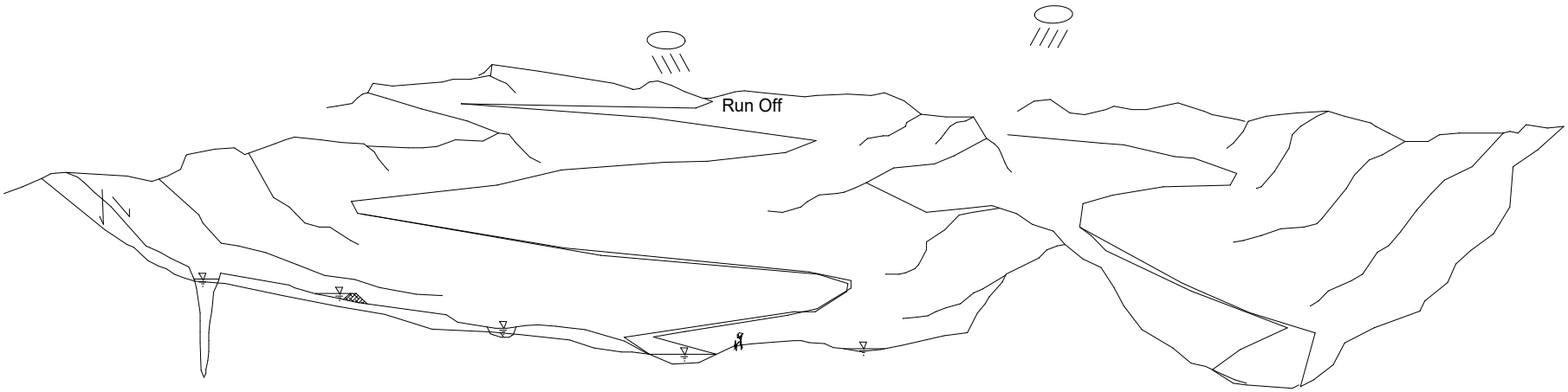



(421) Runoff And Rivers
Rain
Water Flows Over
The Surface Of
The Land.
(Runoff)
Water infiltrates into ground
(Groundwater)
Run Off
Run Off(Overflow)
Sun Light
Crops
Underground
Water
(Infiltrates into the ground)
Lake
Irrigation
Reservoir
Fill Dam
Pond
Drinking Water
River,Stream
Swamp,Dambo

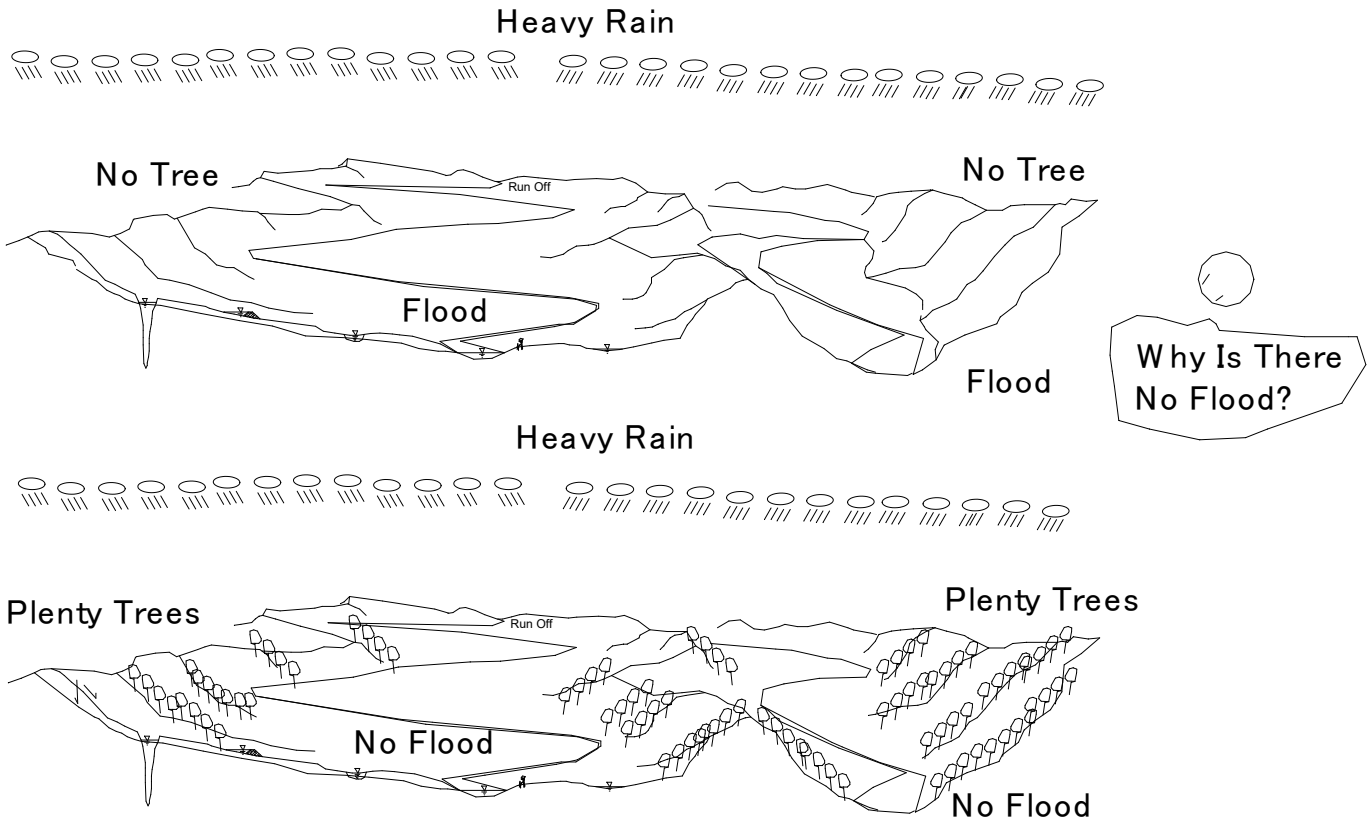
(422) Watersheds And Floodplains

The Watershed
Of The Zambezi River

The Watershed
Of The Kafue River

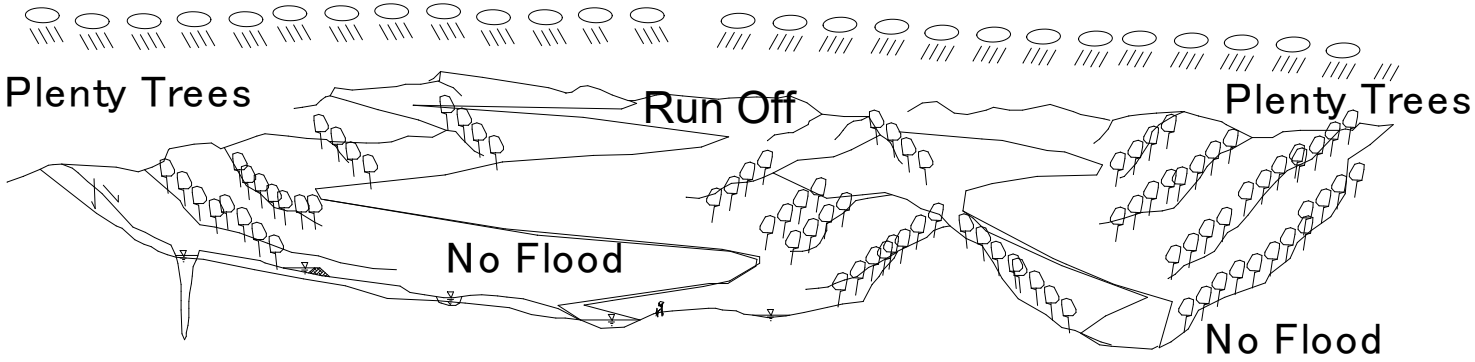


(423) Watersheds And Floodplains



(424) Trees And Flood

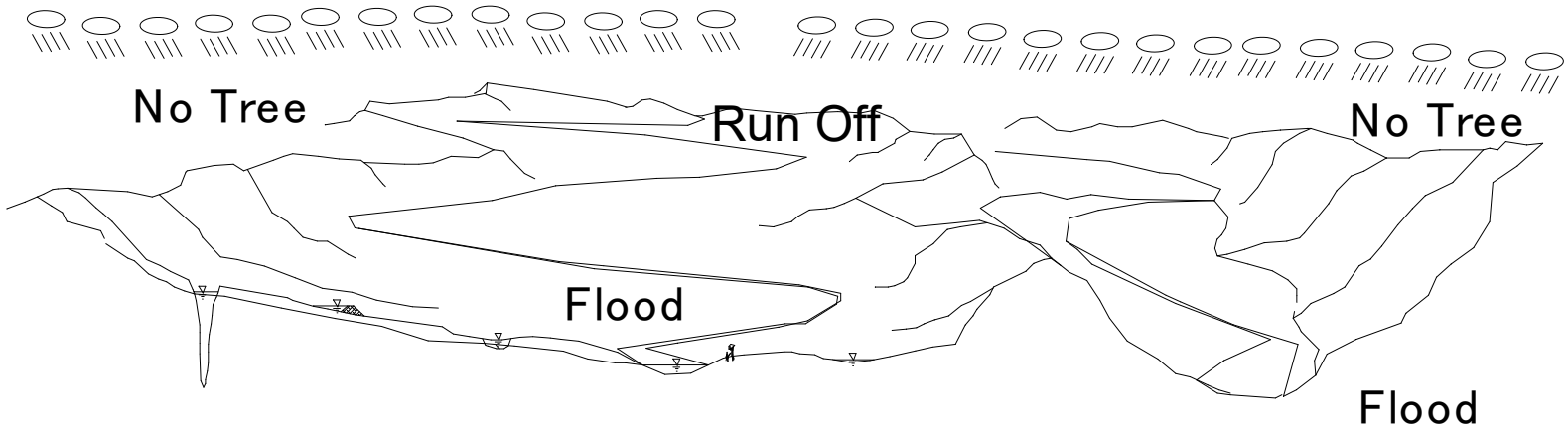
Heavy Rain



1,Trees help protect the land from uncontrolled runoff.
2,The roots of the trees help the ground to hold water for a long time.

(425) No Trees And Flood

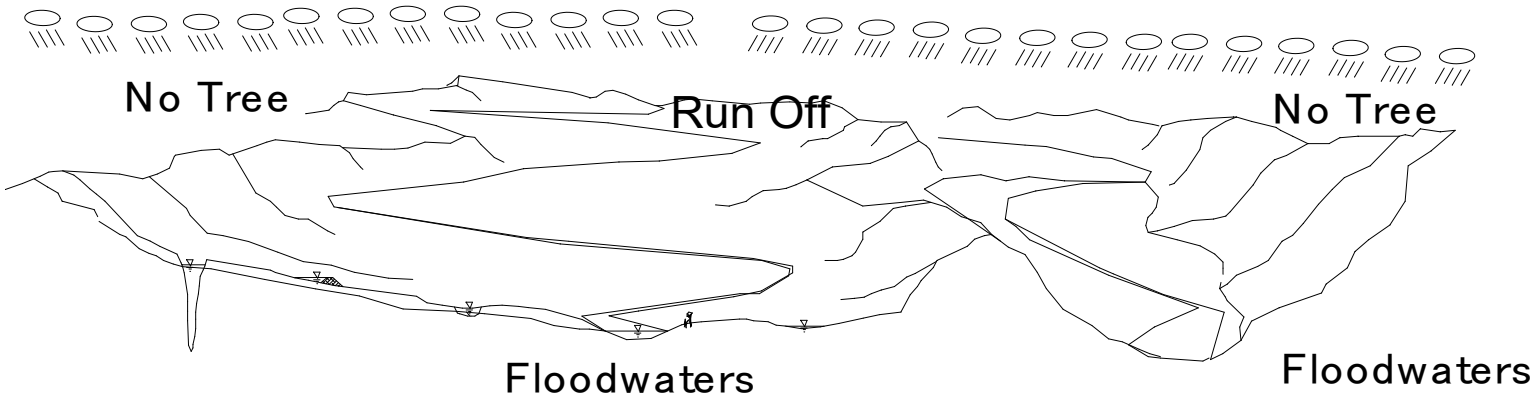
Heavy Rain



1,Uncontrolled runoff causes much damage to the land.
2,Much top soil is washed away from land where trees are cut down.

(426) Uncontrolled Runoff And Flooding

Heavy Rain

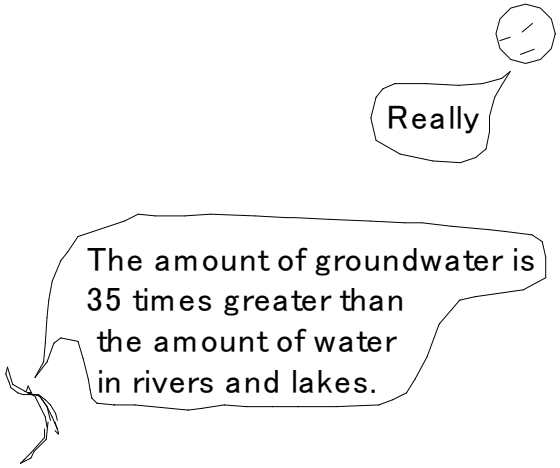


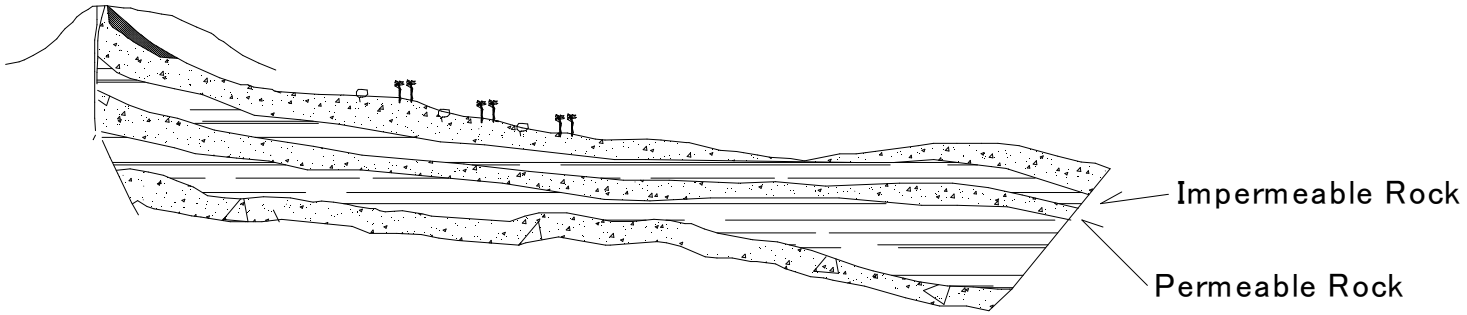
1,Floodwaters erode the topsoil .
2,Floodwaters(Muddy water) is not useful to people as a source of water.

（ 427） Underground Fresh Water

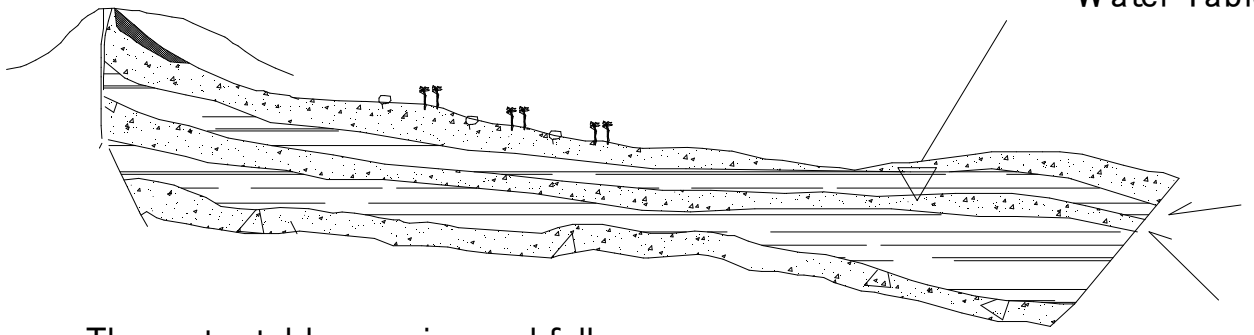
Aquiclude
(Impermeable Rock)

Aquifer
Permeable Rock
Zone Of Saturation
(Saturated Rock)
Sandstone ,Limestone
These kinds of rock
are layered and contain
many tiny cracks and spaces.





(428) Underground Fresh Water



Heavy Rain

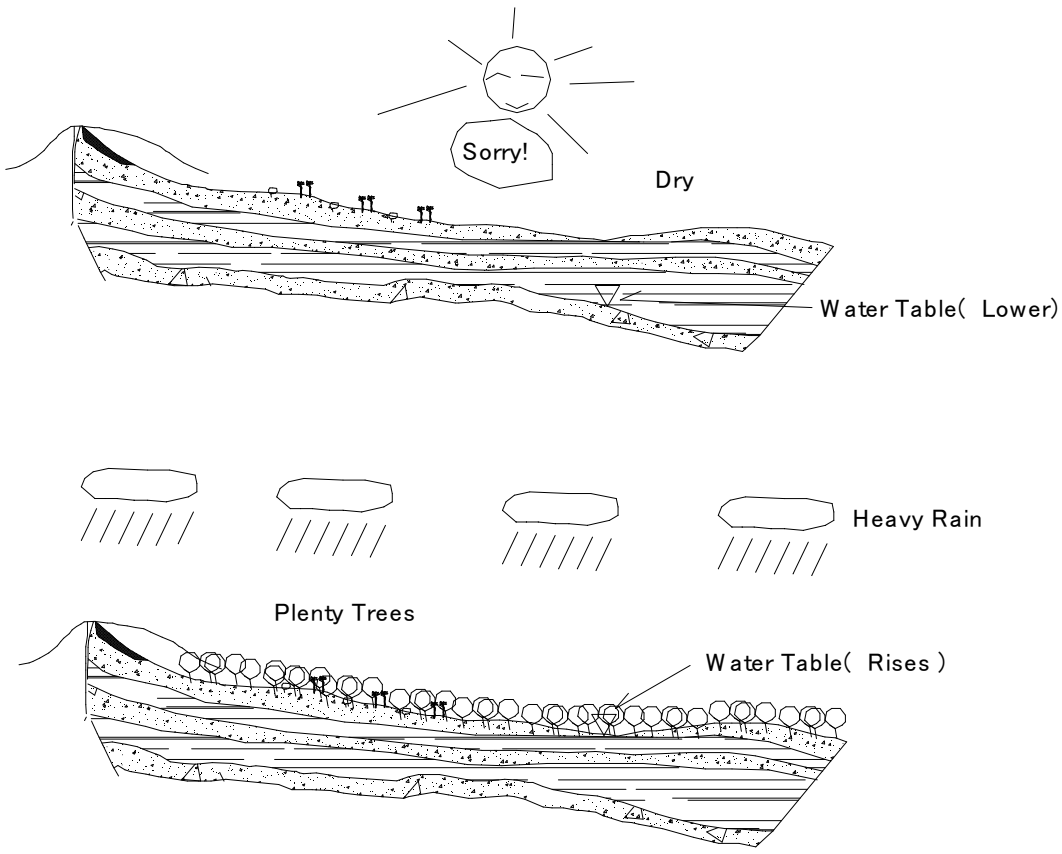
Dry,Heavy use
Underground water

(1)Aquiclude
(Impermeable Rock)

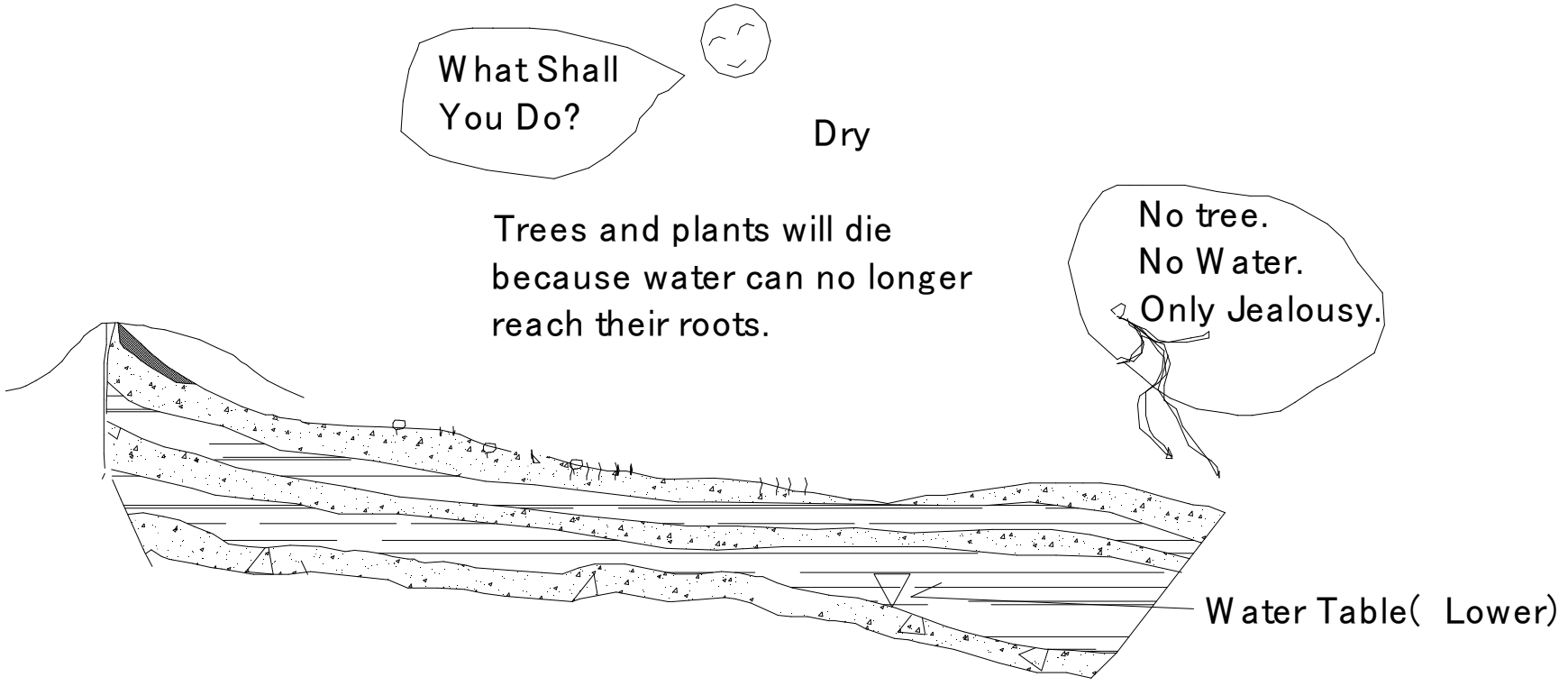
(2) Aquifer
Permeable Rock
Zone Of Saturation
(Saturated Rock)
Sandstone ,Limestone
These kinds of rock
are layered and contain
many tiny cracks and spaces.

The water table can rise and fall.
Heavy rain raises the water table.
Dry spells or heavy use of ground
water can lower the water table.

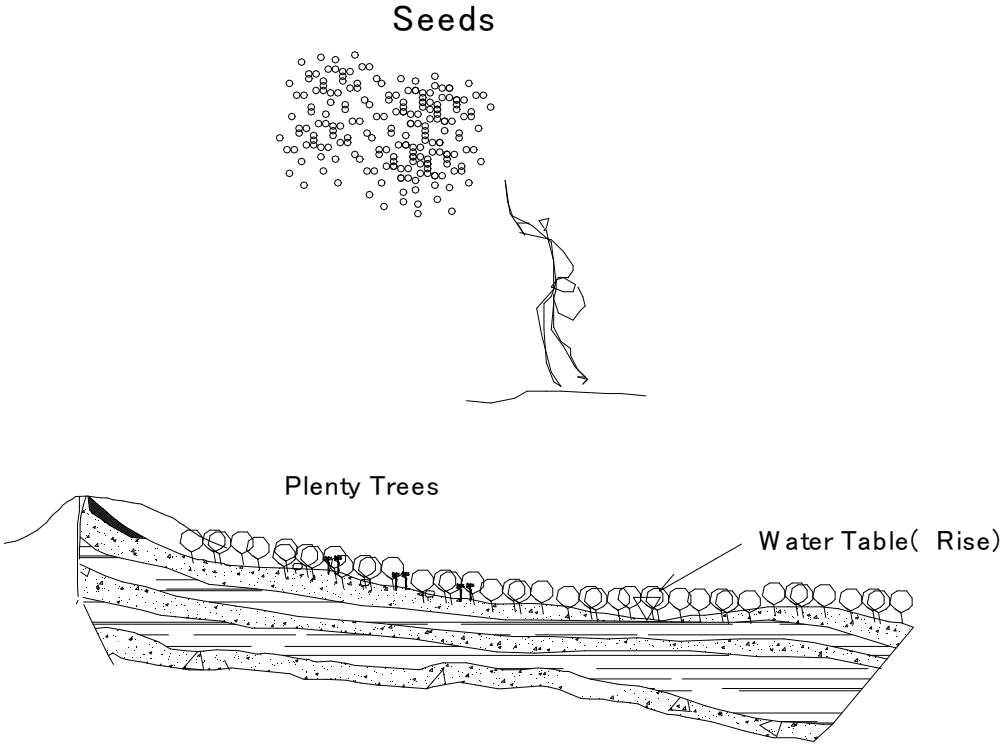
(429) Underground Fresh Water



(430) Underground Fresh Water

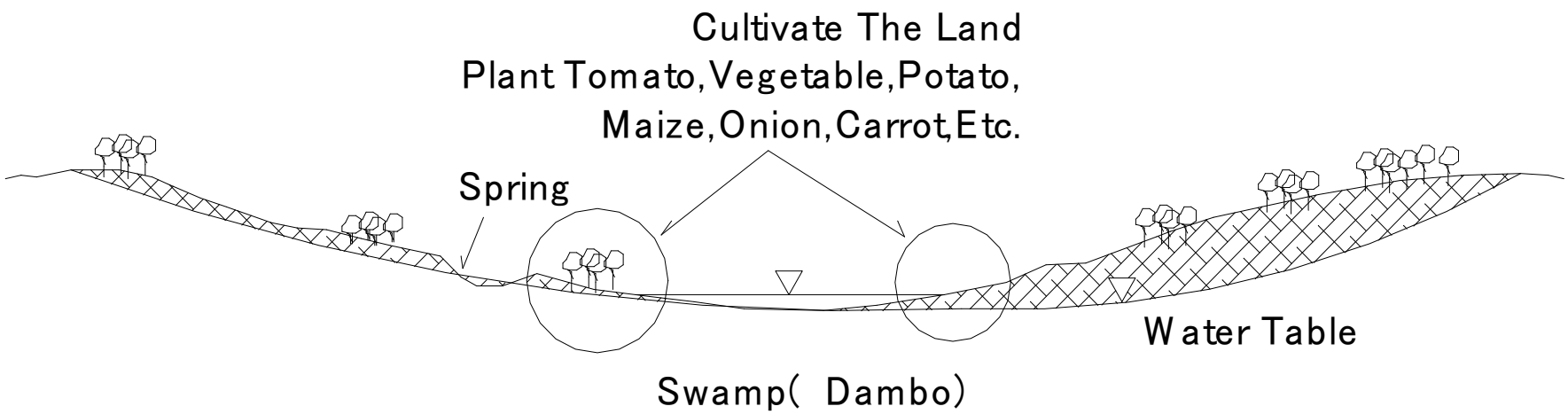


(431) Underground Fresh Water(After Planting Trees)

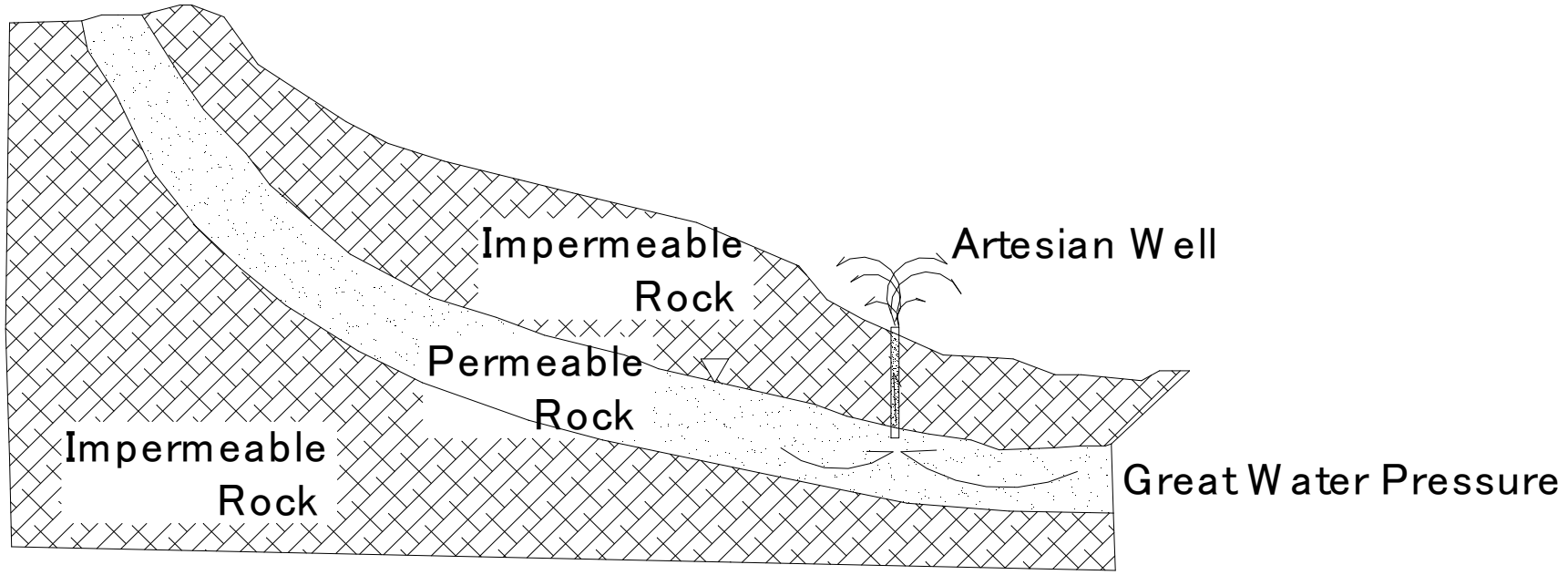


After Planting Trees.
1.Water Table(Rises)
2.Plenty Rain.
3.Rich Soil.
4.No Erosion.
5.No Flood.
6.Spring.
7.Plenty Animals,Plenty Earth Worms,
And Plenty Birds.
8.No Envy.
9.No Fighting.No War.
10.Escaped Wife Returns.

(432) Spring And Swamp(Dambo)

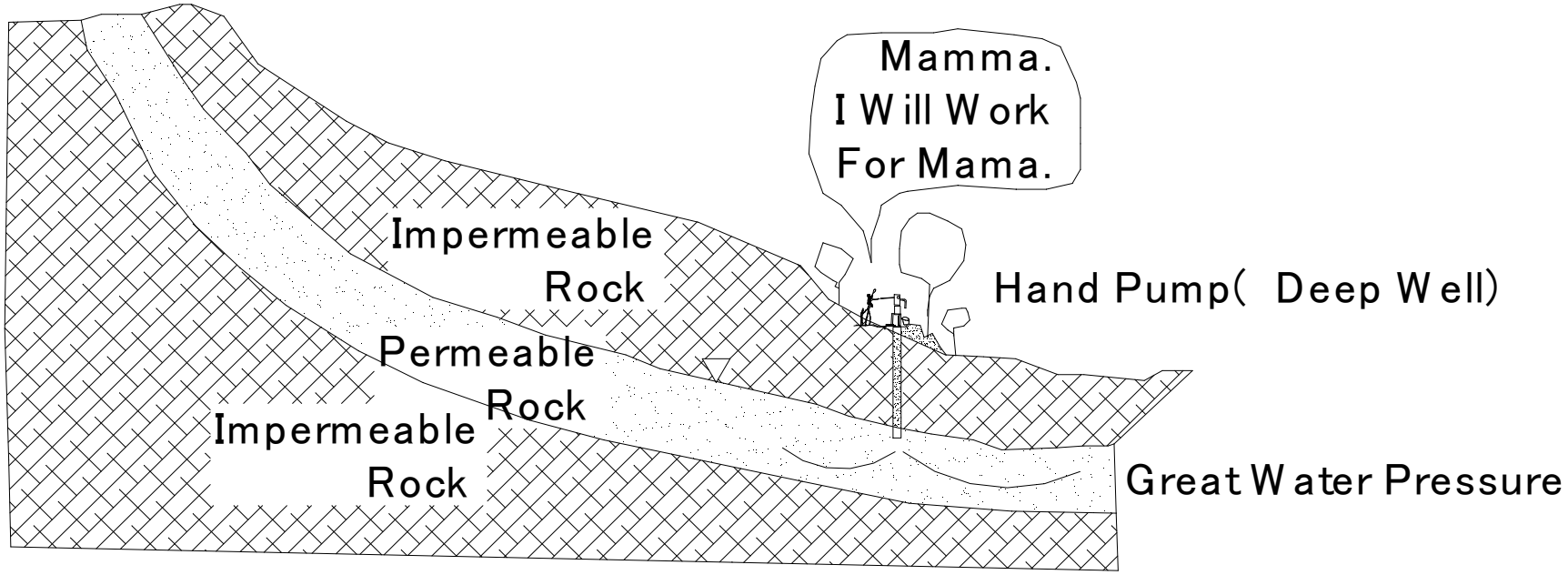


(433) Artesian Well

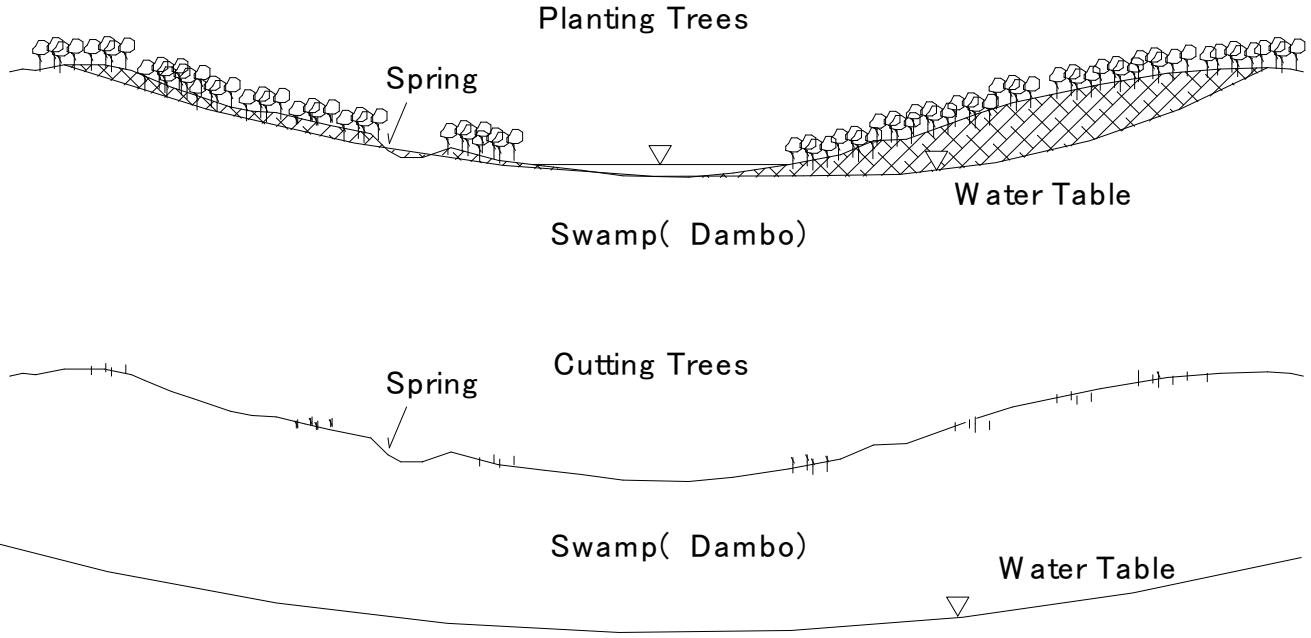


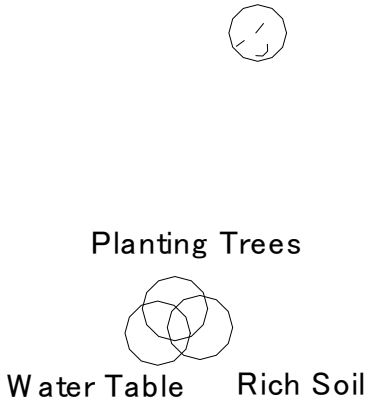
(434) Hand Pump(Deep Well)

(434) Hand Pump(Deep Well)



(435) Springs,Streams, And Swamps(Dambo)
Depend On Water Table

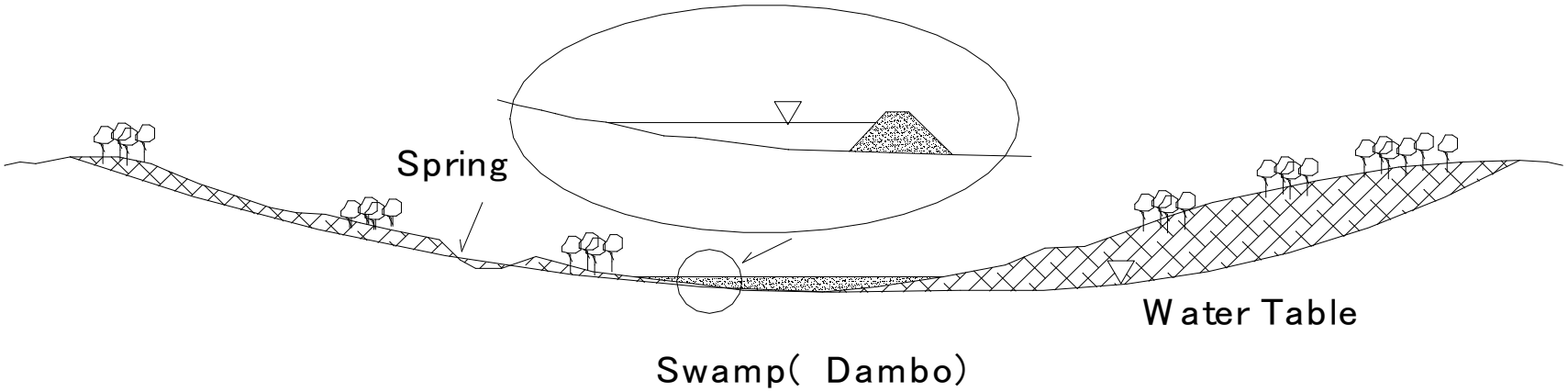




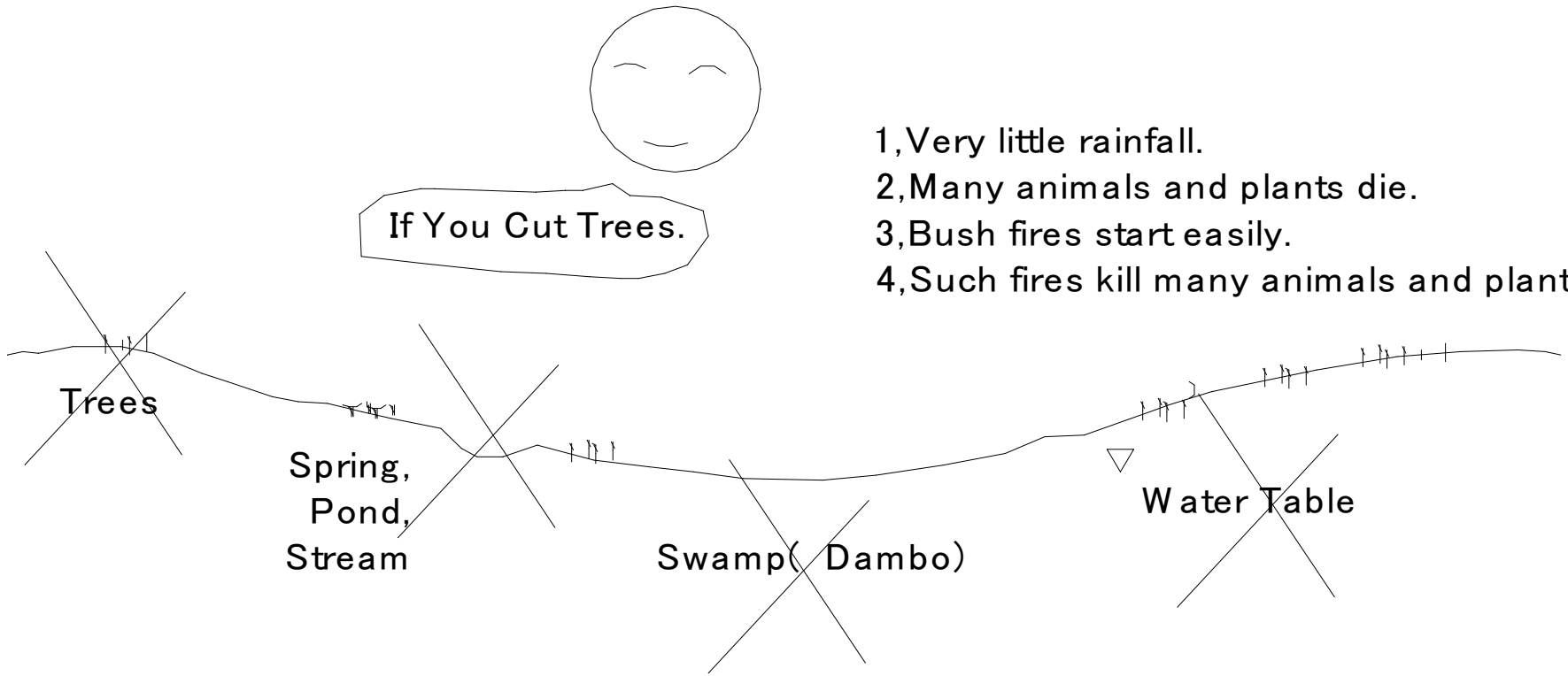
(436) Dams,Aqueducts,And Reservoirs

(436) Dams,Aqueducts,And Reservoirs

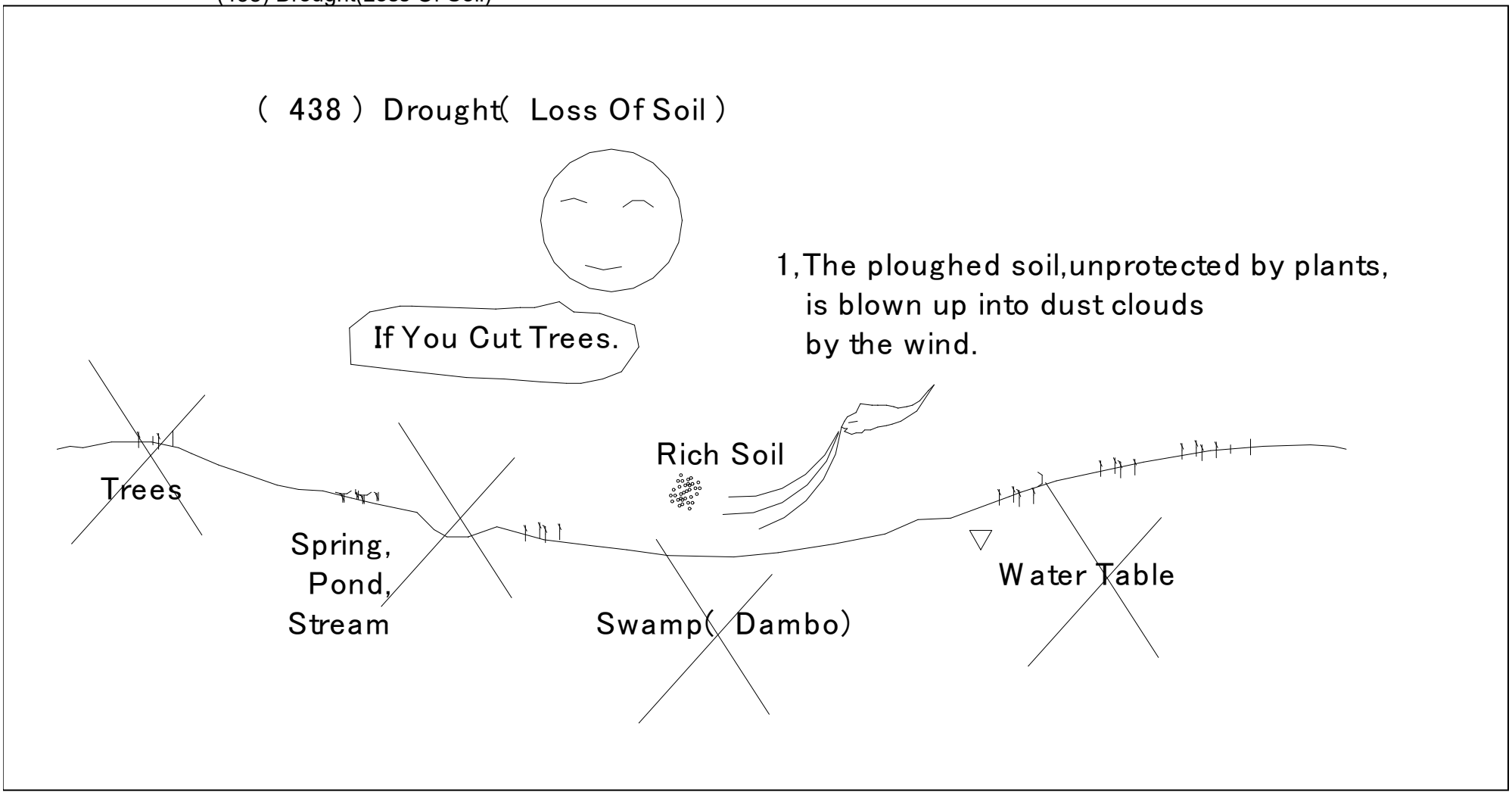
1,To Build Dams And Aqueducts Is Expensive.
2,To Build Small Fill Dams On Swamp
(Height=2~3m) Is Cheap.



(437) Drought

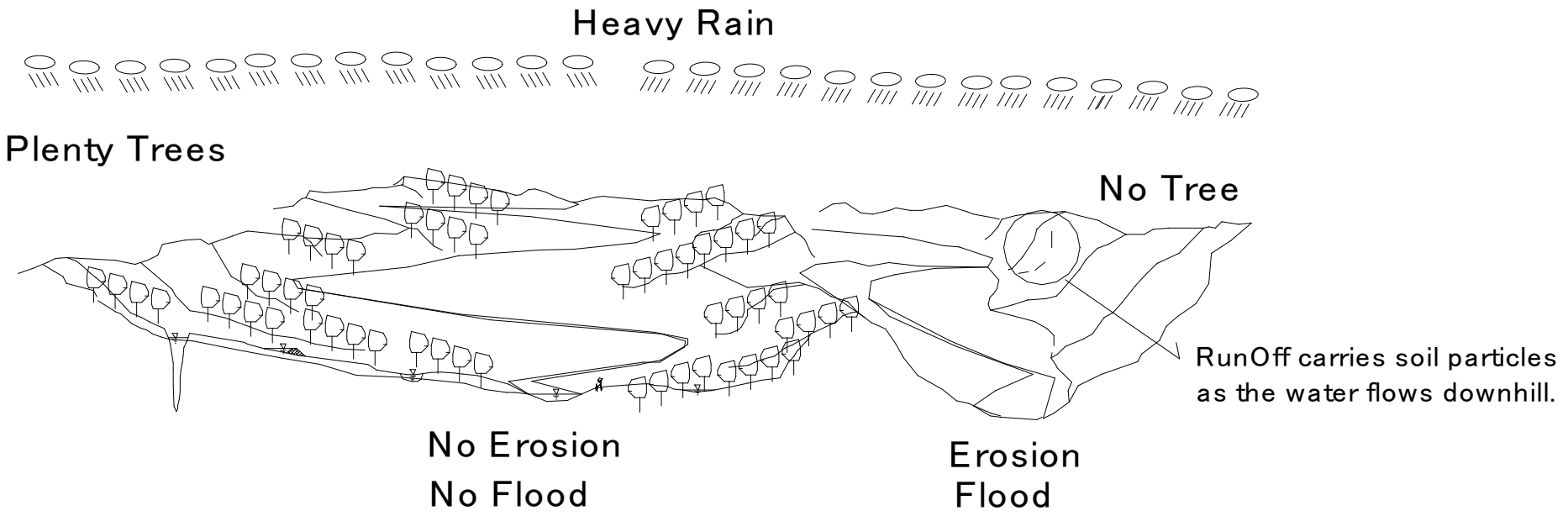

If You Cut Trees.
1,Very little rainfall.
2,Many animals and plants die.
3,Bush fires start easily.
4,Such fires kill many animals and plants.
Trees
Spring,
Pond,
Stream
Swamp(Dambo)
Water Table

(438) Drought(Loss Of Soil)

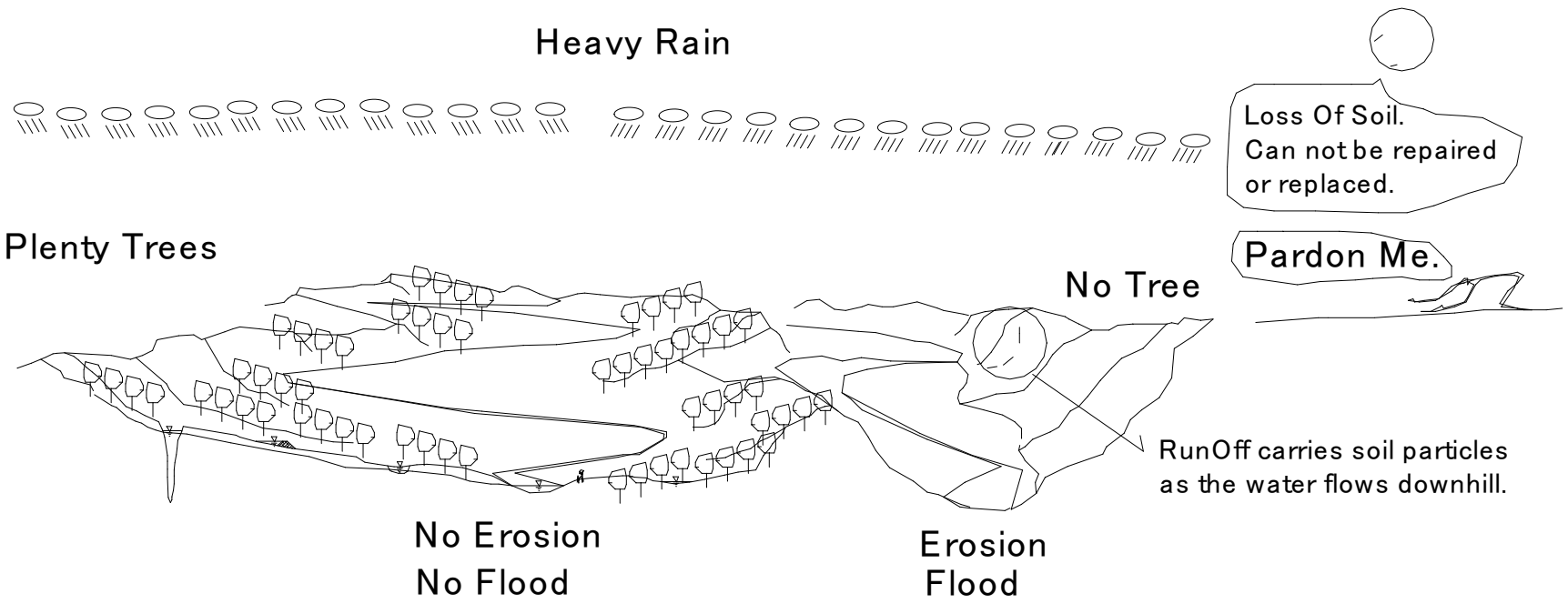



(439) Drought(Self Help)
Never Hope Governments
will help you.
Firstly,Plant Trees.
Let Me Try.
Wind

(440) Erosion

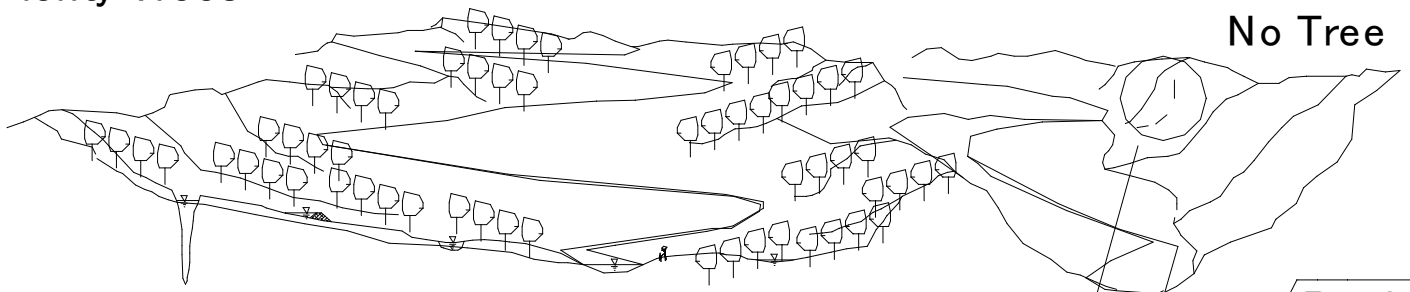

Heavy Rain
Plenty Trees
No Tree
RunOff carries soil particles as the water flows downhill.
No Erosion
No Flood
Erosion
Flood

(441) Erosion(Soil)



(442) Heavy Rain Causes Erosion

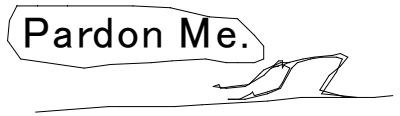
Plenty Trees



No Tree

No Erosion
No Flood

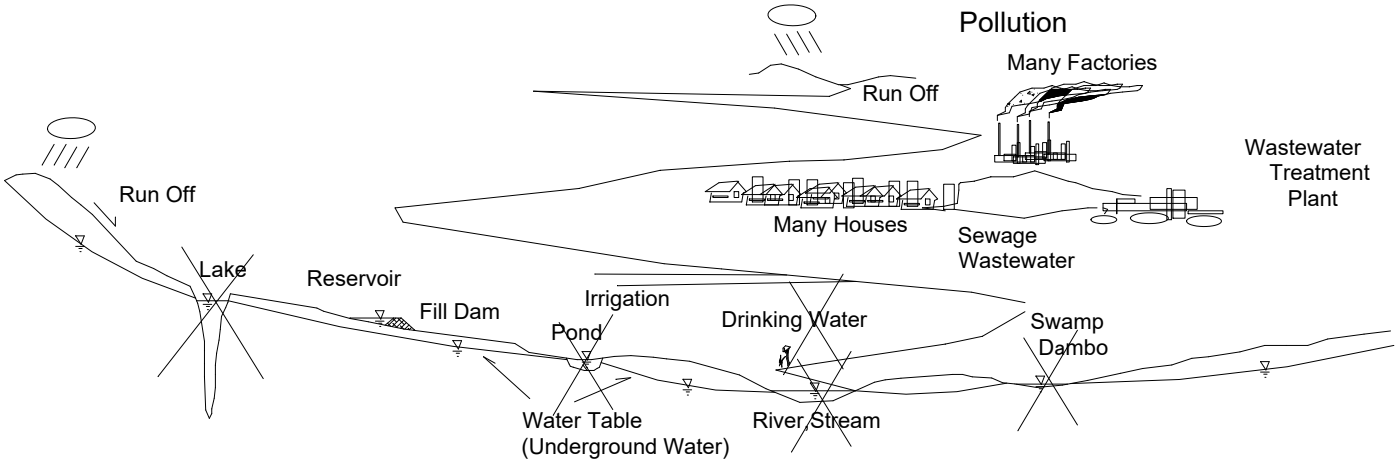
Erosion
Flood



Water picks up and carries much sand and silt.
The sand and silt make the water dirty.
It has to be filtered to remove the particles.
Filtered water is costly.

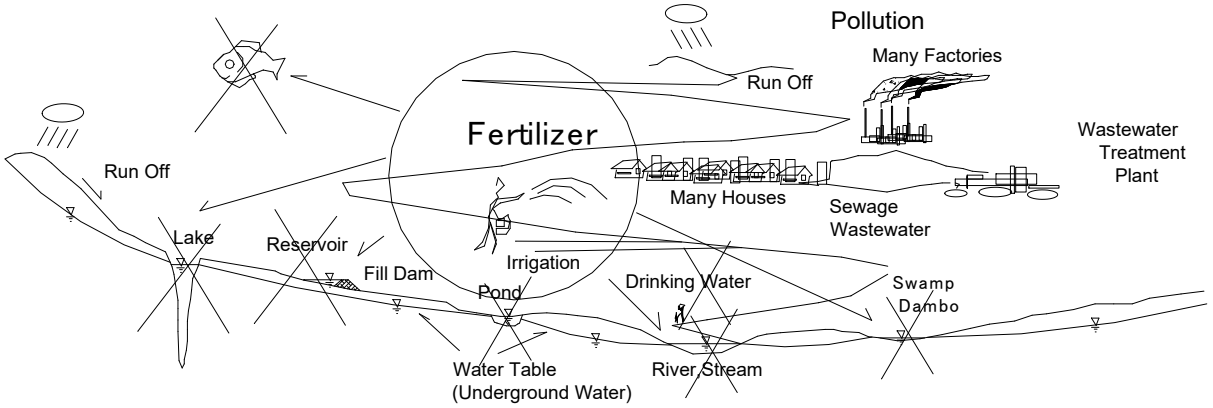
(443) Water Pollution

Many kinds of wastes cause water pollution.
1.Polluted water contains disease.
2.People become sick from drinking polluted water.
3.Industries dump polluted water.
4.Polluted water contains chemical and organic wastes.



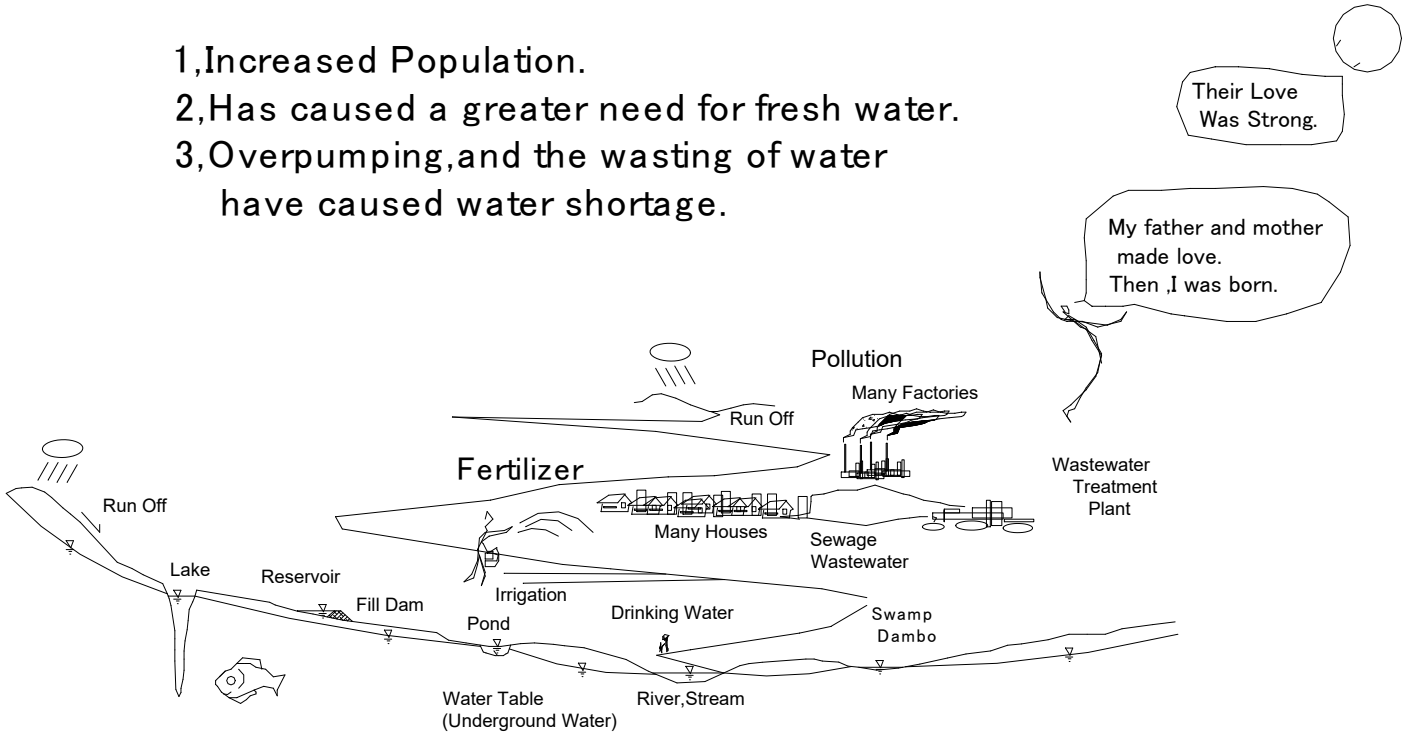
(444) Farming Causes Water Pollution

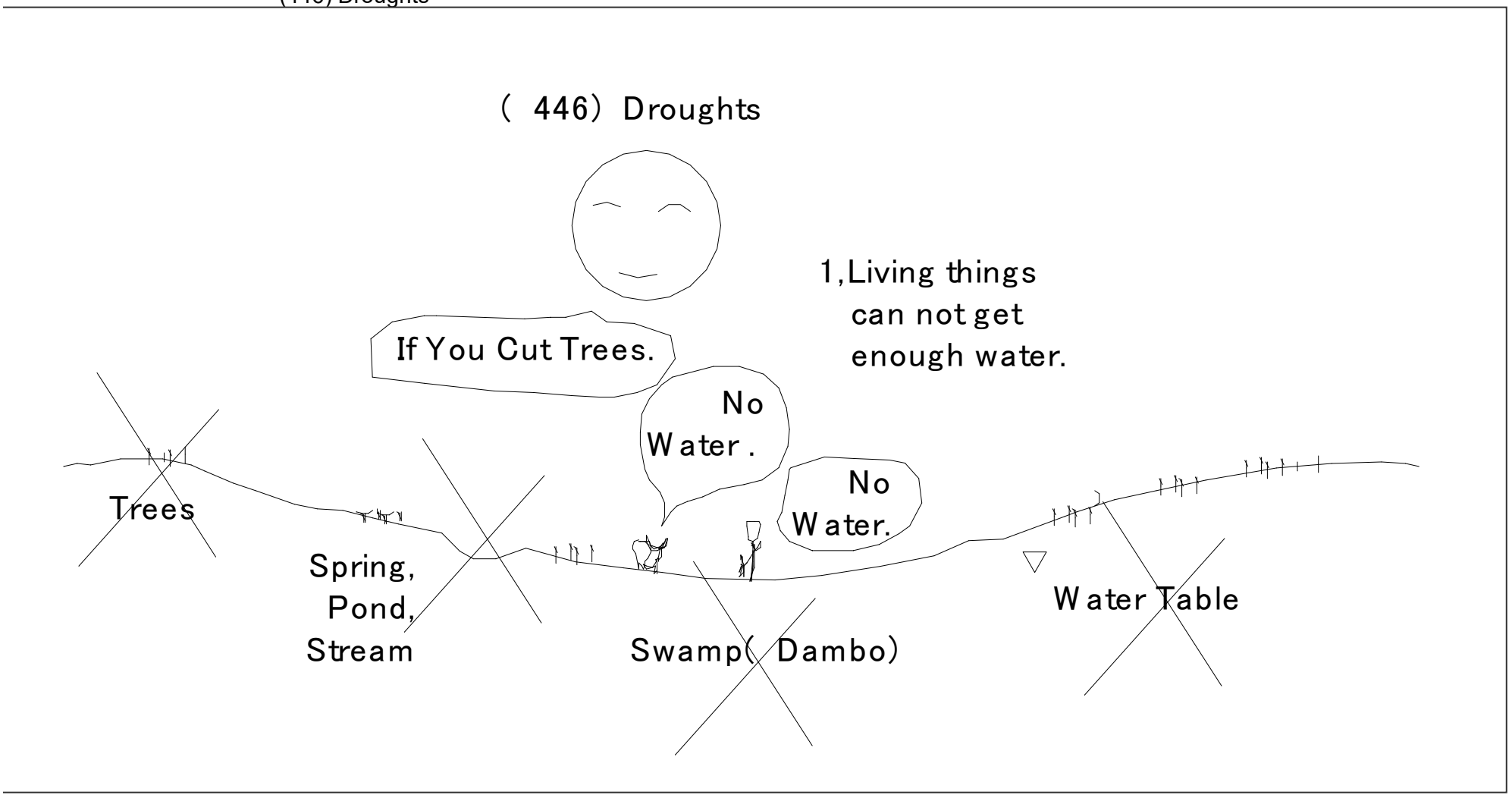
1.Modern farming uses large amounts of fertilizer.
2.Most of the fertilizer is used up by crops.
3.Some of the fertilizer may be washed into nearby rivers and lakes.
4.Many kinds of wastes cause water pollution.
5.The fertilizer causes water plants to grow in great numbers.
6.Later these plants die and decay.
7.Oxygen in the water is used up.
8.Without oxygen ,fish and other animals in the water die.



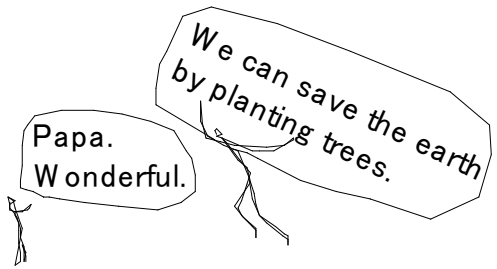
(445) Increased Population ?

1,Increased Population.
2,Has caused a greater need for fresh water.
3,Overpumping,and the wasting of water
have caused water shortage.




(446) Droughts
1,Living things
can not get
enough water.
If You Cut Trees.
No
Water .
No
Water.
Trees
Spring,
Pond,
Stream
Swamp(Dambo)
Water Table

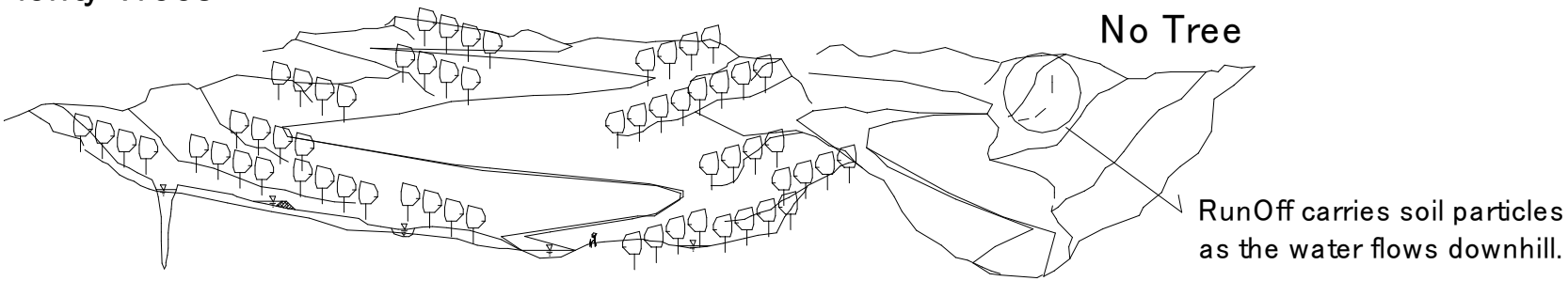
(447) Flooding And Erosion



Flooding and erosion cause problems by making the water unclean

Heavy Rain

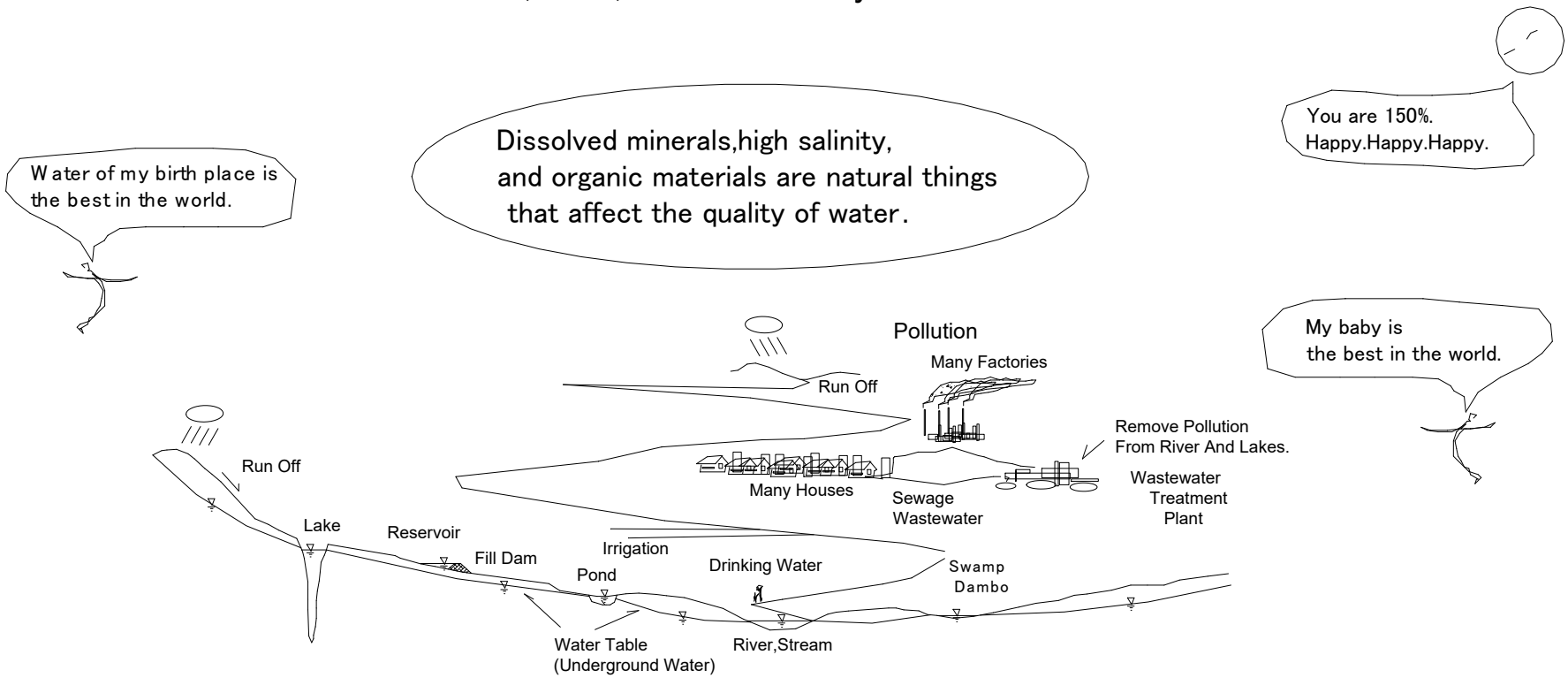
Plenty Trees



No Erosion
No Flood

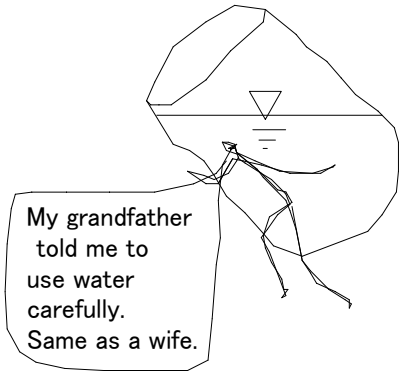
Erosion
Flood

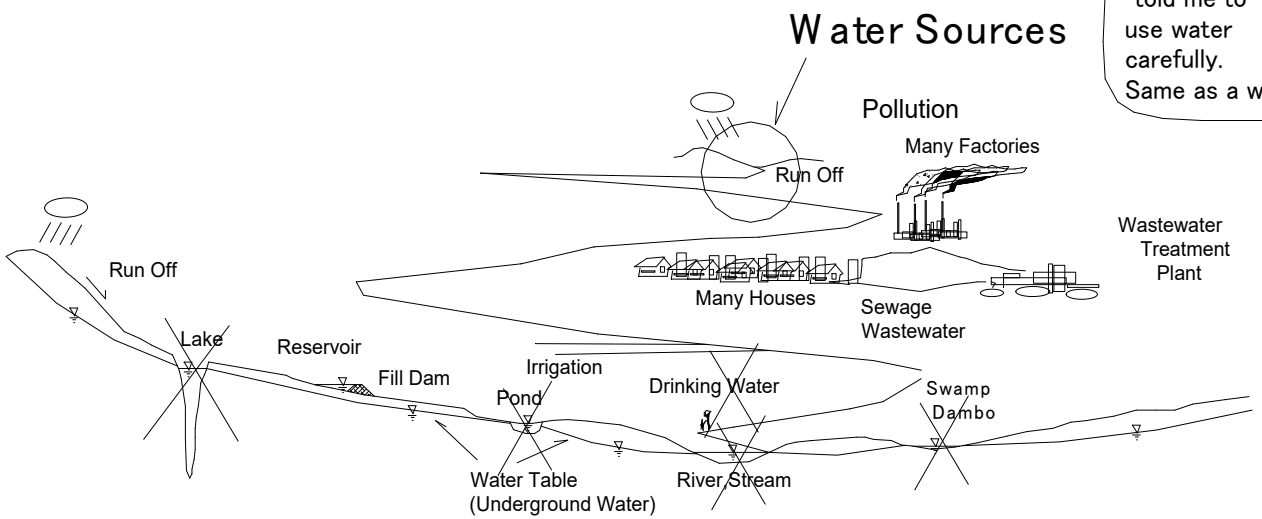
(448) Water Quality



(449) Water Pollution(Sources Of Water)

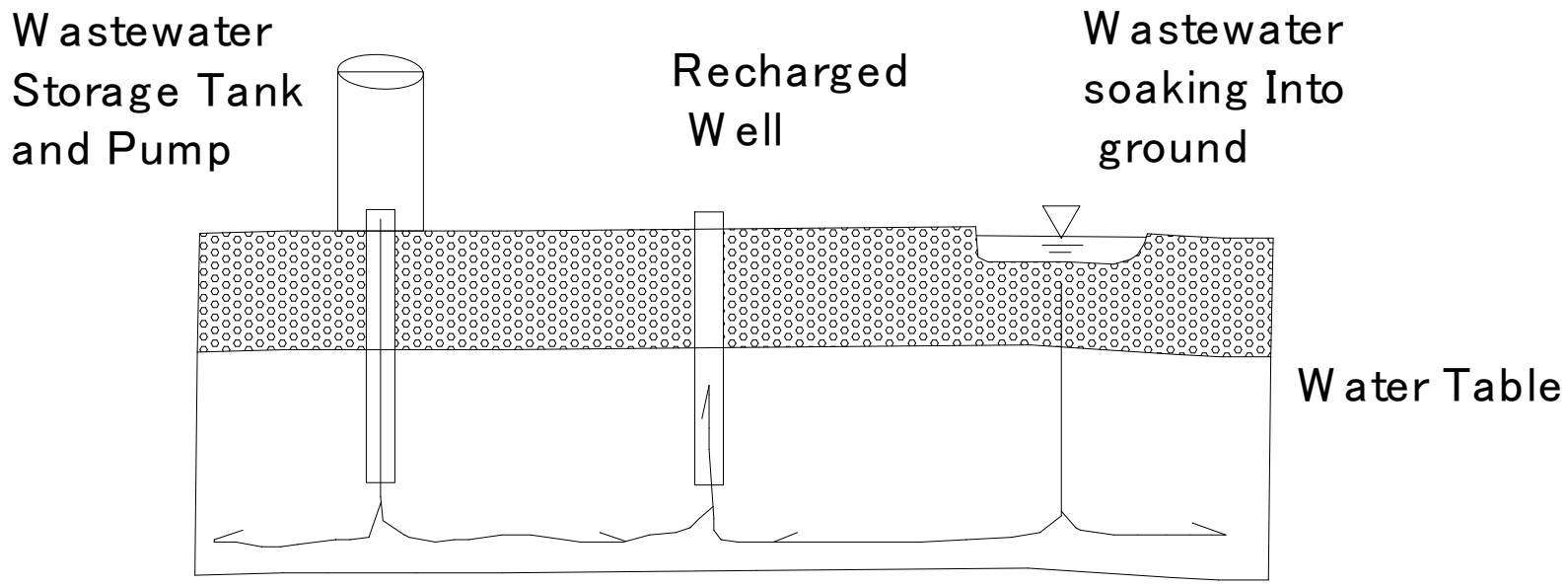
Water pollution keeps people from using sources of water because the water is unclean or dangerous for many uses.





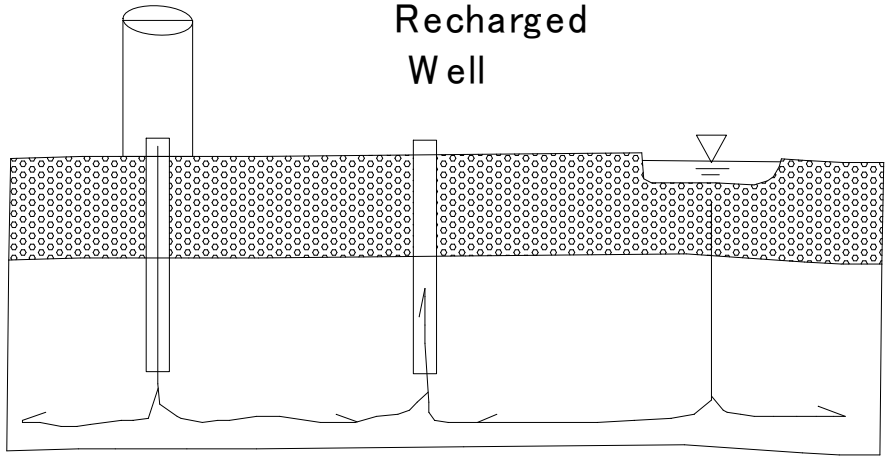
(450) Recharging Wells

Recycle Water



(451) Recharging Wells

Recycle Water



(2) Wastewater
Storage Tank
and Pump

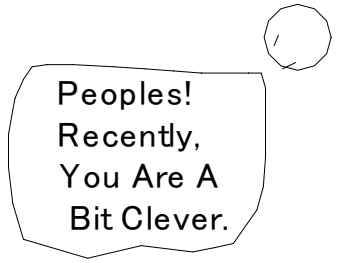
Pumping wastewater or
extra water into the ground
by using special wells.

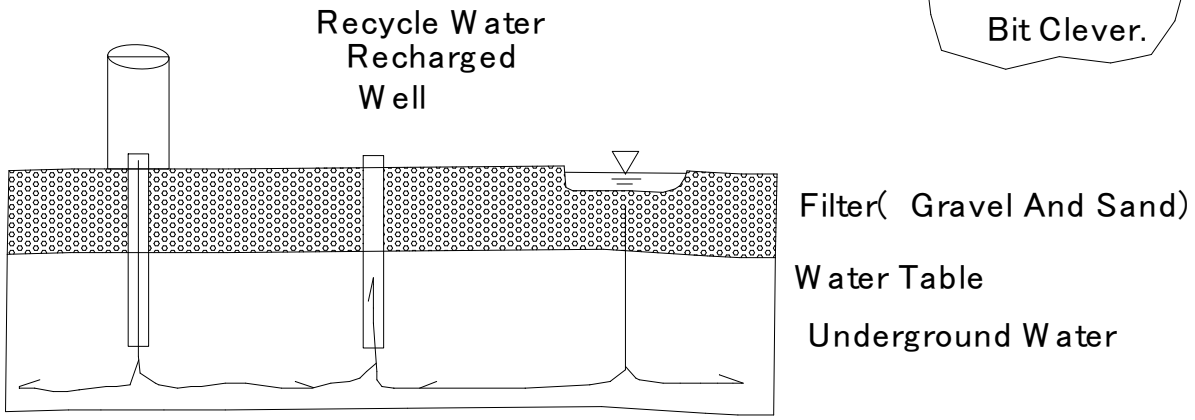
(1) Wastewater
soaking Into
ground

spreading wastewater
over the land

（ 452 ） Recharging Wells

Recharged Well
A,Return the water table to normal.
B,Store extra water in the ground for dry times.





（ 2） Wastewater
Storage Tank
and Pump

Pumping wastewater or
extra water into the ground
by using special wells.

（ 1） Wastewater
soaking Into
ground

spreading wastewater
over the land

(453) History Of Water Purification

Some sources of water make people sick.

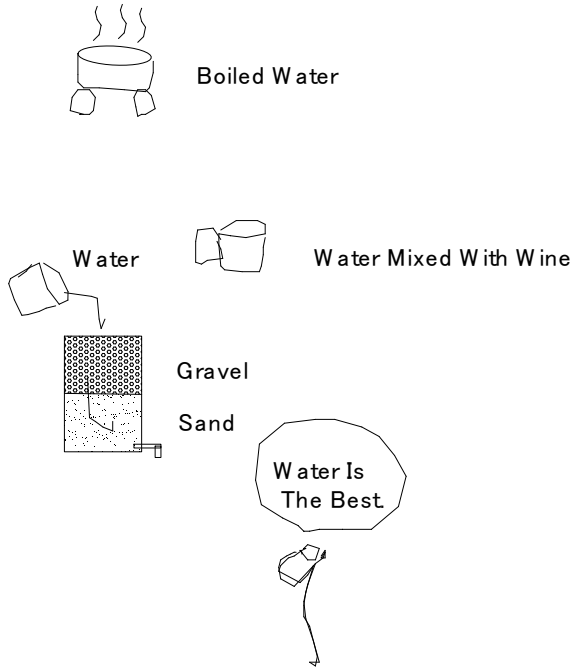
2000B.C. People in Many Civilization.They treat their drinking water by boiling.
Put alum in tubs of dirty water to make the water safer to use.

Roman soldiers mix wine with drinking water.

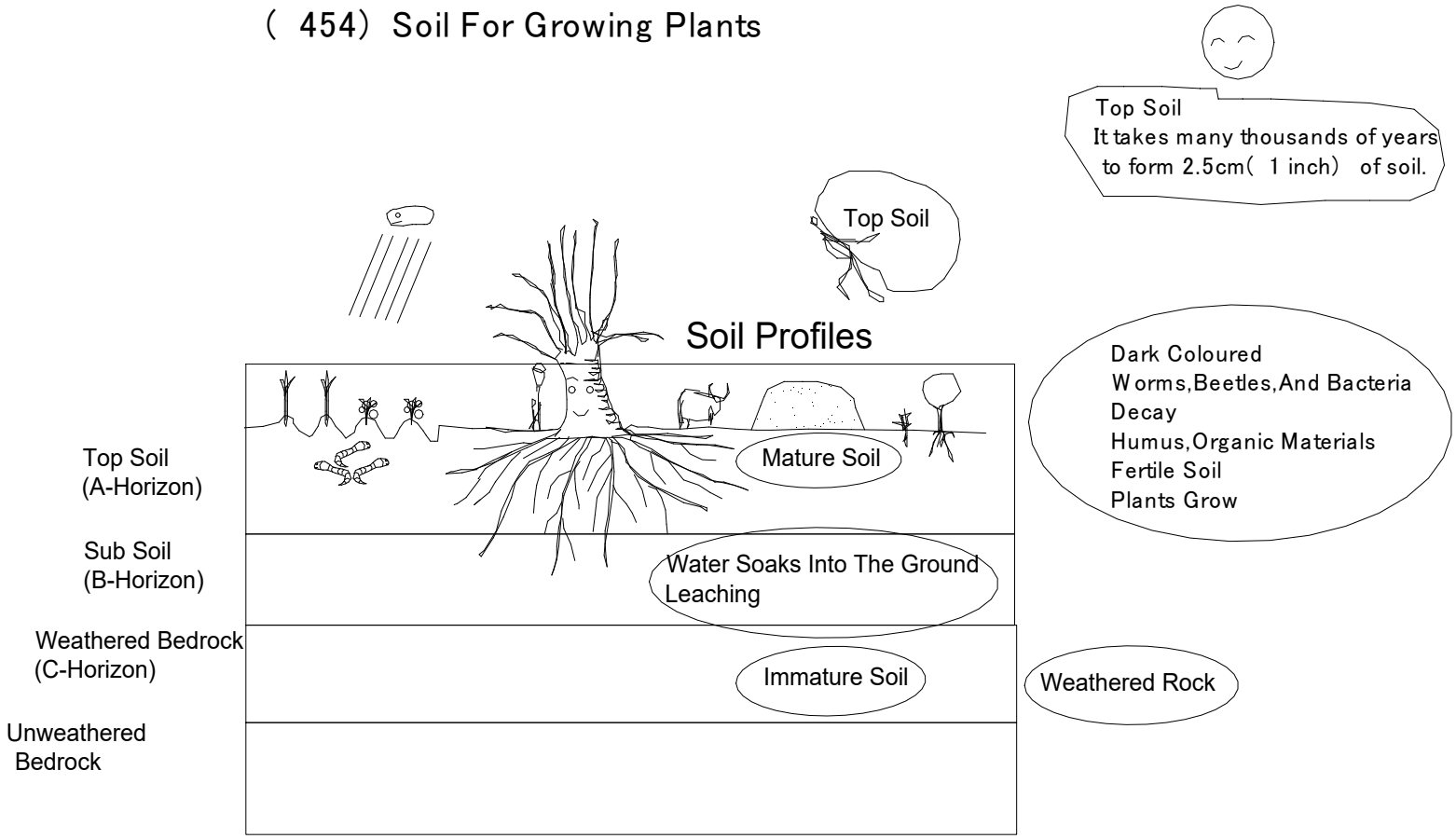
In 1885 The city of London began filtering its water through sand filters.

In 1892 Many people in the world ,became sick from cholera,caused by certain germs in unfiltered drinking water.

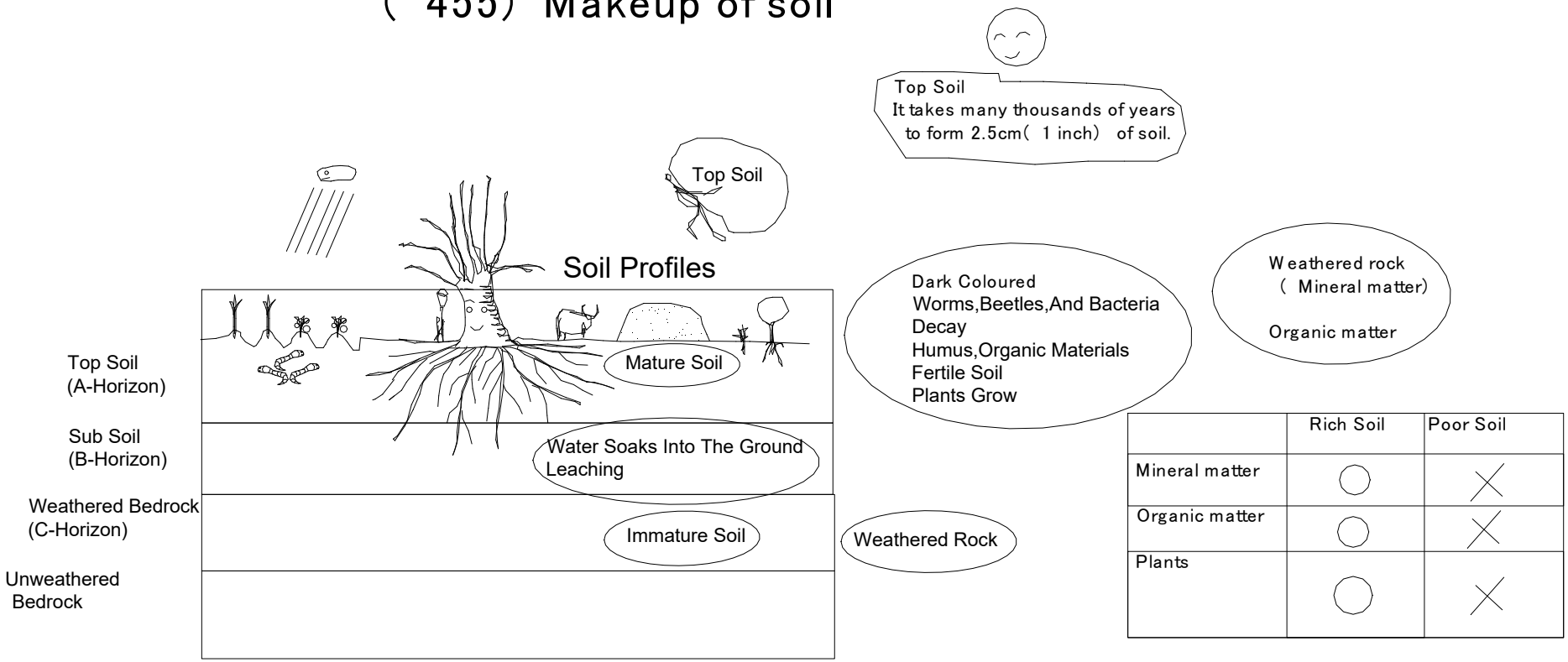
In 1909 People began to use chlorine to kill certain germs that cause Typhoid Fever.



（ 454） Soil For Growing Plants

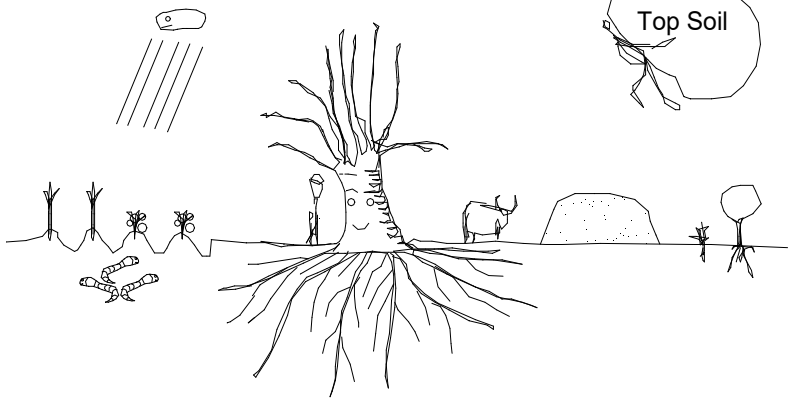


(455) Makeup of soil



	Rich Soil	Poor Soil
Mineral matter	○	×
Organic matter	○	×
Plants	○	×

（ 456）Plants and soil



Top Soil
It takes many thousands of years
to form 2.5cm（ 1 inch） of soil.

Top Soil
(A-Horizon)

Dark Coloured
Worms,Beetles,And Bacteria
Decay
Humus,Organic Materials
Fertile Soil
Plants Grow

Weathered rock
（ Mineral matter）

Organic matter

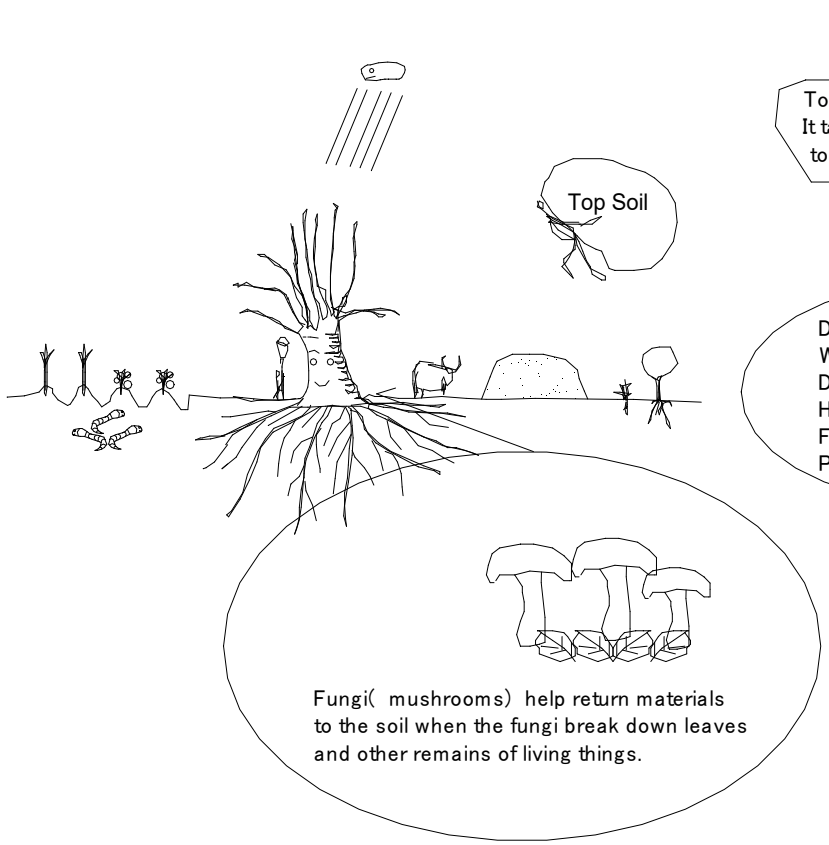
	Rich Soil	Poor Soil
Mineral matter	○	×
Organic matter	○	×
Plants	○	×

Plants Grow

Soil becomes poor

The mineral and organic matter used
by the plants is returned to the soil)

(457) Plants and soil(Fungi,Mushroom)



Top Soil.
It takes thousands of years
to form 2.5cm(1 inch) of soil.

Top Soil
(A-Horizon)

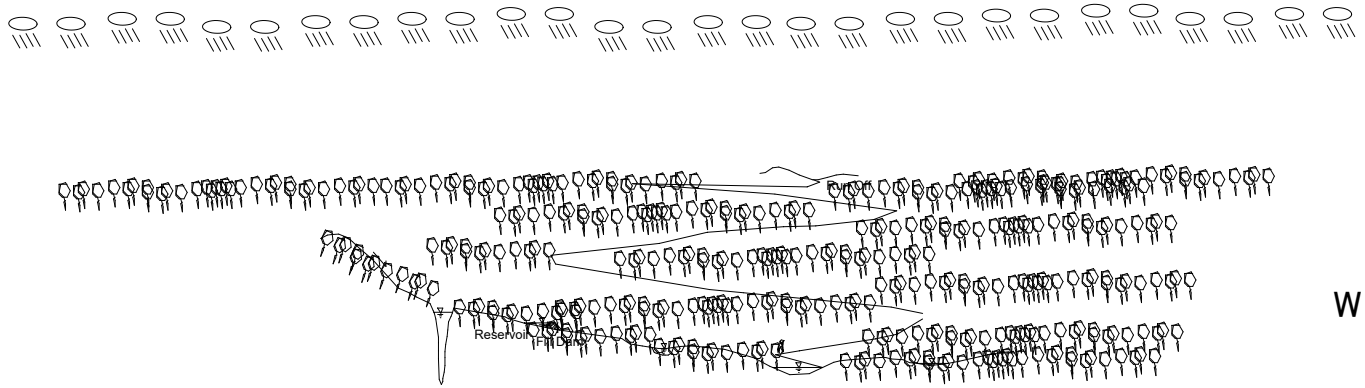
Dark Coloured
Worms,Beetles,And Bacteria
Decay
Humus,Organic Materials
Fertile Soil
Plants Grow

Weathered rock
(Mineral matter)

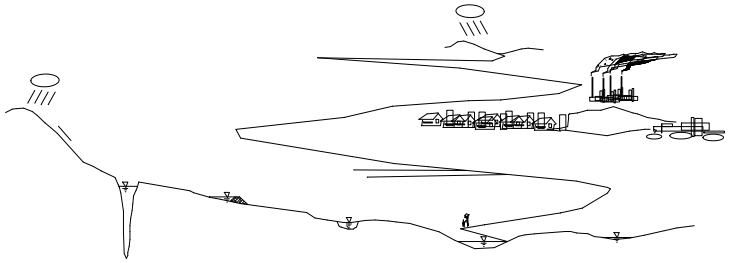
Organic matter

	Rich Soil	Poor Soil
Mineral matter	○	×
Organic matter	○	×
Plants	○	×

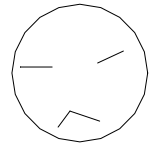
（ 458） More People,More Change



Was

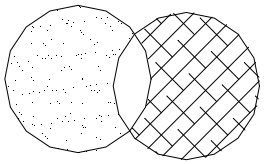


Is

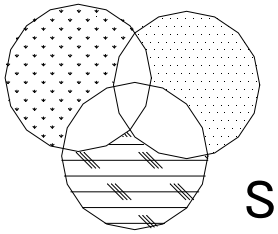


（ 459 ） Natural resources and people

Oxygen Water



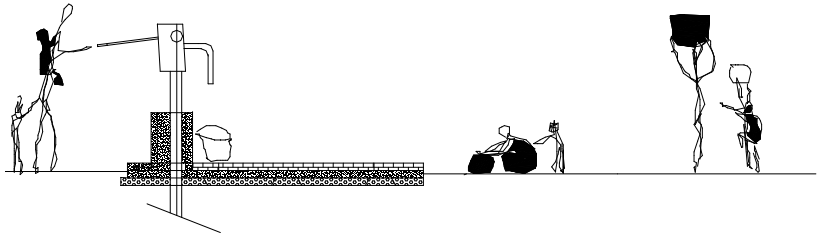
Plants Animals



Soil

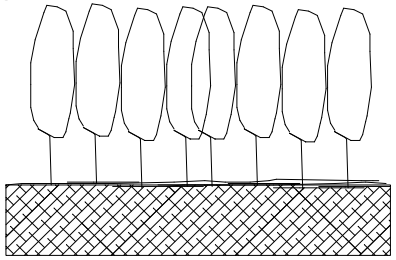
Our Life

Food

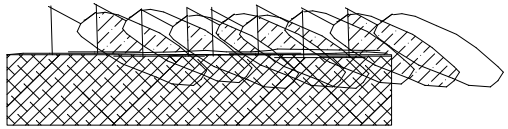


(460) Lumbering Results

Before Cutting Trees

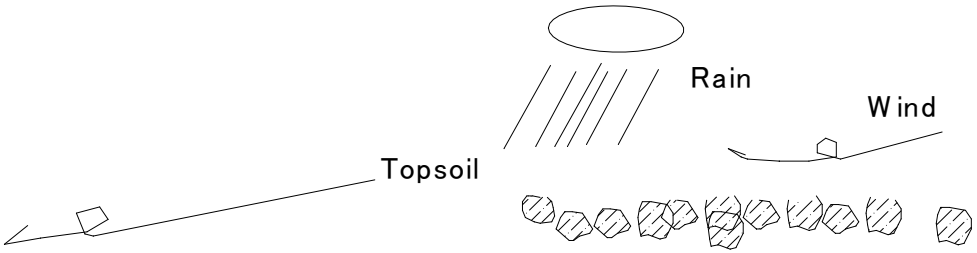


Cutting Trees



The roots of trees help
hold the soil in place.

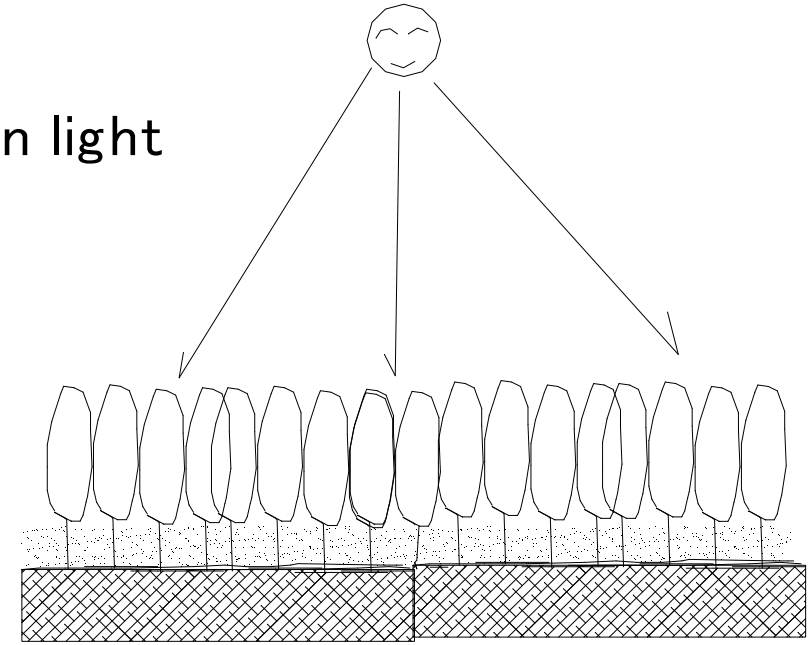
After Cutting Trees



Trees and plants keep
the soil from being eroded
by water or wind.

The soil may be carried into rivers,
making the water very muddy.

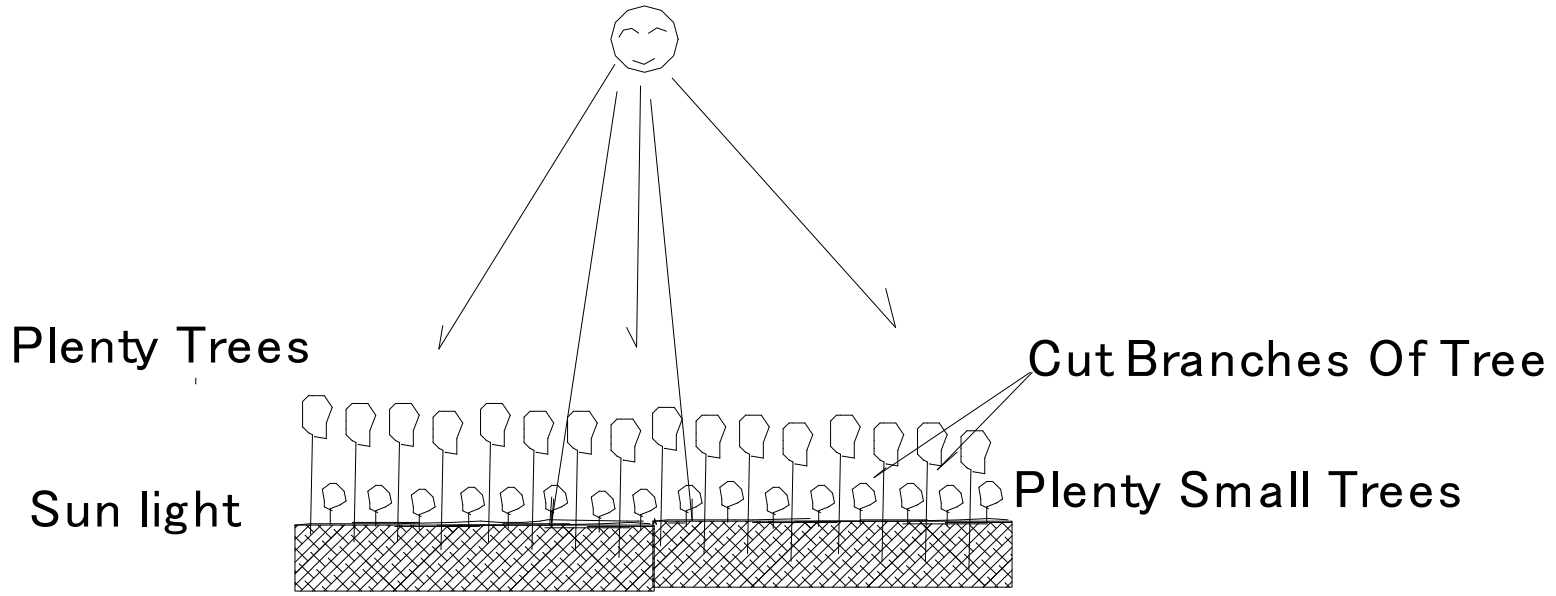
(461) Lumbering Results(Close Together)



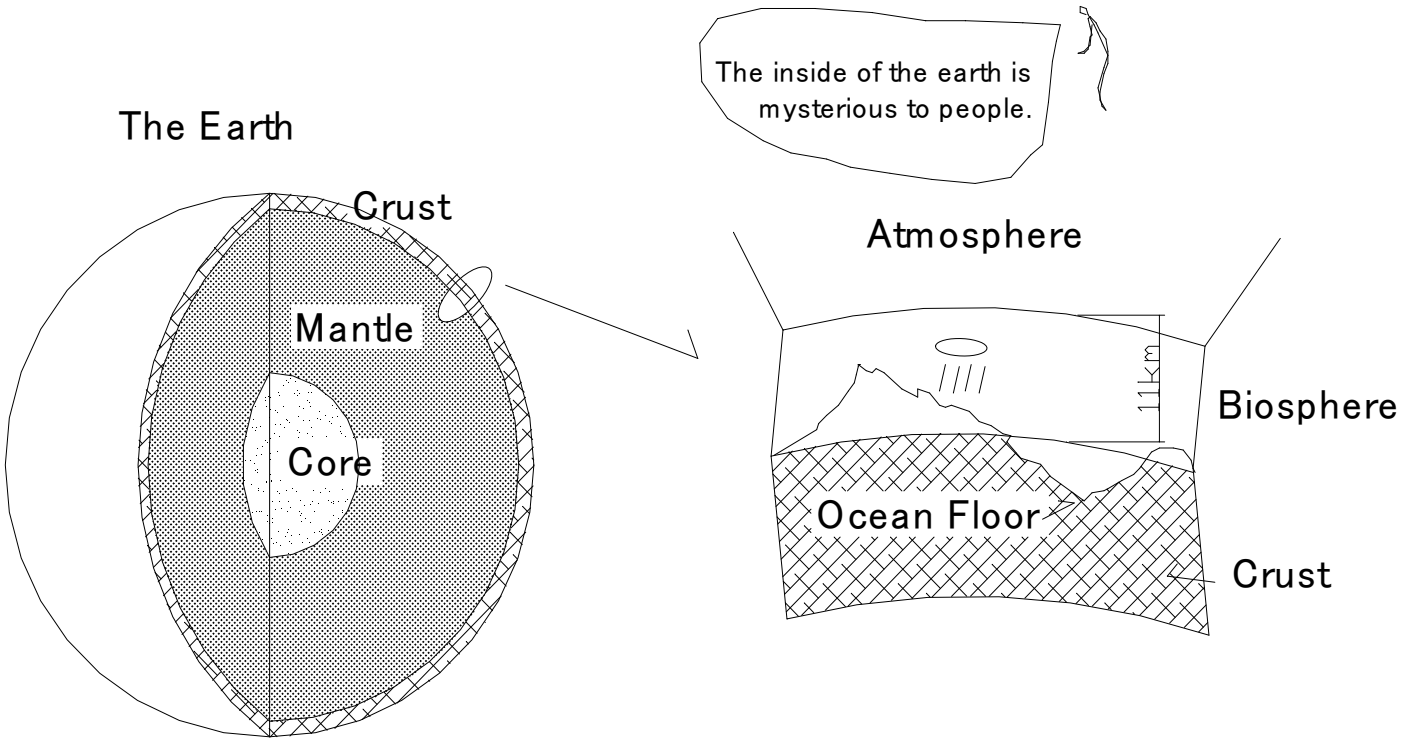
The branches of the trees
may be close together
that little sunlight reaches
the forest floor.

As a result
there may be few plants
other than trees growing in the forest.

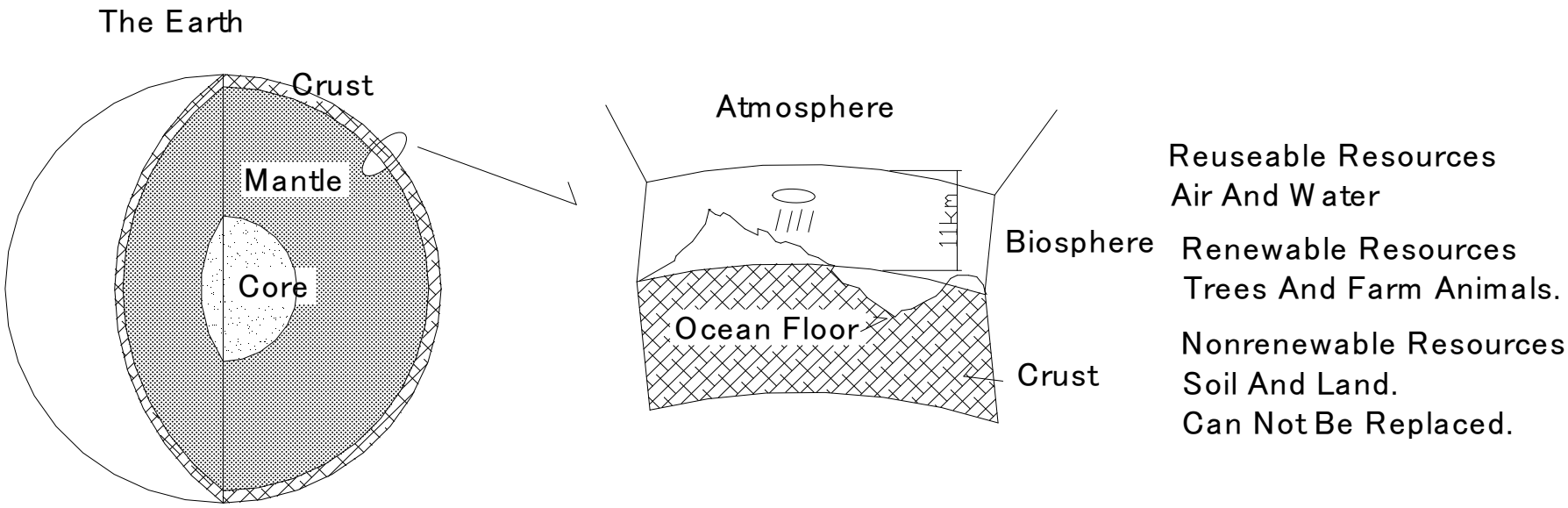
(462) Lumbering Results(Cut Branches Of Trees)



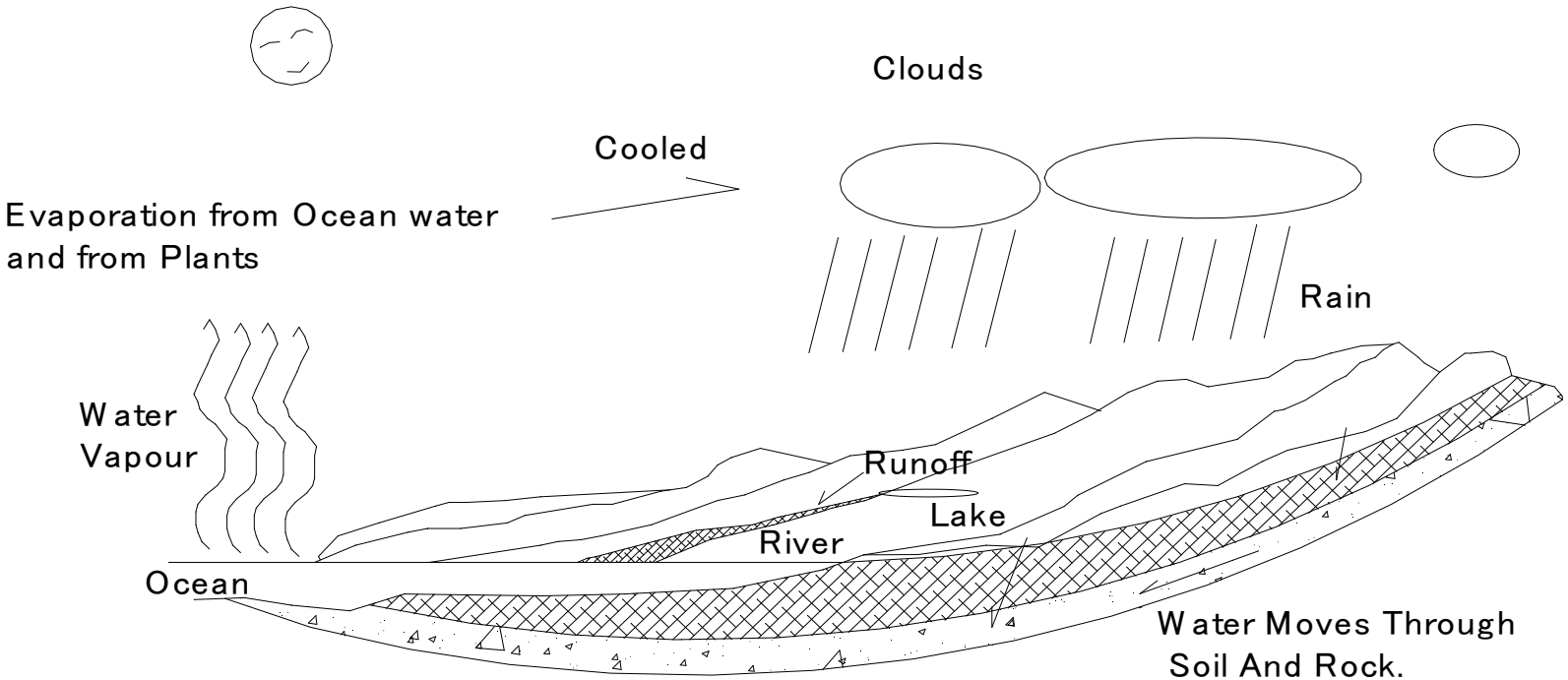
(463) The Earth



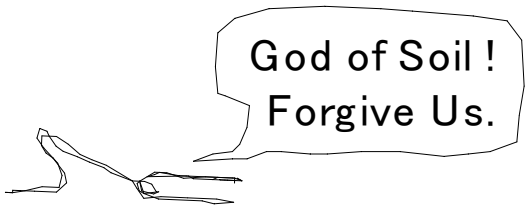
(464) Kinds Of Resources Of The Earth



(465) Water As A Reuseable Resource(Water Cycle)



(466) Wind



No Tree

Soil

Wind

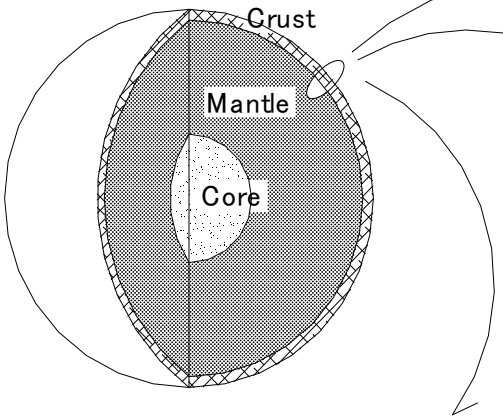
Top layer of soil

Wasteland

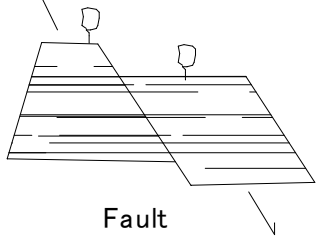
(467) Earthquakes

1,Earthquake is shaking
or rolling of the ground.
2,Earthquakes are caused
by movement of continental plates.

The Earth

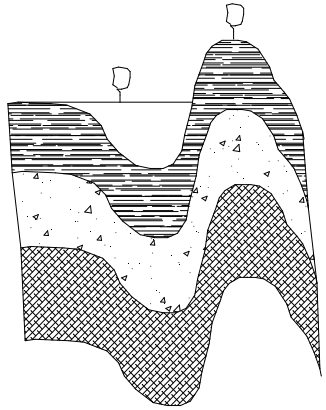


When rock moves along a fault,
great energy is given off.
This energy takes
the form of waves and moves
in all directions away from the fault.
These waves are called seismic waves.



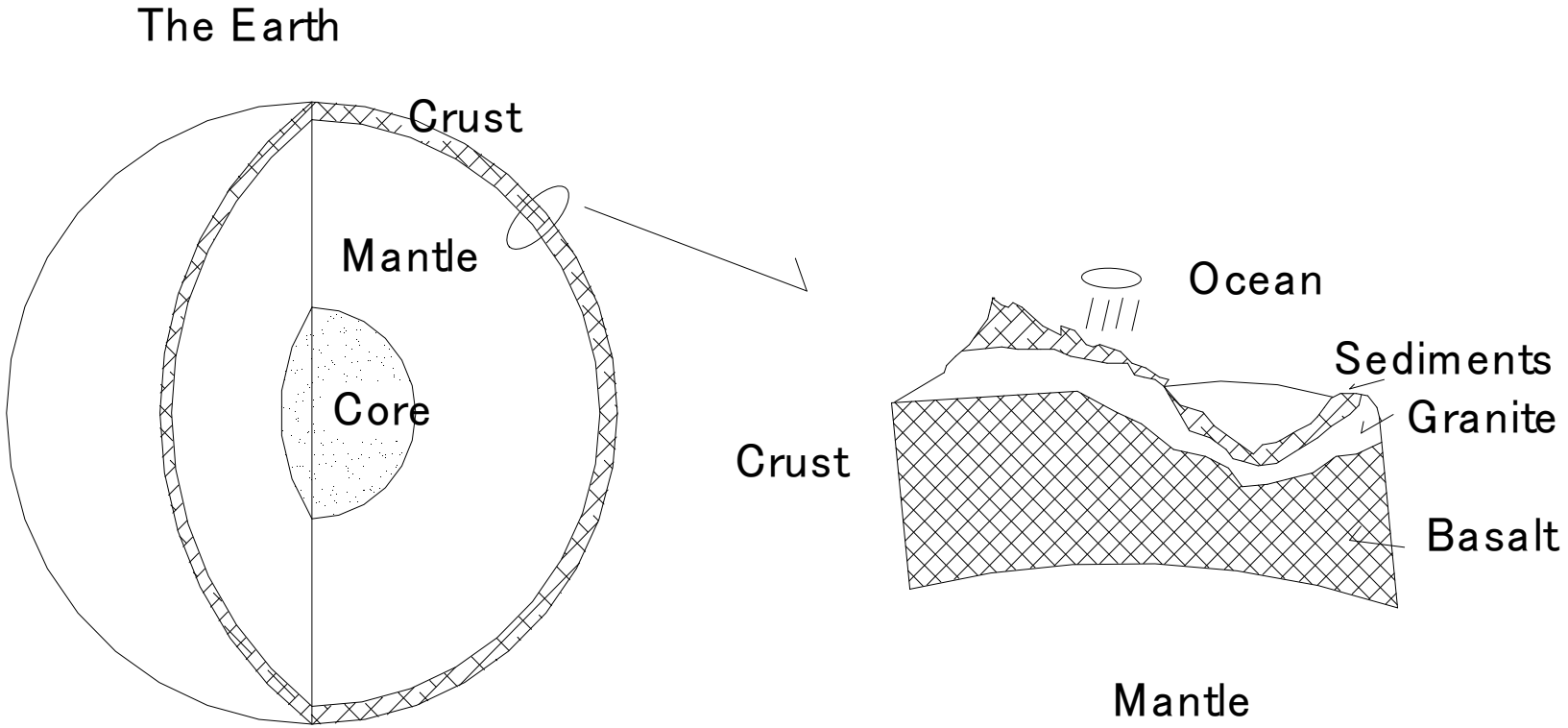
Fault

The rock of the earth is
pushed and pulled
in many directions.



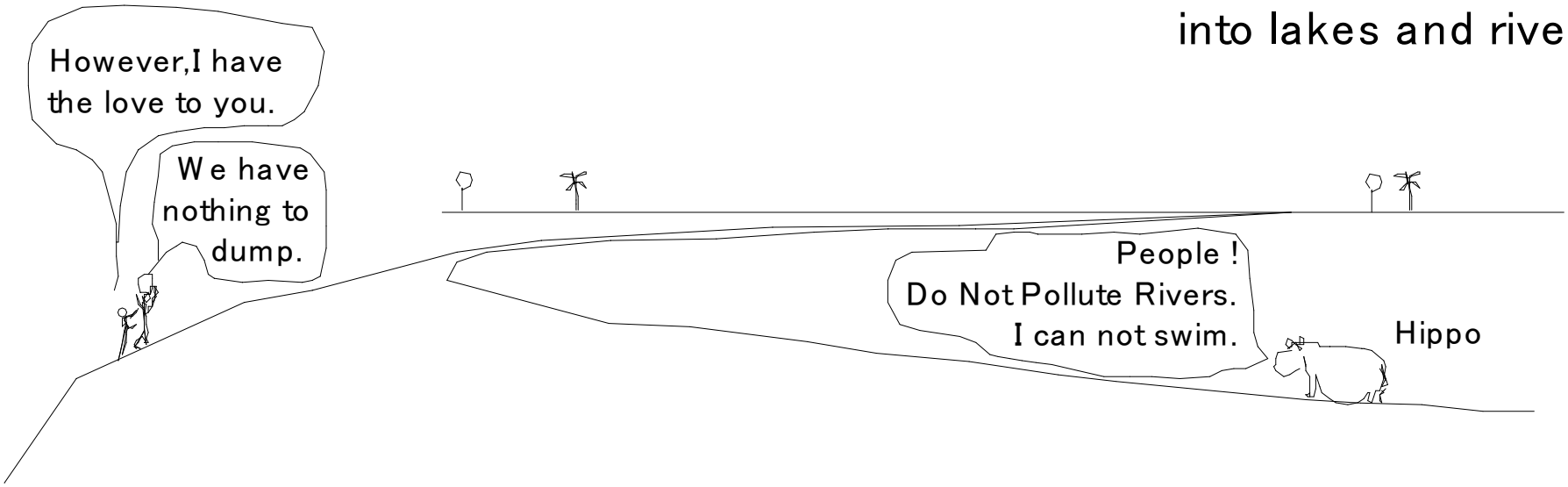
Friction.
Whenever rock surfaces
rub together,
There is Friction.

(468) Rock Of The Crust



(469) People Change The Water(Pollution)

People dump their garbage and other wastes into lakes and rivers.



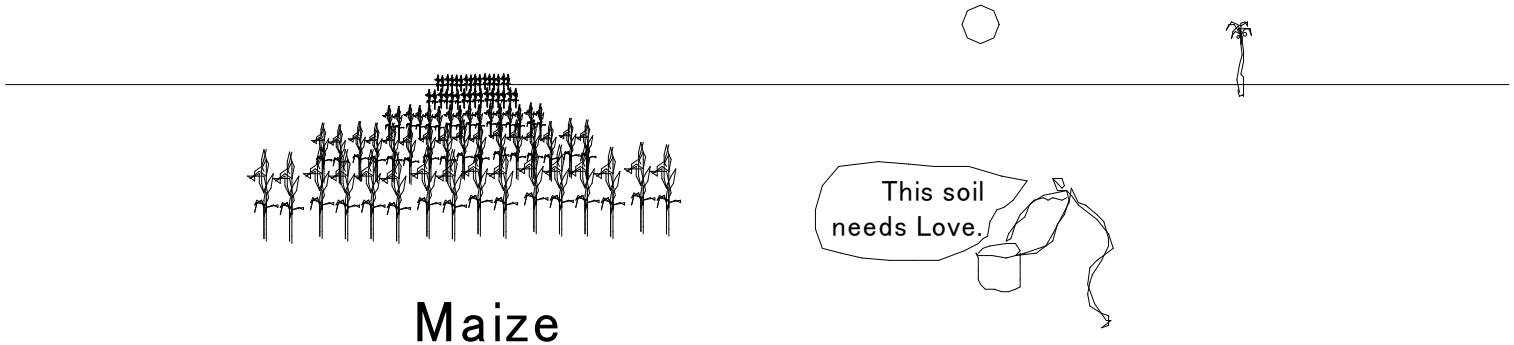
（ 470） Soil Conservationist

Soil conservationists help farmers take care of their soil.

1,To prevent erosion.

2,To make the best use of their land.

3,To find ways of improving poor soil.

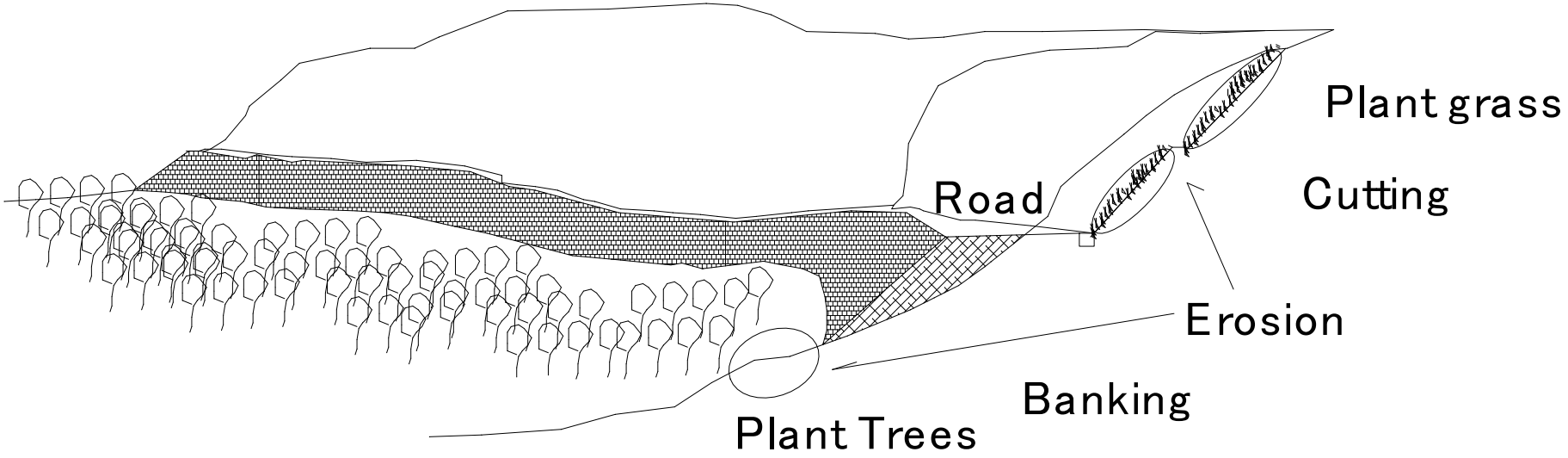


Maize

（ 472） Restoring the land

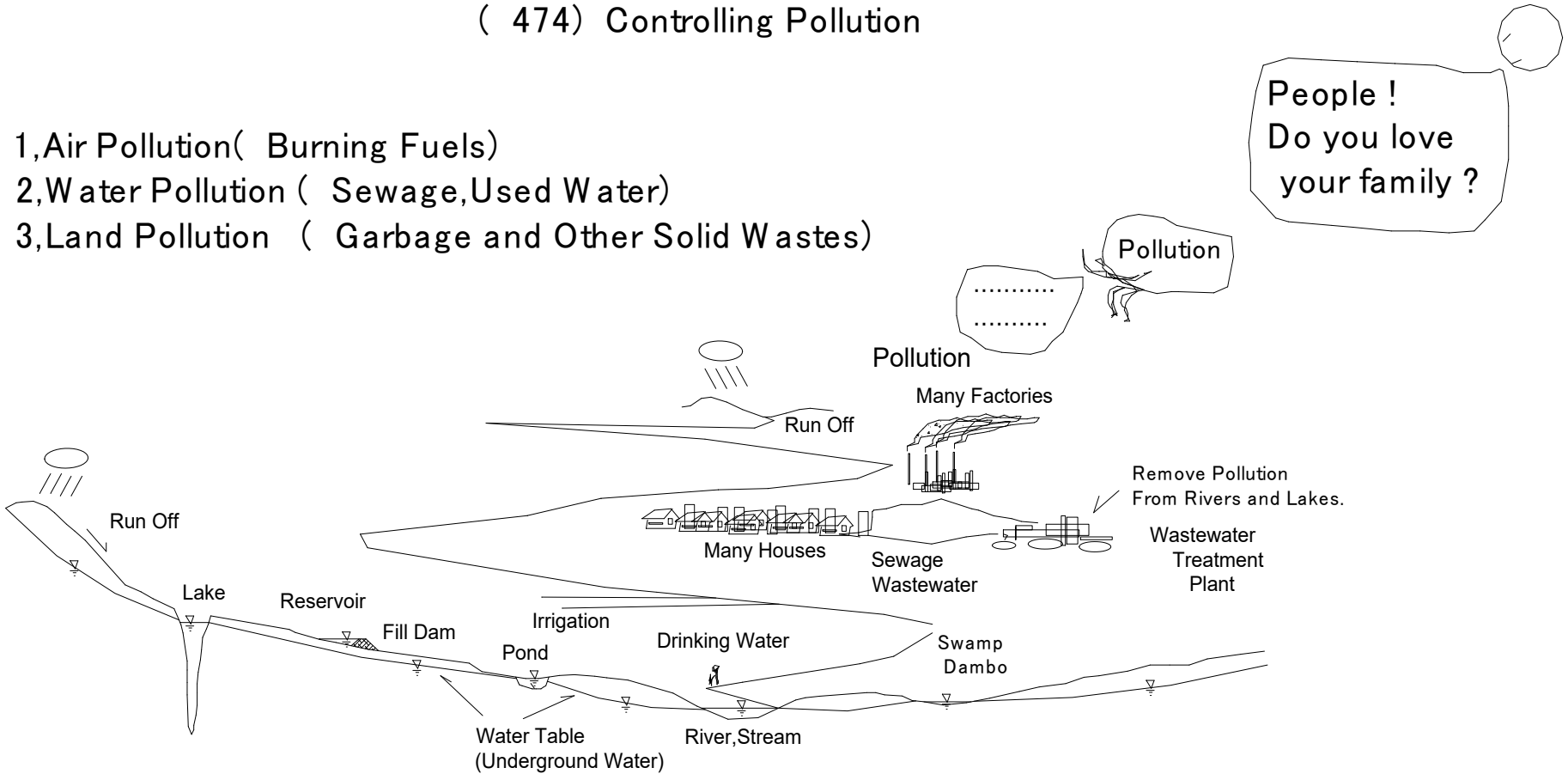
After construction
The land became wasteland and was useless to people.
Soil eroded from such land,then made streams and rivers muddy.

Grass is used to hold the soil in place.
Later,trees or crops may be grown in the soil.
Land become useful as parkland or farmland.



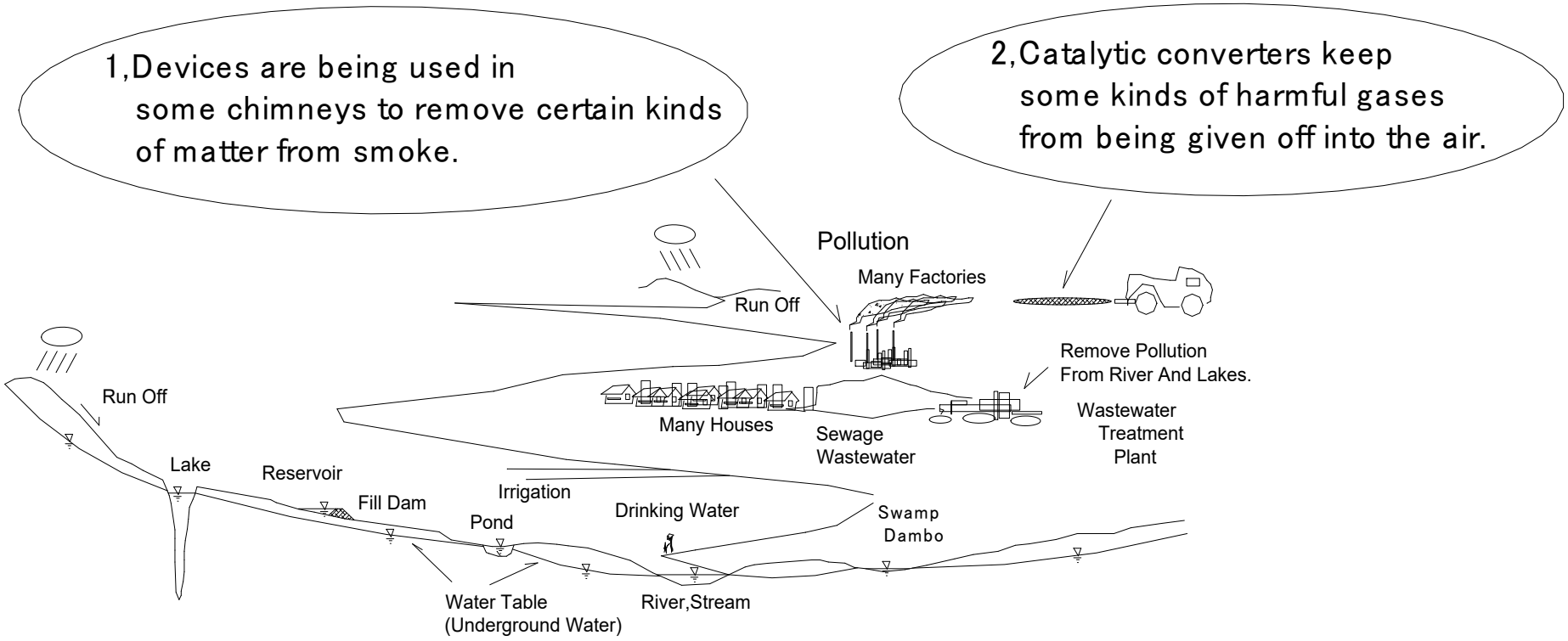
(474) Controlling Pollution

1,Air Pollution(Burning Fuels)
2,Water Pollution (Sewage,Used Water)
3,Land Pollution (Garbage and Other Solid Wastes)



(475) Controlling Pollution(Air Pollution)

Air Pollution(Burning Fuels)



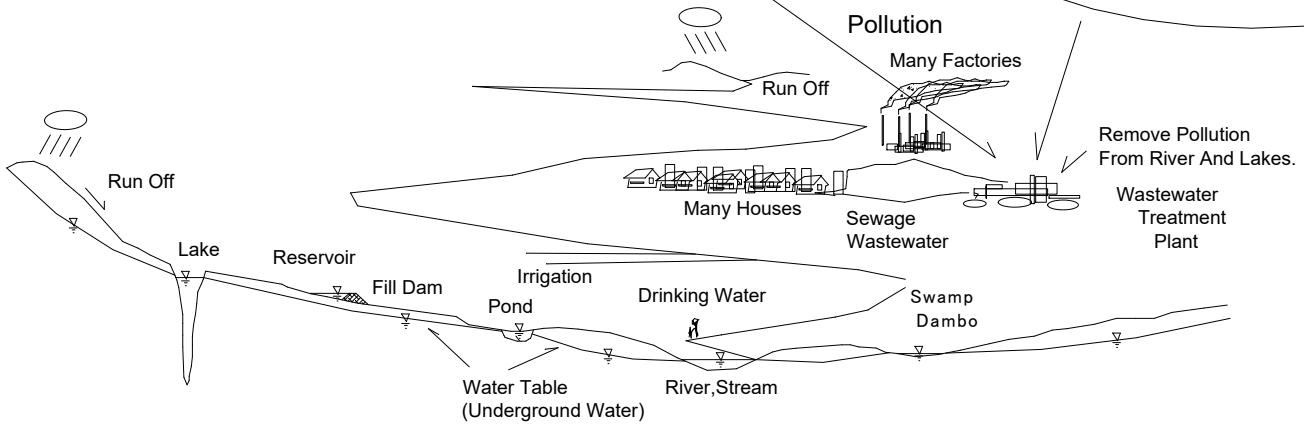
(476) Controlling Pollution(Sewage,Waste Water)

Water Pollution (Sewage,Waste Water)

Ladies And Gentlemen.
The Best Way Is
To Treat Water Carefully.

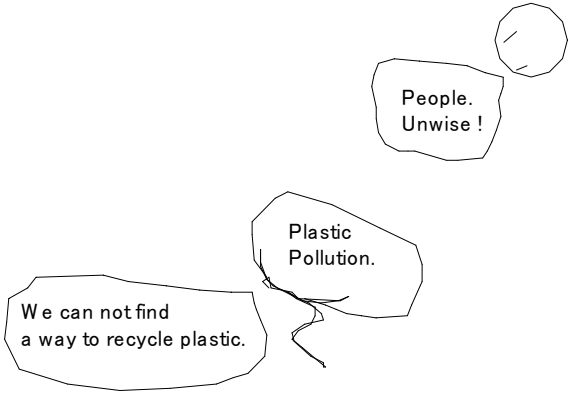
1,To control sewage
and other wastes
from getting into water.

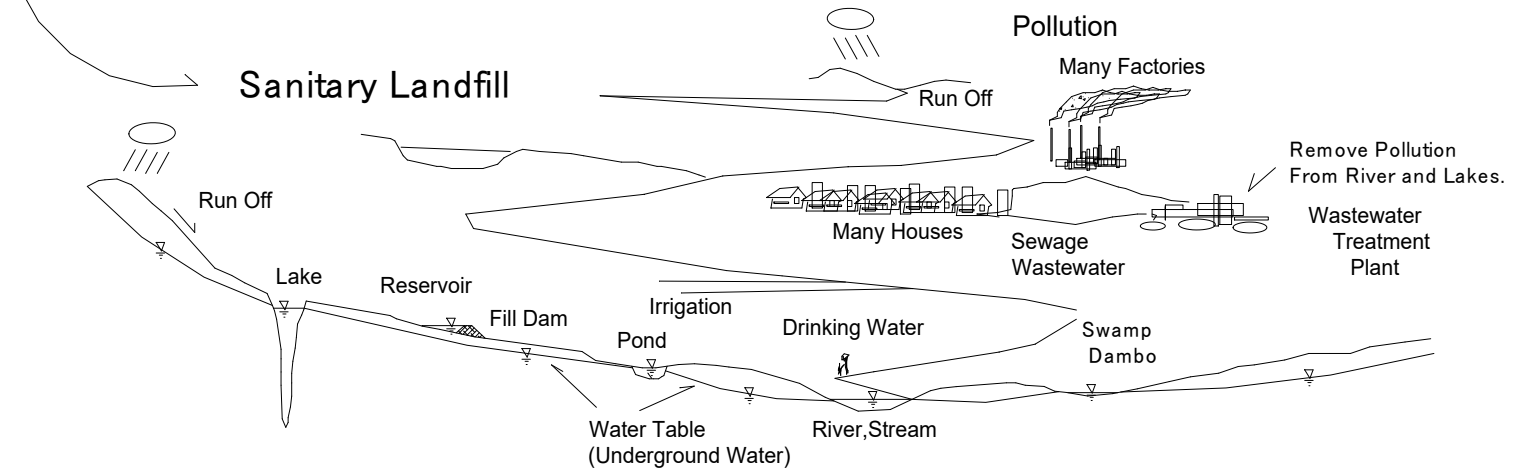
2,Waste water from factories
and water carrying sewage
must be treated
before the water is
put into a river or a lake.



(477) Controlling Pollution(Land Pollution)

Land Pollution (Garbage and Other Solid Wastes)
Food,cans,bottles,papers,plastic containers,and junk cars.
These dumps smell bad.
They provide food and homes for rats.
Some wastes can be recycled.(Sanitary Landfill)
These wastes break down and become part of soil.
But,Plastic does not break down,and does not become part of the soil.

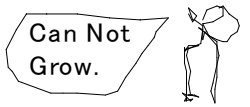


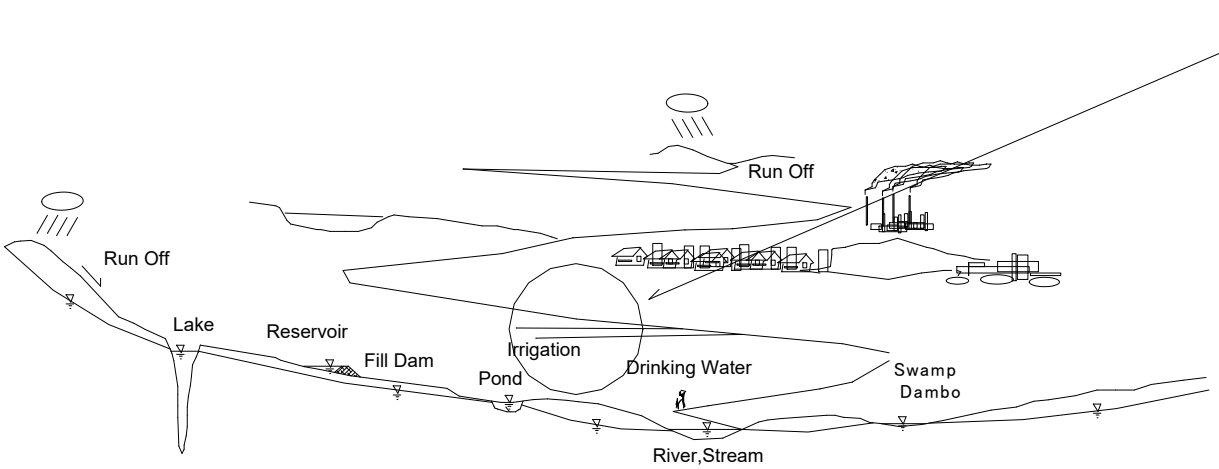


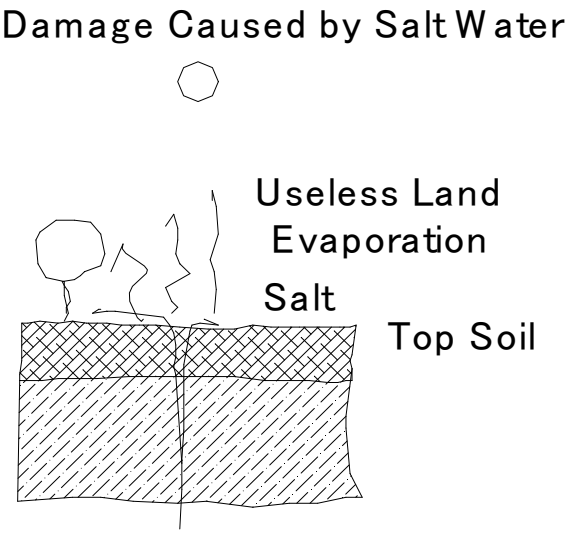
(478) Damage Caused By Salt Water

One problem is to develop farming on deserts.

1,All fresh water contains small amounts of salt.
2,When a river flows to the ocean,little of this salt remains on the land.
3,Most of the water used to irrigate desert farmland evaporates.
4,Desert farmland may become too salty for crops or any other plants to grow.





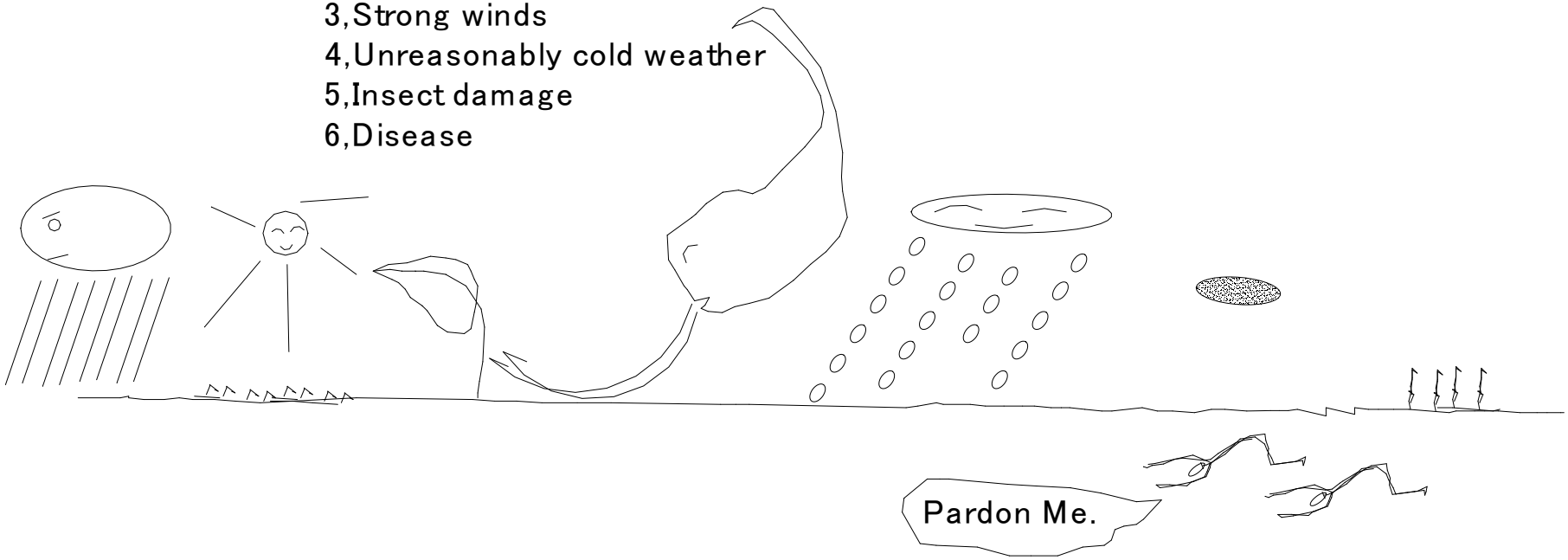


(479) Weather and Crops

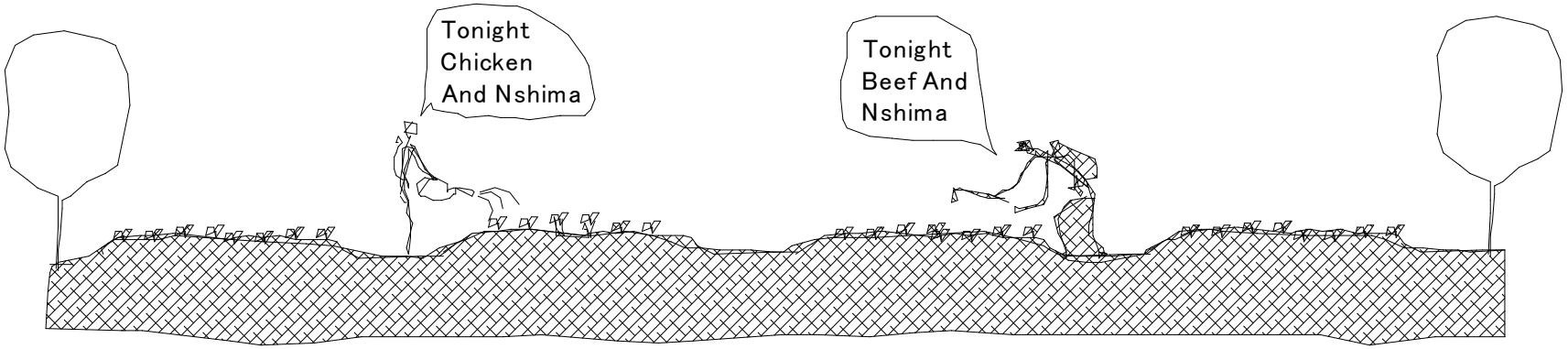
Crop Failure

Corn,wheat,and soyabeans are completely wiped out.

1,Too much rain
2,Too little rain
3,Strong winds
4,Unreasonably cold weather
5,Insect damage
6,Disease

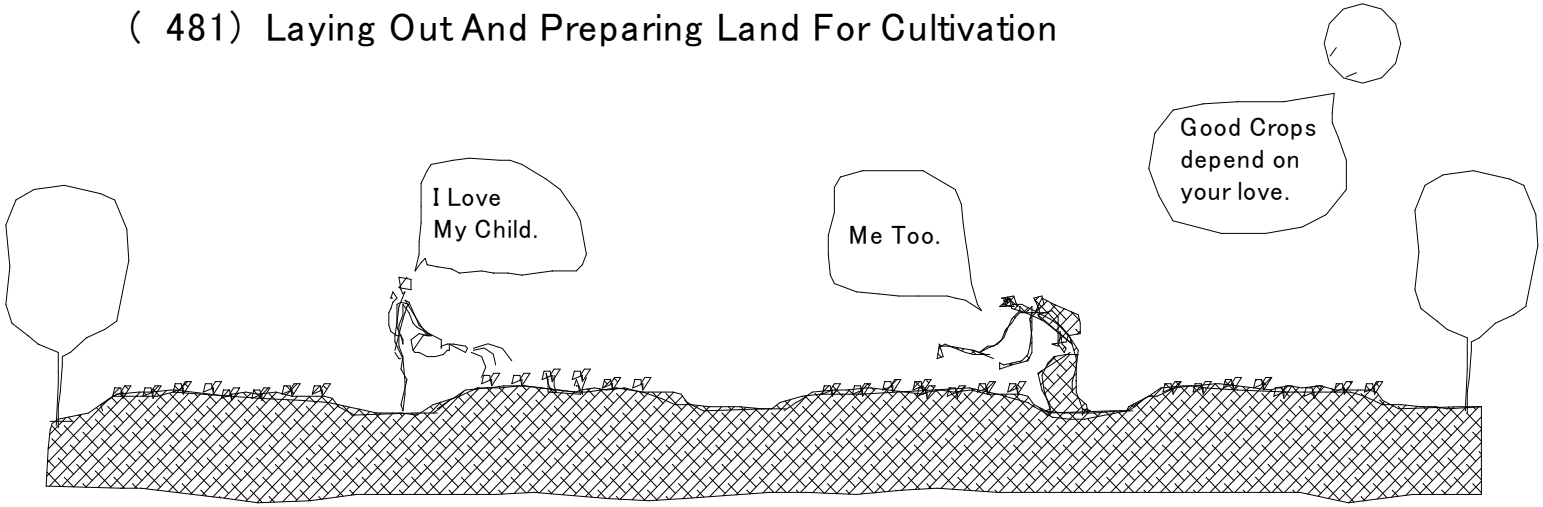


(480) Laying Out and Preparing Land for Cultivation



1,The soil must be loosened.
2,The soil must be moist,but not wet.
3,The soil must be aerated.
4,The soil must be fertile and living.

(481) Laying Out And Preparing Land For Cultivation

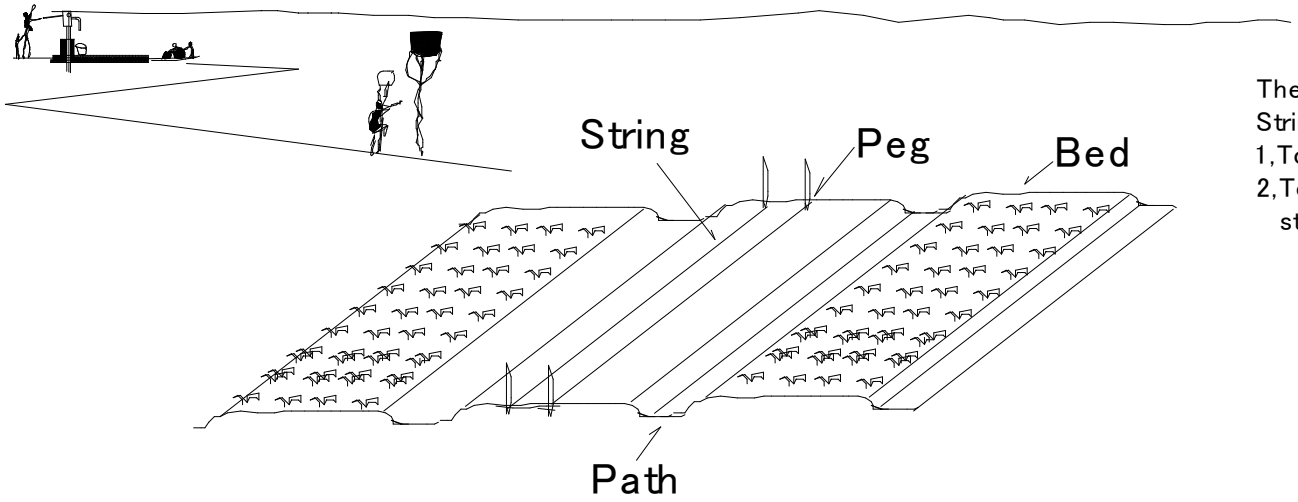


1,The soil must be loosened.
2,The soil must be moist,but not wet.
3,The soil must be aerated.
4,The soil must be fertile and living.

Conditions
1,Types of soil
Clayey soil,difficult to drain or hard to irrigate.
Sandy soil,water infiltrates easily.
2,Kind of manure
Mixed into cultivated soil.
Well-decomposed vegetable manure.
Lightly decomposed trash.
Compost.
Green manure,etc.

(482) Bed Preparation For Seasonal Crops

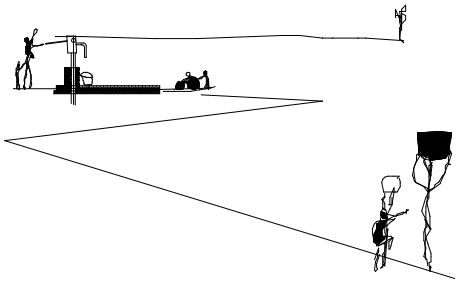
Vegetable Bed

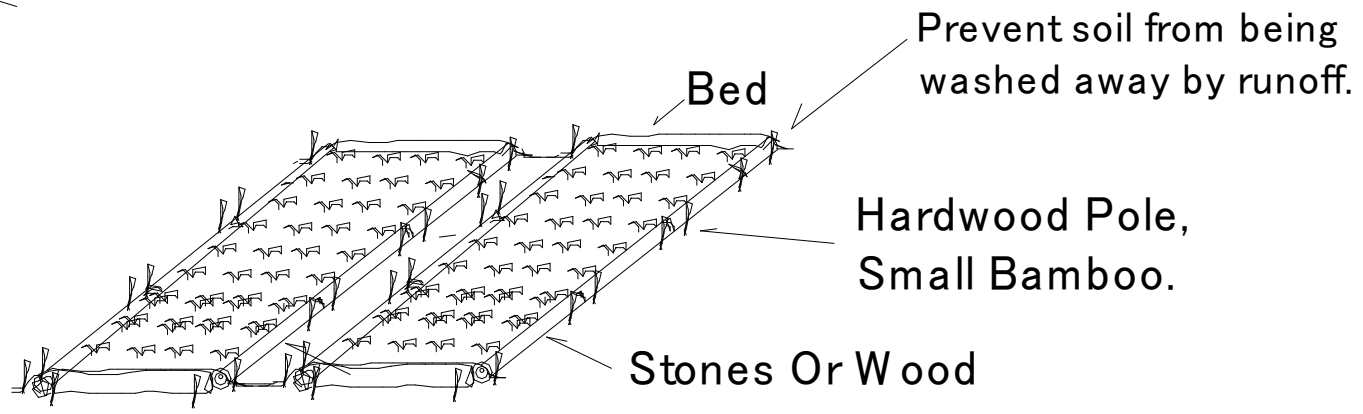


The beds are raised higher than the paths.
String
1,To Establish straight edges
2,To Level the surface of the patch in order to stop rain or irrigation runoff.

(483) Bed Preparation for Seasonal Crops(2)

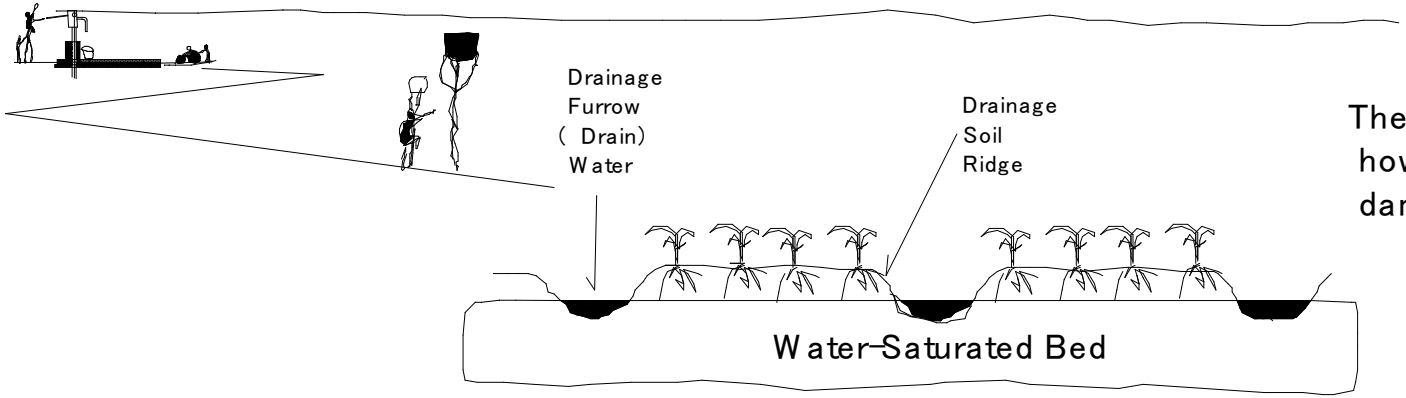
Vegetable Bed





(484) Bed Preparation For Seasonal Crops(3)

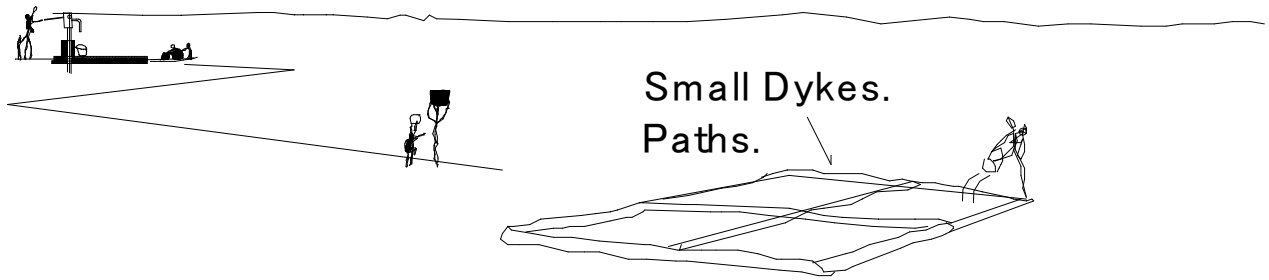
Cultivated Bed



The problem is one of drainage and how to let water flow without damaging the roots.

(485) Bed Preparation For Seasonal Crops(4)

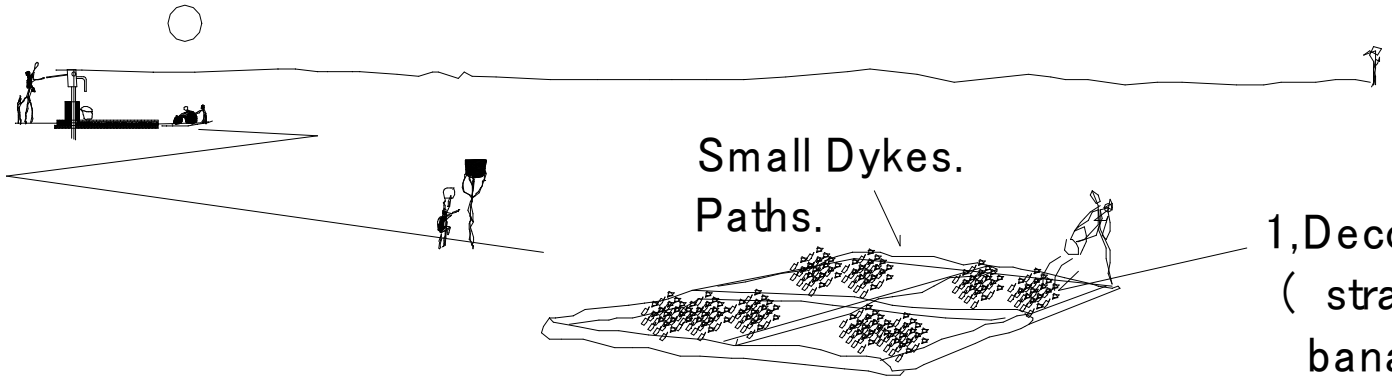
Cultivated Bed(Sunken Beds)



1,Small dykes (paths) are built to prevent rain and irrigation water from leaving the beds.
2,The beds are levelled so that water spreads evenly over the whole surface.

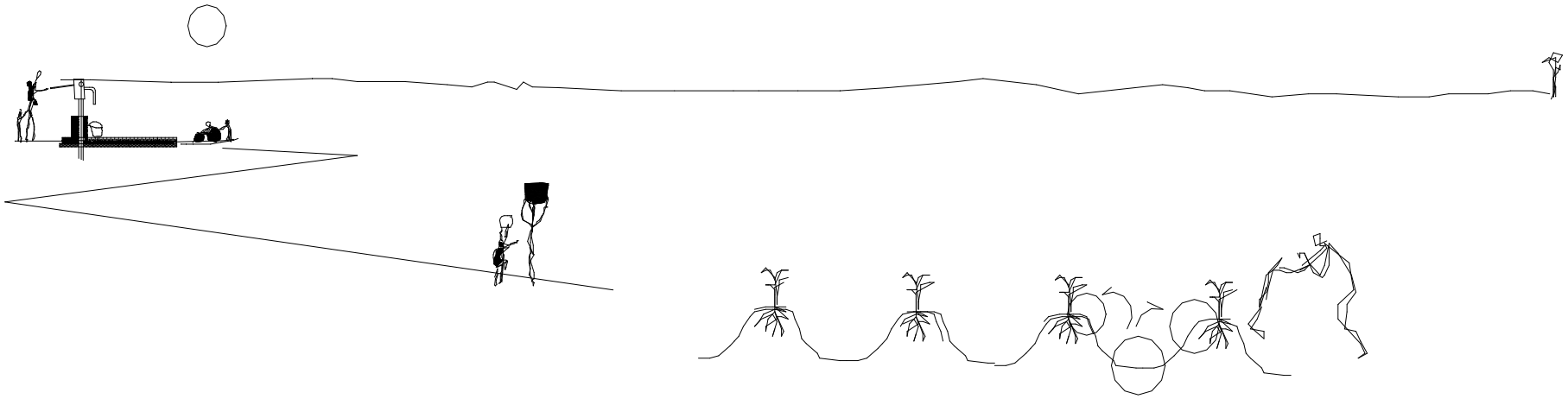
(486) Bed Preparation For Seasonal Crops(5)

Cultivated Bed(Sunken Beds)



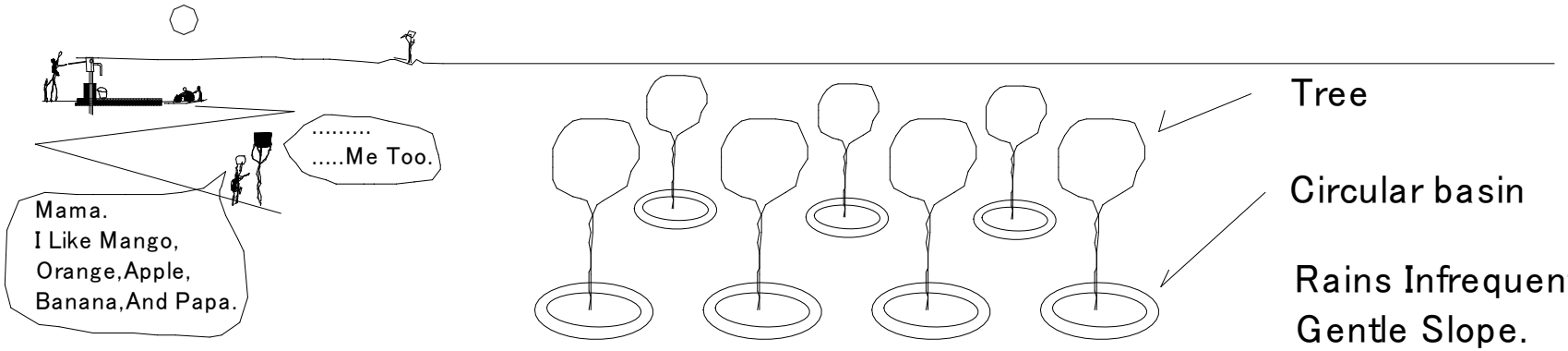
(487) Bed Preparation For Seasonal Crops(6)

Cultivated Bed(Earth Up)

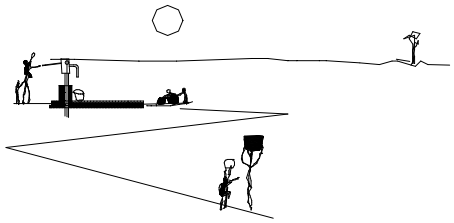


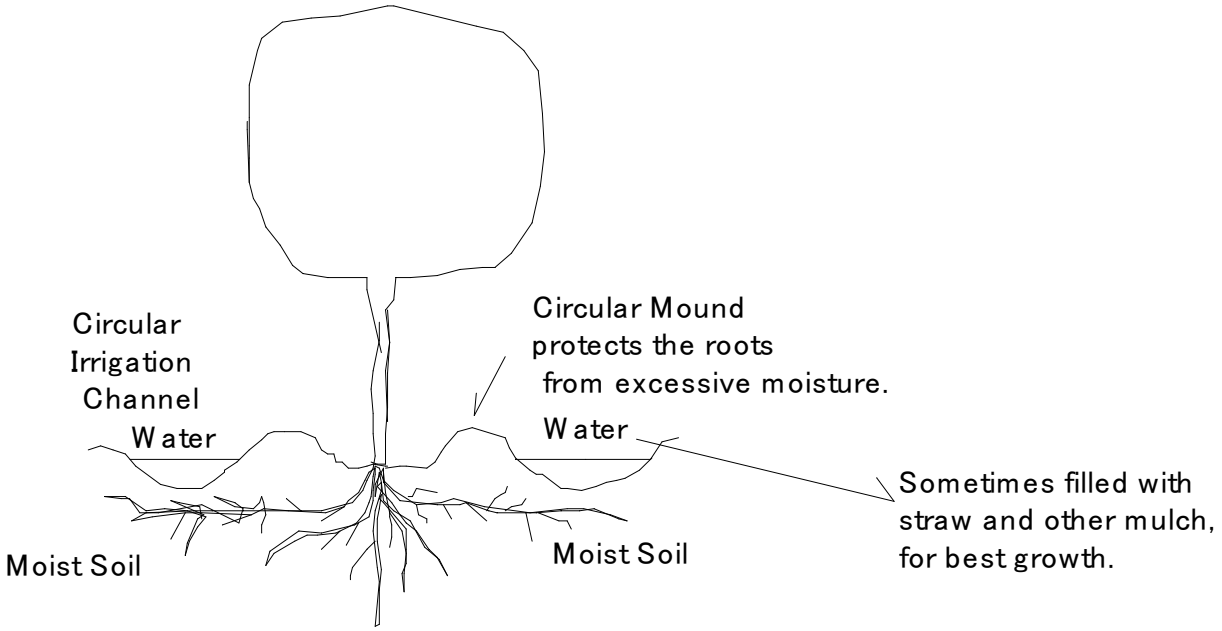
(488) Bed Preparation For Seasonal Crops(7)

Cultivated Bed(Trees)



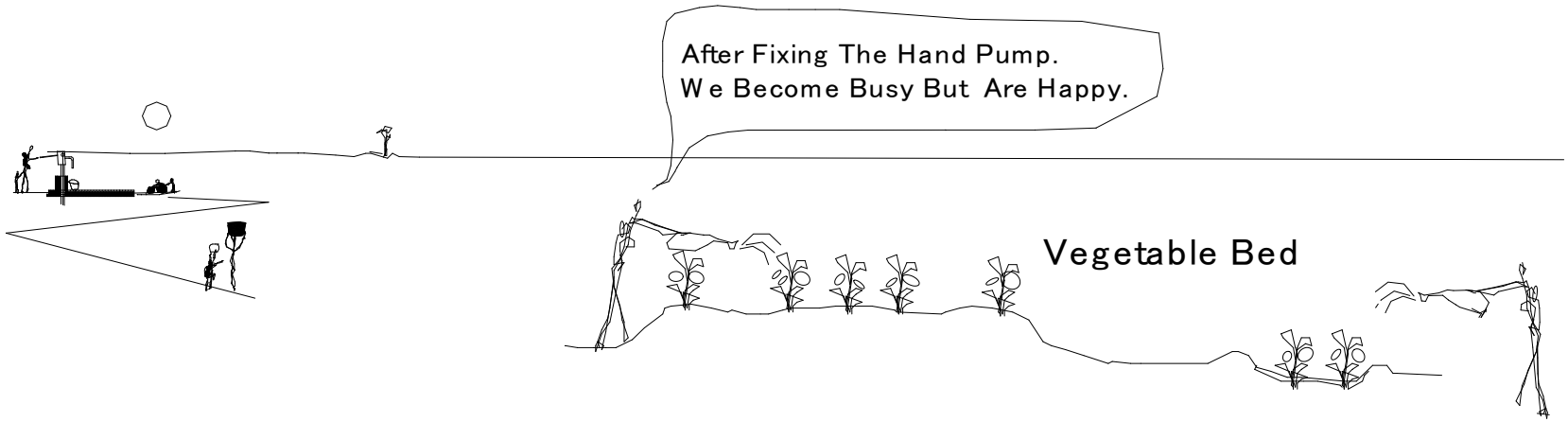
(489) Bed Preparation For Seasonal Crops(8)
Cultivated Bed(Orange Tree)





(490) Bed Preparation For Seasonal Crops(9)

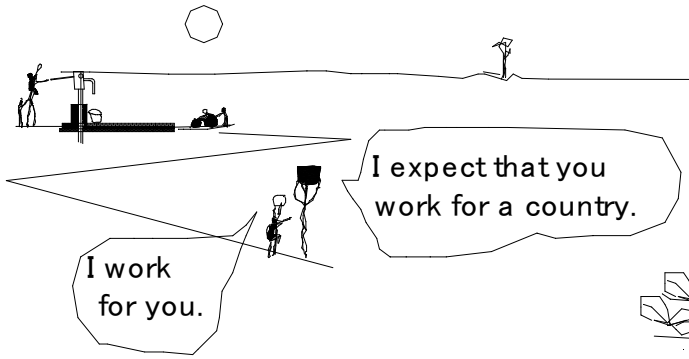
Egg Plant

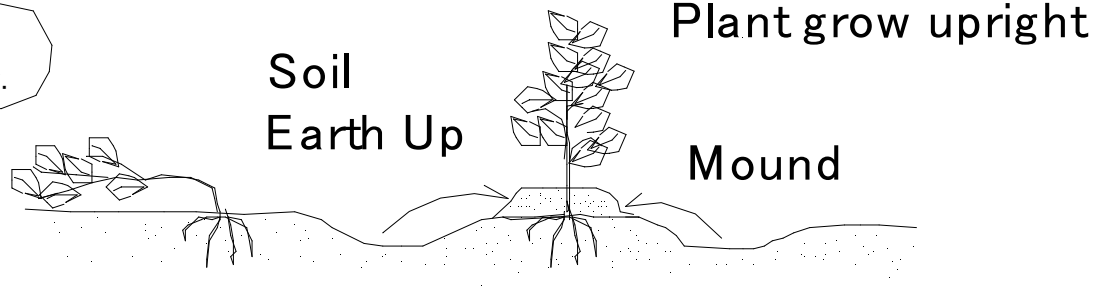


Irrigation water poured into soil.

EggPlant is planted in shallow holes that are watered daily.

(491) Earthing Up(1)

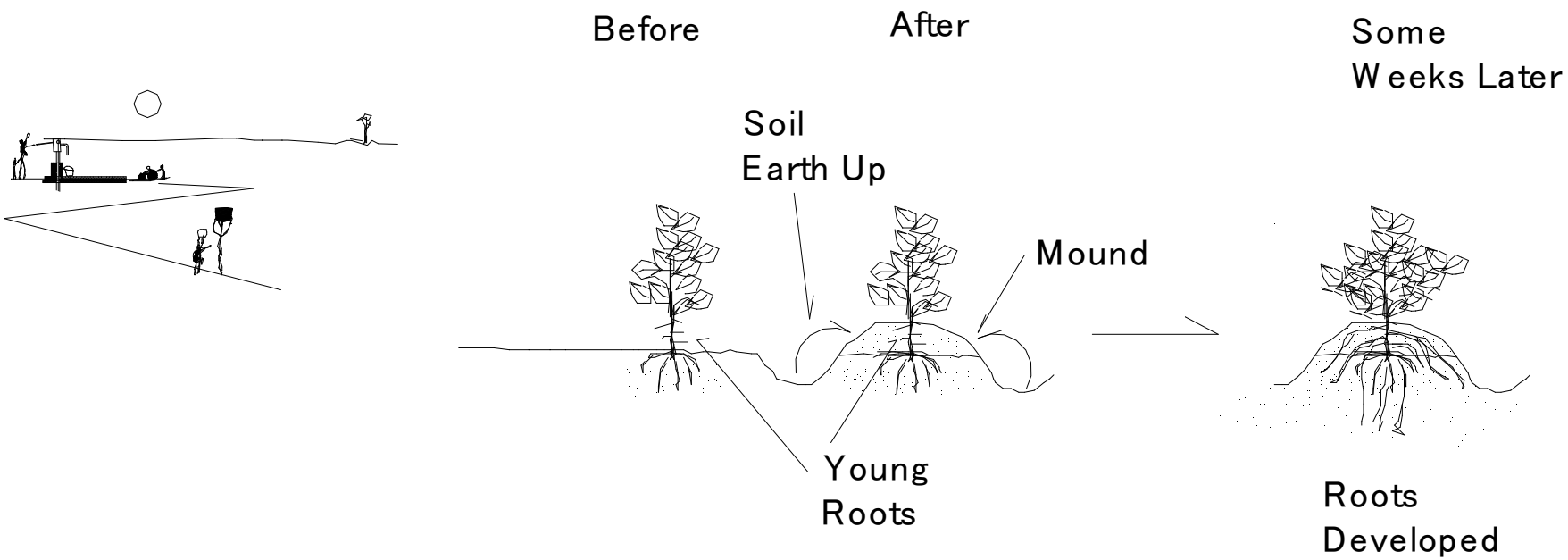




Before Earthing Up

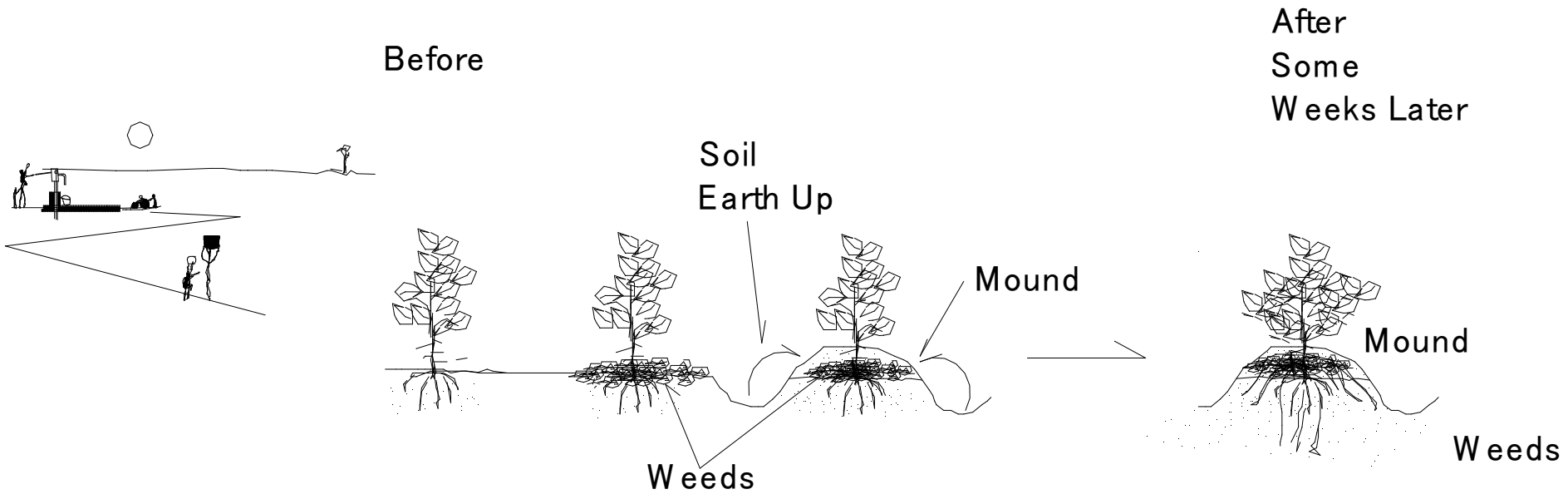
After Earthing Up

(492) Earthing Up(2)

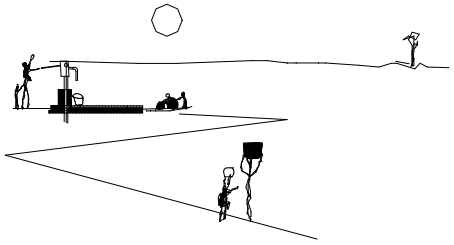


(493) Earthing Up(3)

The weeds are buried under the mound.
They rot there and improve the soil structure.



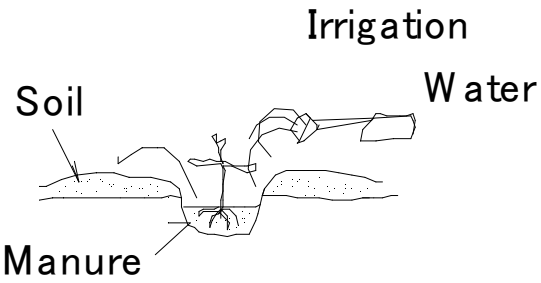
(494) Earthing Up(4)
Transplants



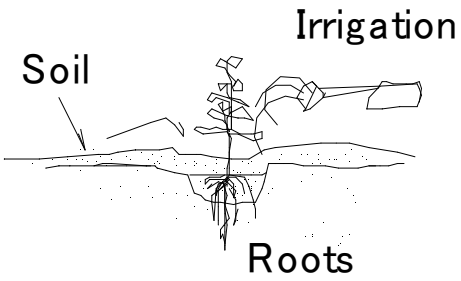
When Transplants

some weeks after Transplants

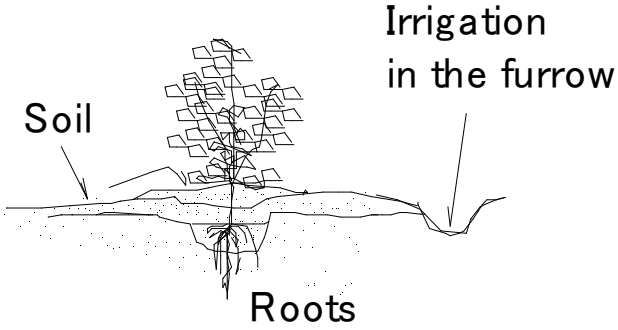
Later Still



The seedling is transplanted into a small trench.

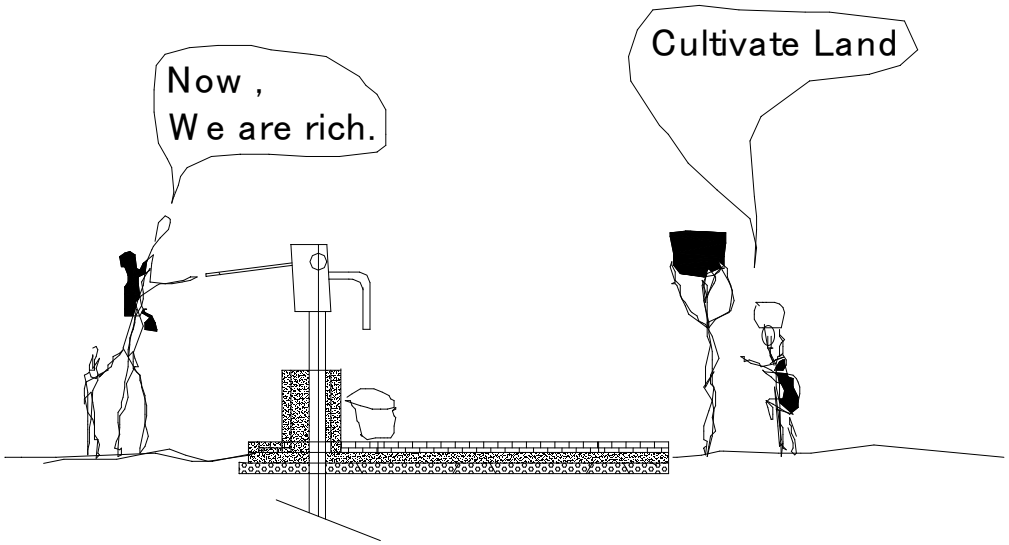


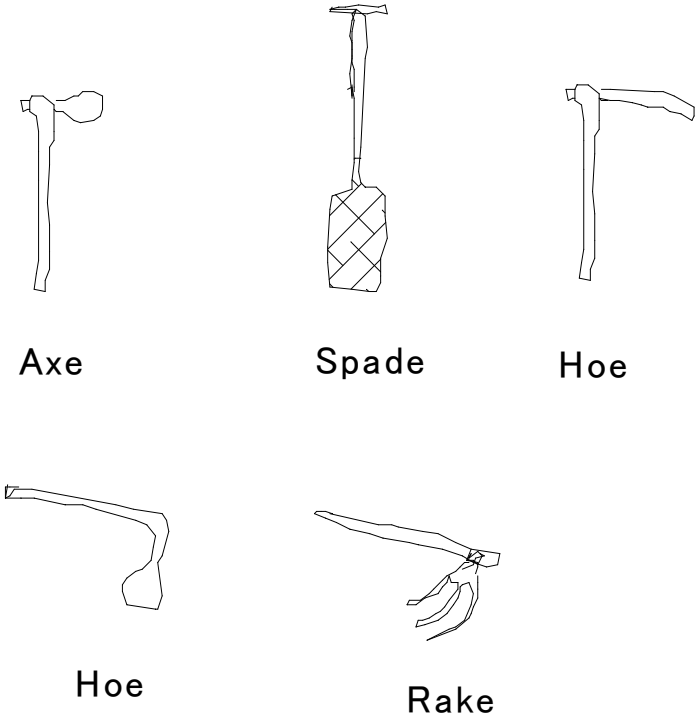
Roots develop in the soil.



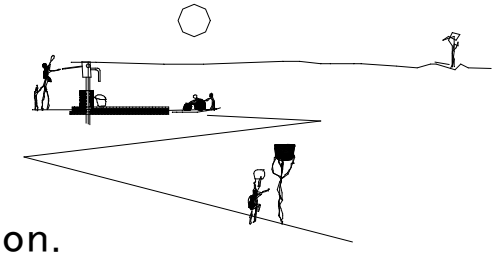
Roots are well established and they nourish the plant actively.

(495)Some Gardening Tools

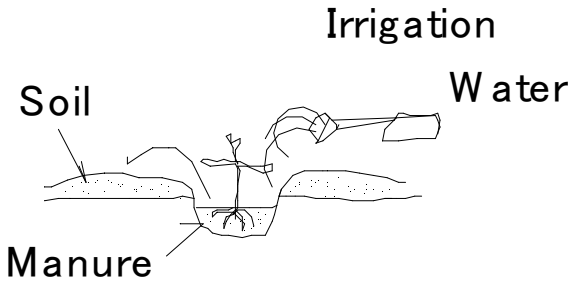




(496) Planting Holes(1)

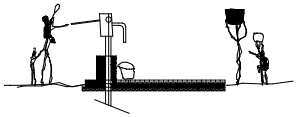


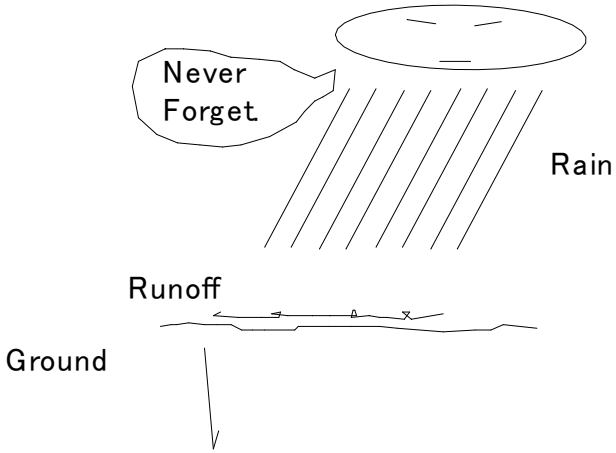
When planting trees.
Planting hole is filled with loosened soil.
50cm-70cm ,width ,depth.
Holes are dug before planting ,after beginning of rainy season.
At planting time,the soil is aerated and fertilized.



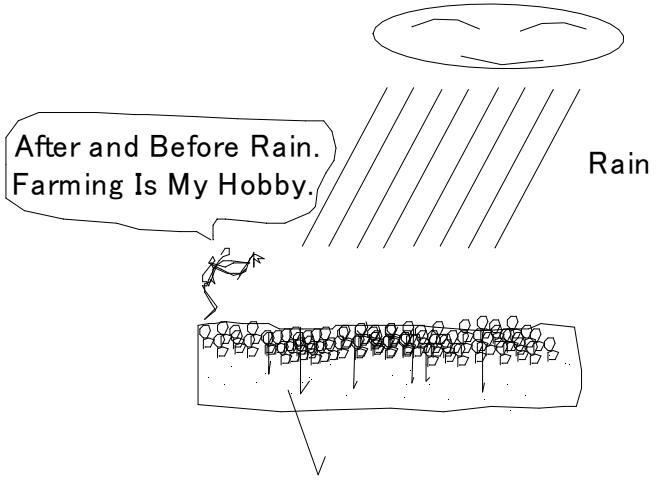
1,Dig a hole,some weeks
before planting time.
2,Improve the soil in the hole
by mixing it with plant or
animal manure before planting.
3,At planting time,fill the hole
with enriched ,well structured soil.

(497)The effects of hoe cultivation





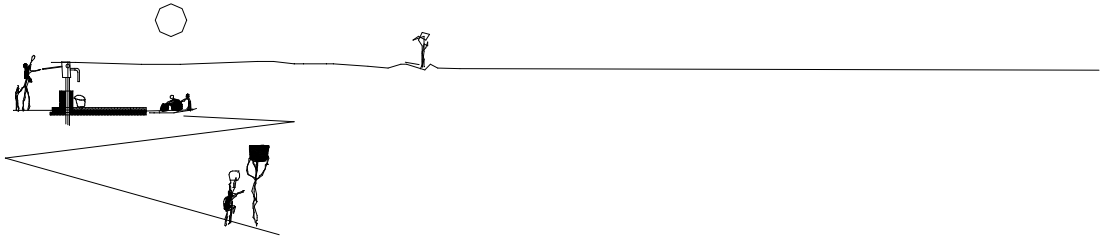
Impermeable Soil.
Erosion.
Soil particles are washed down.

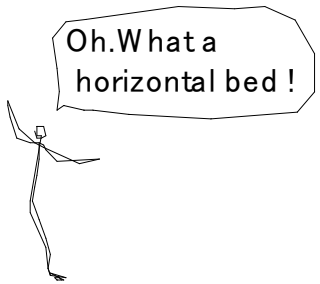


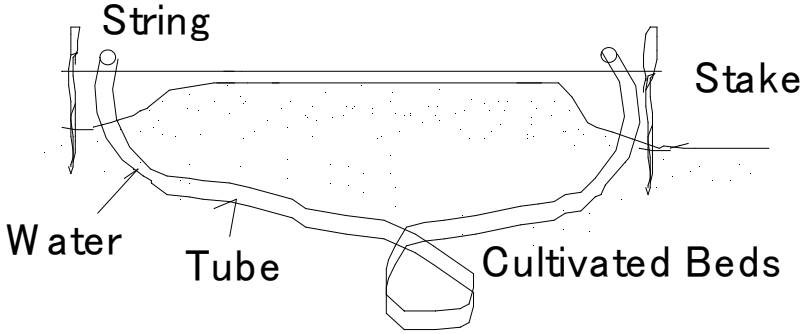
Permeable Soil.
Infiltration.
Protect from overheating.
Reduce evaporation .

(498) levelling cultivated Beds(1)

1,Levelling by
means of a level.

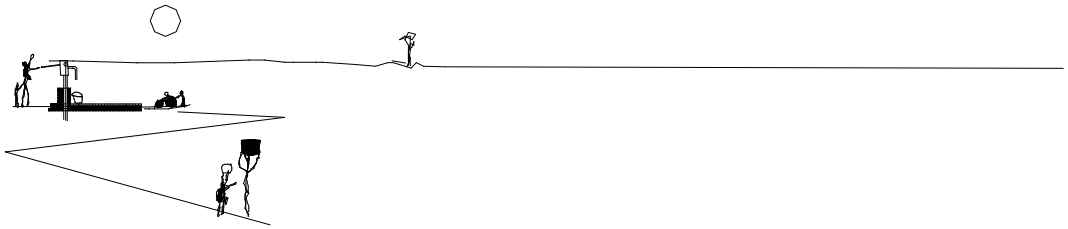


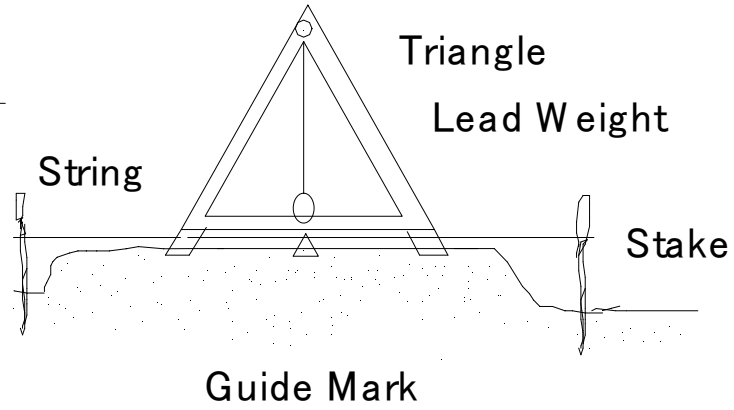




(499) levelling cultivated Beds(2)

1,Levelling by
means of a triangle.

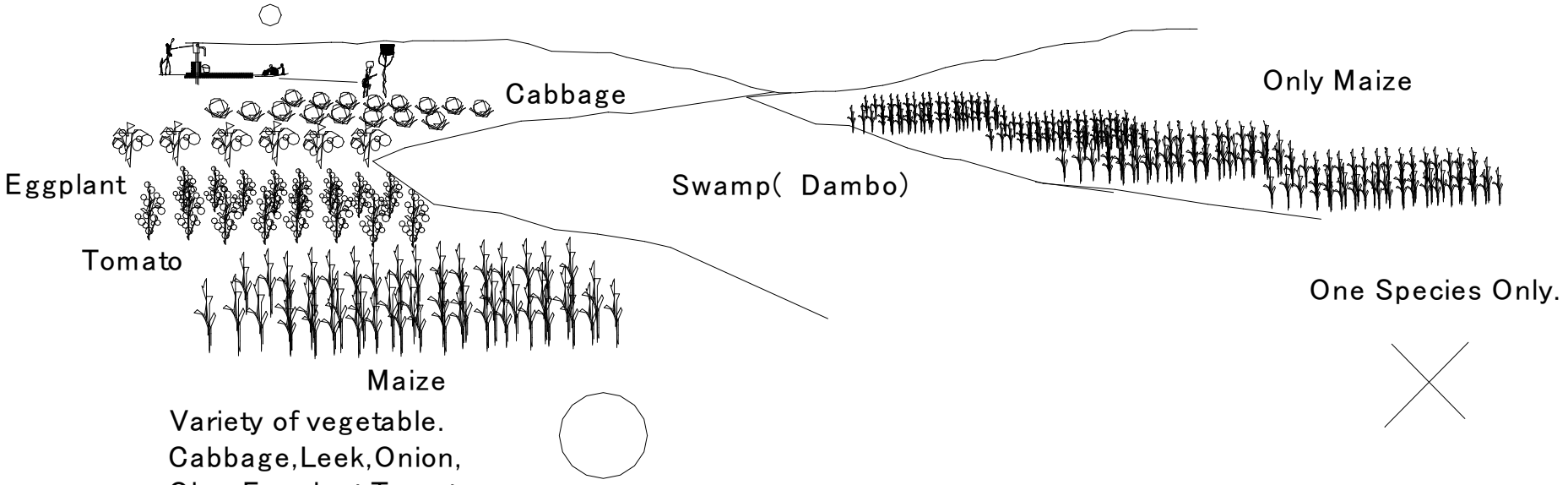




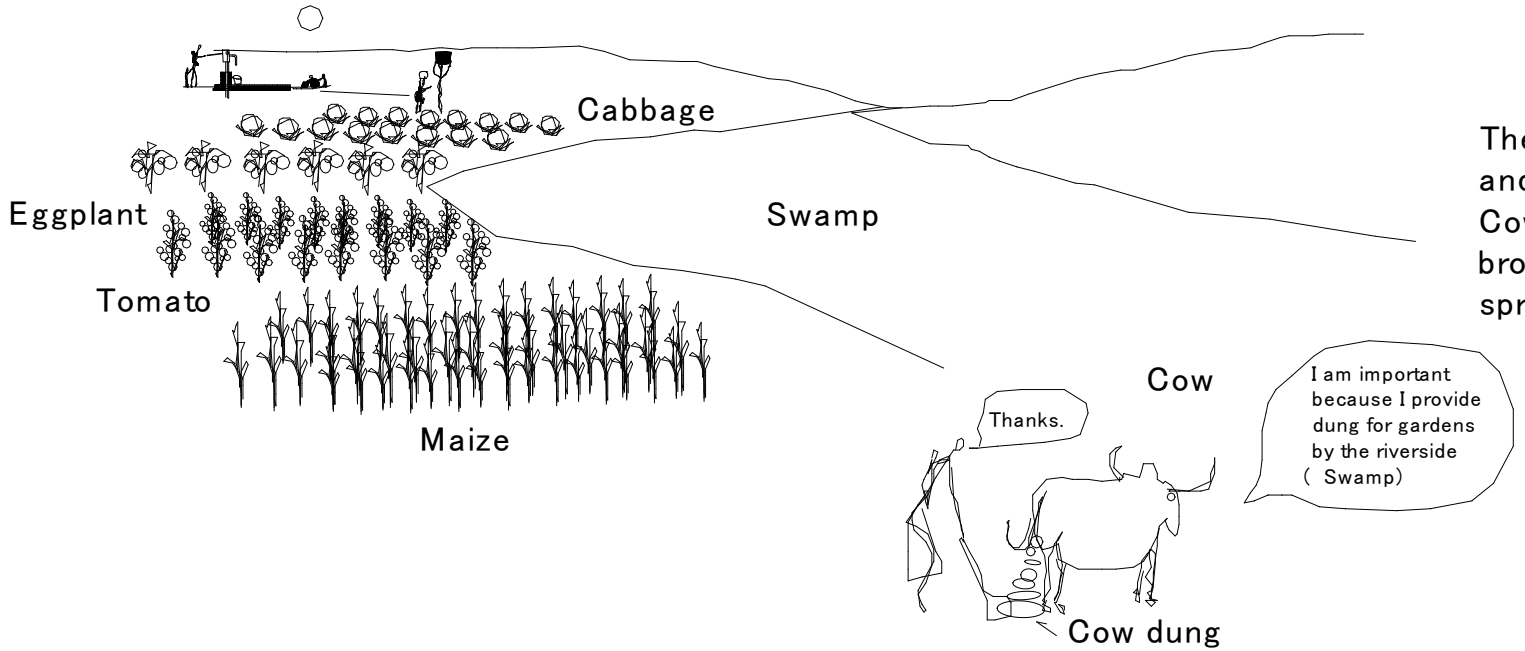
Cultivated Beds

(500) Vegetable Garden(1)

(500) Vegetable Garden(1)

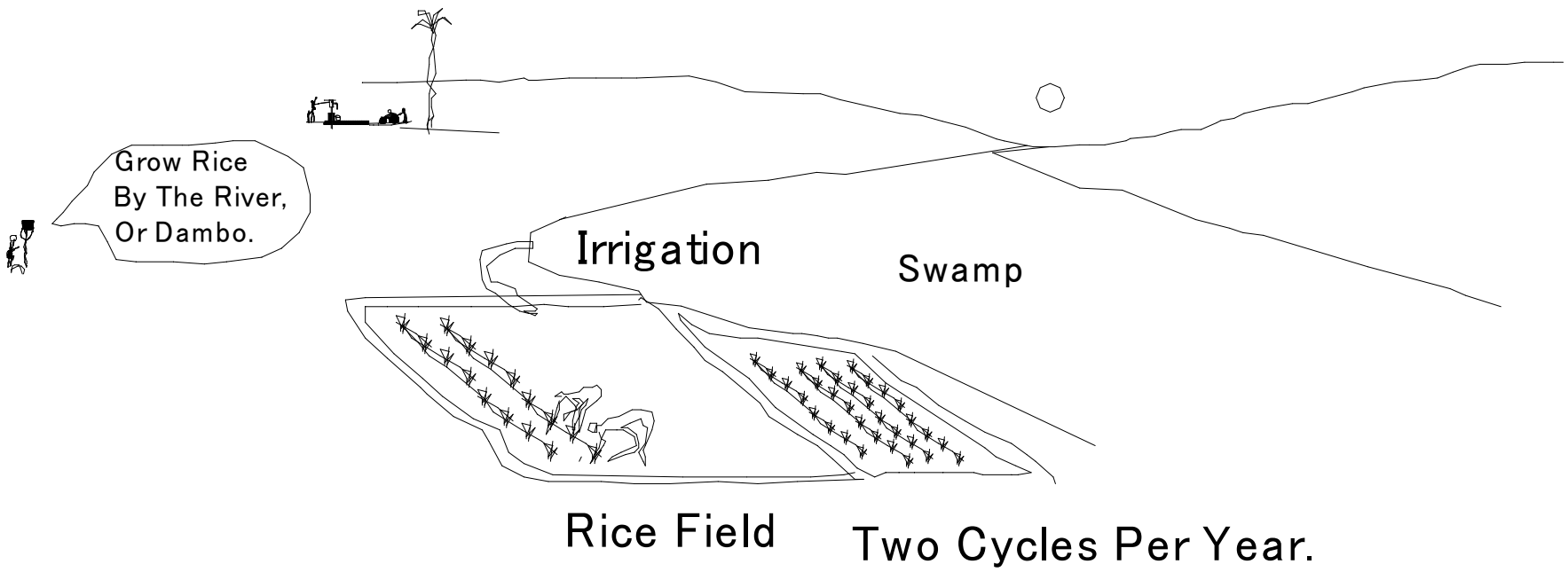


（ 501）Cattle In The Vegetable Garden

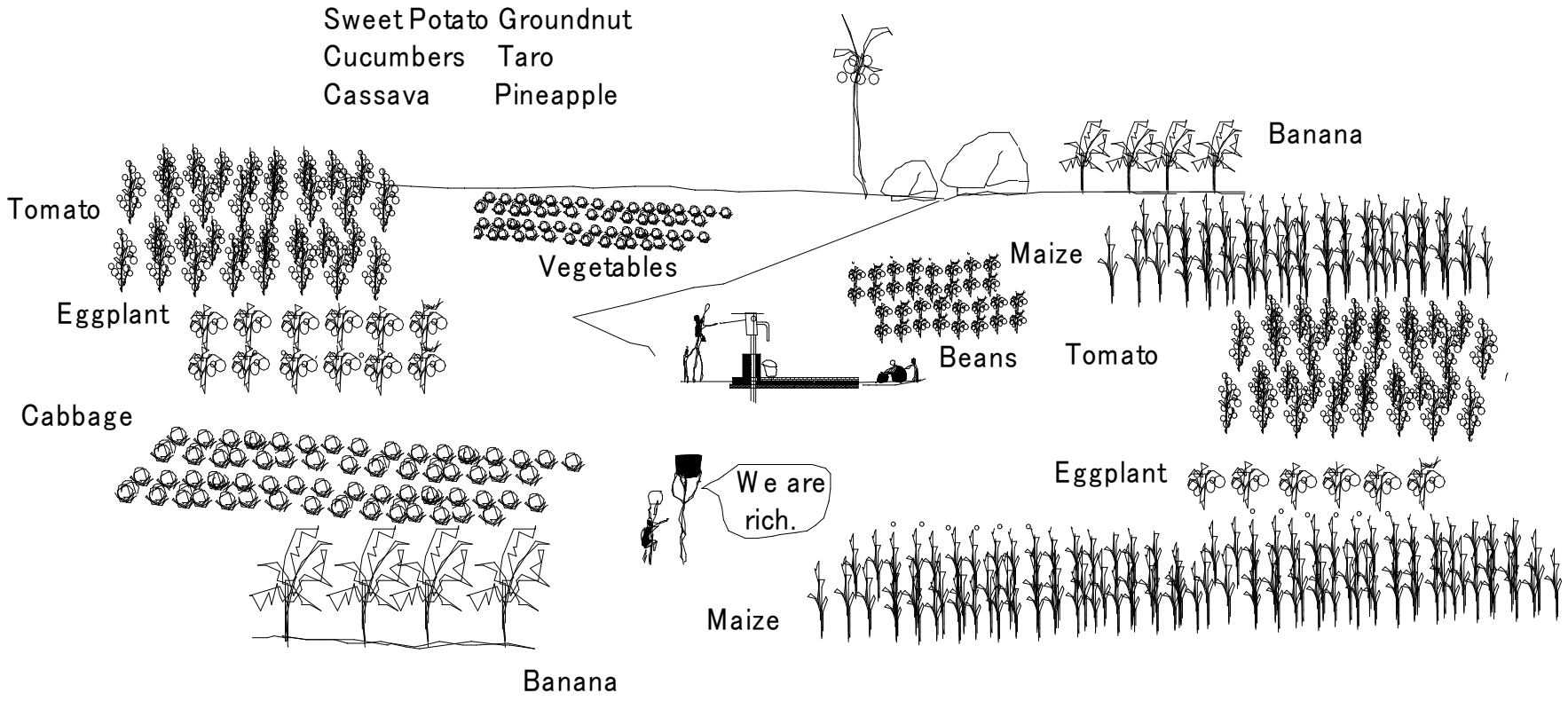


The soil is sandy and poor. and needs fertilizing.
Cow dung is collected,then brought to the garden and spread on the beds.

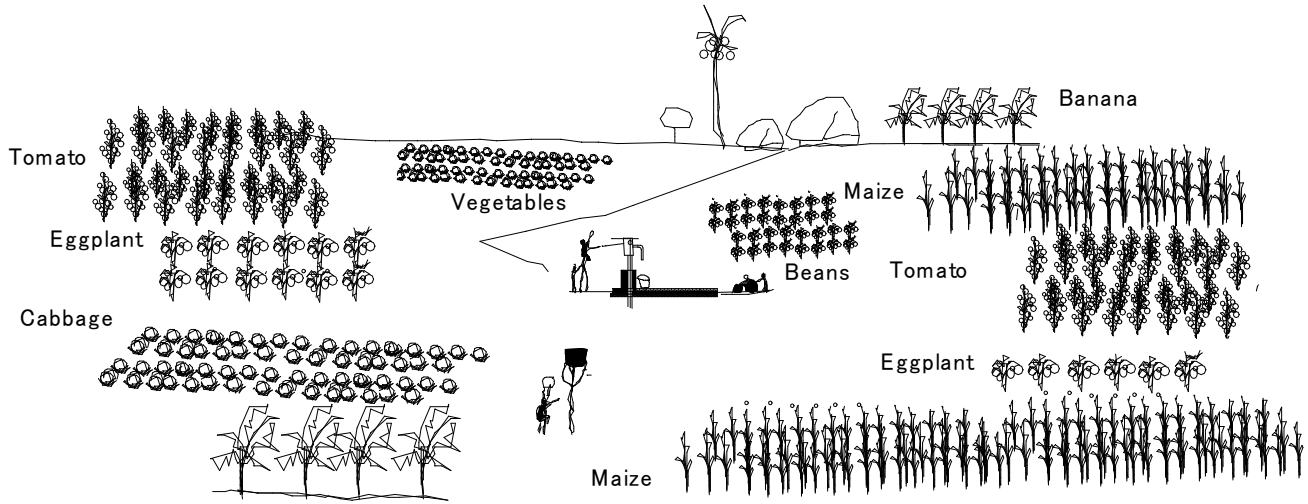
(502) Rice Field

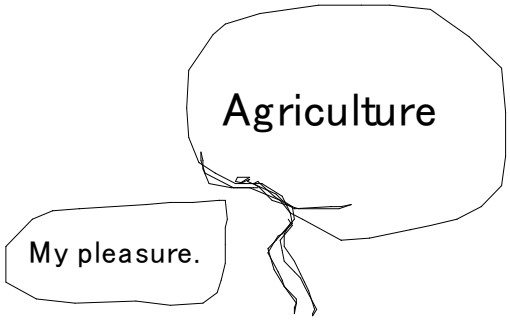


(503) Dividing up the land .The occupation of land surface space.



（ 504）An agricultural production system

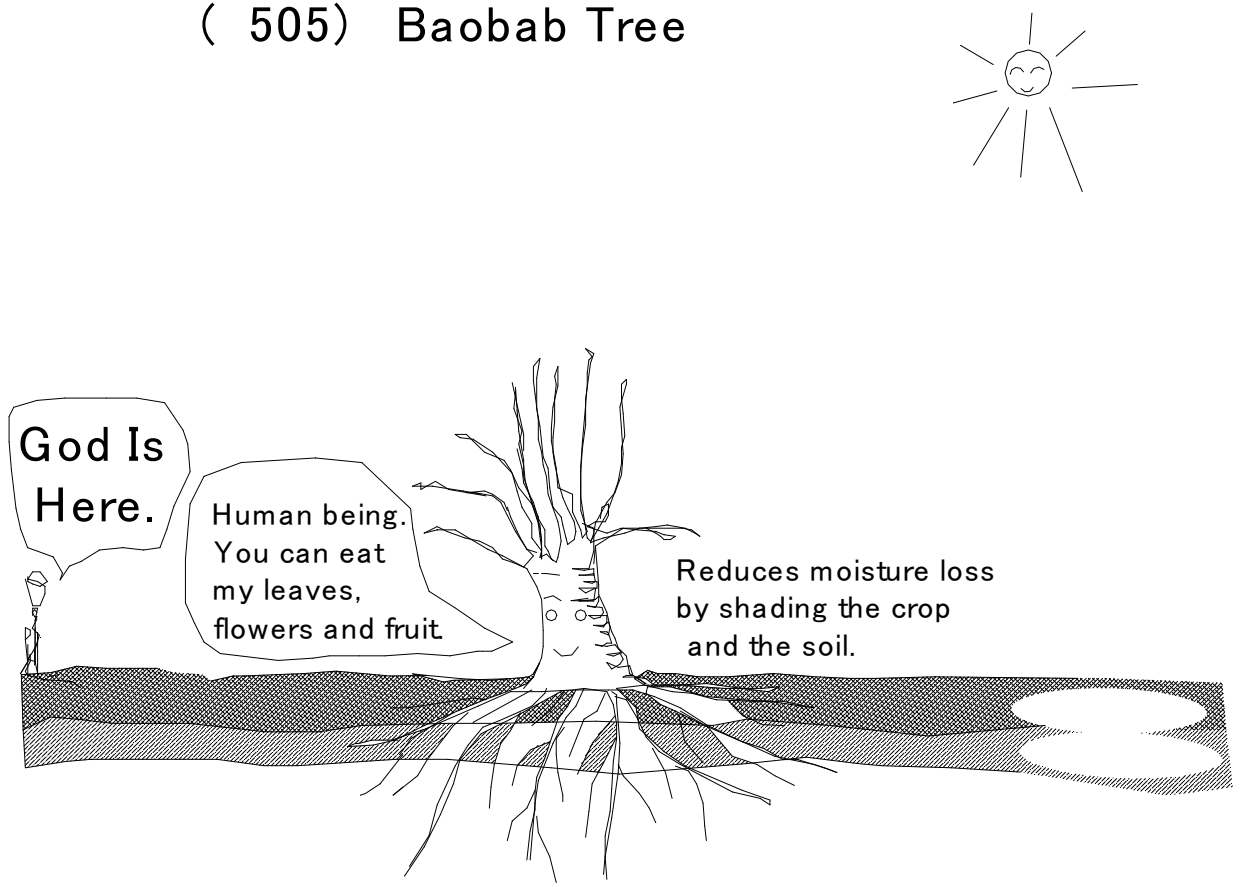




1,Avoid wasting land resources.
2,Preserve and improve soil structure.
3,Preserve soil fertility.
4,Avoid erosion.
5,Use fertilizers efficiently.
6,Reduce problems caused by climate and pests.
7,Use of available labour for planting,maintenance and harvesting efficiently.
8,Reduce economic risks.(price,transport,etc)
9,Divide the land.(staples,fruit,vegetables)

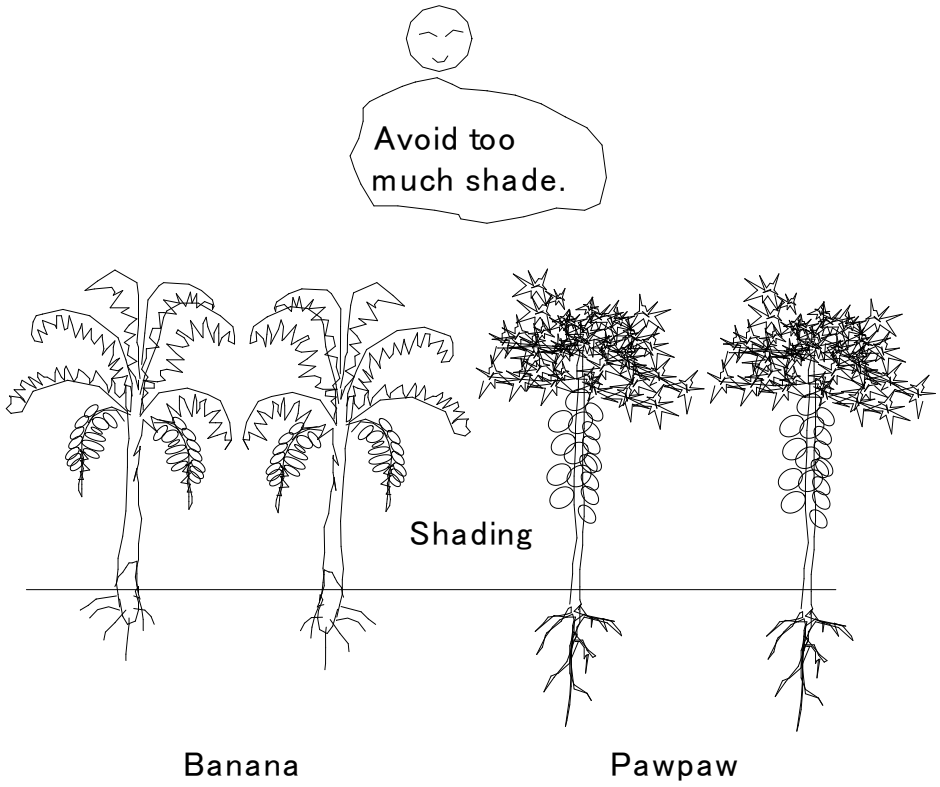
505 Baobab Tree

（ 505） Baobab Tree



BaoBab Tree

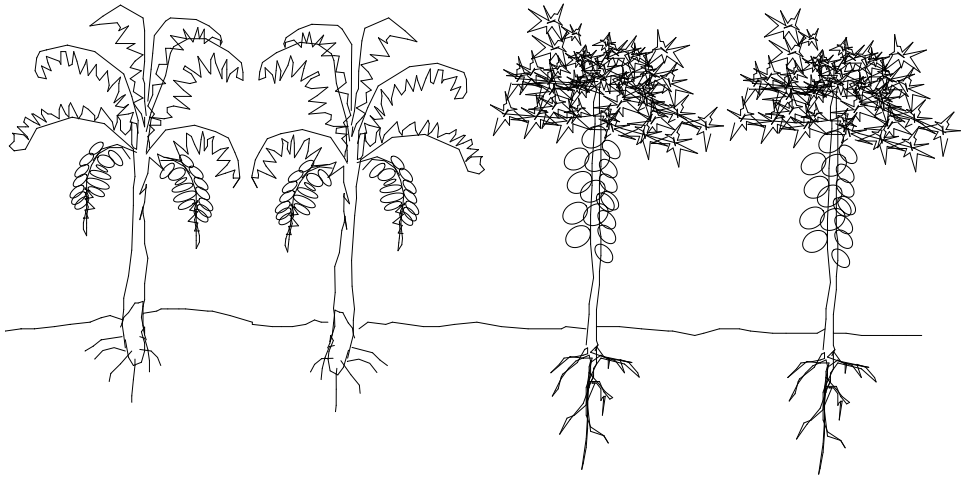
（ 506） Banana And Pawpaw



(507) Banana And Pawpaw(2)

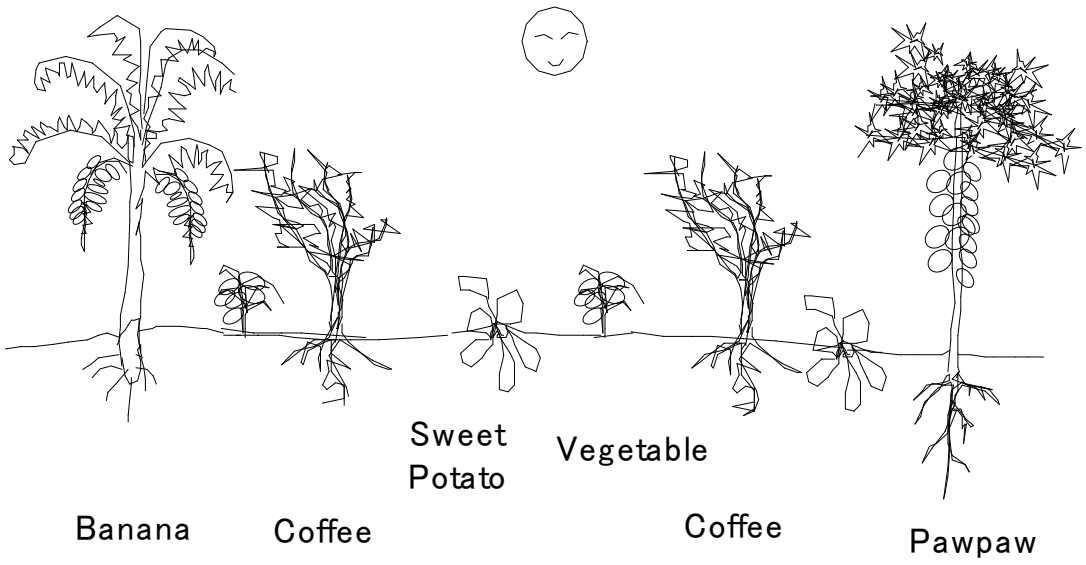
Banana and Pawpaw

1.Produce Organic Matter.
2.Rot .
3.Gives shade.
4,Reduces heat and cold.
5.Gives ground cover during heavy rains.
6.Reduces evaporation.
7.Reduces the risk of drought.



Banana Pawpaw

(508) Banana And Pawpaw(3)

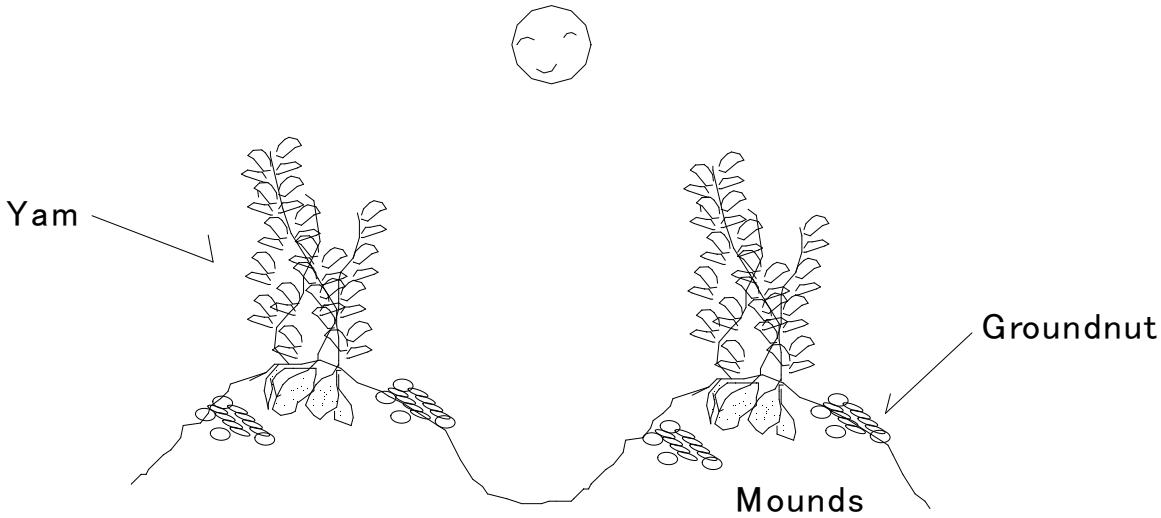


Top Storey(Banana,Pawpaw)

Intermediate Storey(Coffee)

Understorey
(eggplant,taro,sweet potato, lettuce,
cabbage,tomato,okra,bitter leaf,pigeon pea
cassava leaves,and yam.)

(509) Yam And Groundnut



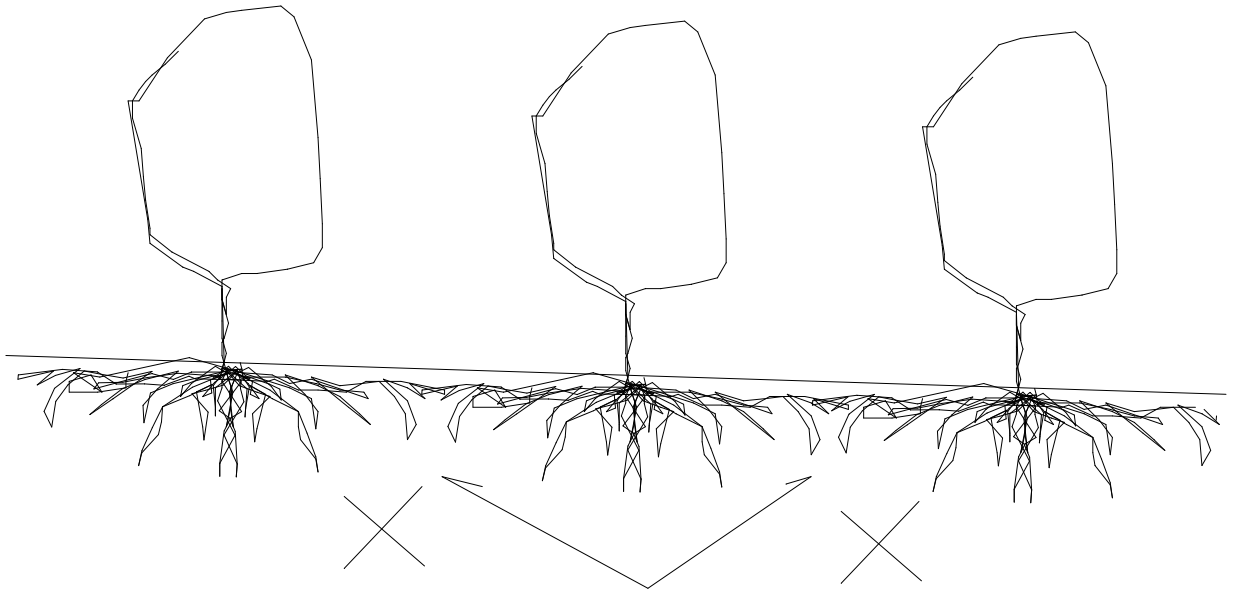
Yam

1.Yam needs plenty of light,
well drained soil and leaves prefer light.
2.Yams should be planted on hill.
3.Yam needs loose,well-drained soil.

Groundnut

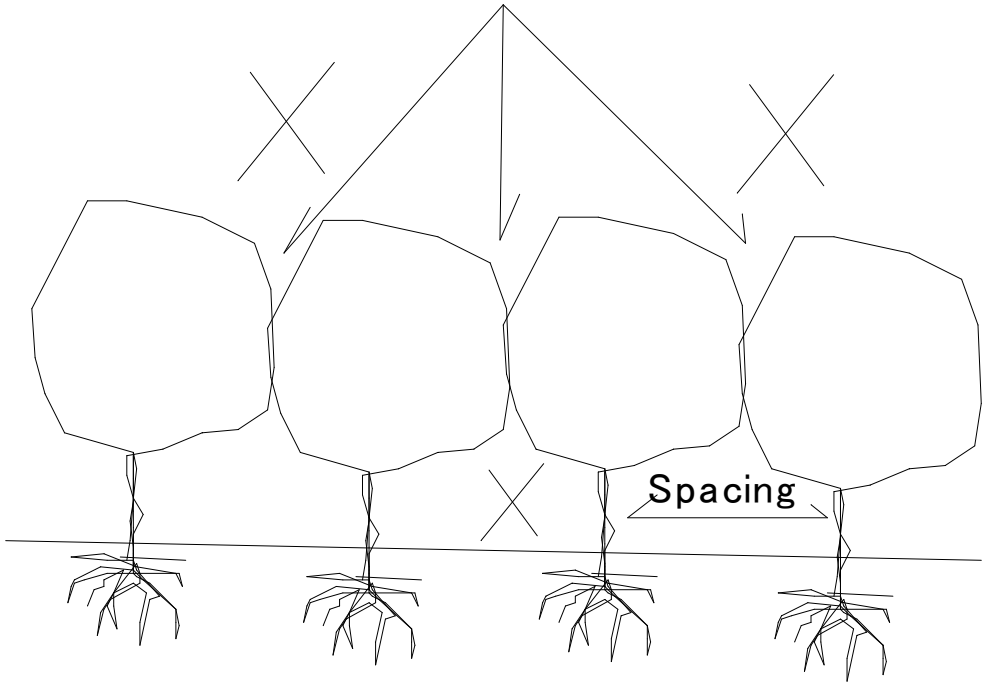
1.Groundnut requires exposure to sun and
grows well on the sides of the yam hills.

(510) Two Ways Of Deciding Plant Spacing(1)

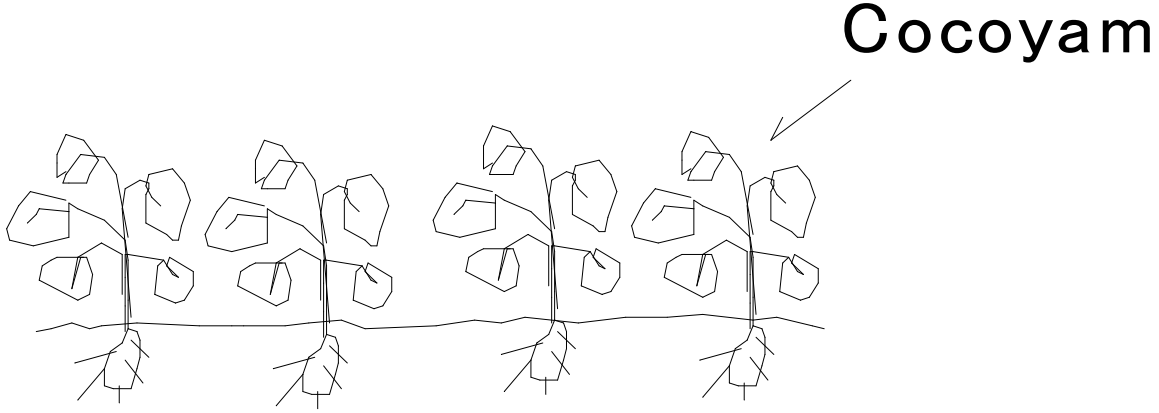


(511) Two Ways Of Deciding Plant Spacing(2)

The crowns touch one another.

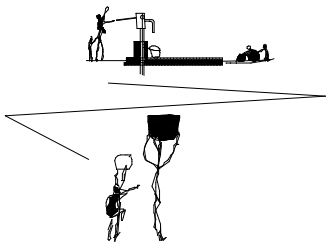


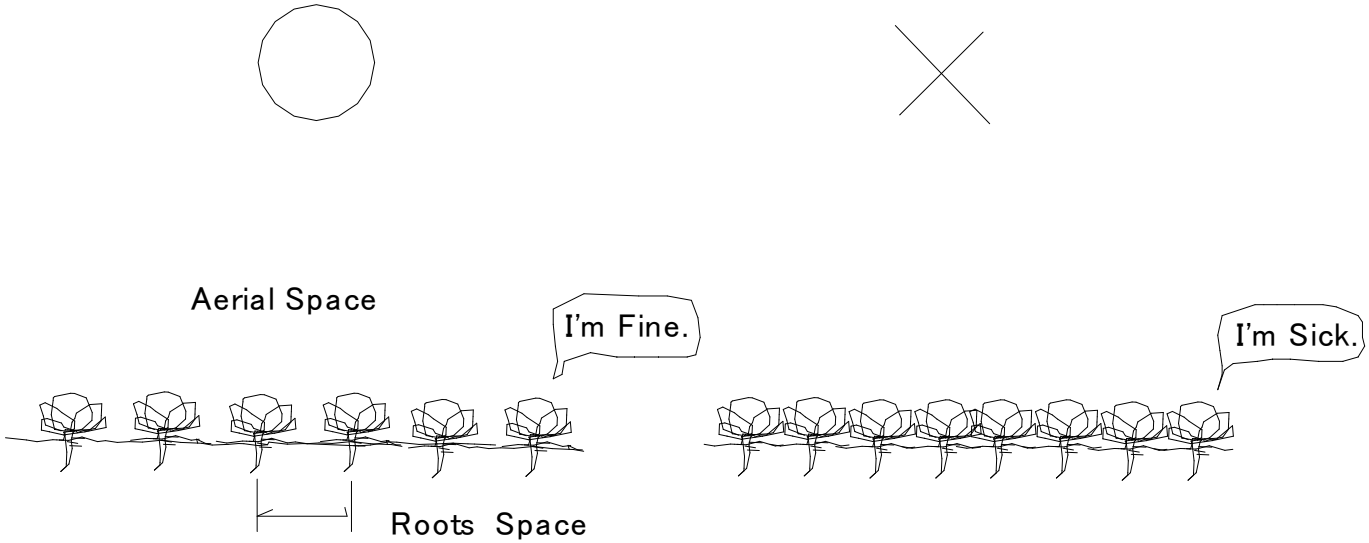
(512) Cocoyam



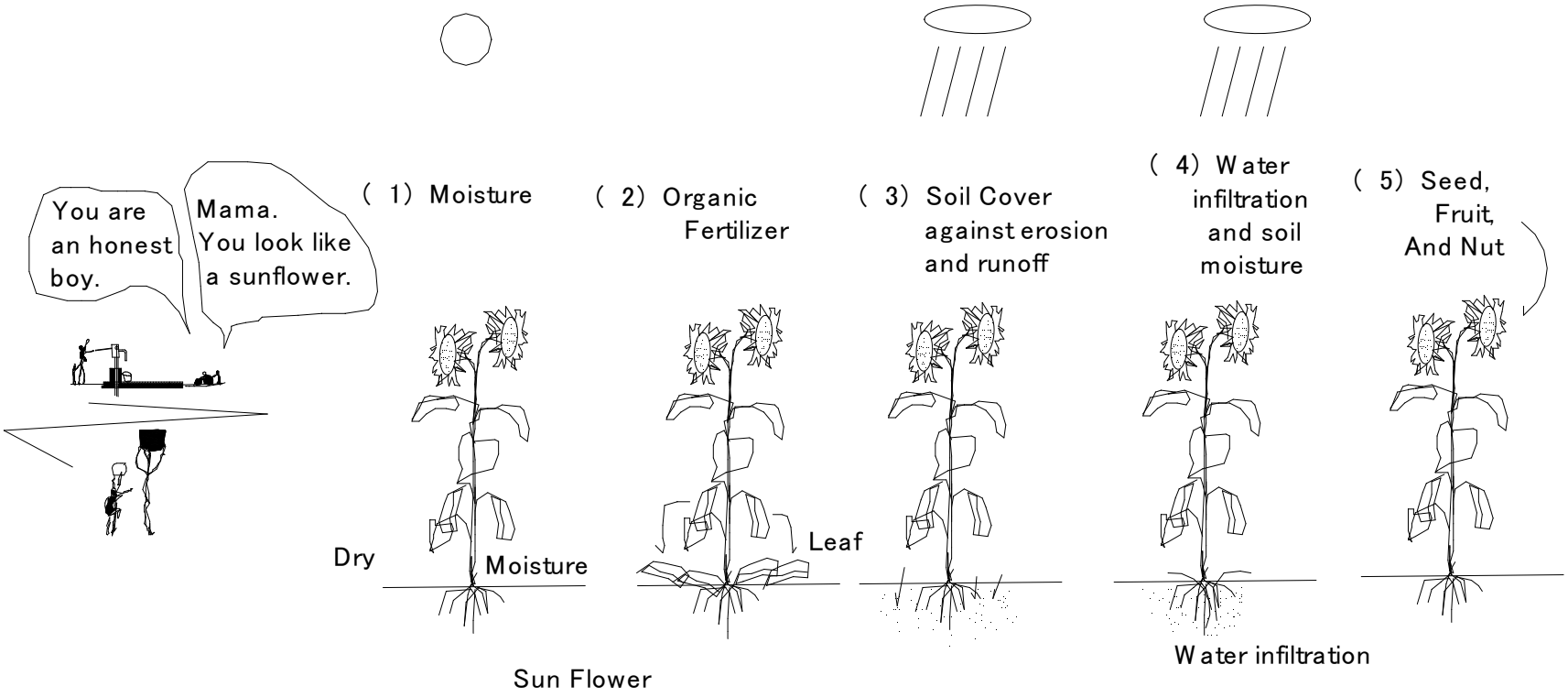
Cocoyam likes moist ground.

(513) Space Occupied By Cabbage Plants



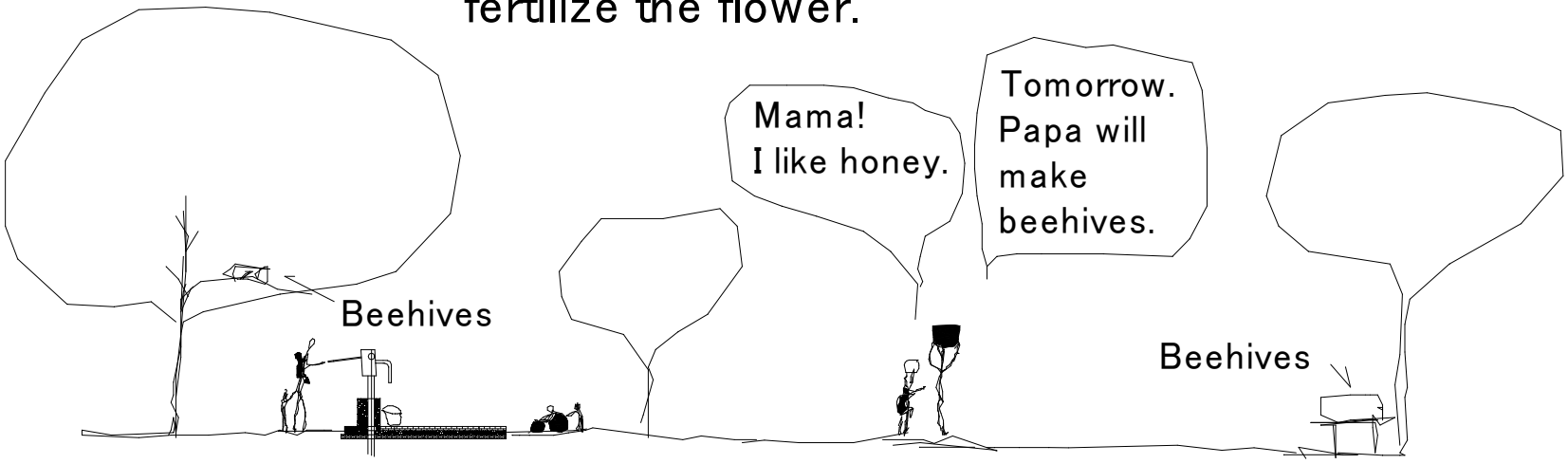


(514) Benefit From A Crop



(515) Bees

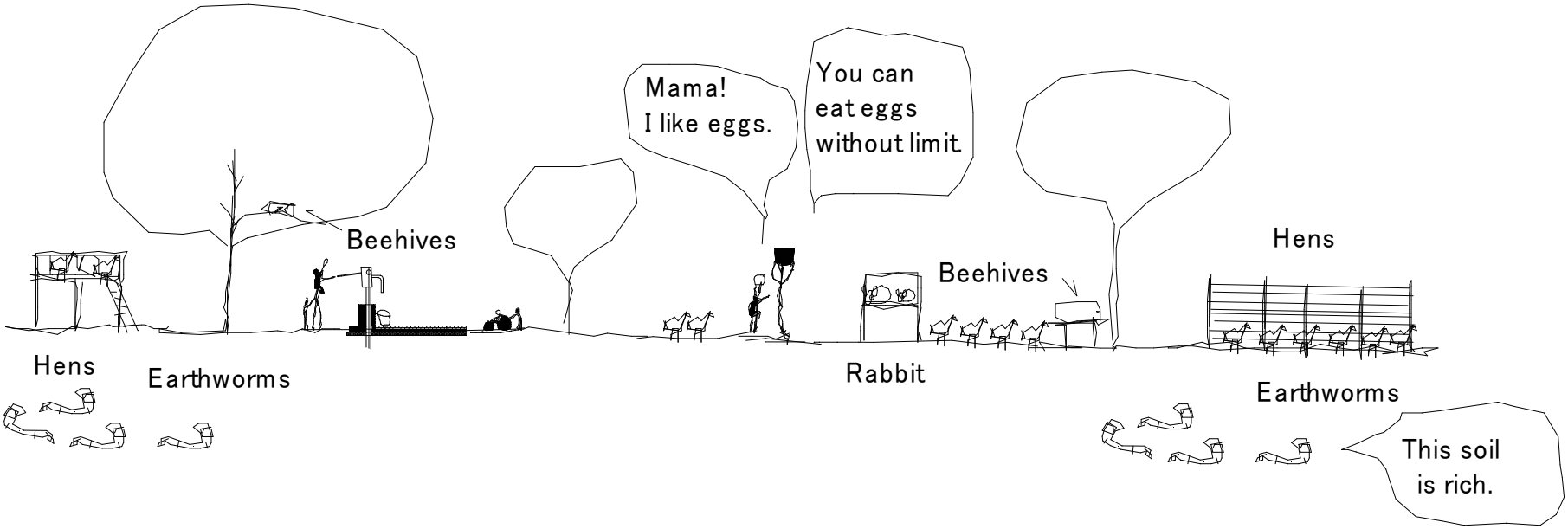
Bees produce honey.
Fruit trees are increased
30~40% when bees
fertilize the flower.



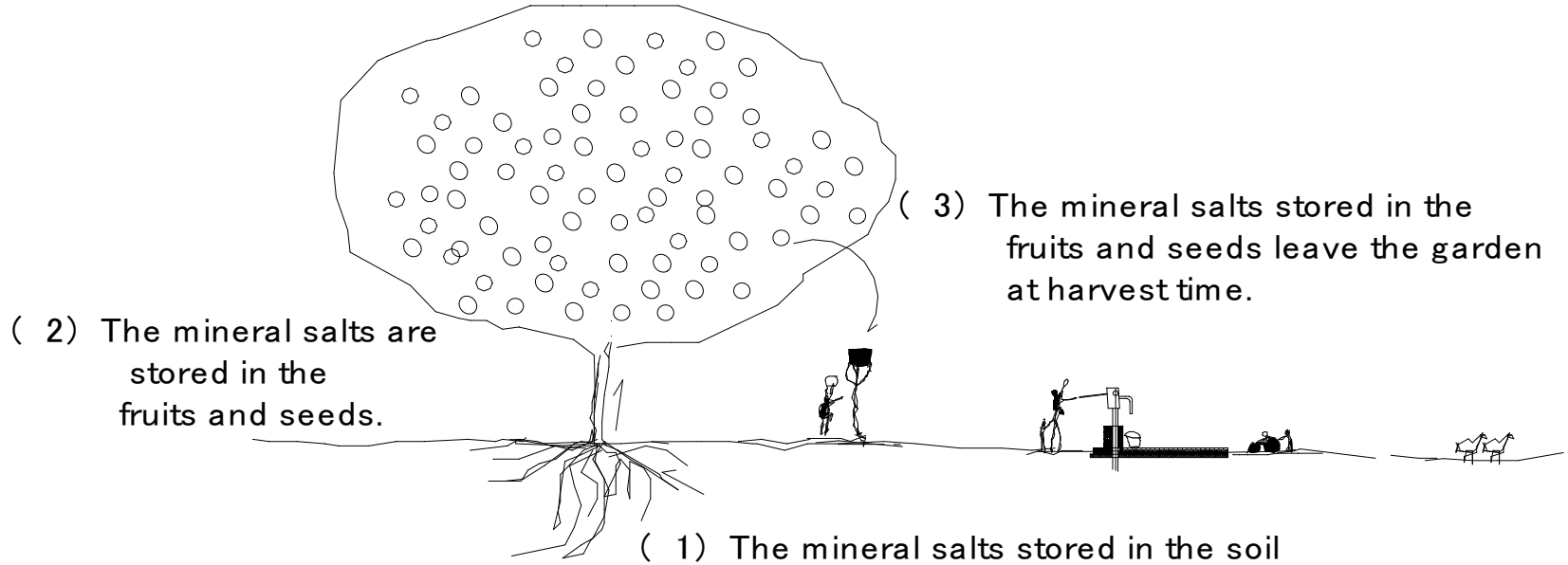
(516) Poultry and rabbits

Poultry and rabbits are associated with gardens

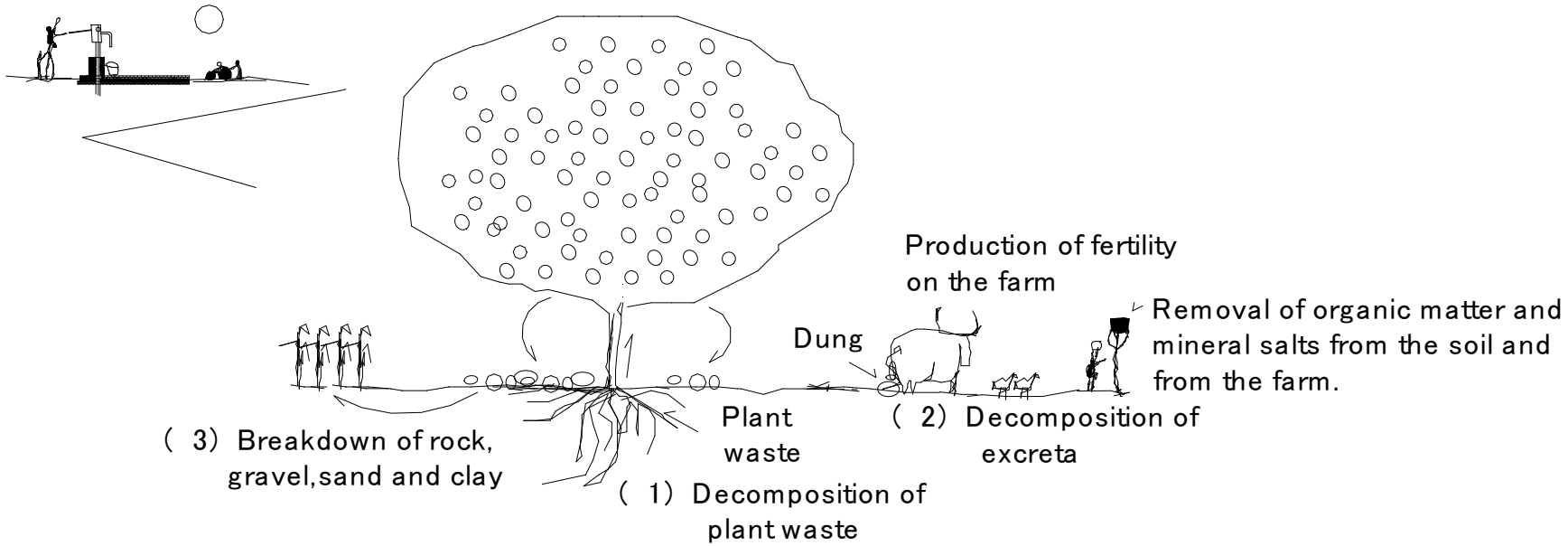
Poultry and rabbits
provide a rich
organic fertilizer.



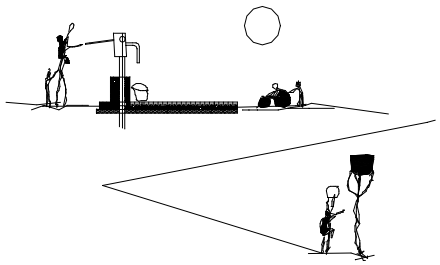
(517) The removal of nutrient mineral salts

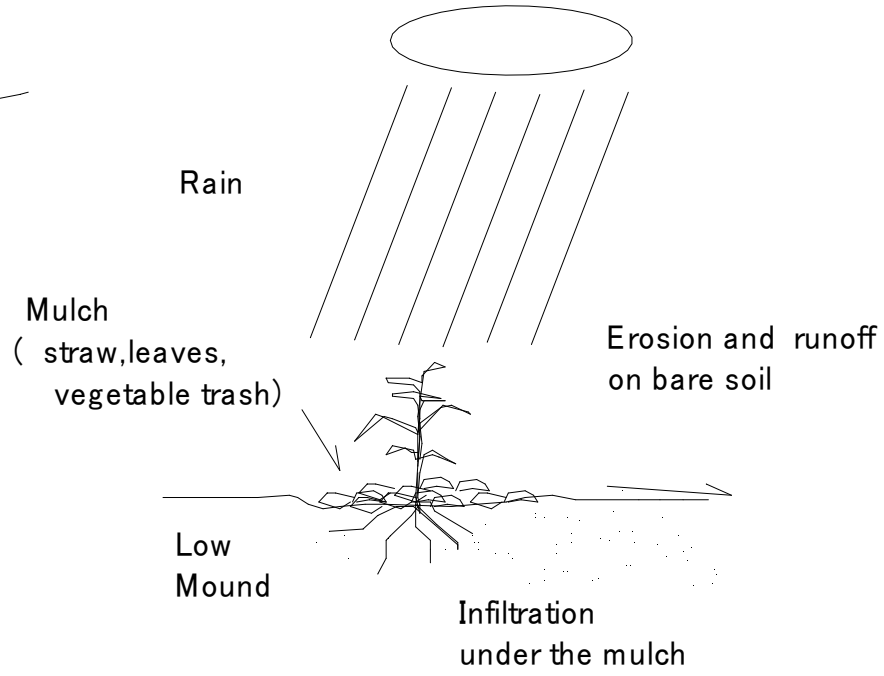


(518) The cycle of organic matter and mineral salts from the soil and from the farm

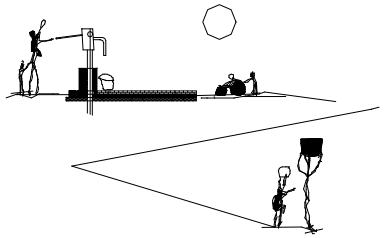


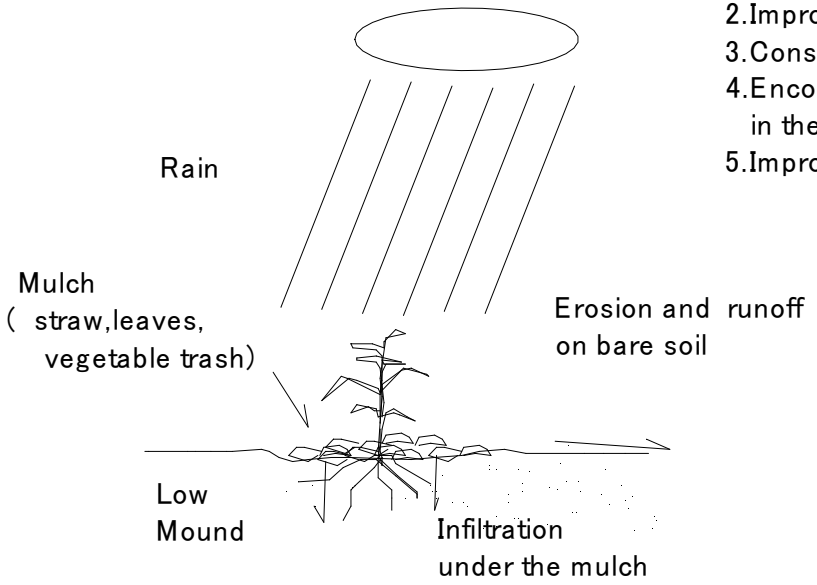
(519) The effects of mulch on soil moisture





（ 520 ） The mulch

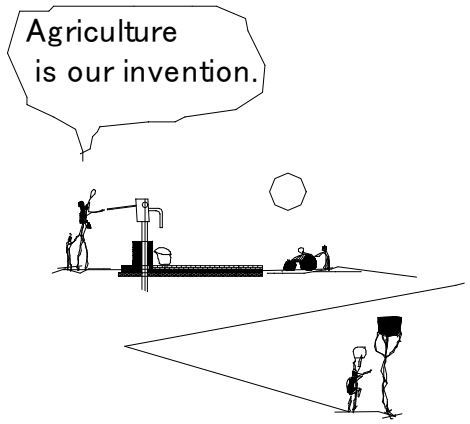


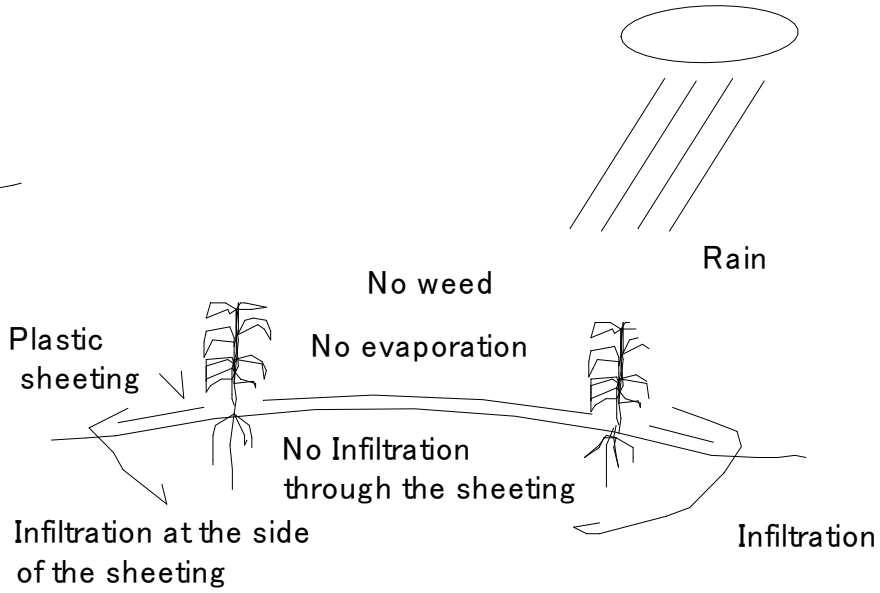


Mulching:covering the soil surface
by spreading straw,leaves,and
other vegetable trash.

1.Protects the soil from rain erosion.
2.Improves water infiltration.
3.Conserves soil moisture.
4.Encourages organisms living
in the soil.
5.Improves soil structure.

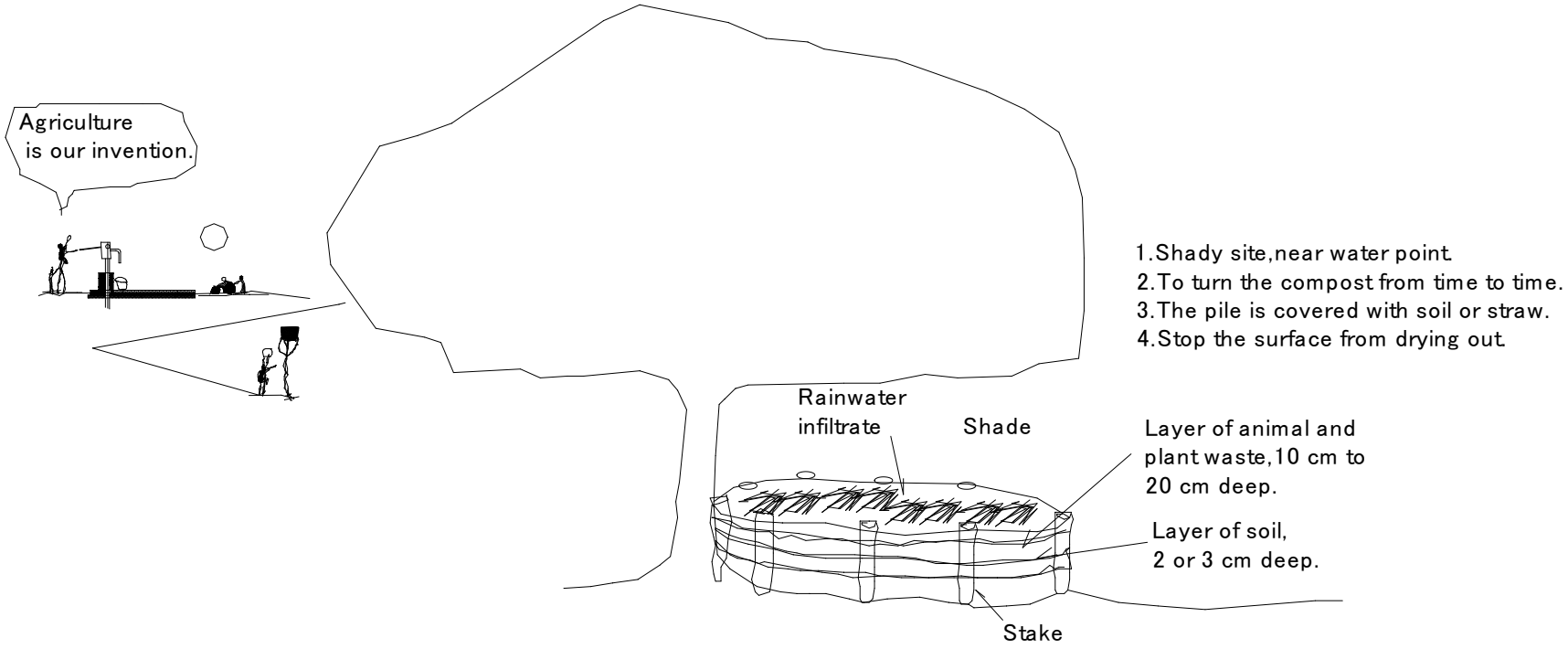
(521) The effect of plastic mulch





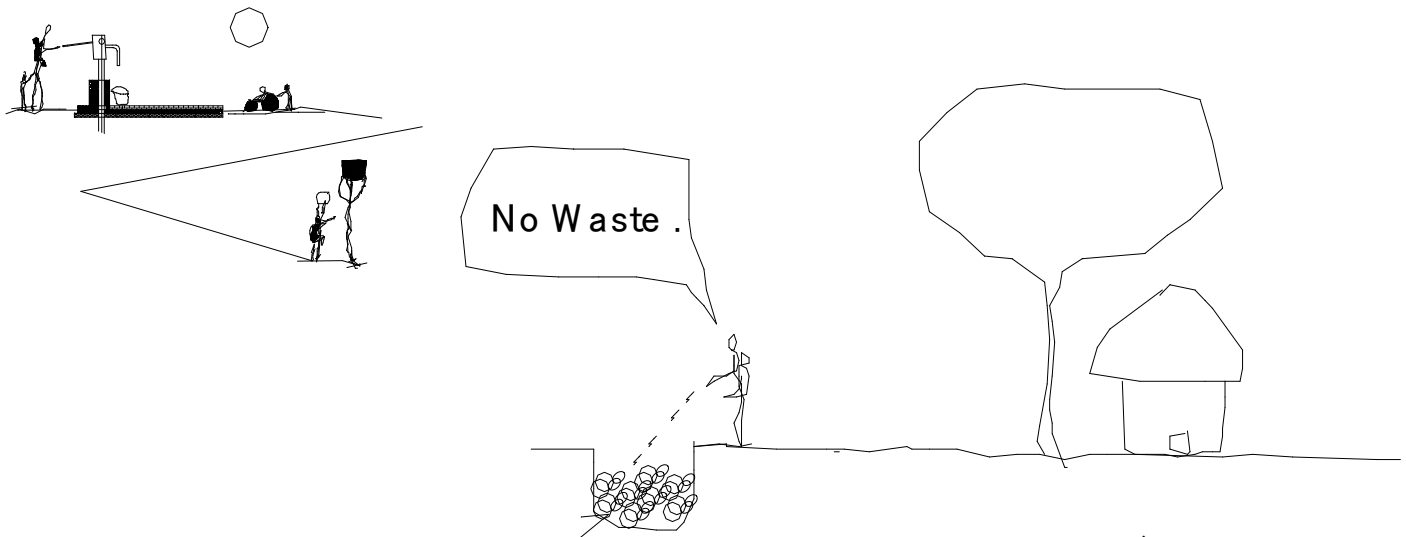
The sheeting prevents
soil water evaporation
and the growth of weeds.

(522) Hotbed Composting



1.Shady site,near water point.
2.To turn the compost from time to time.
3.The pile is covered with soil or straw.
4.Stop the surface from drying out.

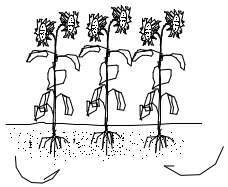
（ 523） Cold Composting



1.Waste accumulates（ kitchen garbage） .
2.Cold composting is improved by mixing the waste and turning it over from time to time.

(524) Using chemical fertilizer to increase return from green manure

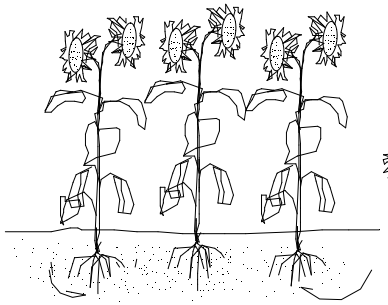
Green manure



Chemical fertilizer

Chemical fertilizers
feed green manure plants.

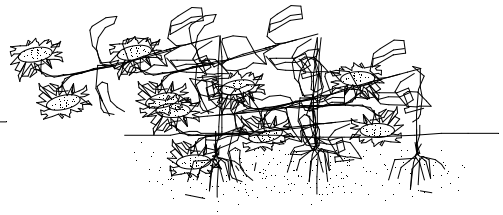
Green manure



Chemical fertilizer

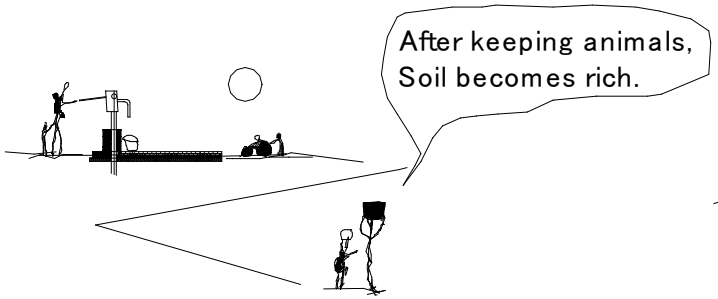
Plenty of manure plants.

Green manure cut and
incorporated into the soil

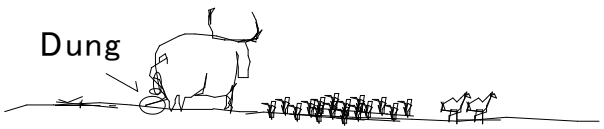


Green manure restores to the soil.
Improves soil structure.

(525) Animal Manure



Cattle

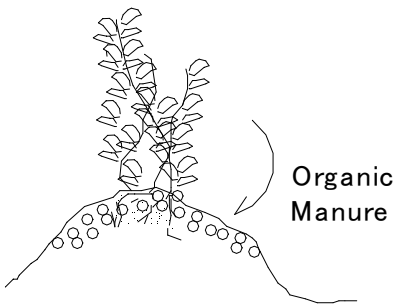


Cowdung,Droppings
(horses,goats,sheep,rabbits,poultry)
Human excreta.

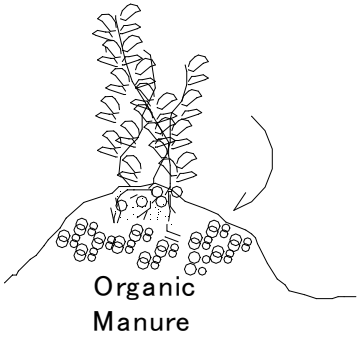
Decomposition of
excreta

Plants take up mineral salts
from pasture soil.
These salts are concentrated
in cow dung.

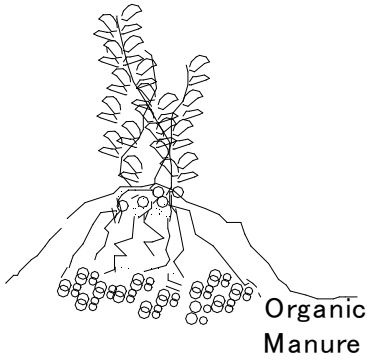
(526) Spreading organic manure



The organic manure spread on the surface of the ridge.
It is in danger of being carried away by runoff water.

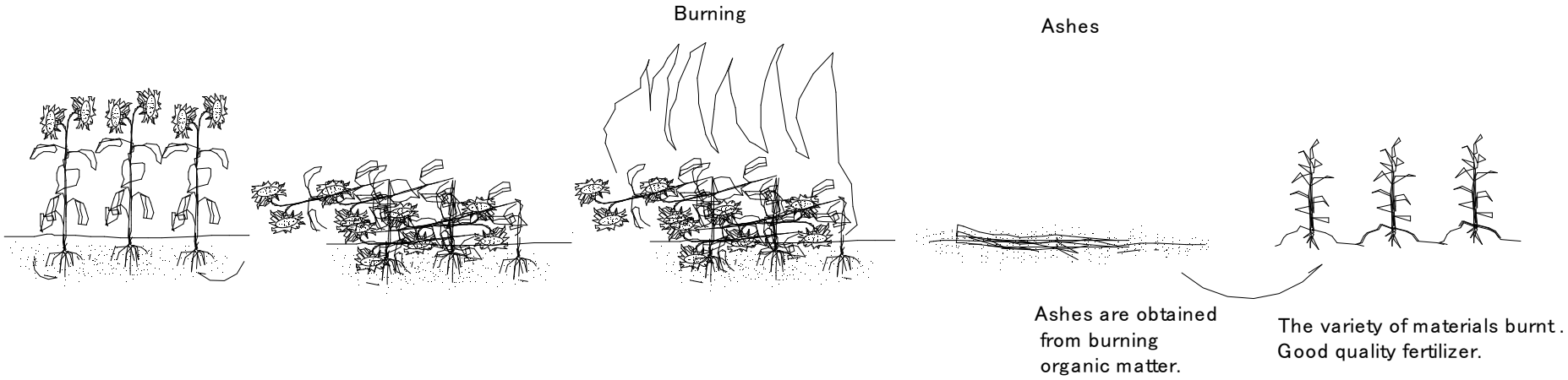


The organic manure is mixed into the soil on the mound during seedbed preparation.
The minerals contained in the organic manure are quickly restored to the soil and can be taken up by plant roots.

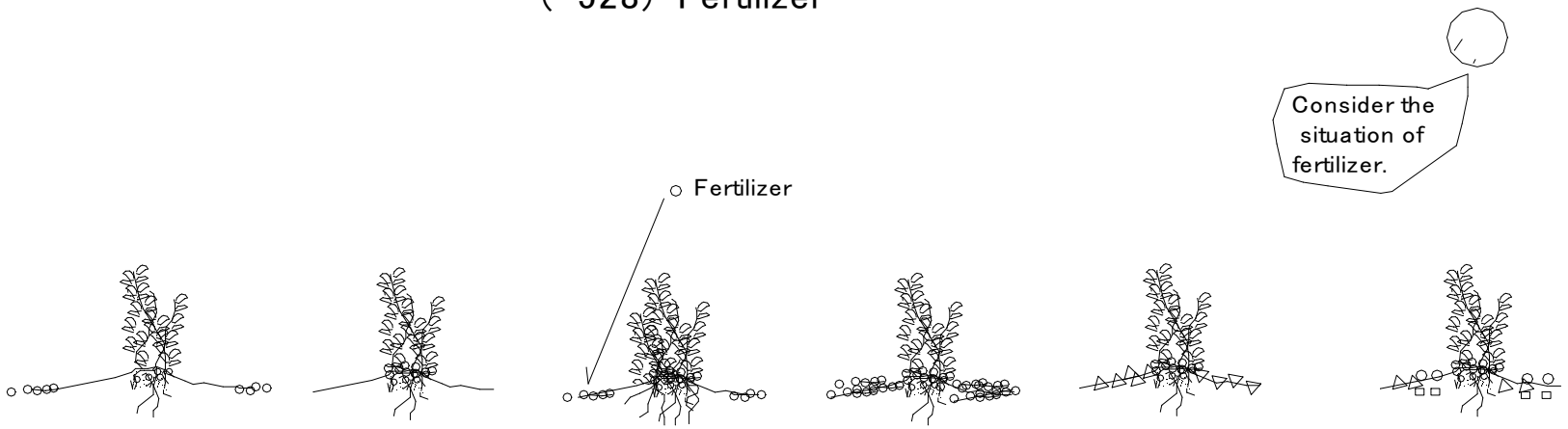


The effects of the organic manure are slow and lasting.

(527) Ashes


Burning
Ashes
Ashes are obtained
from burning
organic matter.
The variety of materials burnt .
Good quality fertilizer.

(528) Fertilizer



(1) Fertilizer is far.

(2) Fertilizer is close.

(3) Fertilizer is not needed.

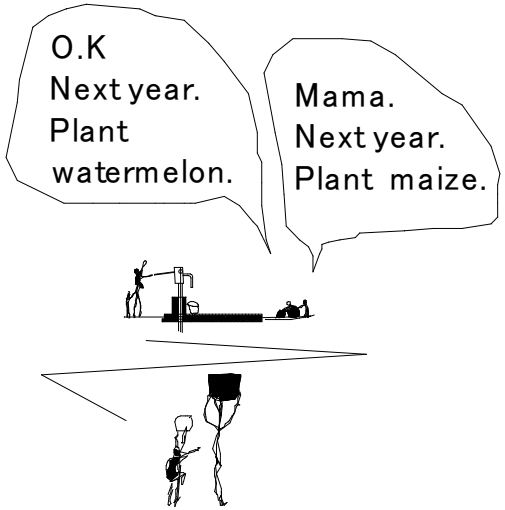
(4) Fertilizer is too much.

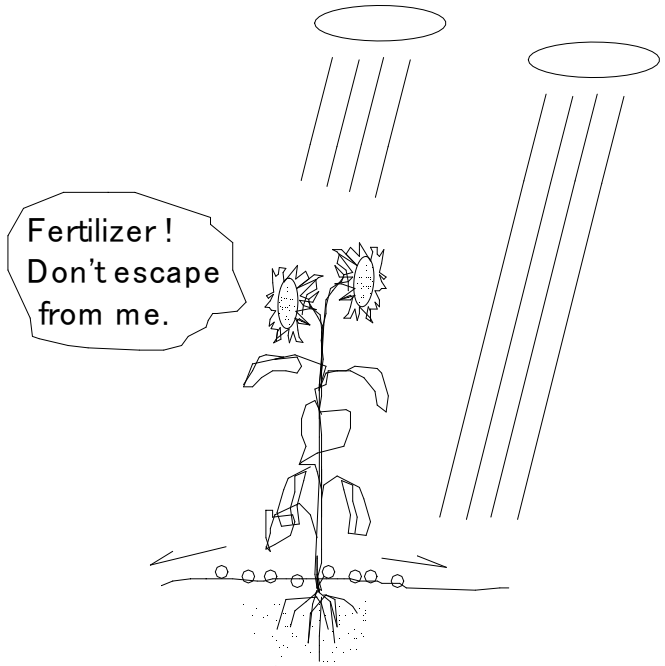
(5) Fertilizer is not proper.

(6) Varied Fertilizer is good.

(529) Rain And Fertilizer

○ Fertilizer

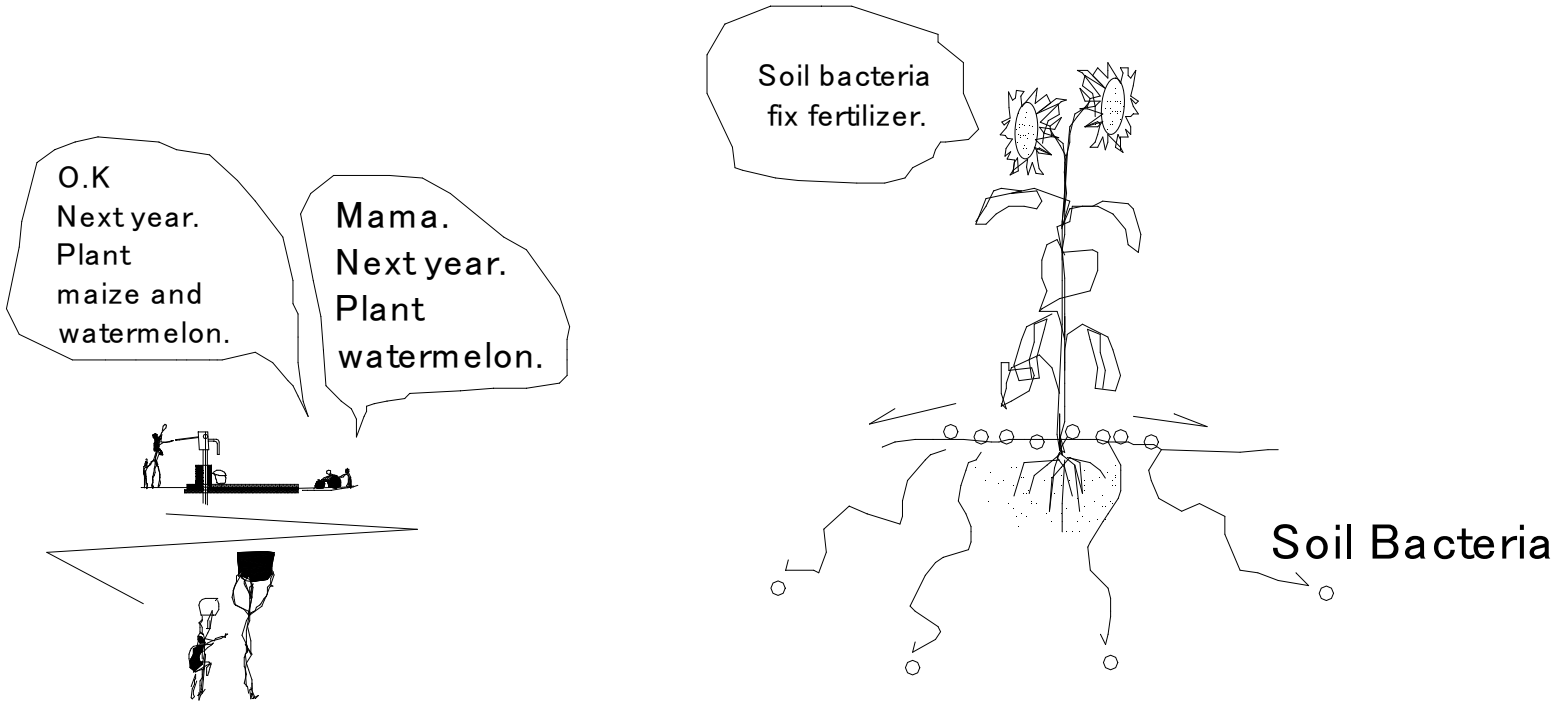




(1) The water is removing fertilizer.
(2) Leaching of the soil.

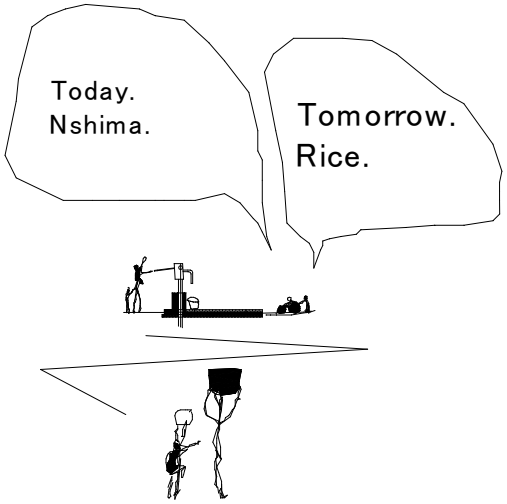
（ 530）Soil Bacteria As Fertilizer

○ Fertilizer



（ 531） Fertilizers Affect Fertility

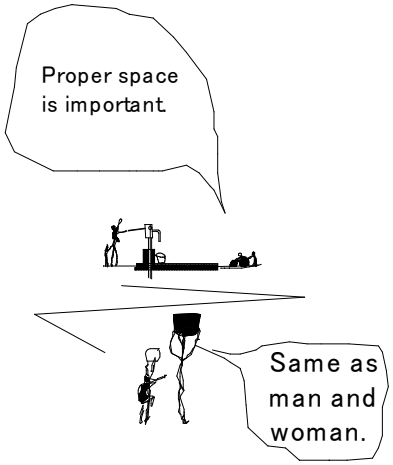
× □ ○ Fertilizer



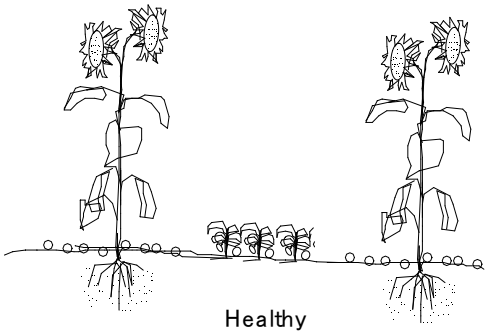
Same
Chemical
Fertilizers

Organic And
Chemical
Fertilizers

(532) The effects of the lack of space

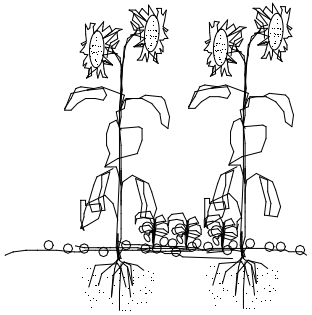


Enough space



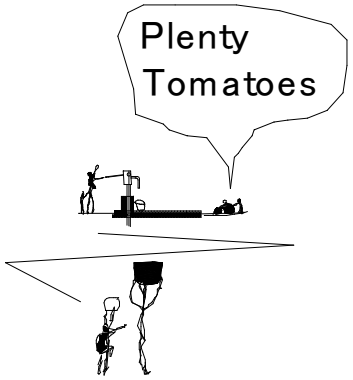
Healthy
plant

Close space

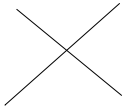


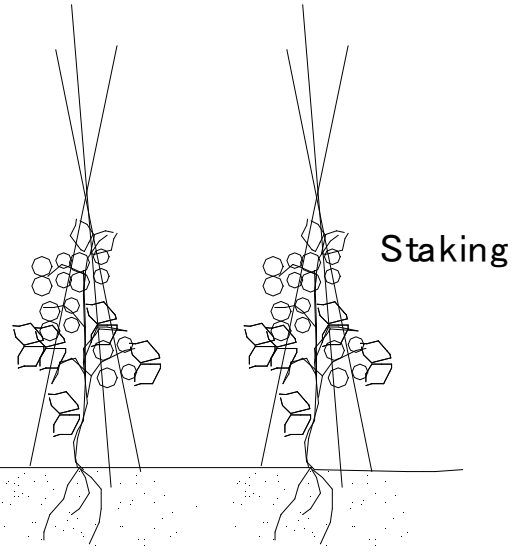
Not healthy
plant

(533) Staking

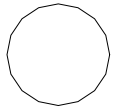


Tomato

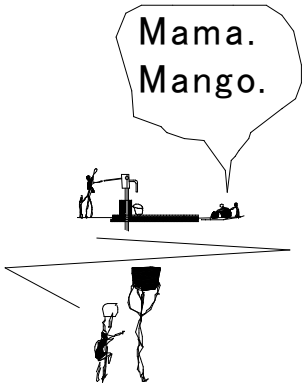


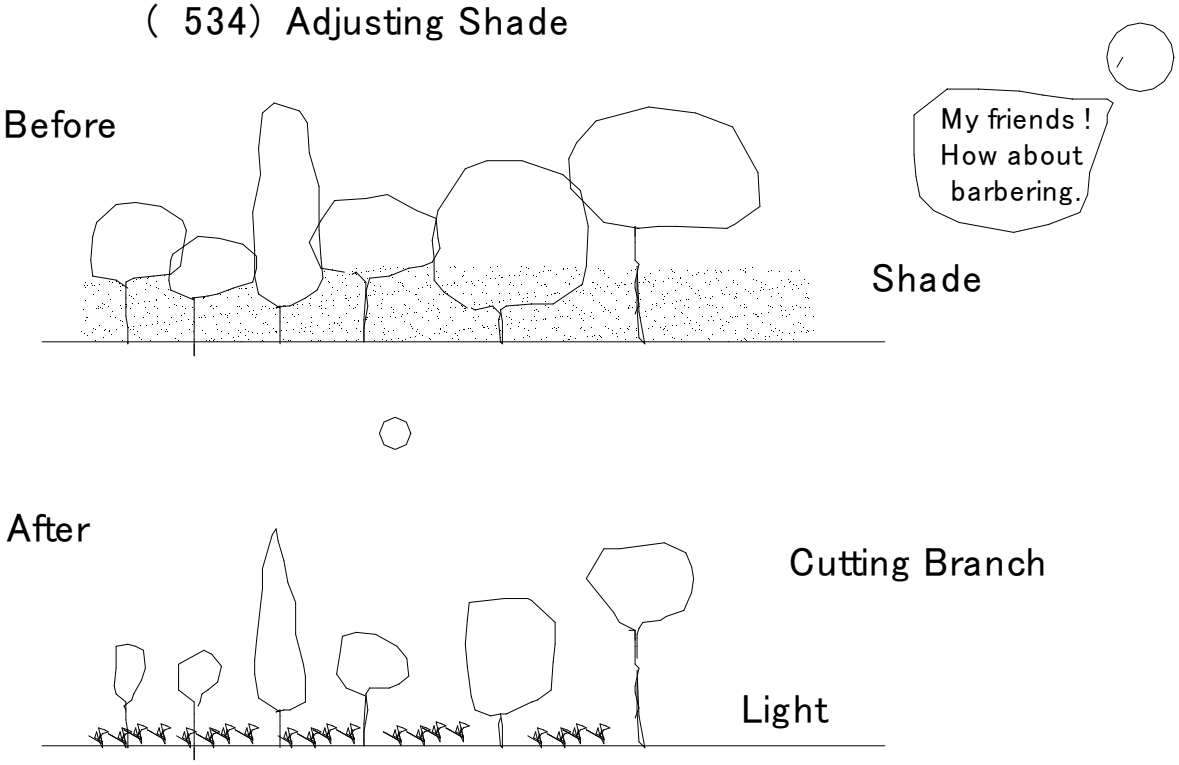


Light and
wind.

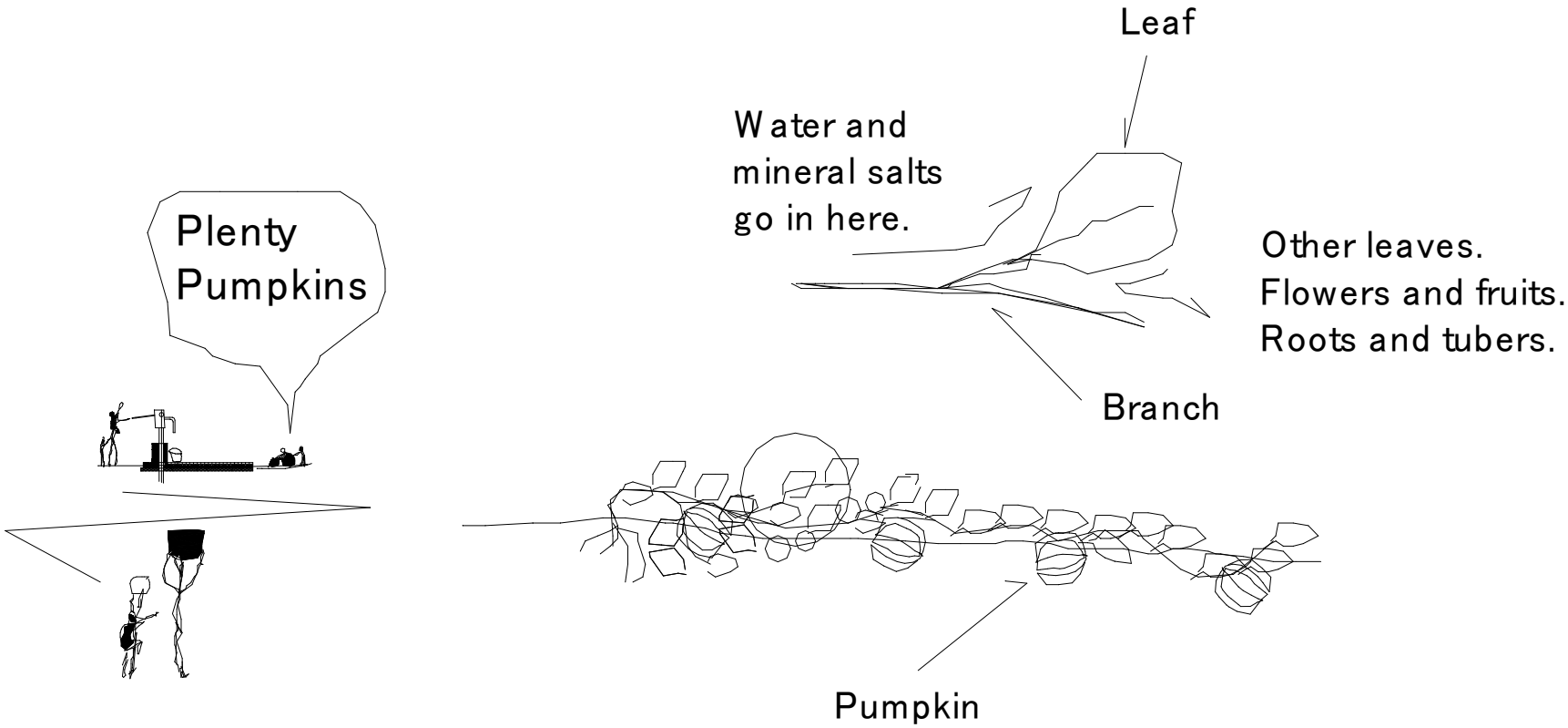


(534) Adjusting Shade

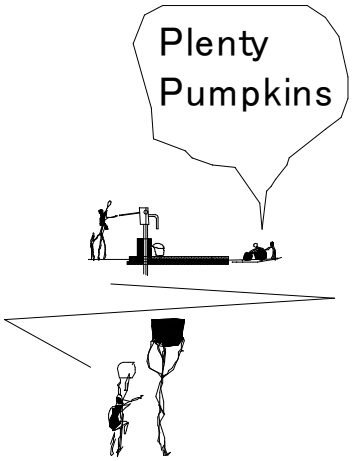


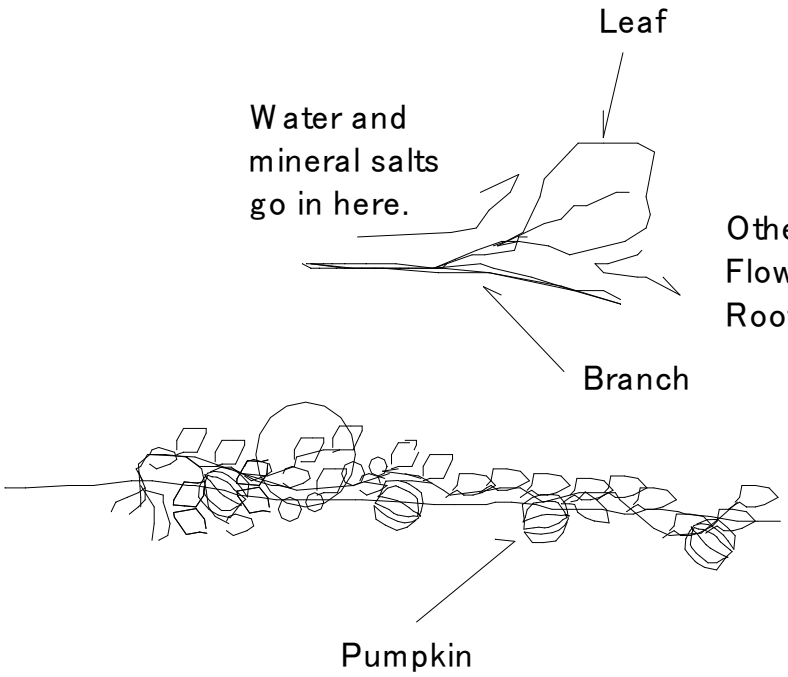


（ 535） The role of leaves in plant life



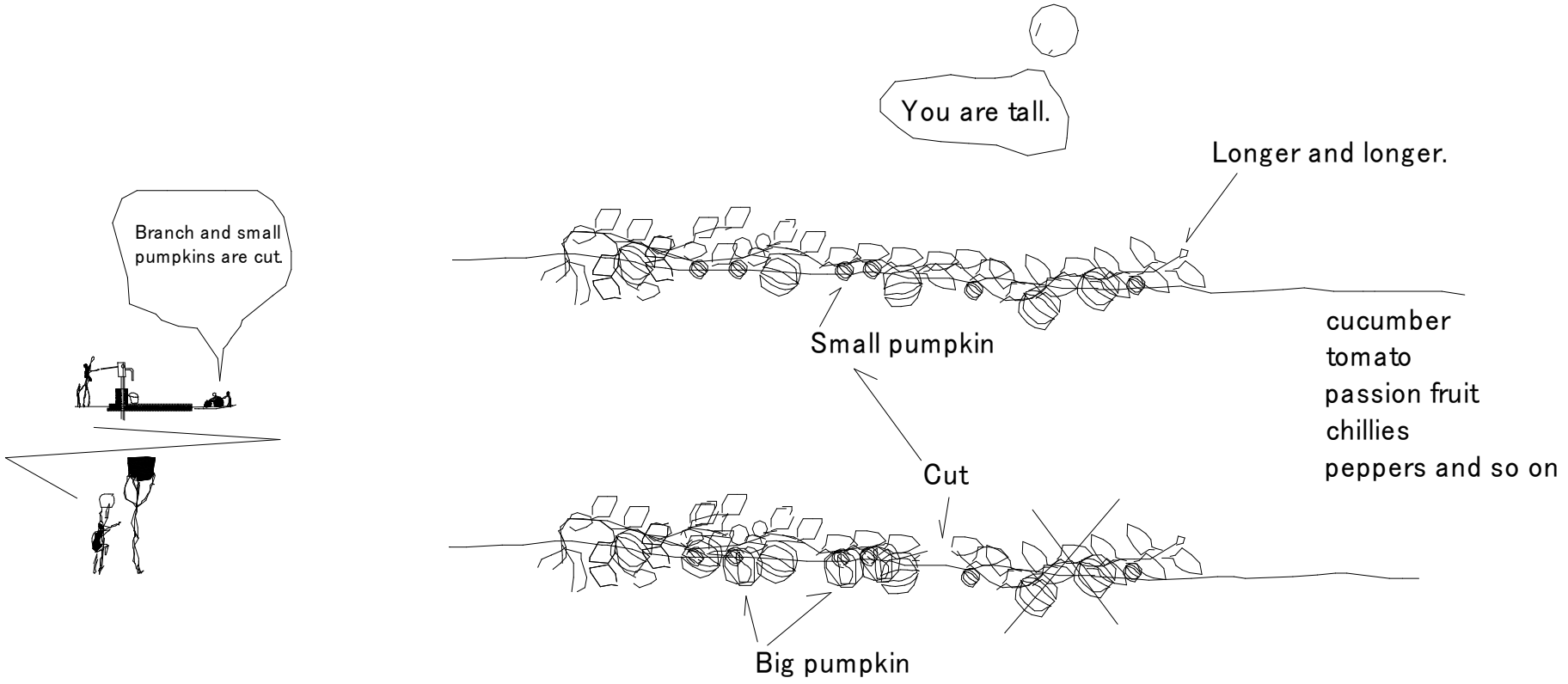
(536) Two factors of plant development



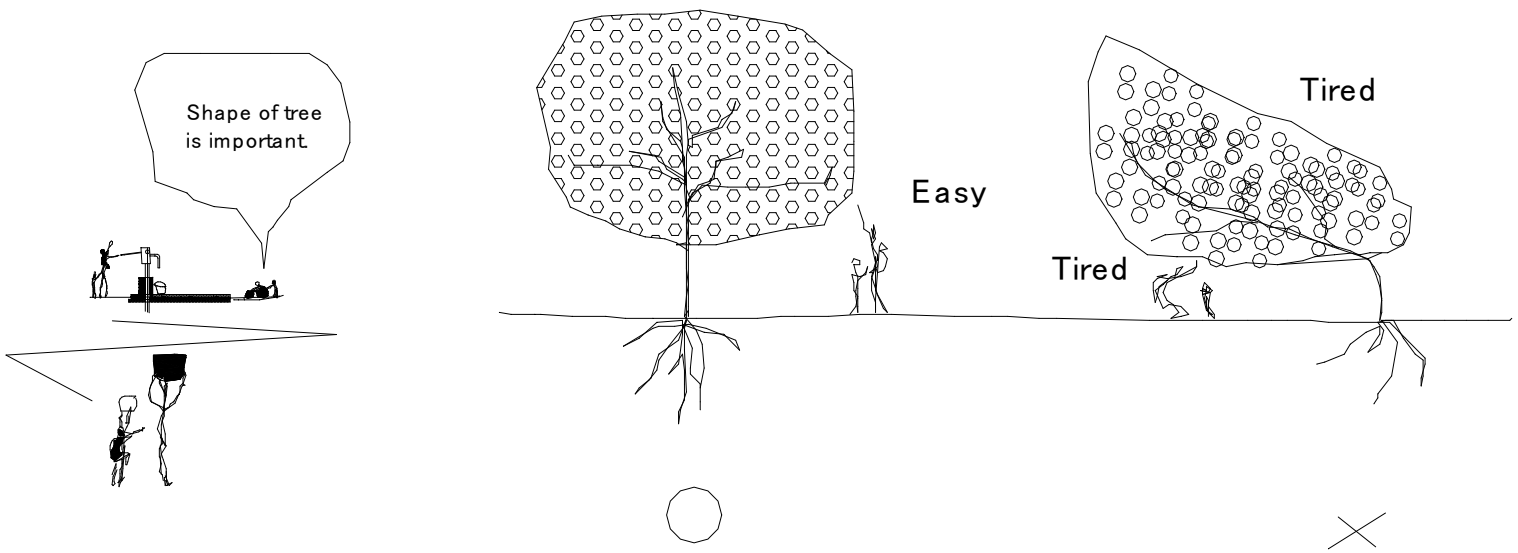


(1) Amount of water and mineral salts.
(2) Ability of the leaves.

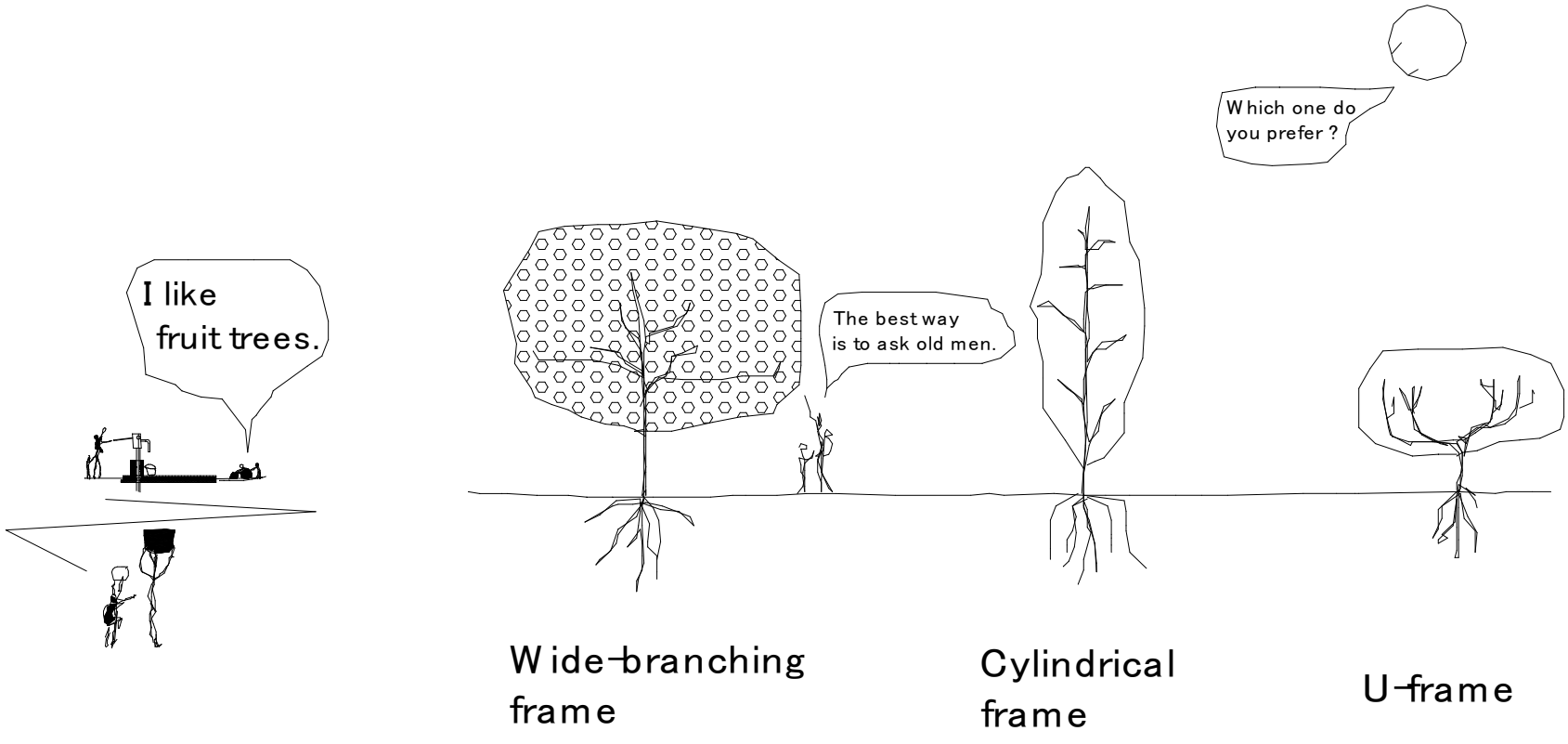
（ 537）Growth competition between runners and fruits



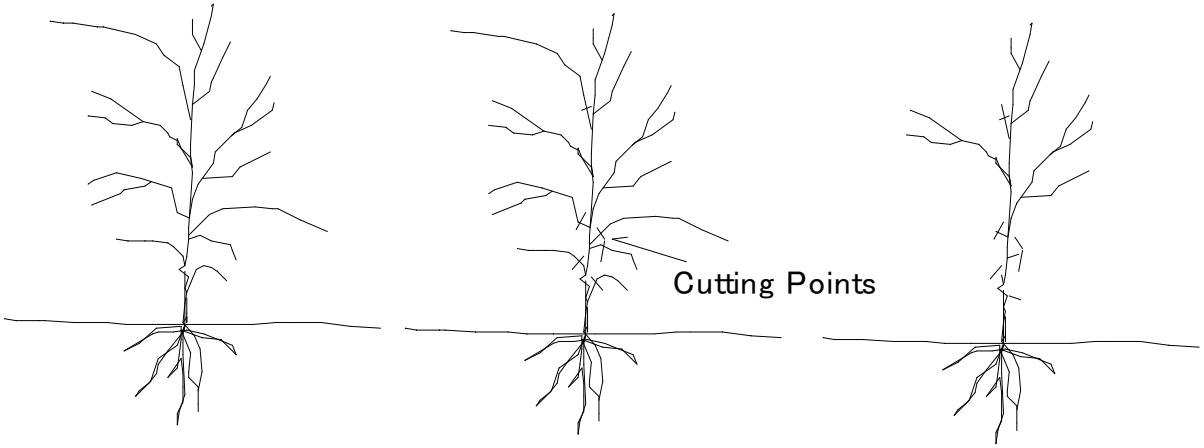
（ 538 ） The framework of fruit trees



（ 539 ） The framework of trees



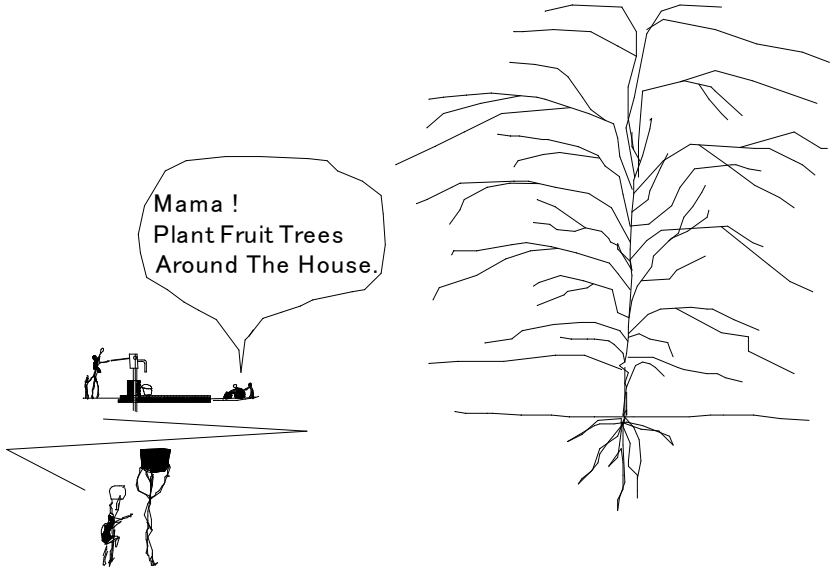
（ 540 ）Cutting Points



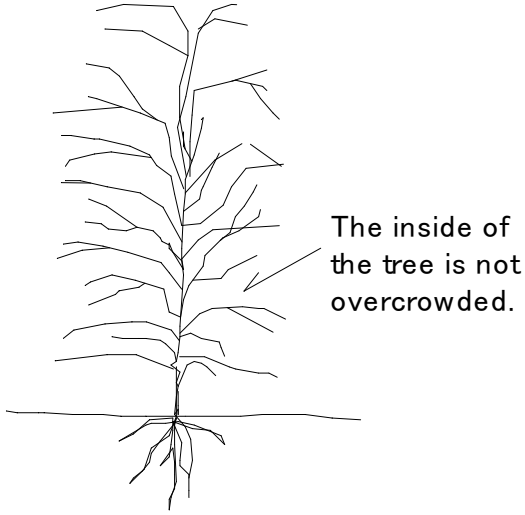
Spreading shape

(541) Cutting Points(2)

Before

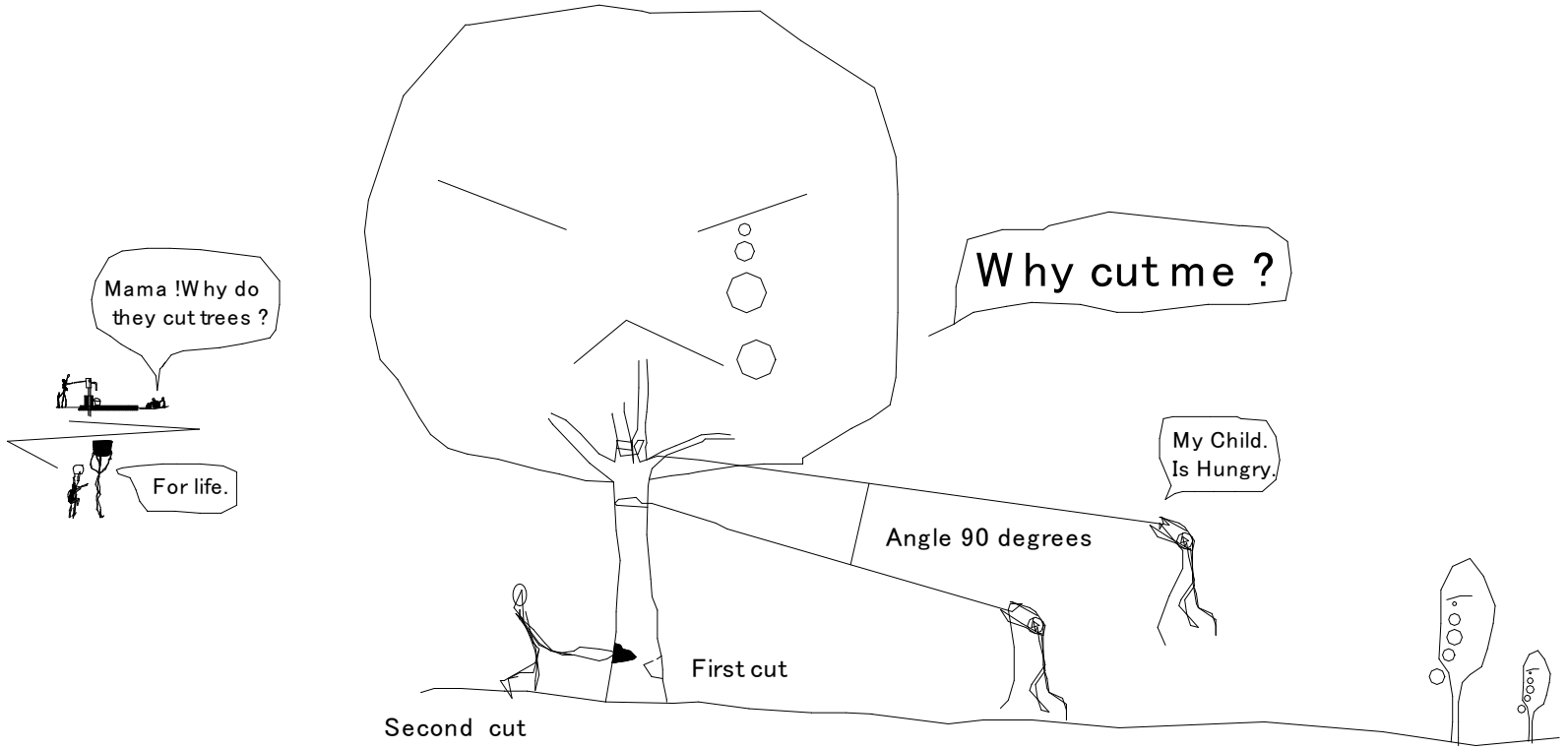


After

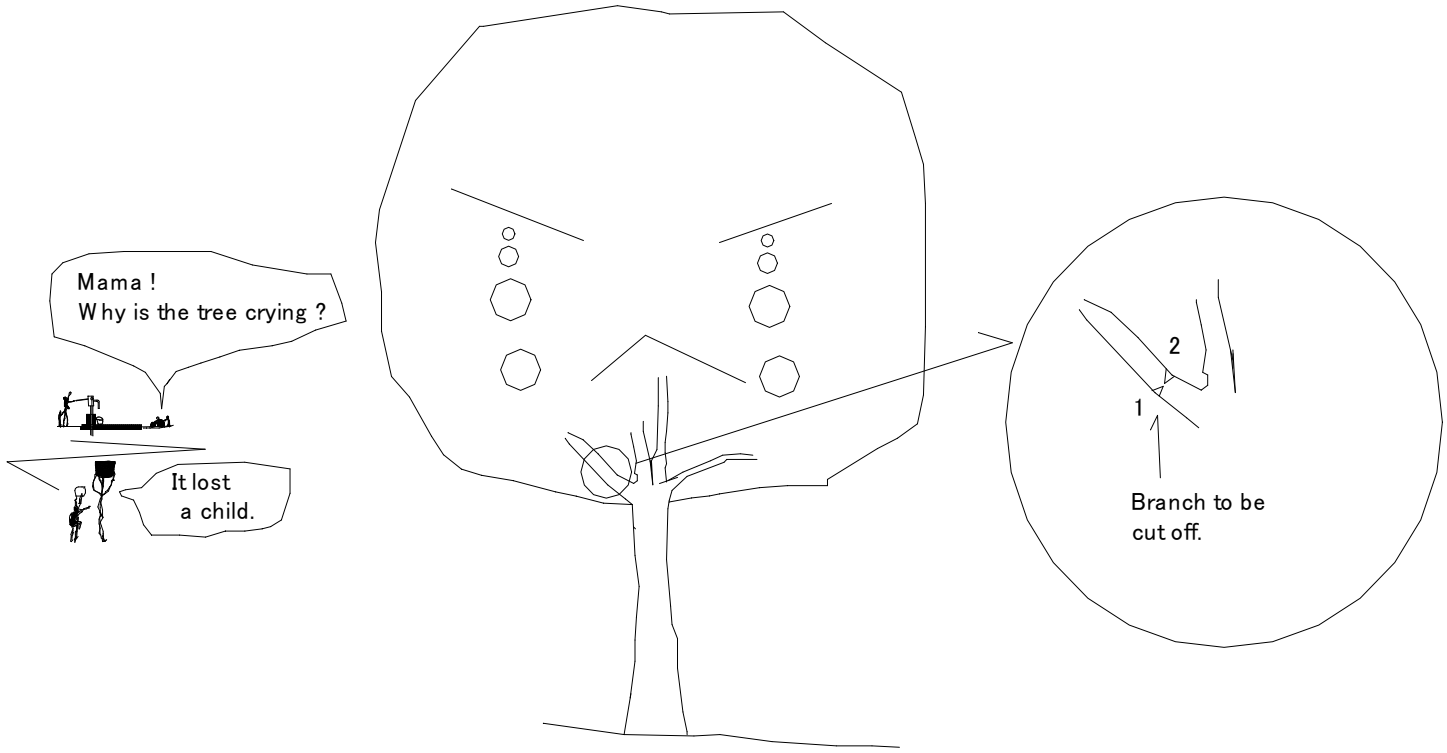


Cylindrical frame

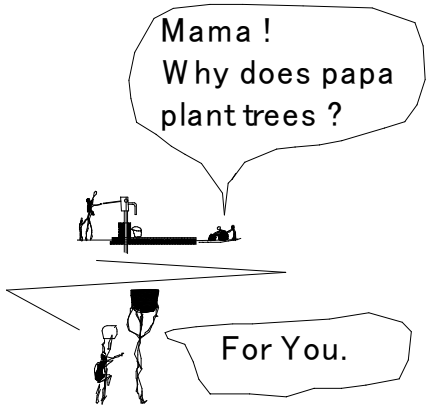
(542) Cutting(1)

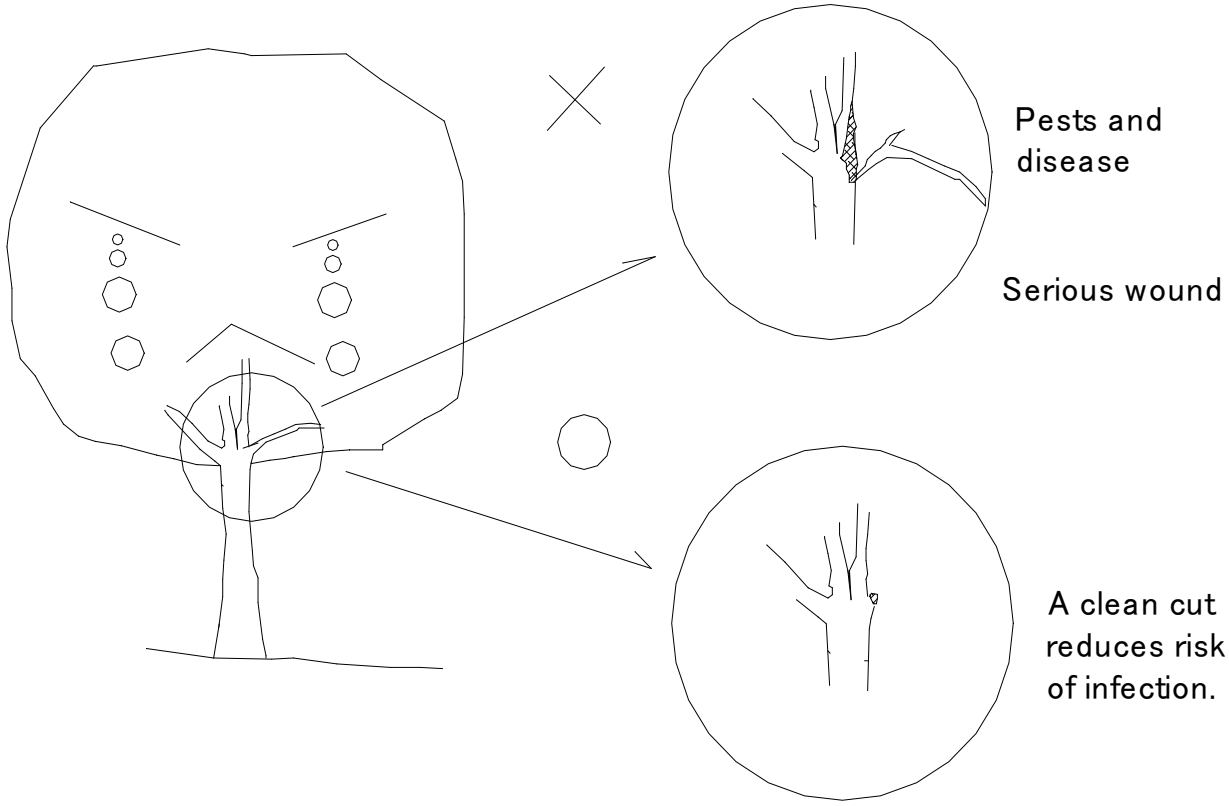


（ 543 ） Cutting a large branch



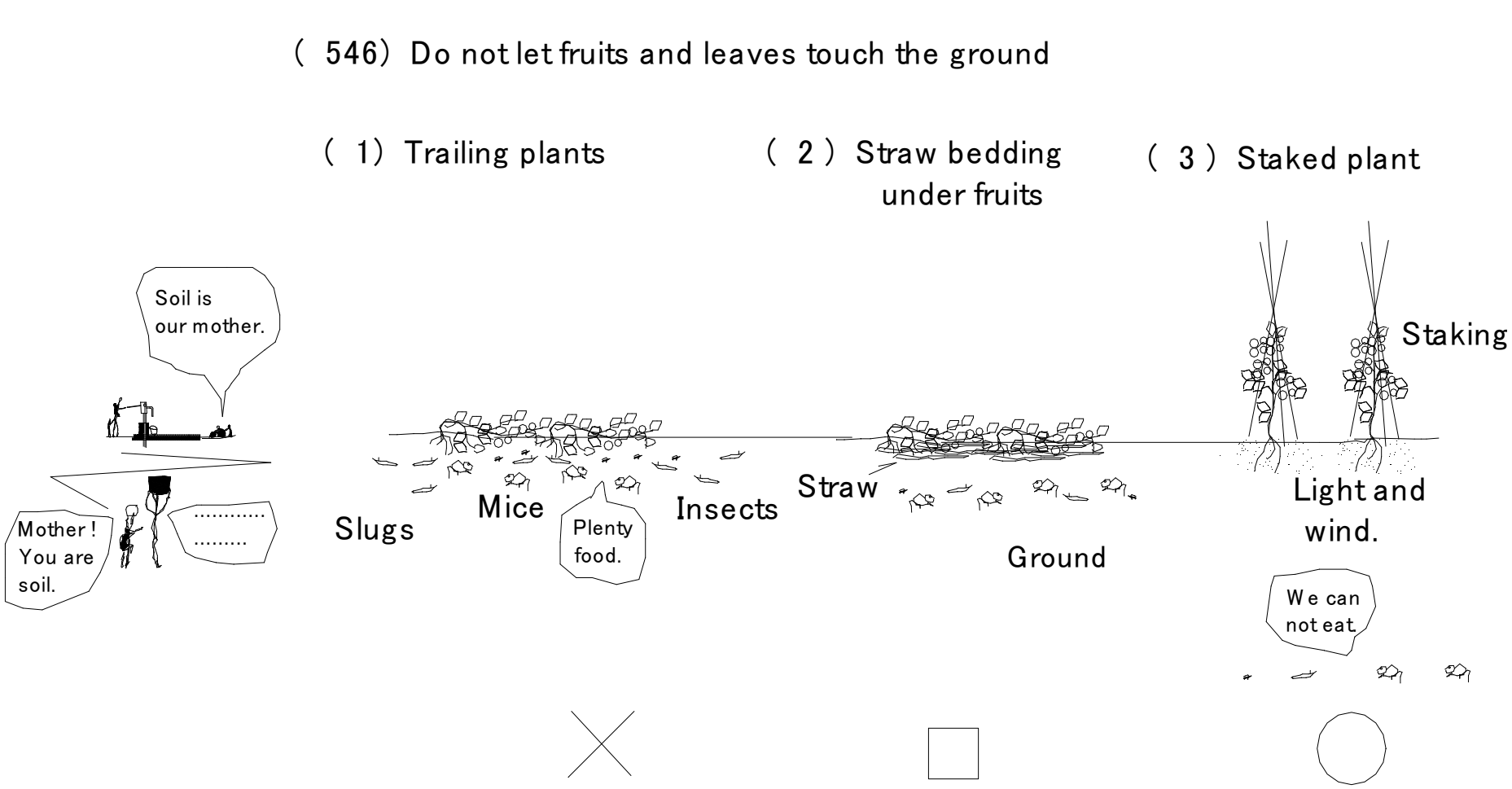
（ 544 ） Do not wound trees when chopping and felling



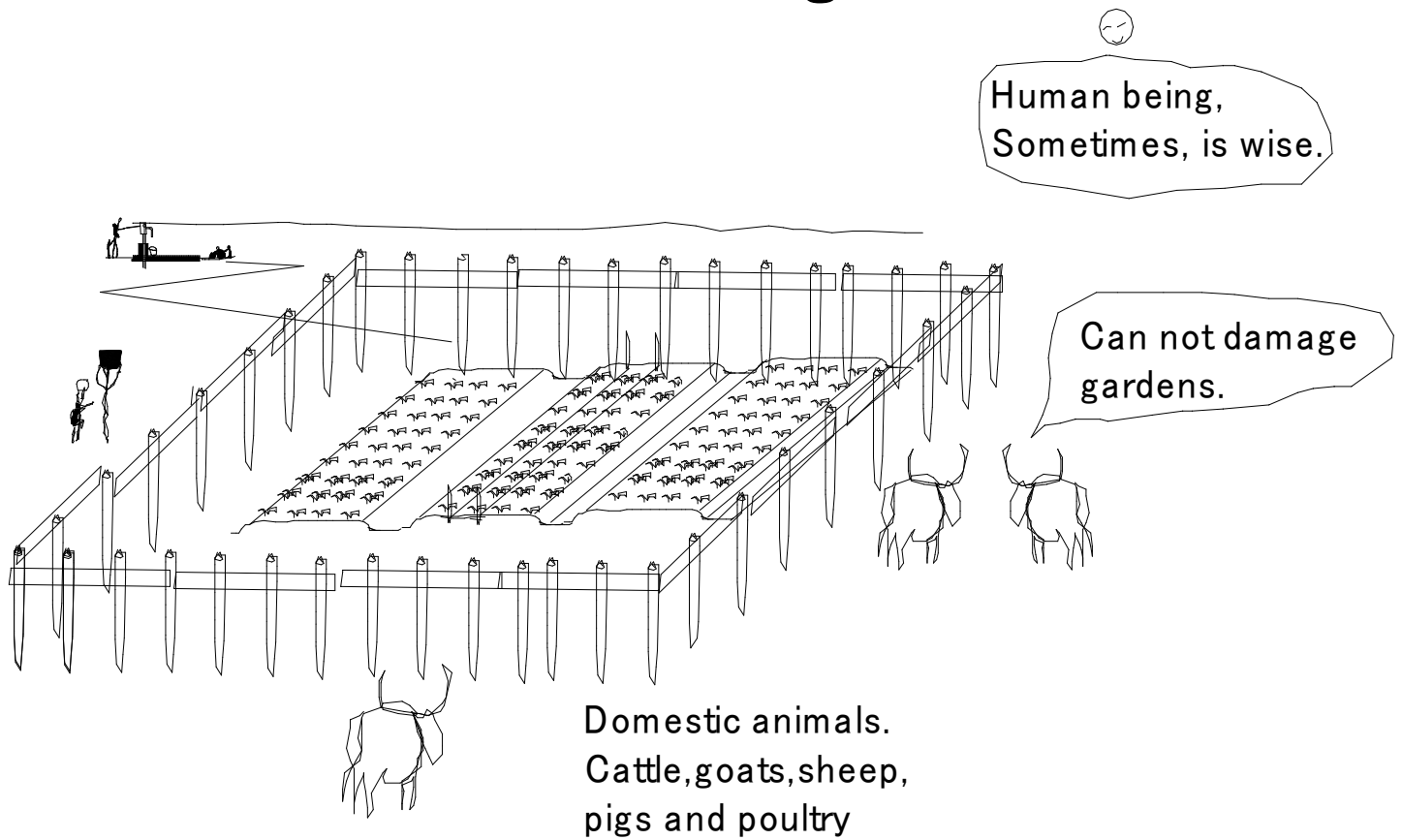


（ 545 ） Do not wound trees when chopping and felling（ 2 ）

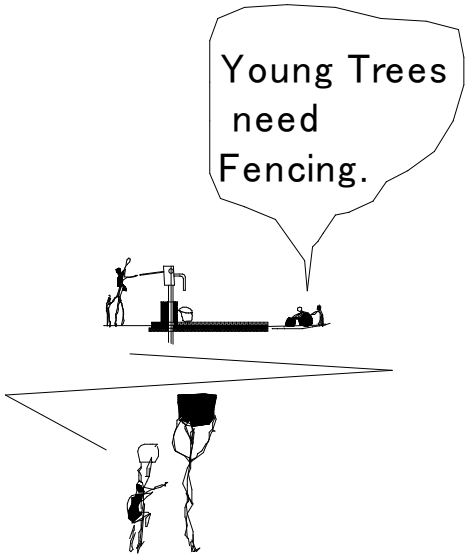
（546）Do not let fruits and leaves touch the ground



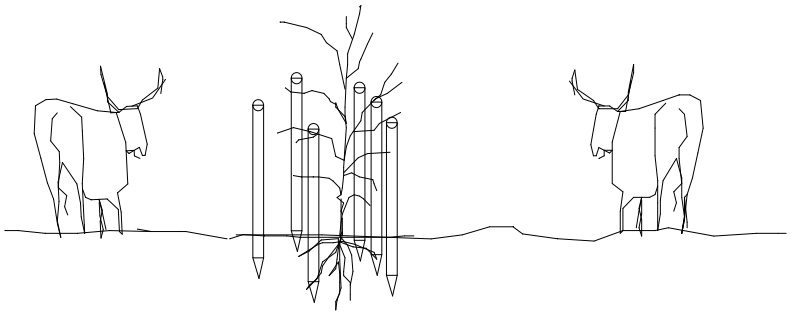
(547) Fencing(1)



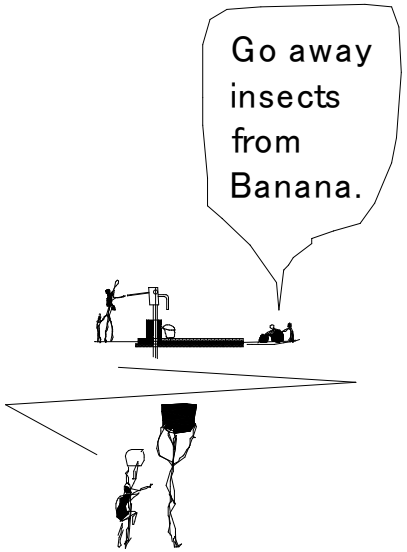
(548) Fencing(2)

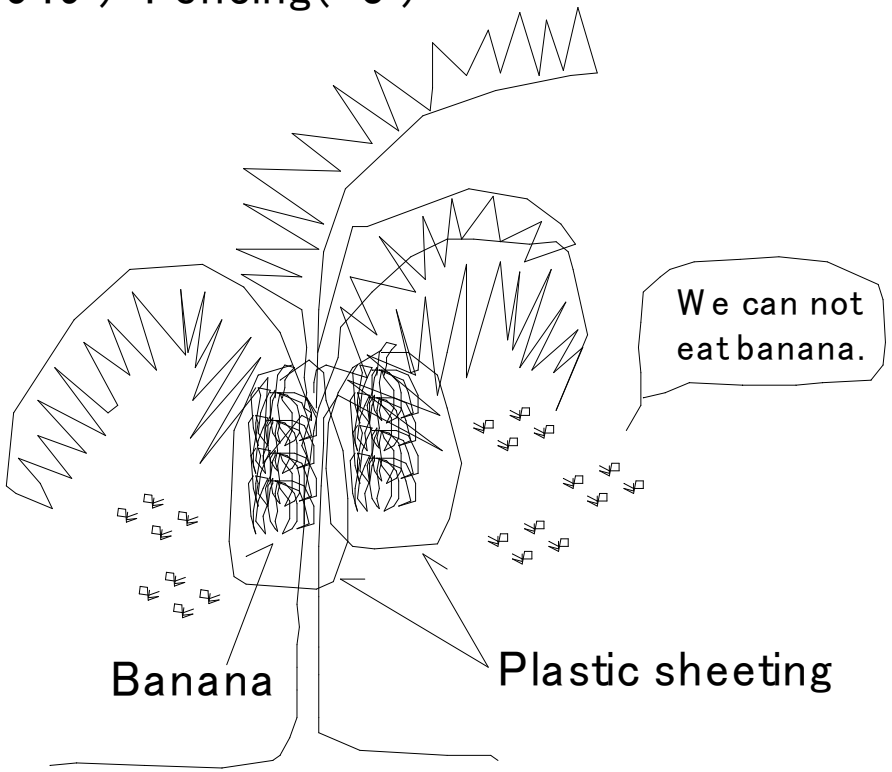


Protect a
young tree.



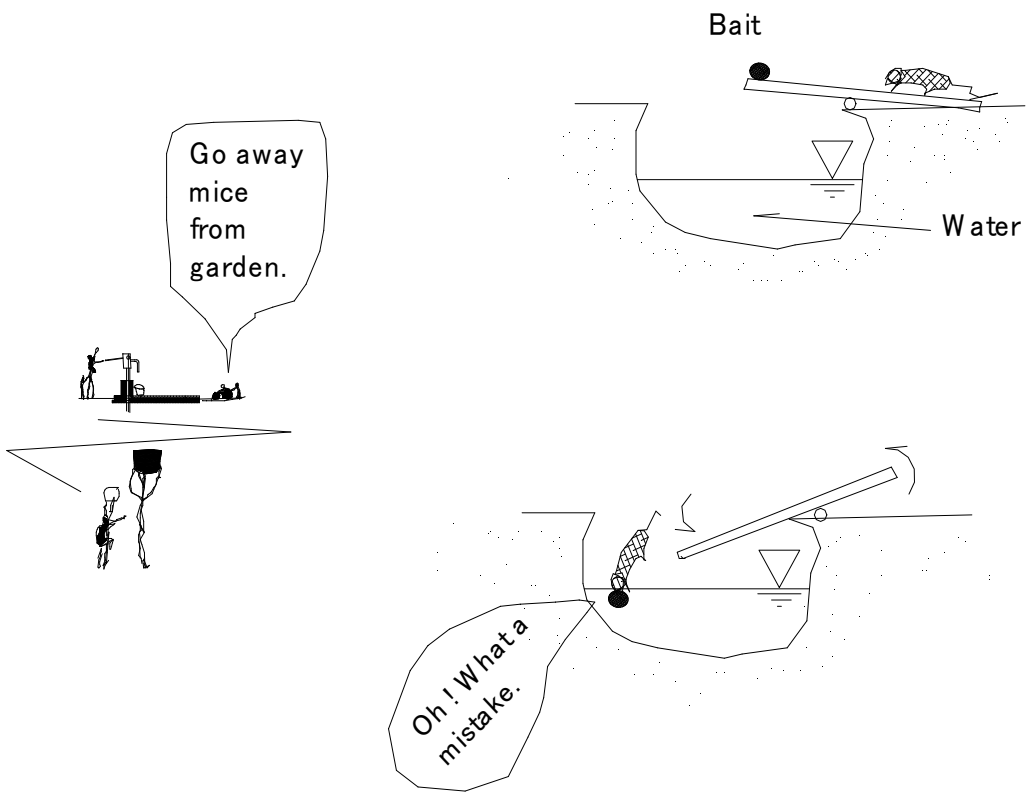
(549) Fencing(3)





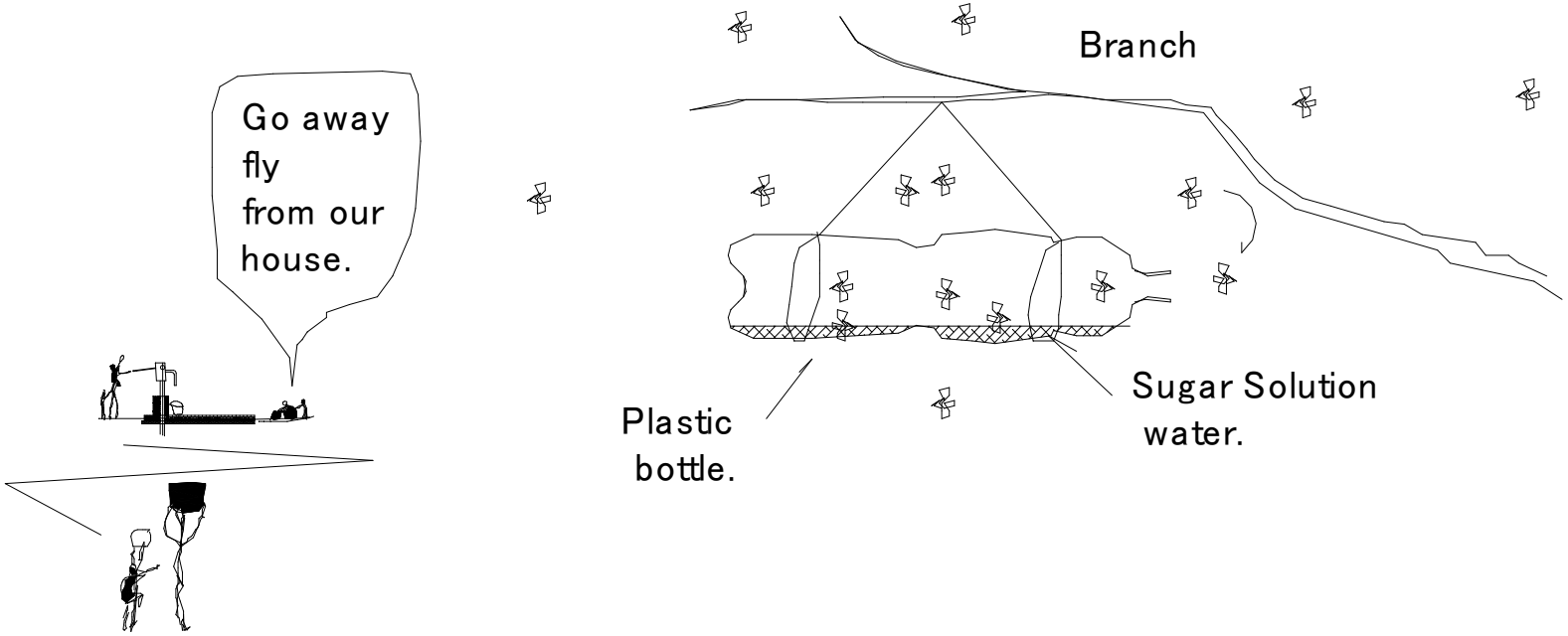
(550) Some traps(1)

Mice Trap.

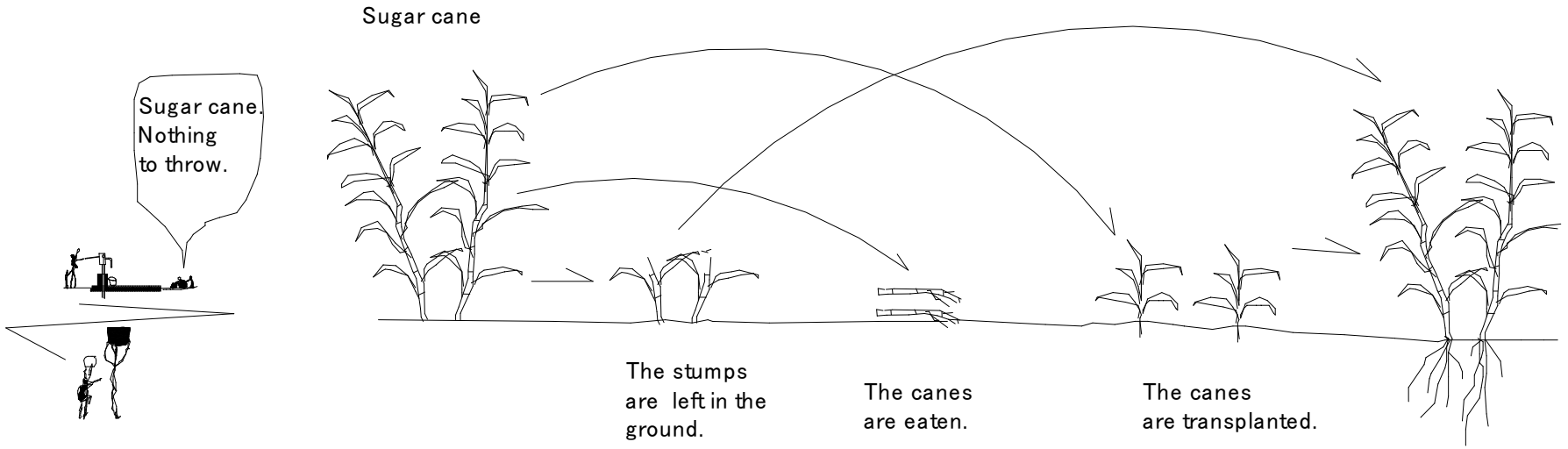


(551) Some traps(2)

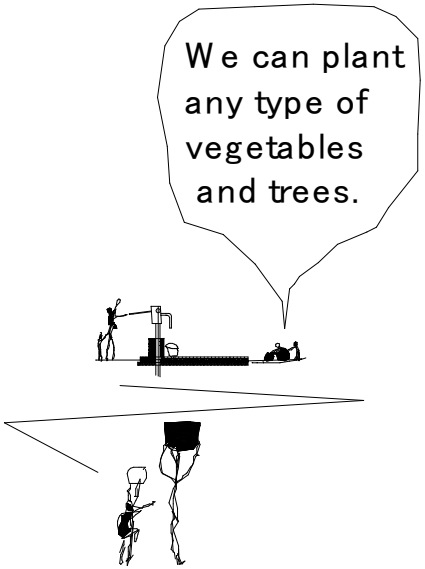
Fly Trap.

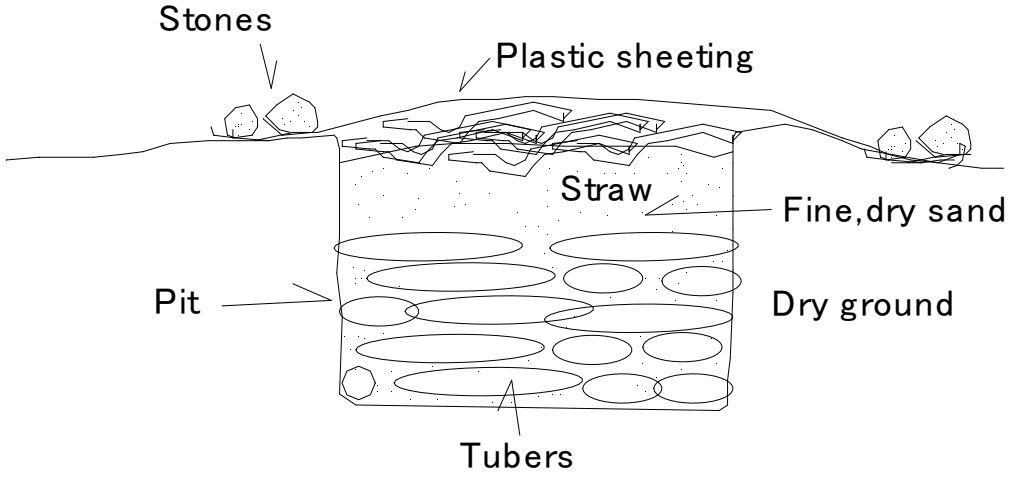


（ 552 ） One way of reproducing sugar cane for chewing without losing the best cane



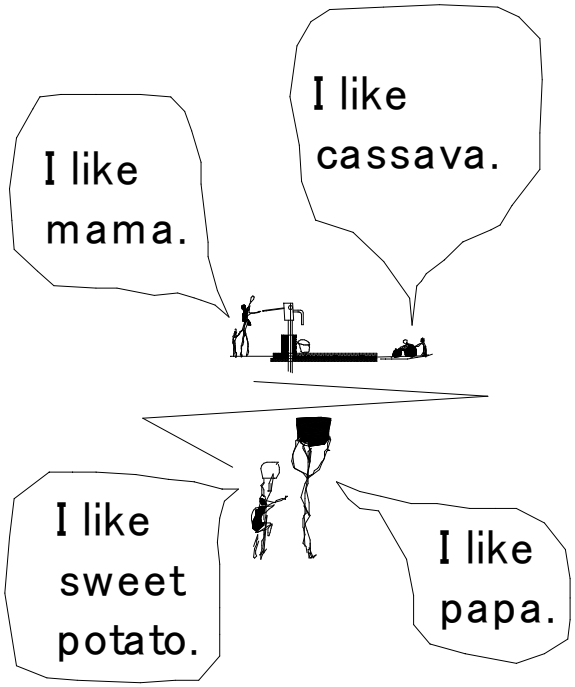
（ 553 ） How to store tubers and tuber tops for seed

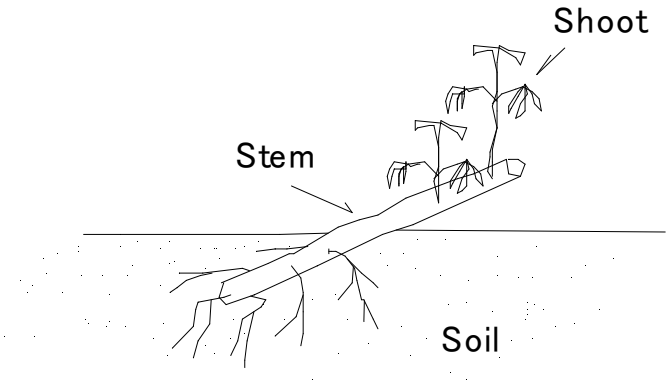




(554) Various kinds of stem cutting(1)

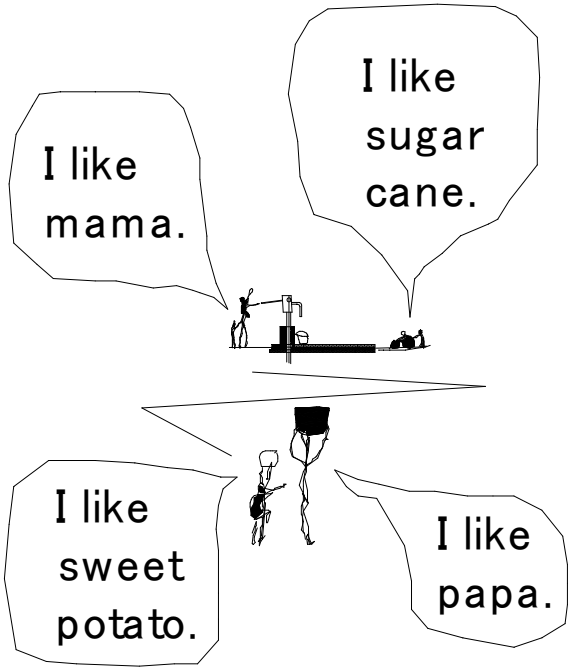
A cassava cutting

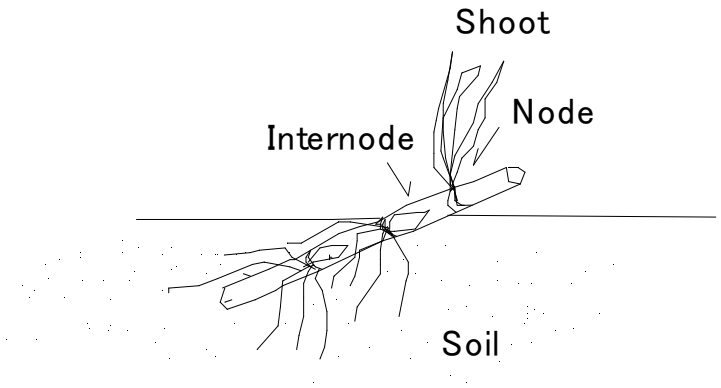




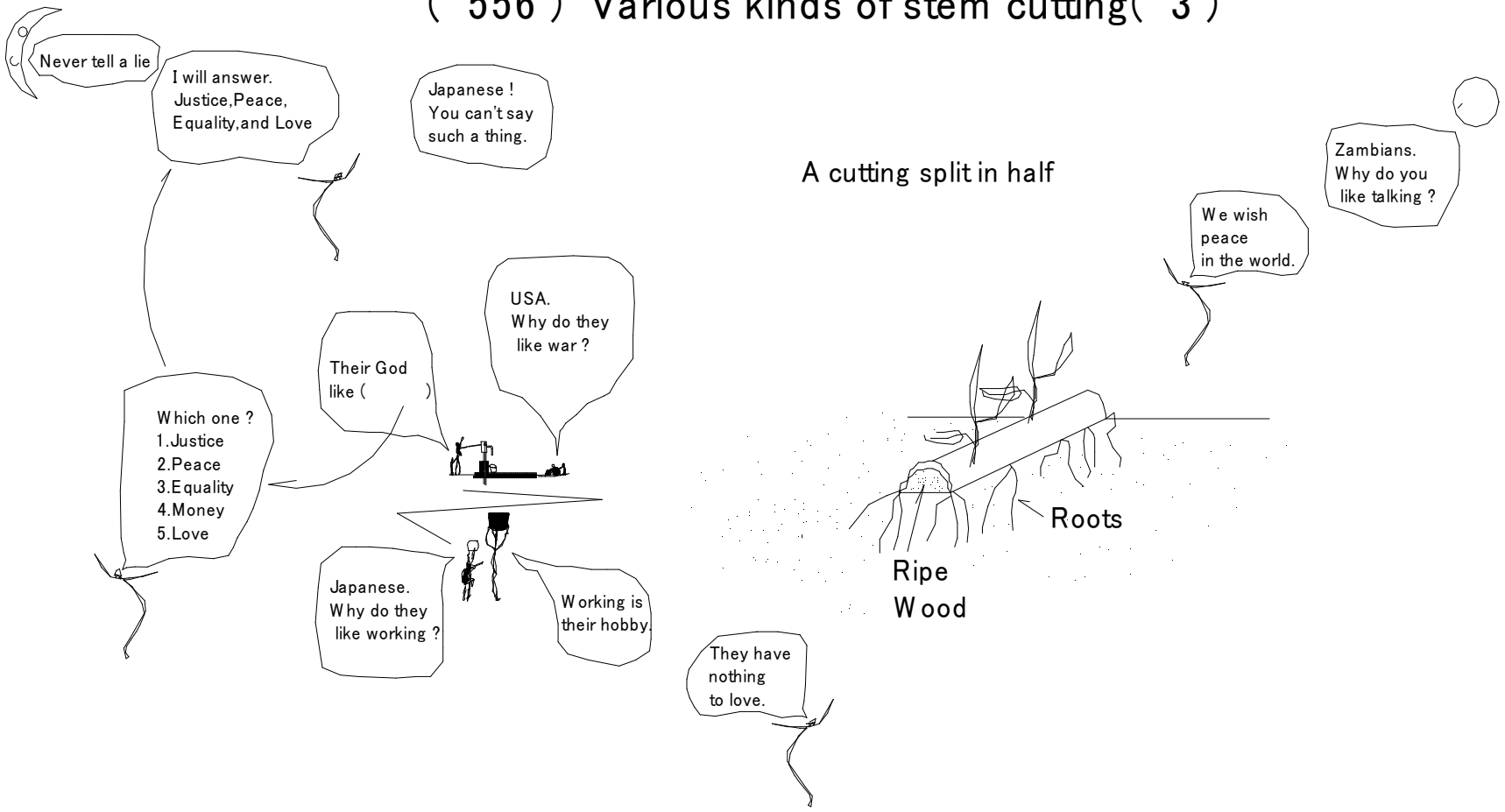
(555) Various kinds of stem cutting(2)

A sugar cane cutting

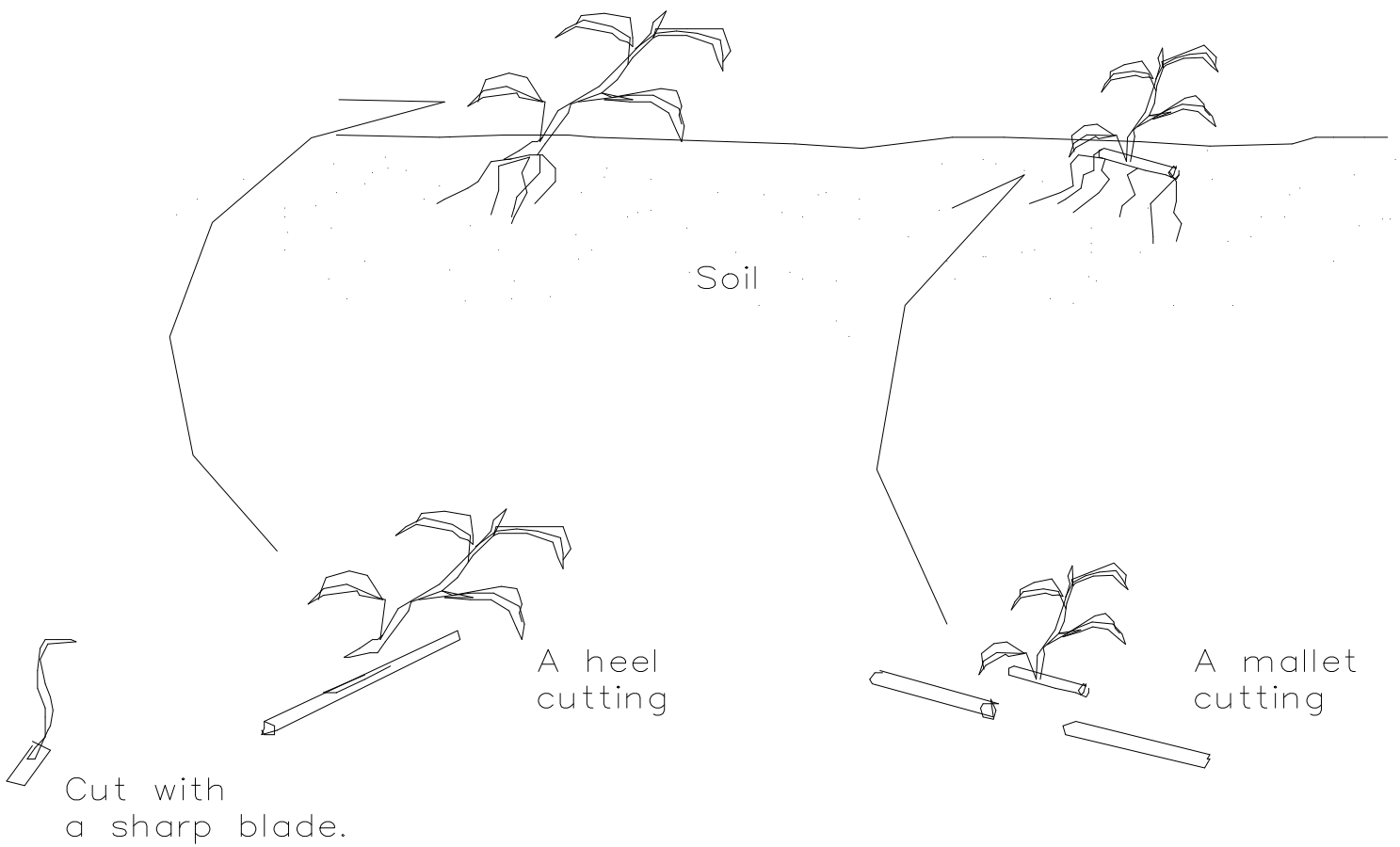




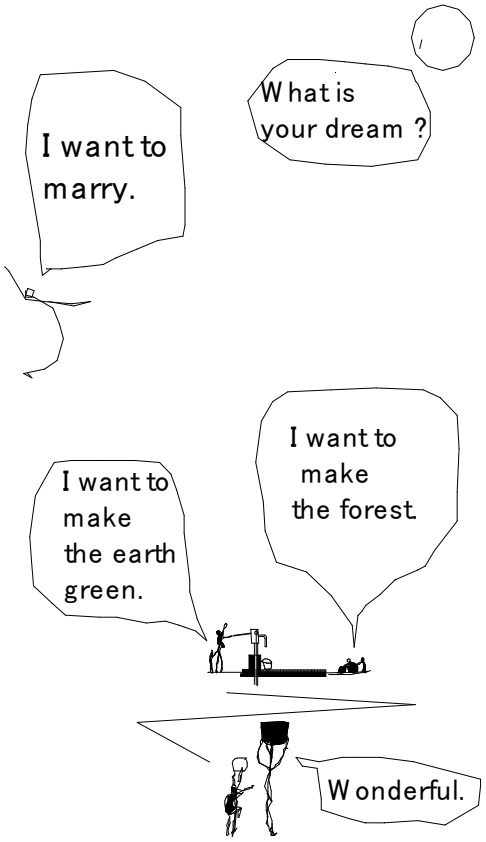
(556) Various kinds of stem cutting(3)

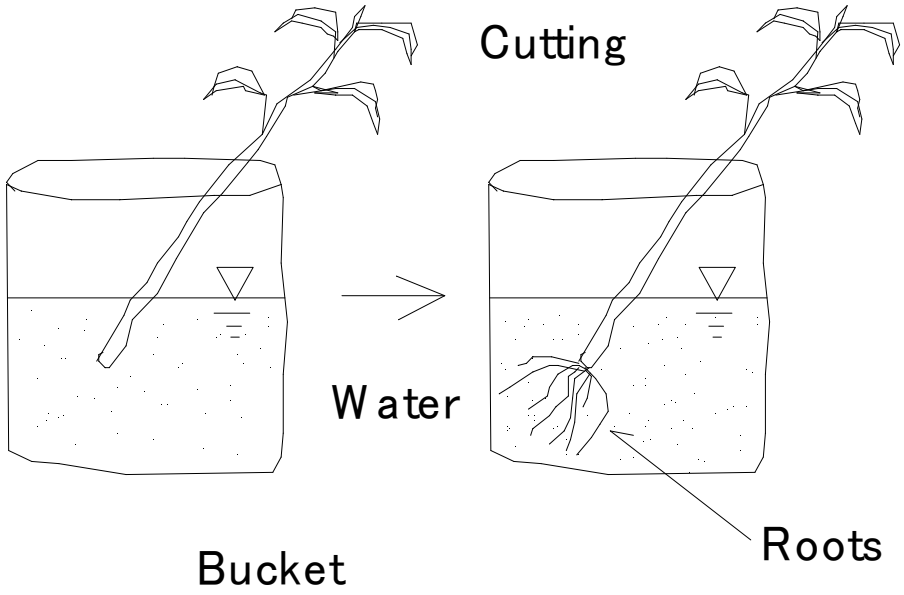


(557)Unusual cuttings

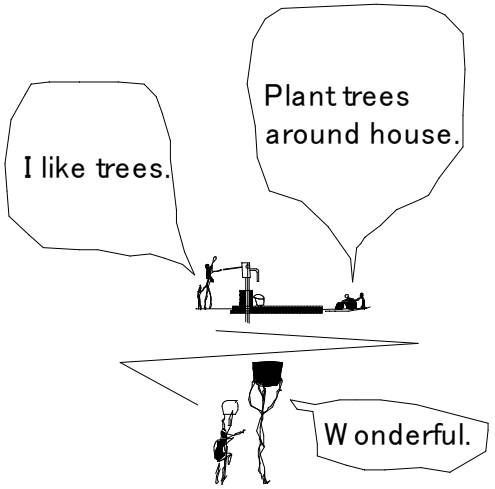


（ 558 ） Placing a cutting in water

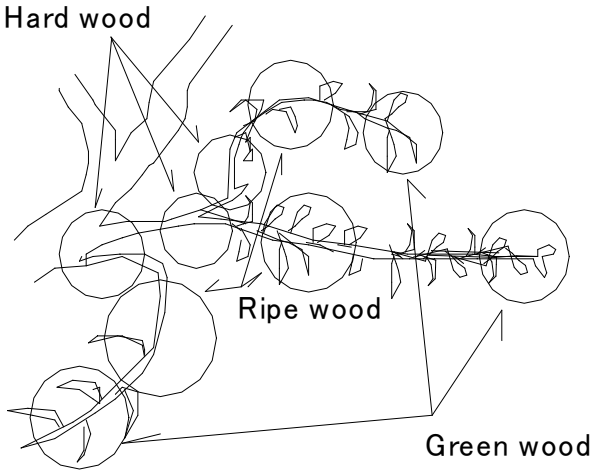




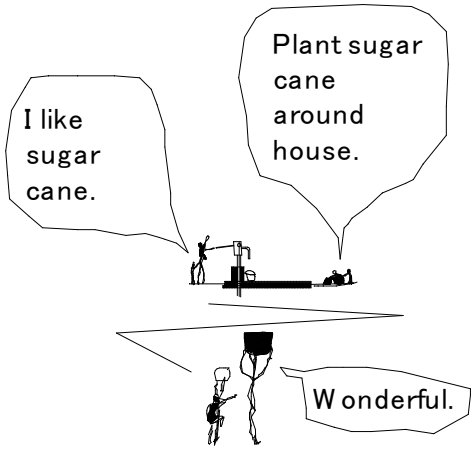
（ 559 ） Stem cuttings are taken from ripe wood

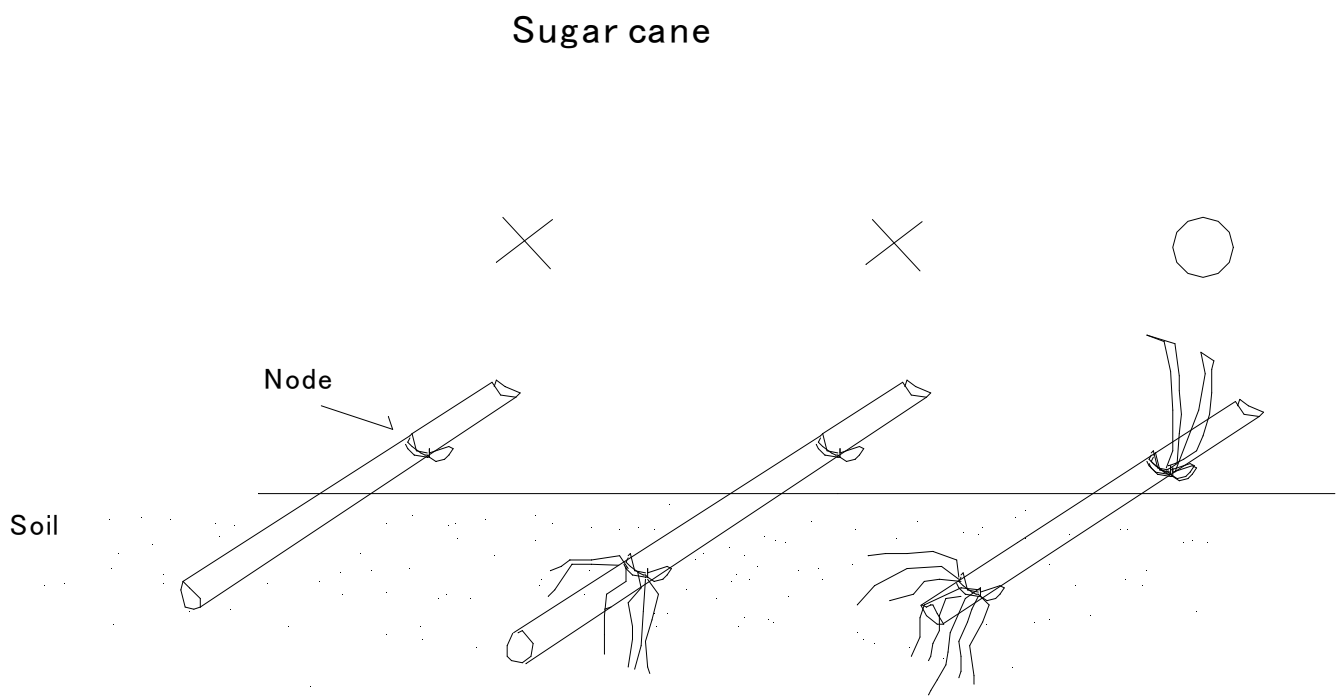


Stem cores are already woody.
Bark is still green.

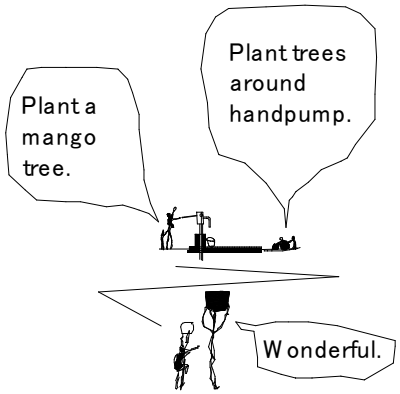


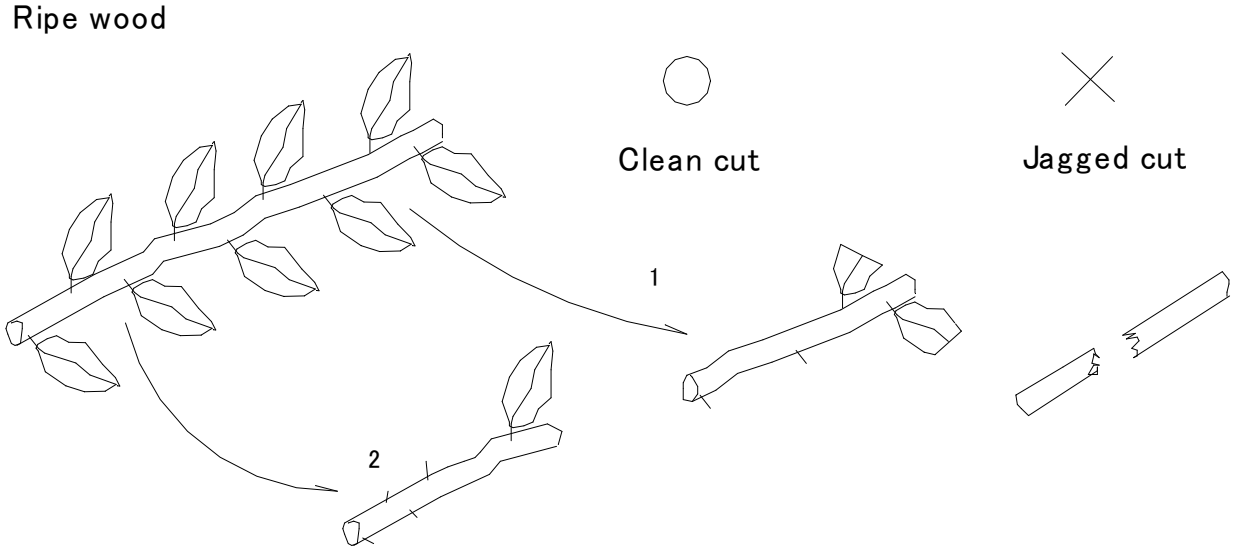
（ 560 ）How to take cuttings



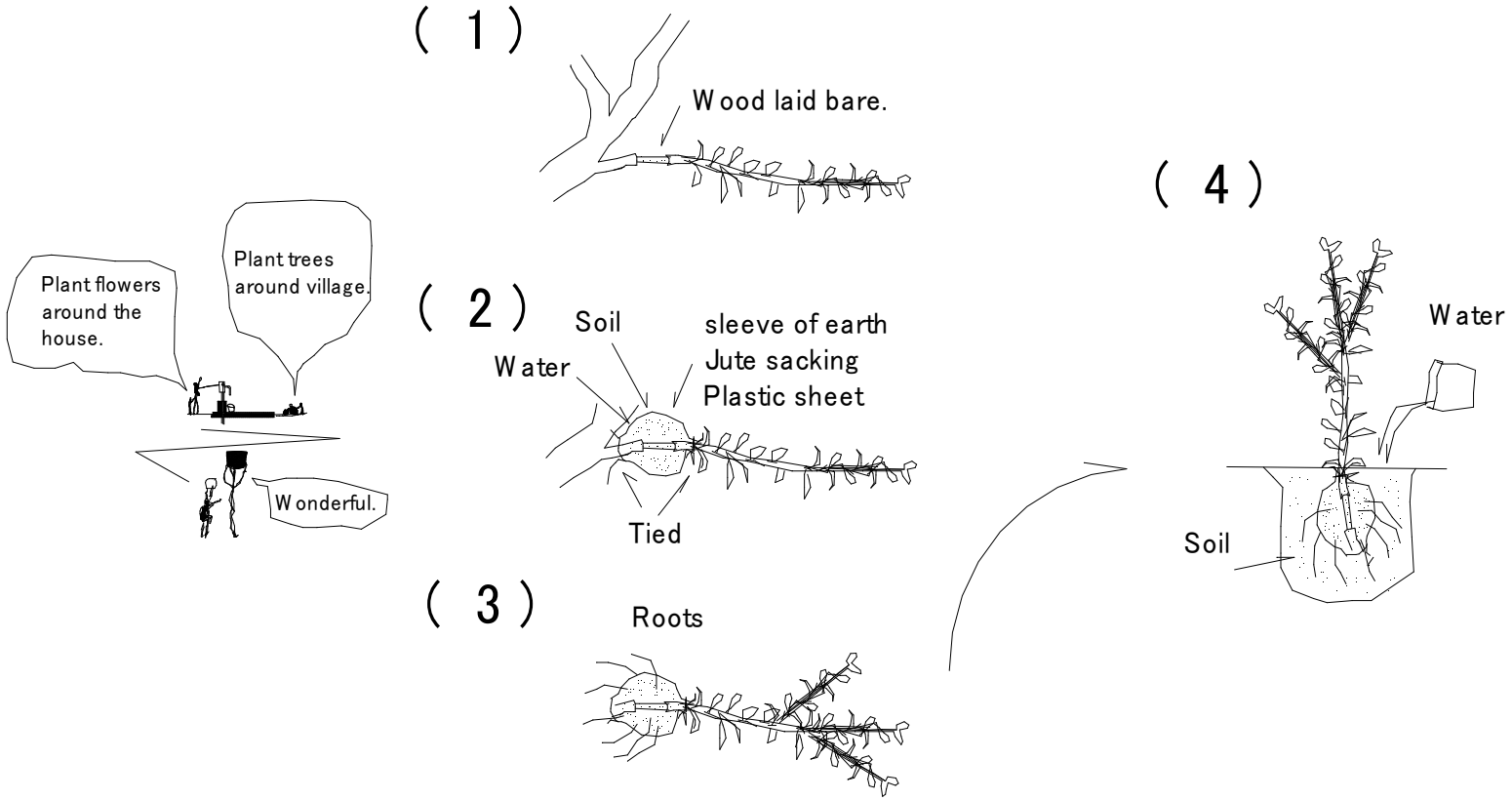


（ 561 ） Cutting and trimming branches for propagation

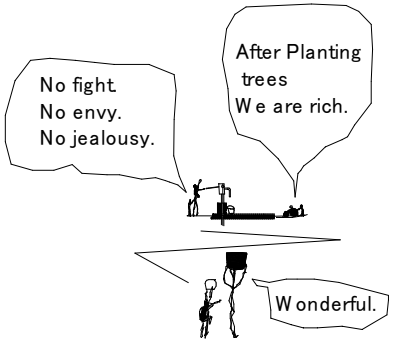


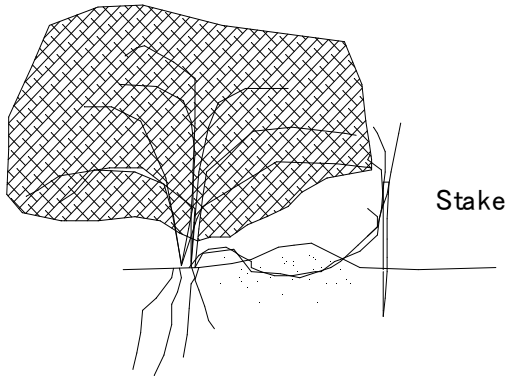


(562) Ringing and air layering

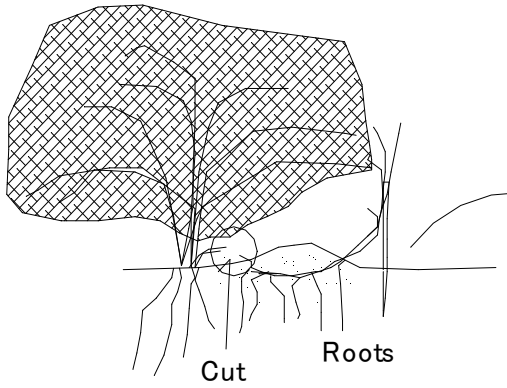


（ 563 ）Layering on the ground

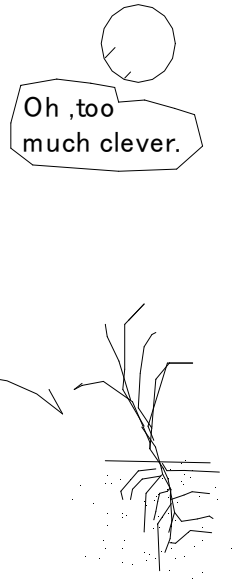




A low branch is bent
and covered with soil.
The end is staked
to keep it in place.

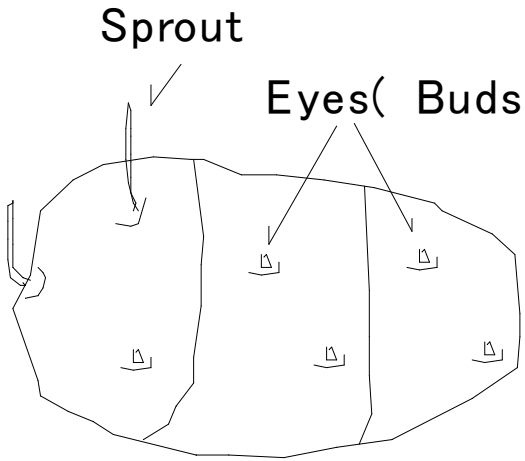


Some weeks later,
roots appear.

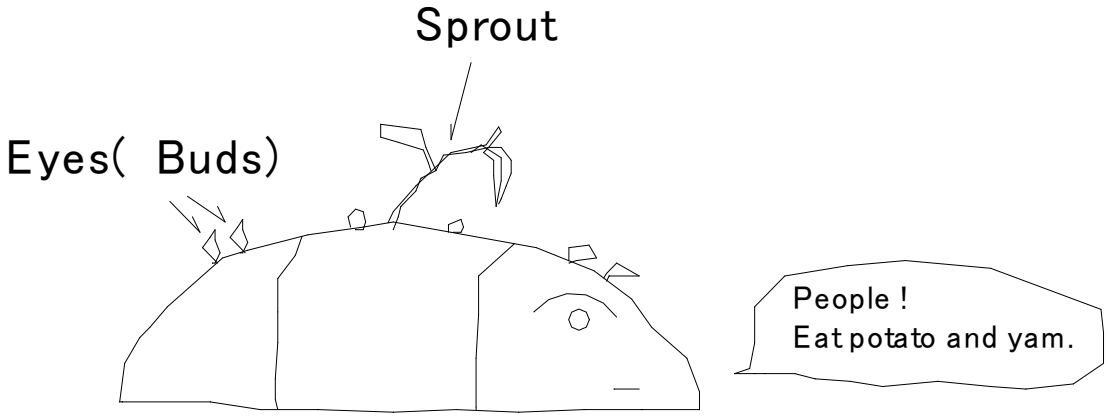


Cut,then
Transplant
on permanent site.

(564) Cutting sets in tubers



Potato divided

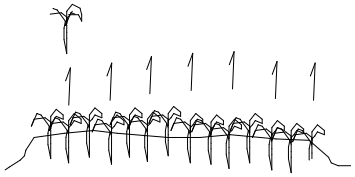


Yam tuber cut off

（ 565 ） Thinning

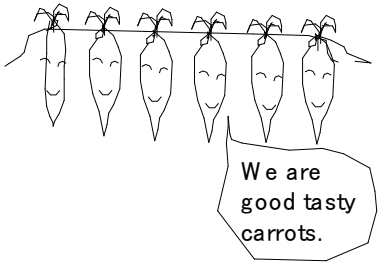
（ 1 ） Carrots are sown very densely.

（ 2 ） Pulled up



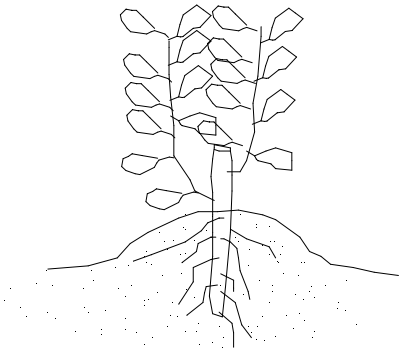
（ 3 ） After Picking out

（ 4 ） After thinning

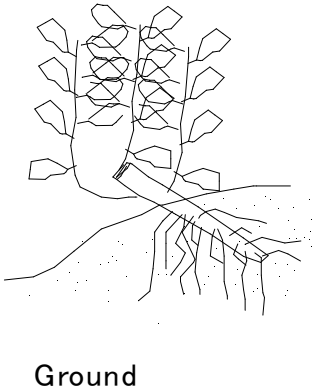


（ 566 ） Three ways of planting cuttings

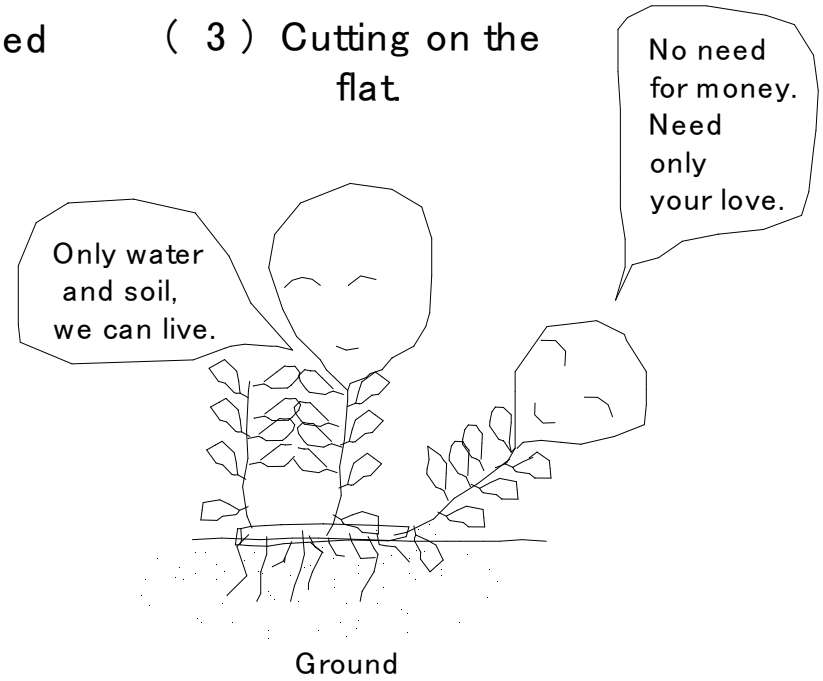
（ 1 ） Erect cutting



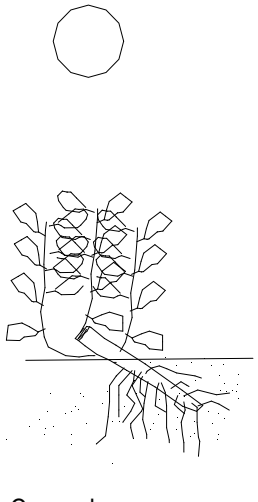
（ 2 ） Cutting buried slantwise

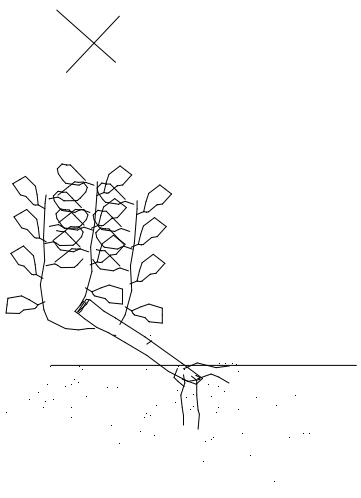


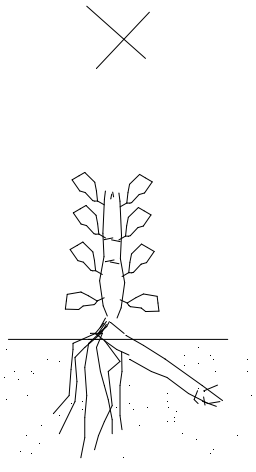
（ 3 ） Cutting on the flat.

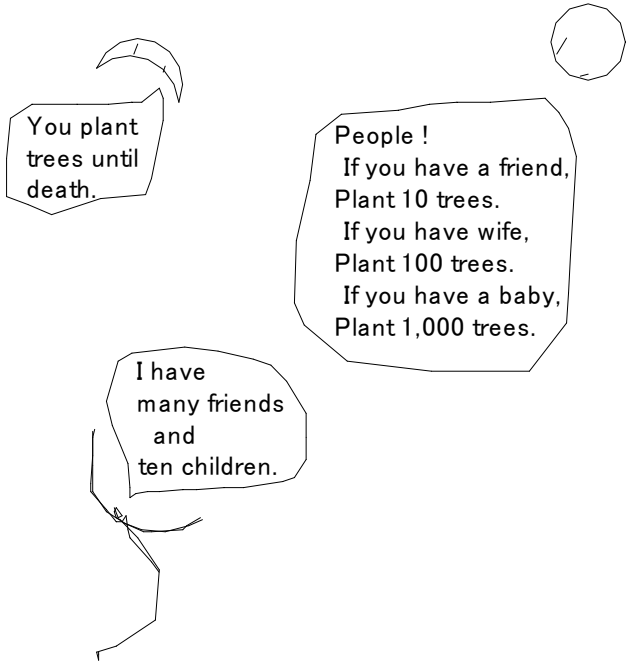


（ 567 ）Planting cuttings in the field

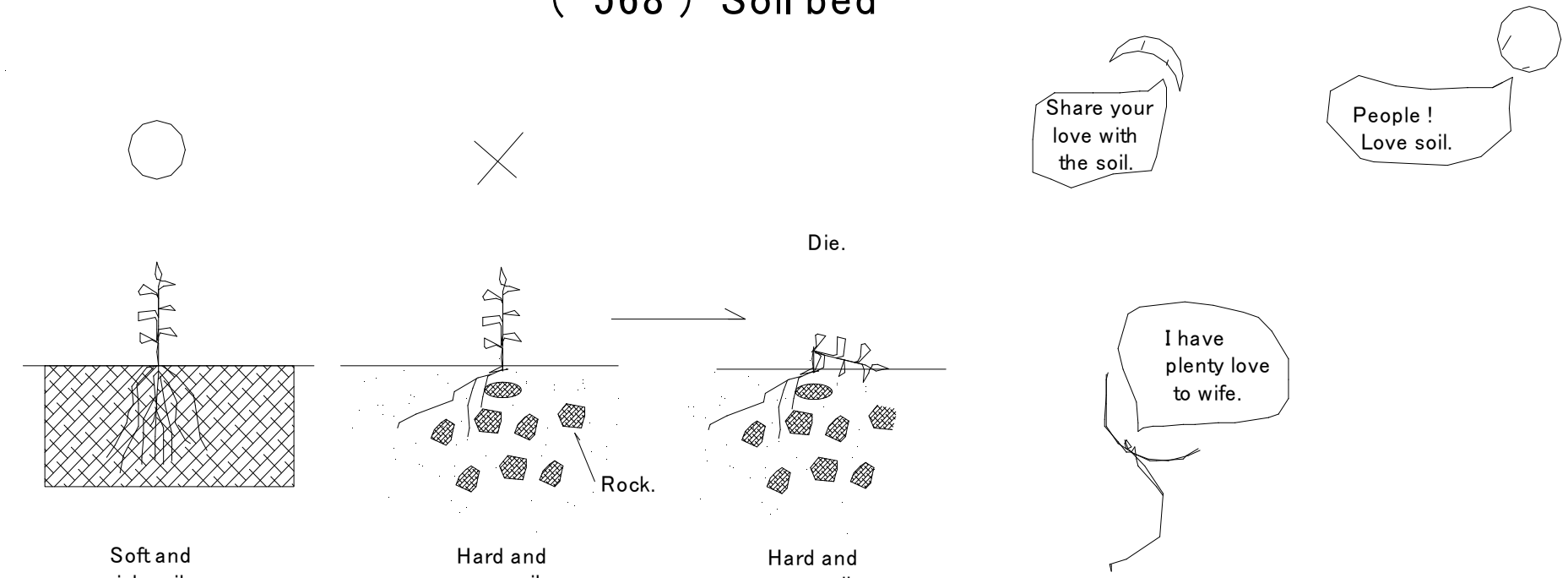




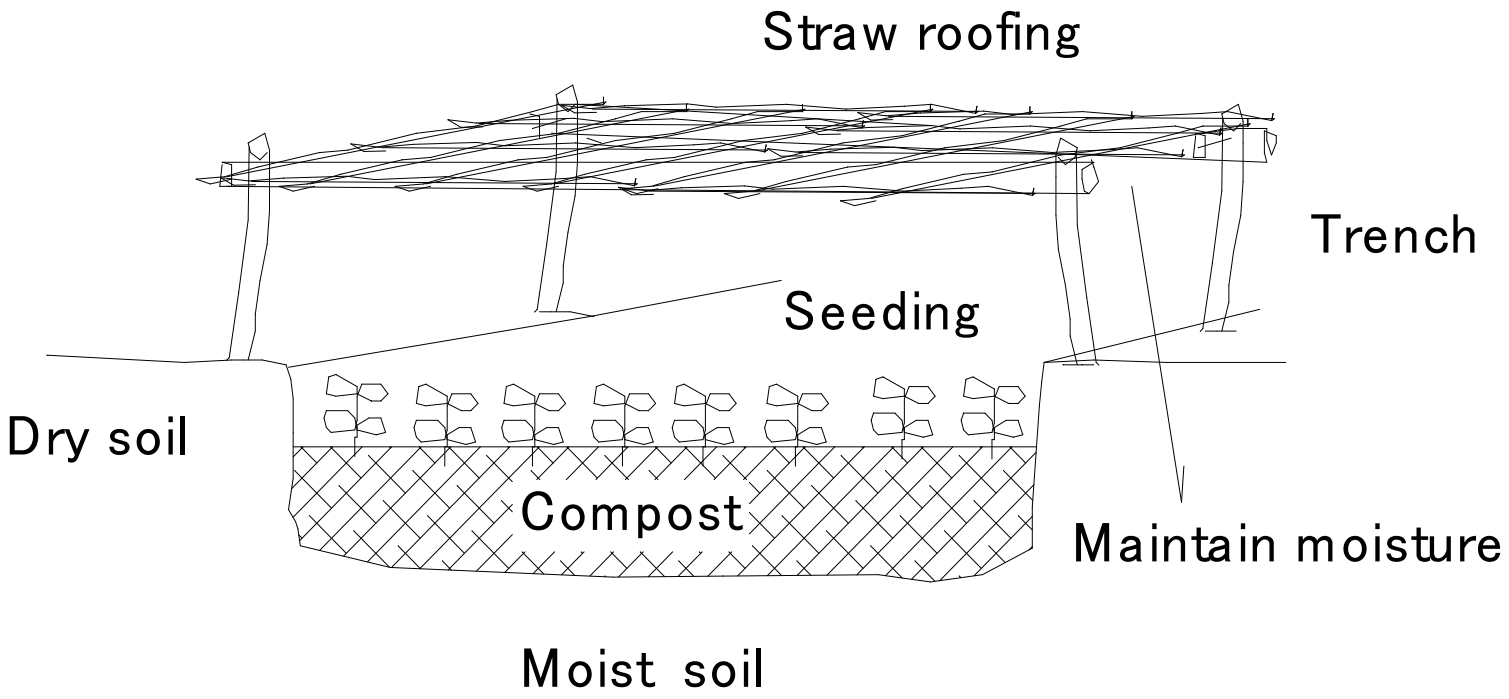




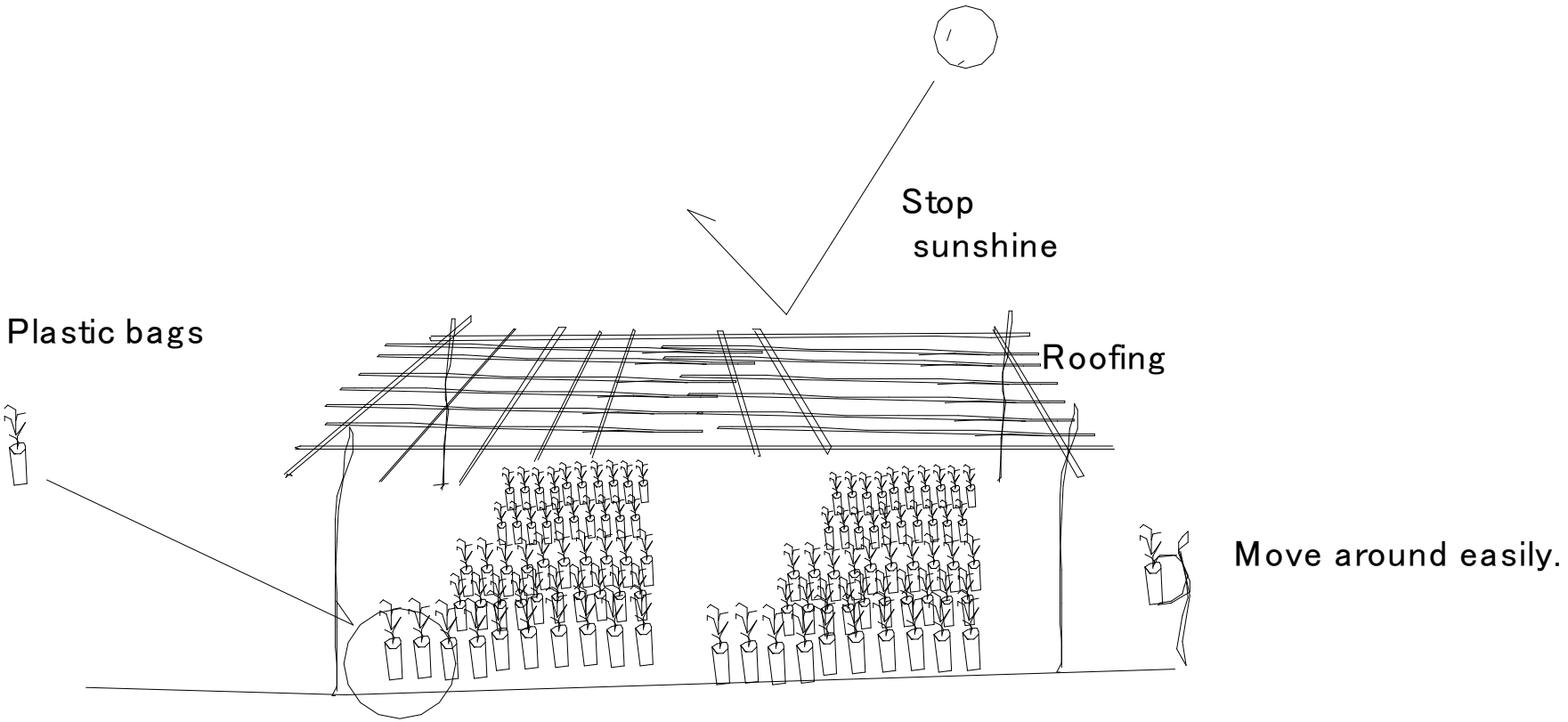
(568) Soil bed


Share your love with the soil.
People ! Love soil.
Die.
Rock.
I have plenty love to wife.
Soft and rich soil.
Hard and poor soil.
Hard and poor soil.

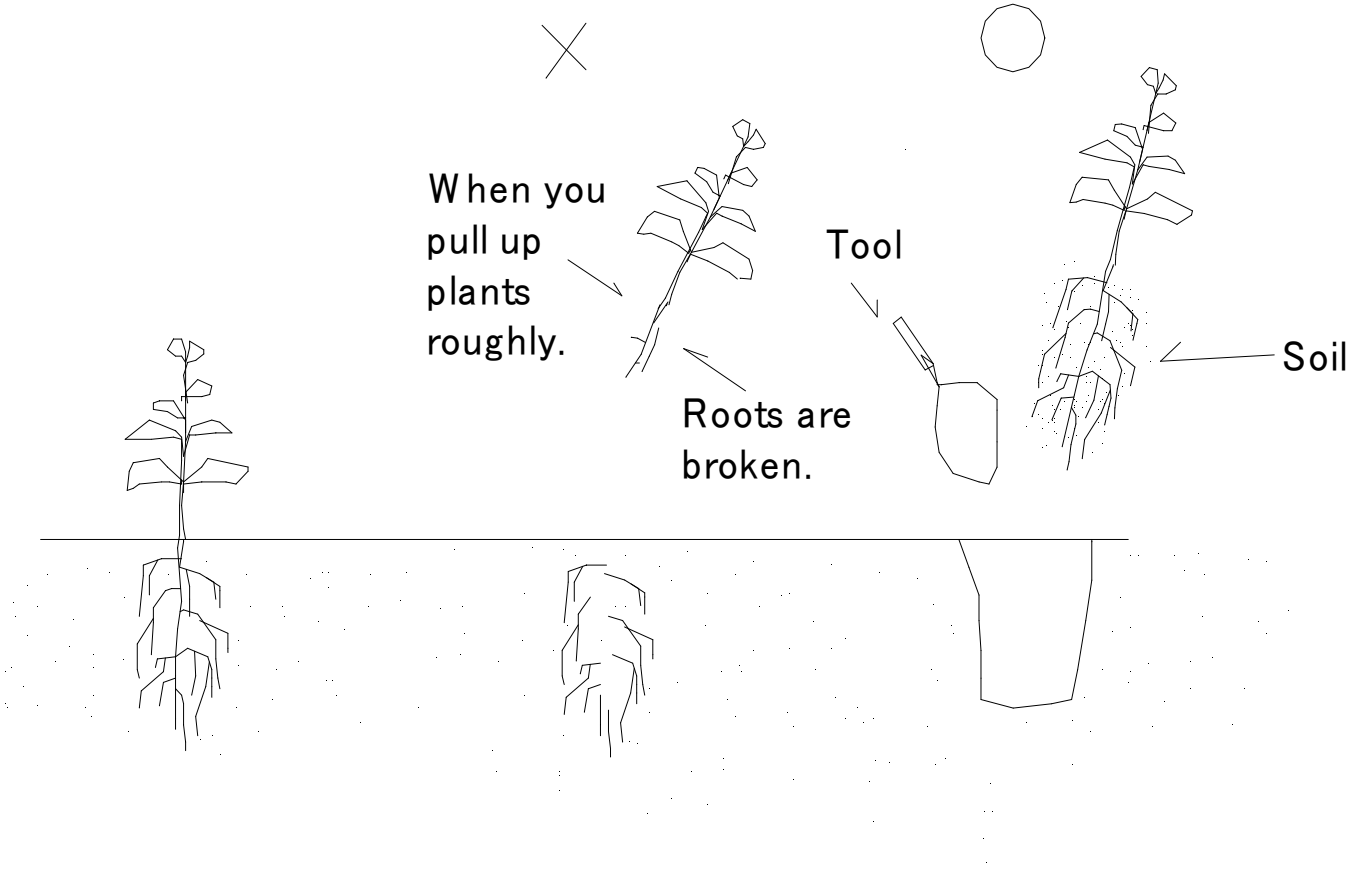
（ 569 ） A nursery in a trench



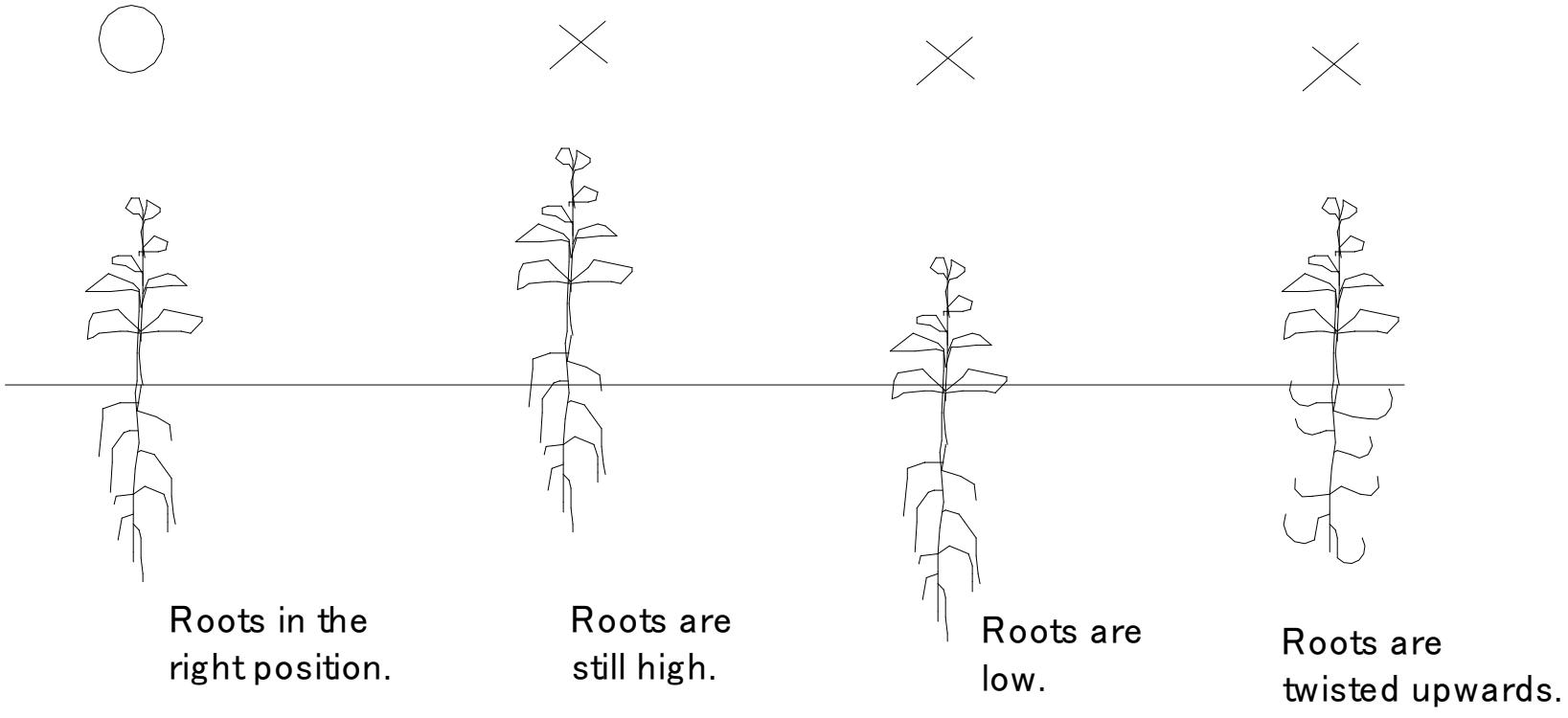
（ 570 ） Roofing



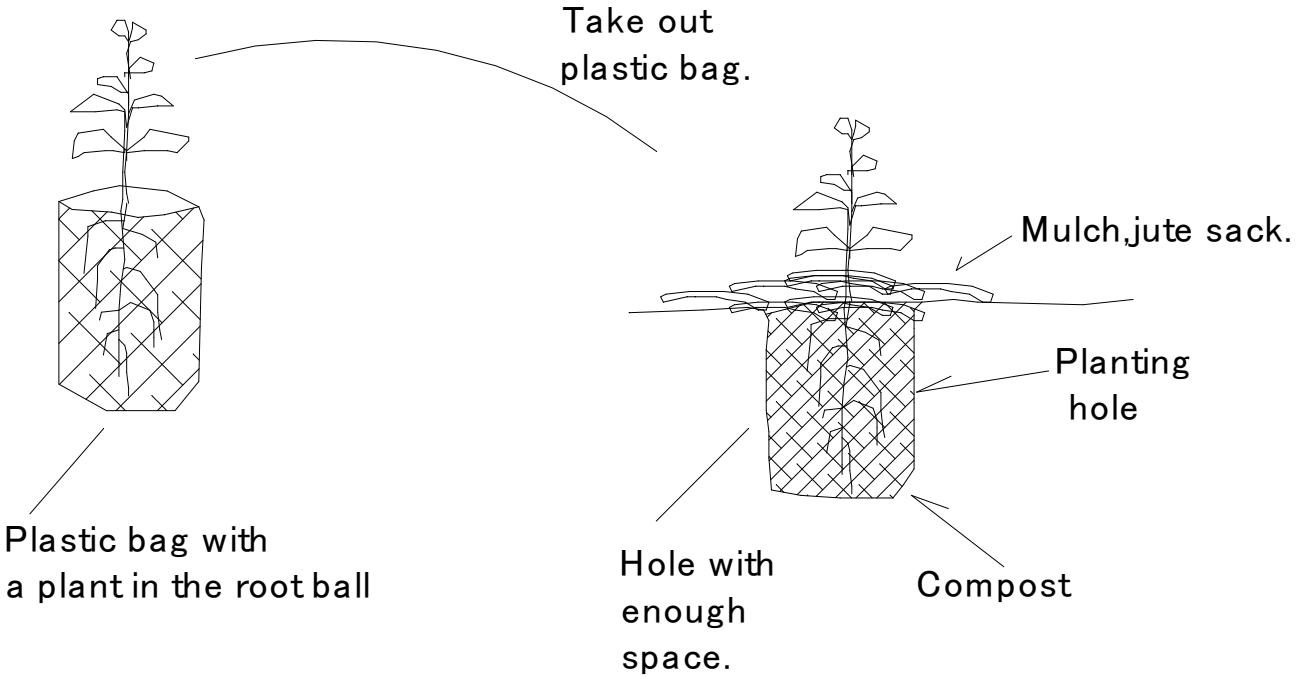
（ 571 ） How to uproot plants for transplanting



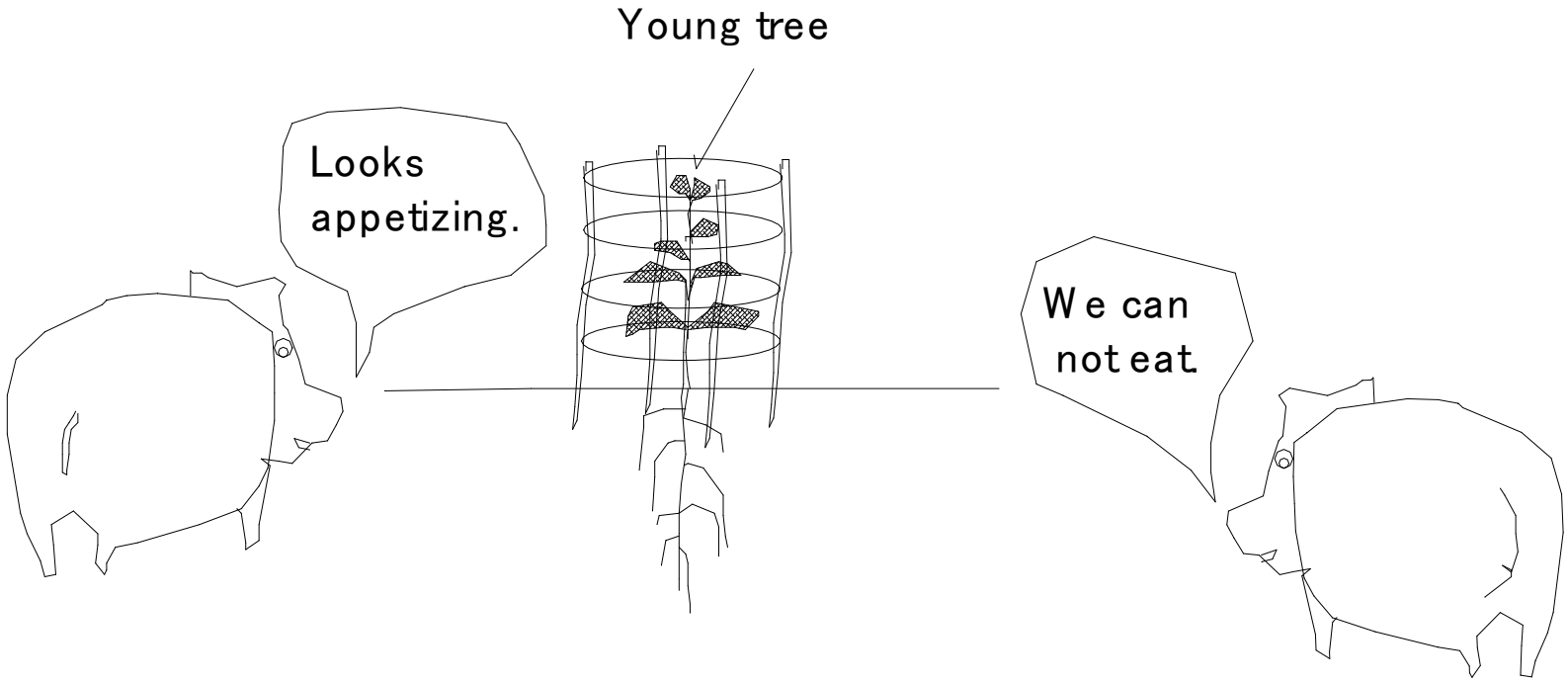
（ 572 ） How to transplant seedlings



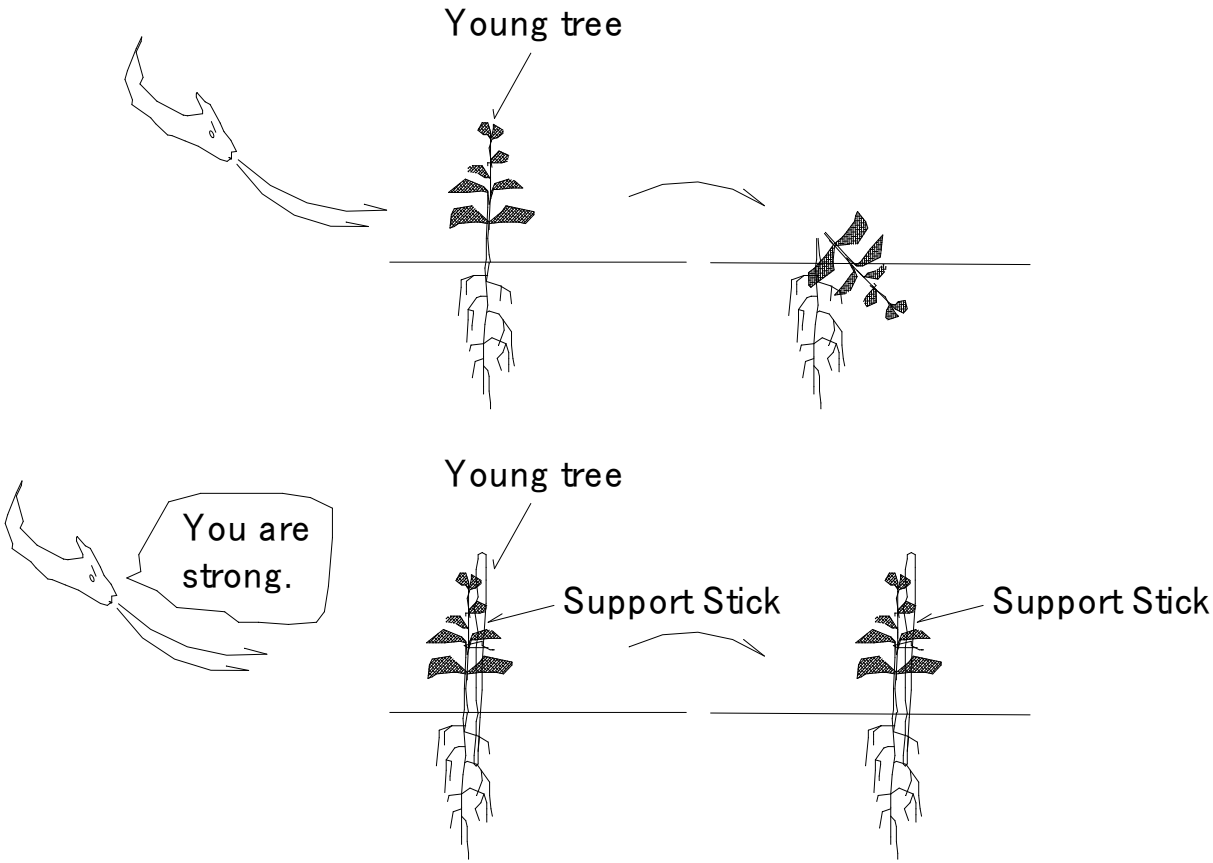
（ 573 ） Positioning a young tree in a planting hole



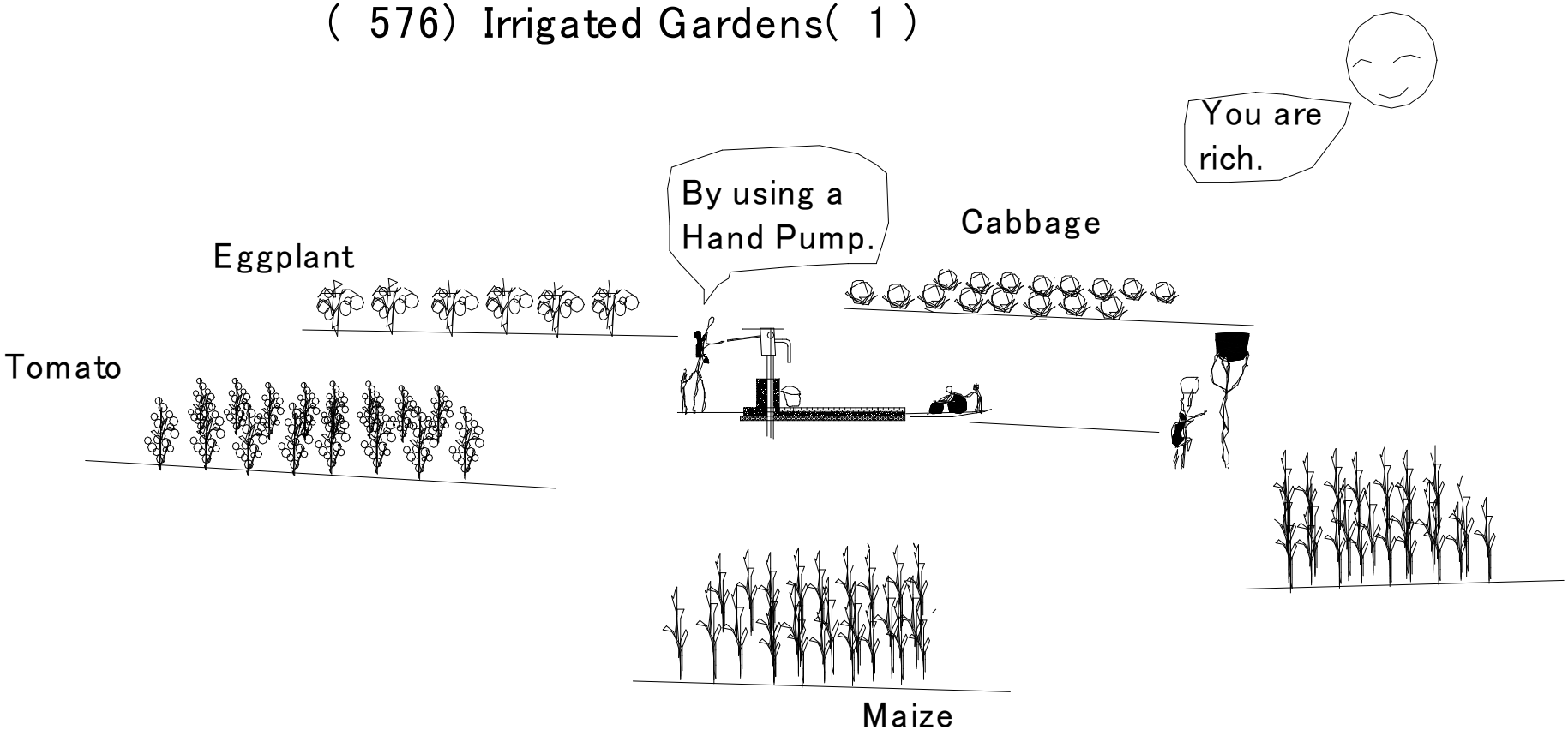
（ 574 ） Protect a young tree



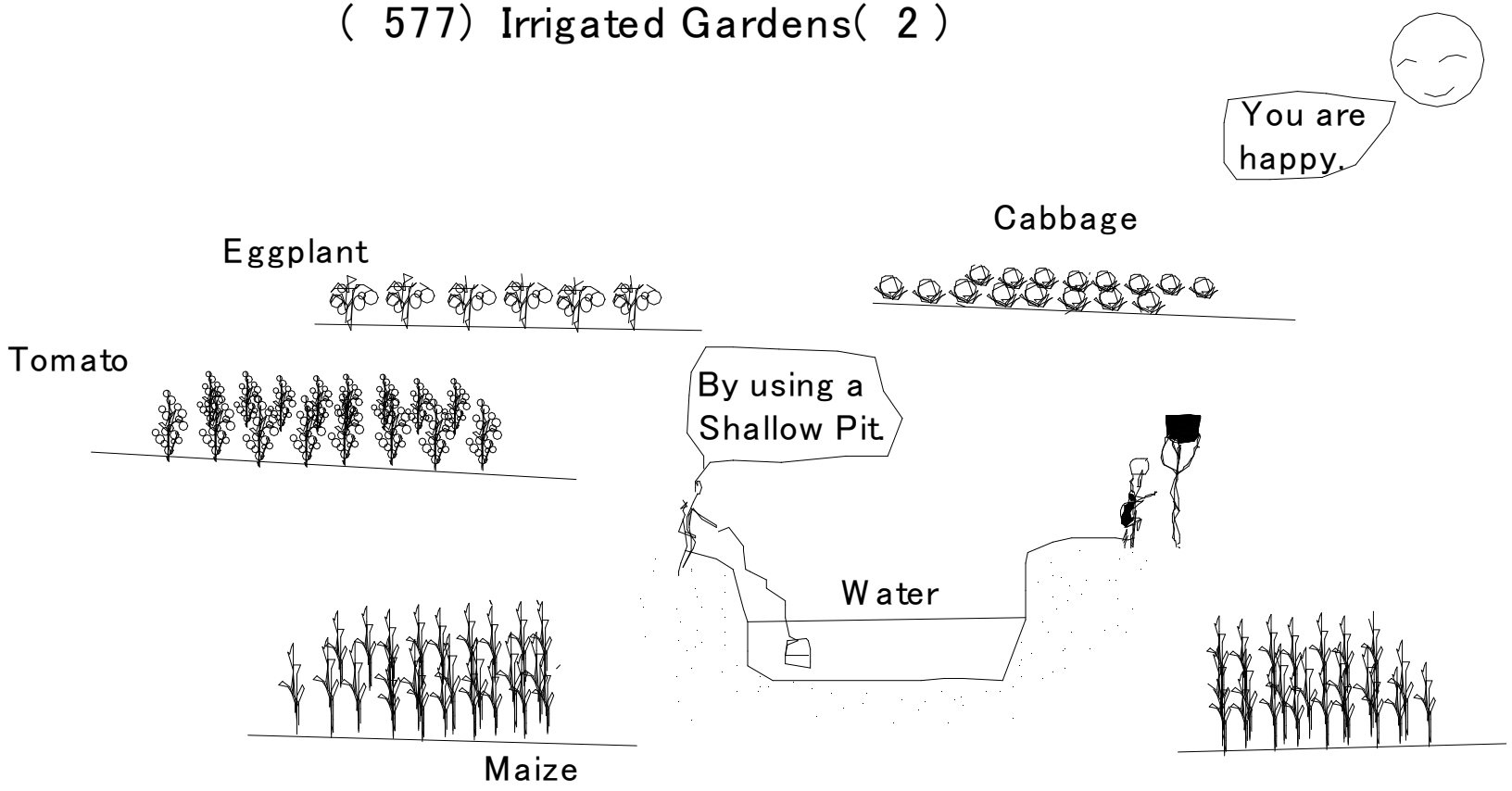
(575) Protect a young tree(2)



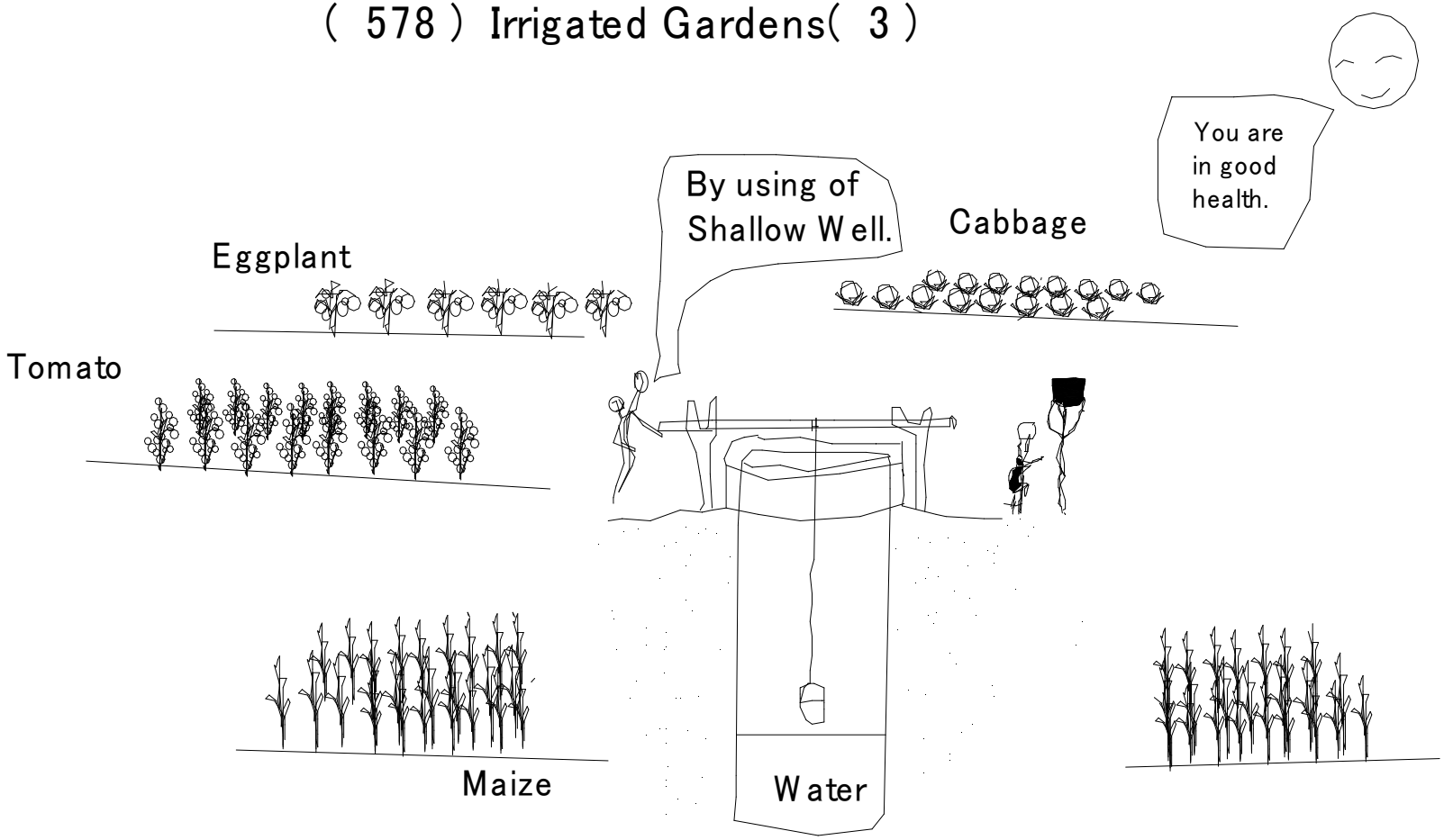
(576) Irrigated Gardens(1)



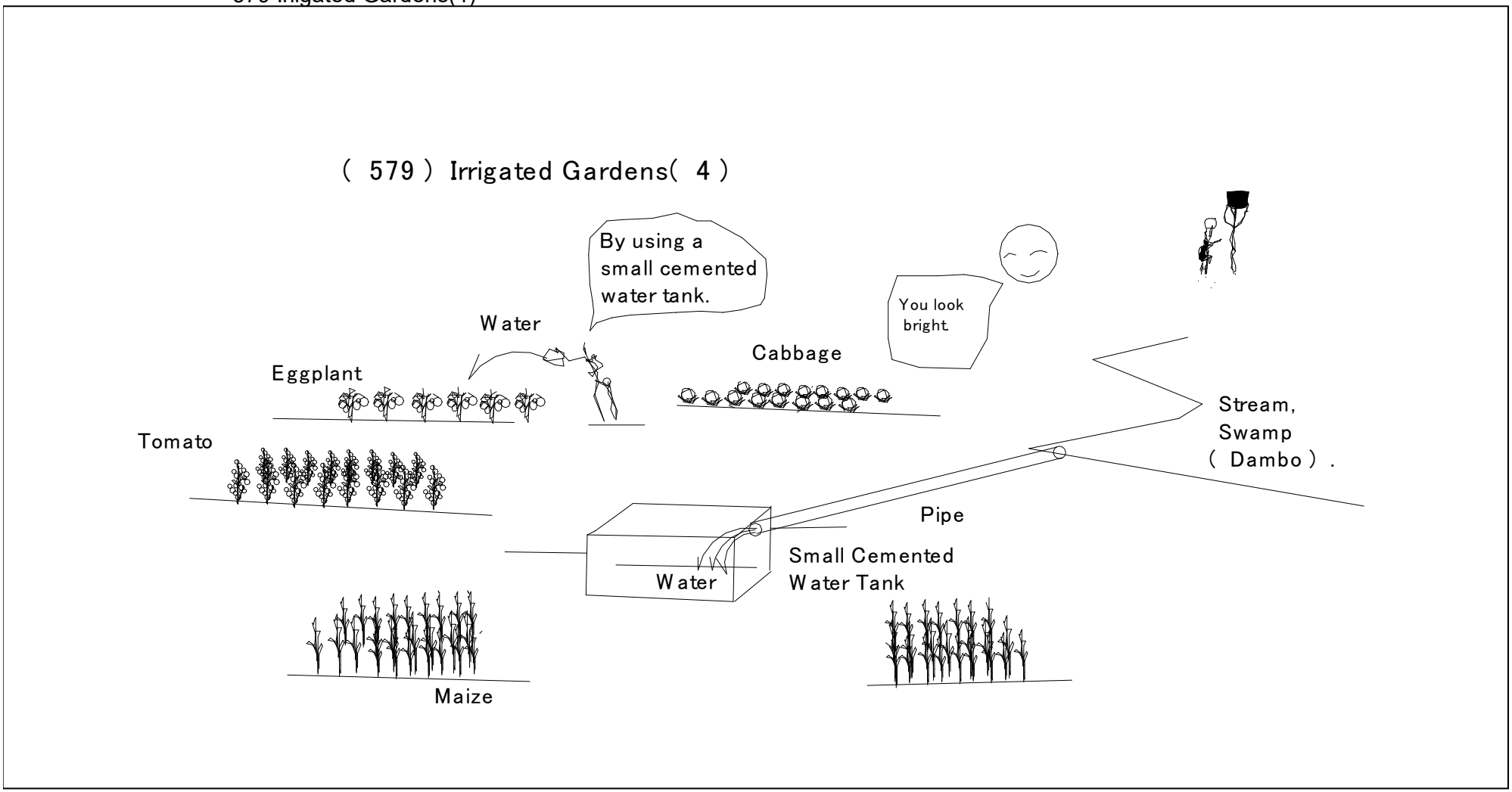
(577) Irrigated Gardens(2)



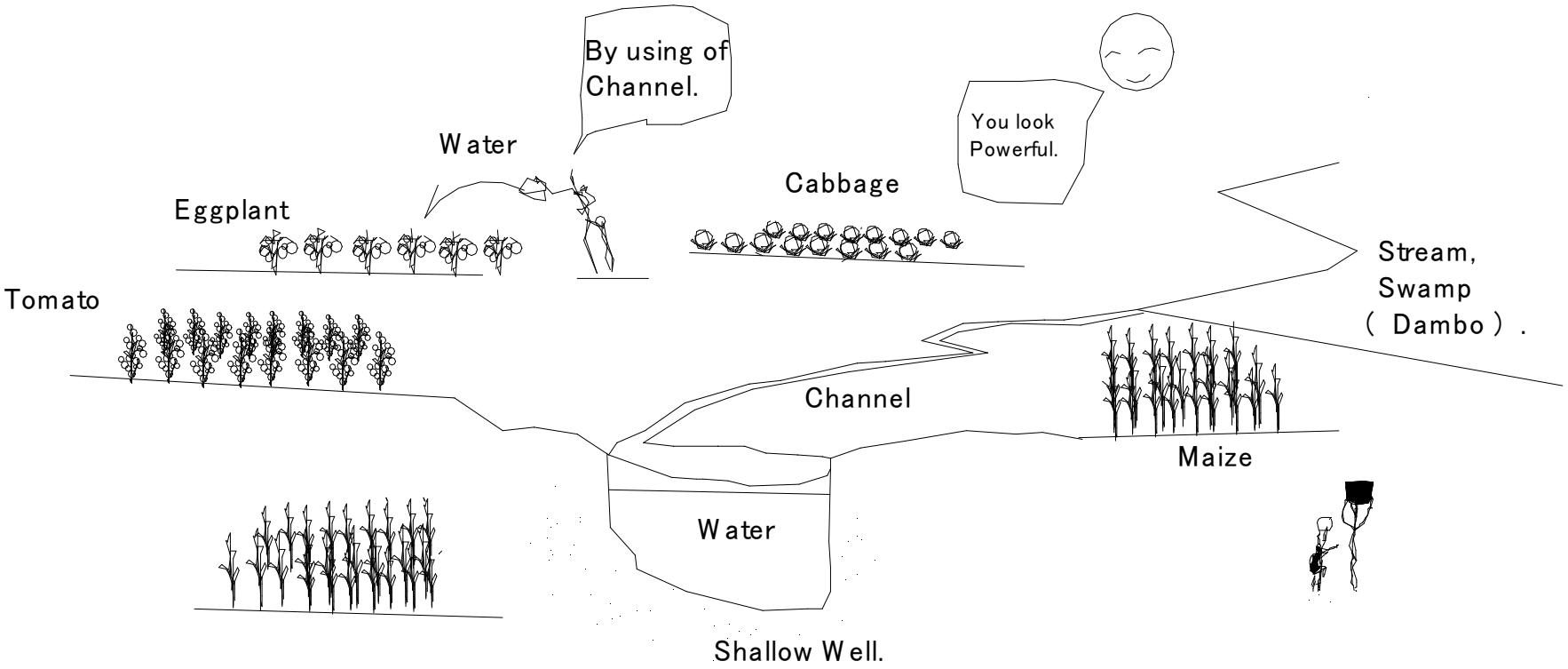
(578) Irrigated Gardens(3)



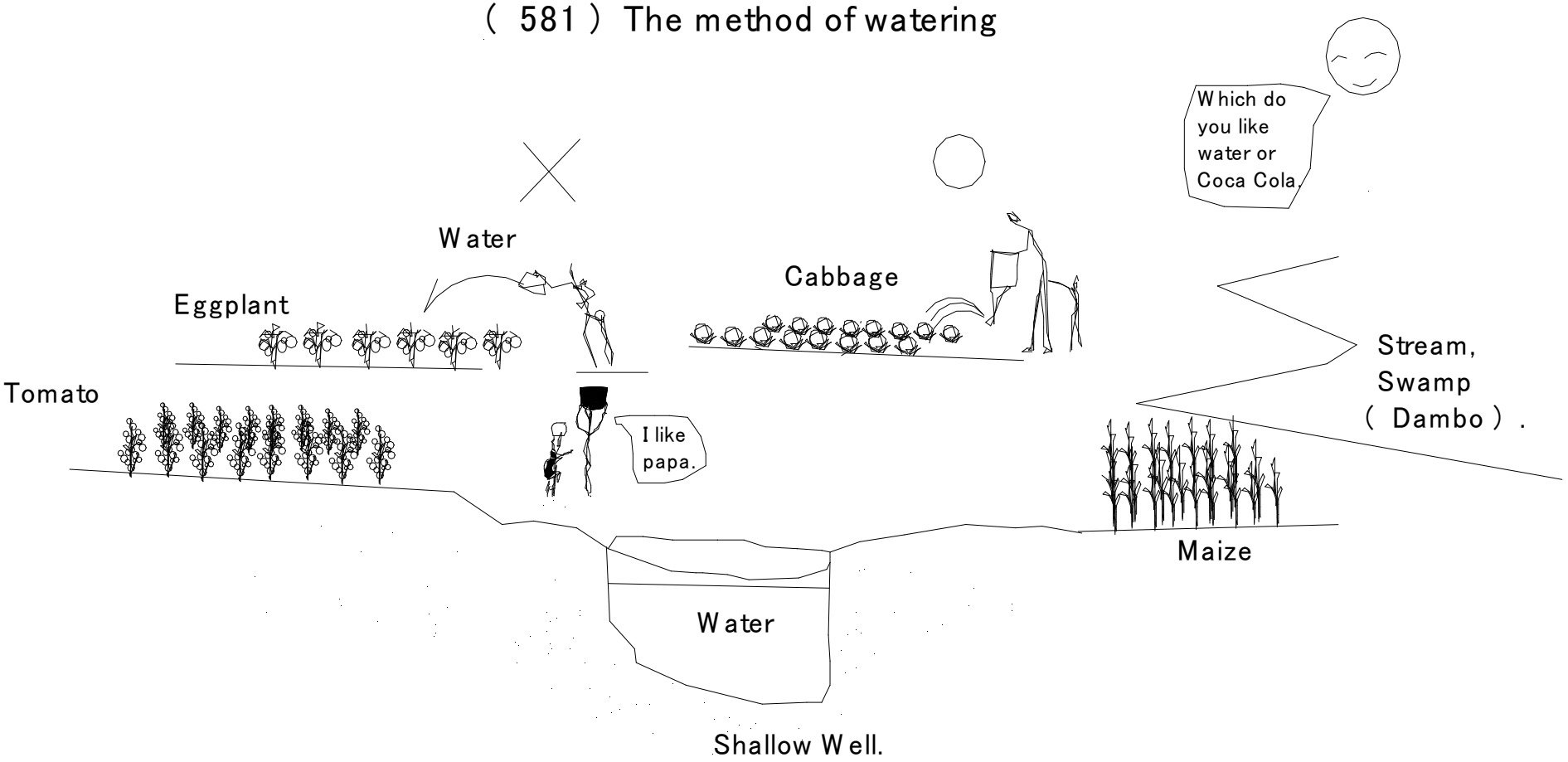
579 Iriigated Gardens(4)

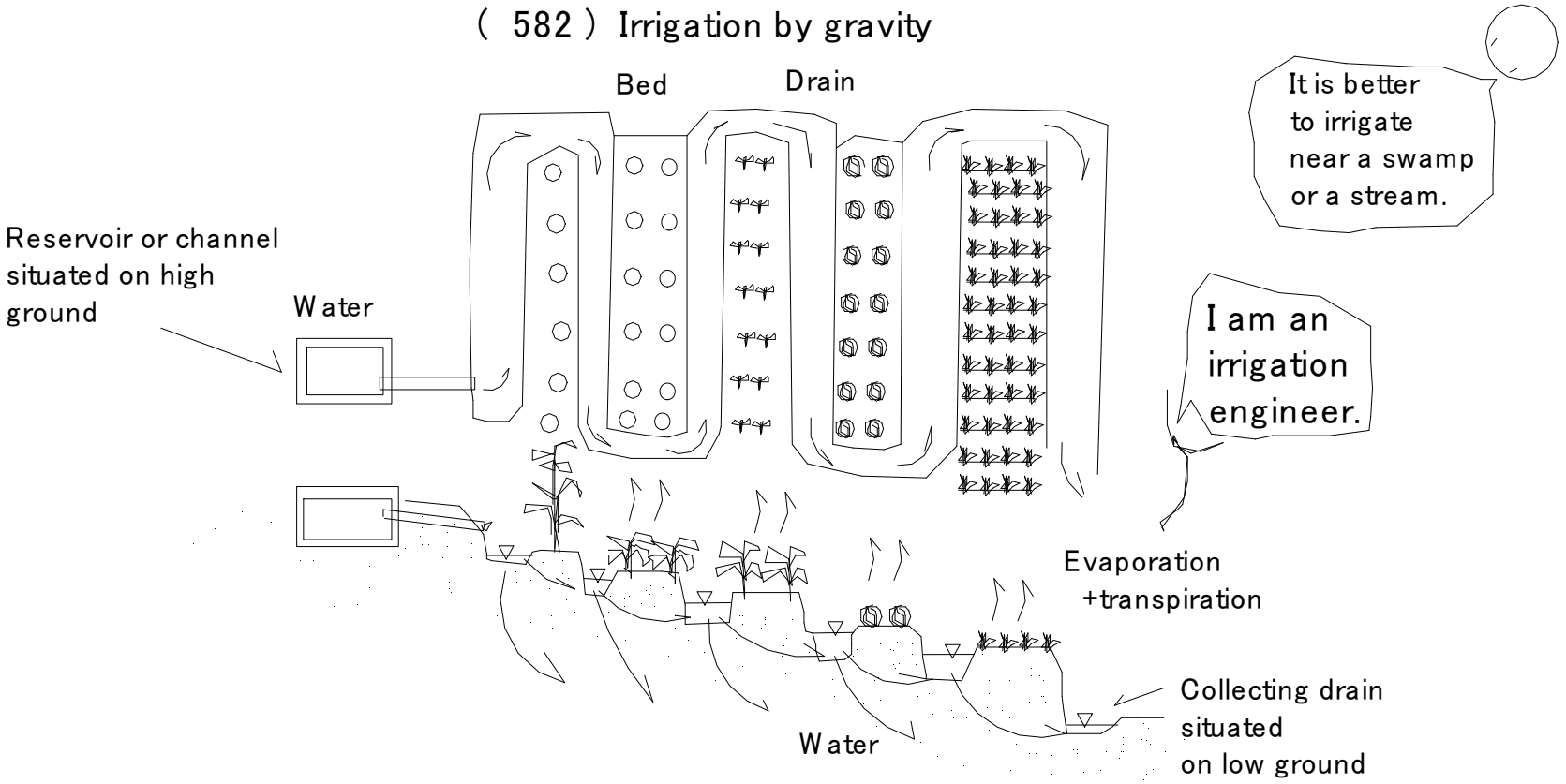


(580) Irrigated Gardens(5)

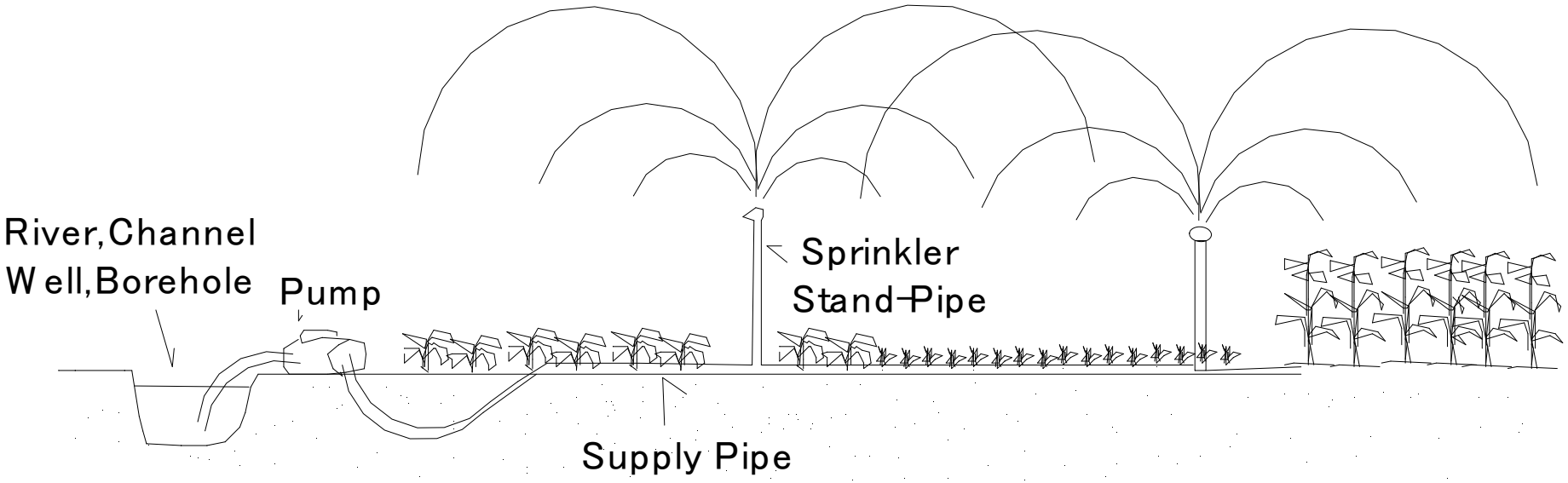


（ 581 ） The method of watering

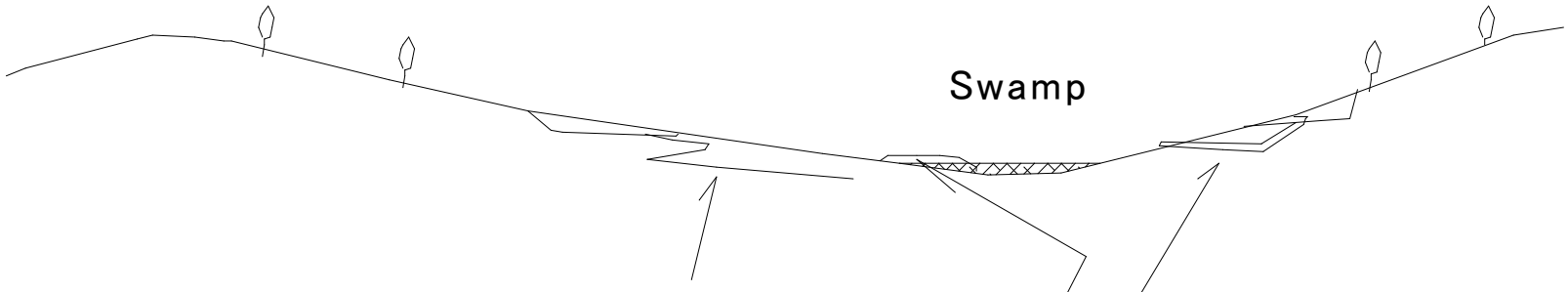



(582) Irrigation by gravity
Bed
Drain
It is better to irrigate near a swamp or a stream.
Reservoir or channel situated on high ground
Water
I am an irrigation engineer.
Evaporation +transpiration
Collecting drain situated on low ground
Water

(583) Sprinkler Irrigation



（ 584 ） Valley bottom cultivation and drainage

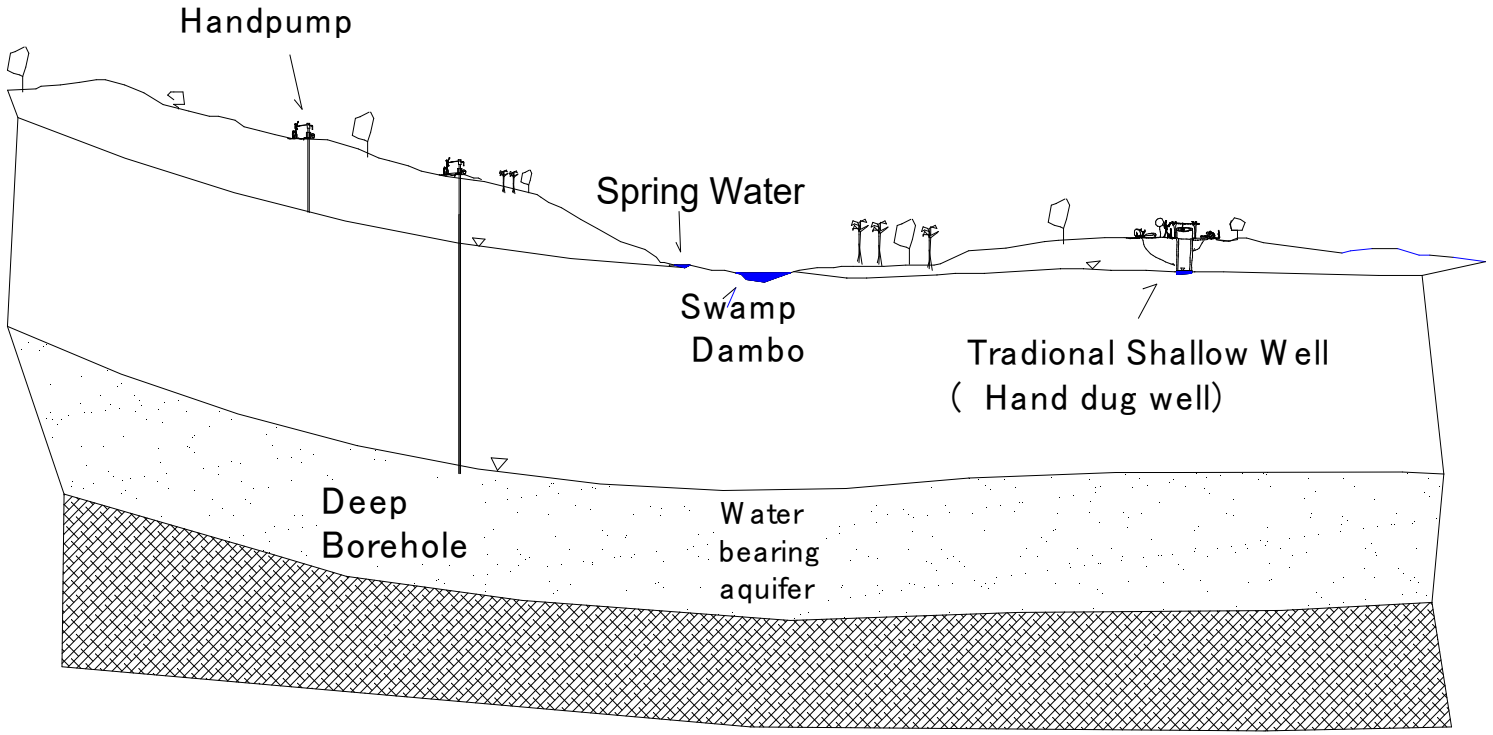


Good drainage
and Good Irrigation
are important.

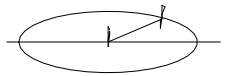
1,Digging channel.
2,Raised beds.
3,Concrete or PVC
drainage pipe in the
ground.

1,Crops may be at risk
from too much water.
2,Roots need moisture.
3,Well aerated soil.

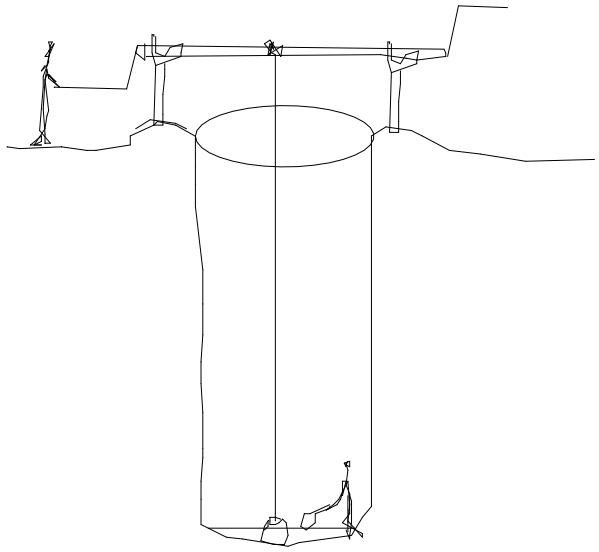
(585) Methods of tapping groundwater



(586) Well excavation

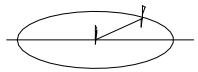


1,Mark a 1.5m diameter ring
on the ground.

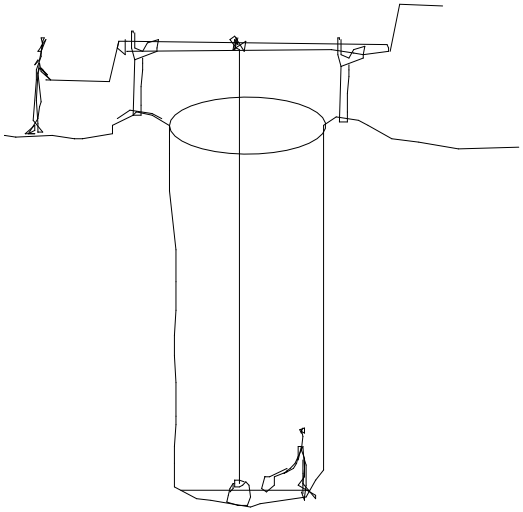


2,The well is dug straight.
Continue to dig,even when water
is first struck.

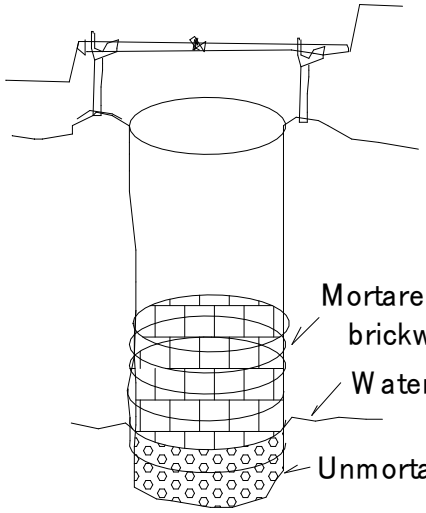
(587) Well Lining



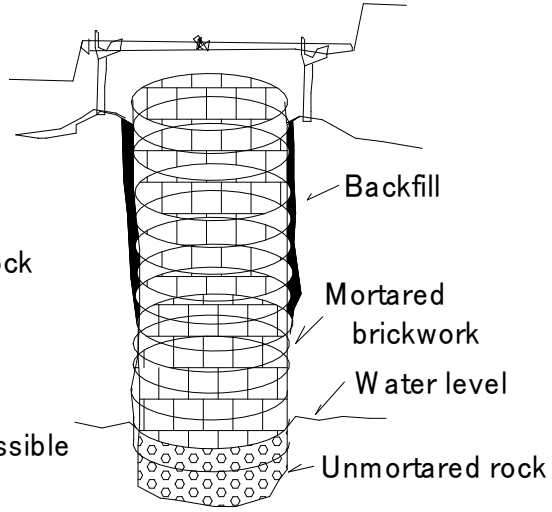
1,Mark a 1.5m diameter ring on the ground.



2,The well is dug straight down. Continue to dig,even when water is first reached.

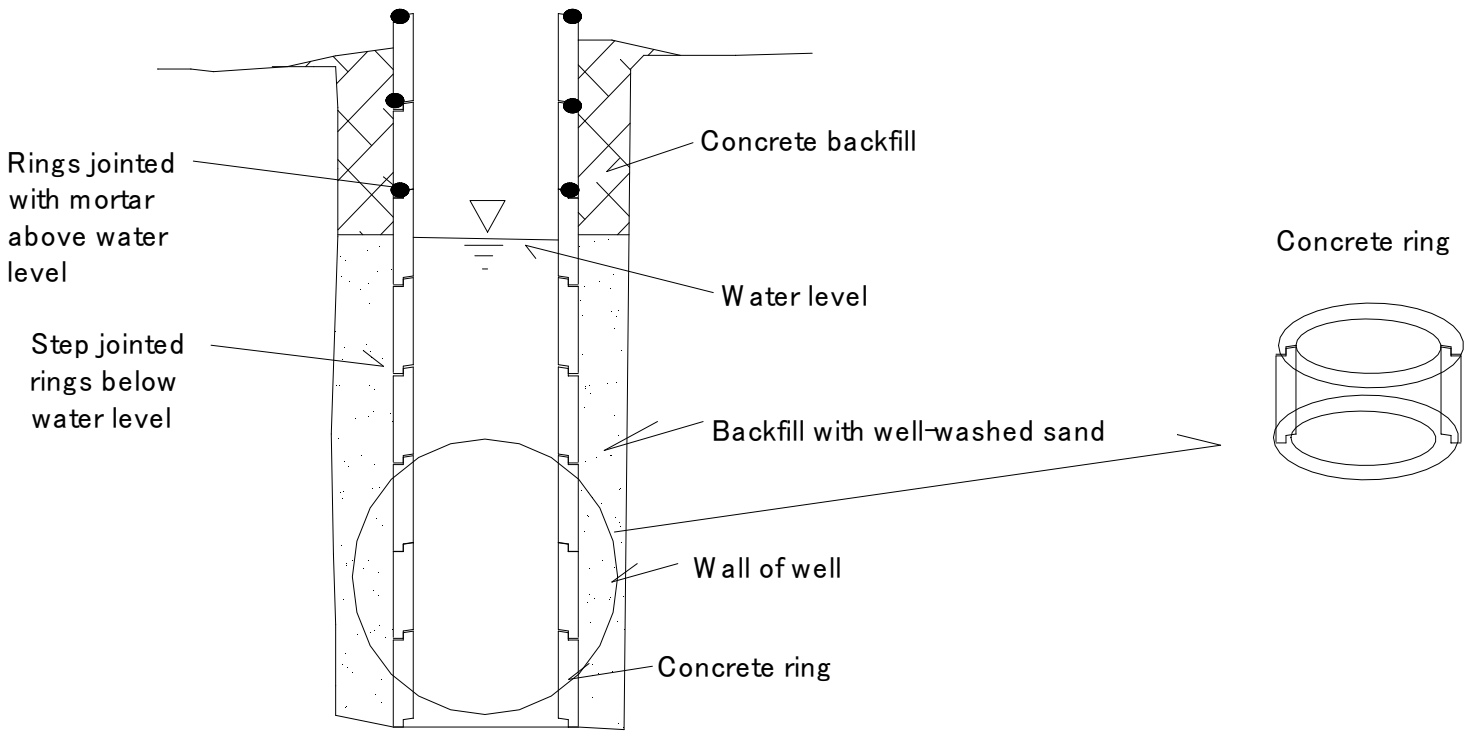


3,Well Lining

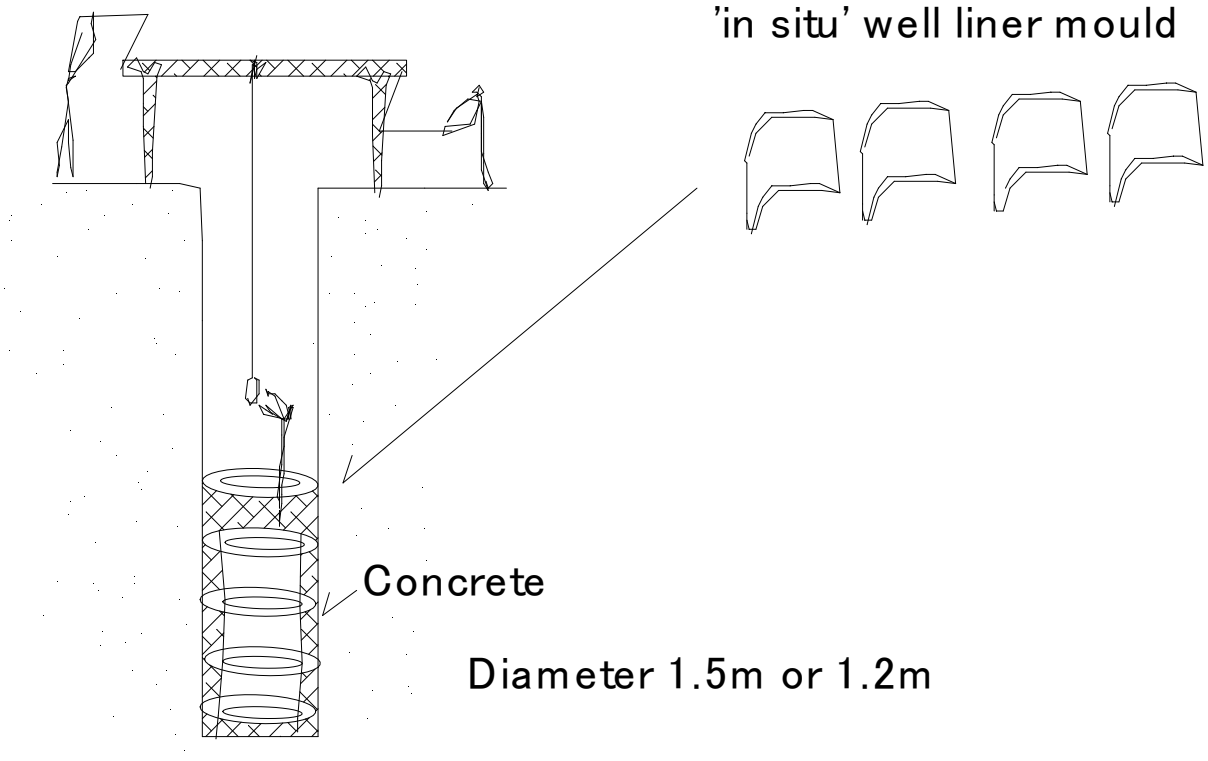


Many types of well lining are possible
1,Stones or rocks
2,Burnt bricks
3,Concrete rings(Prefabricated)
4,Concrete rings(Cast 'in situ')

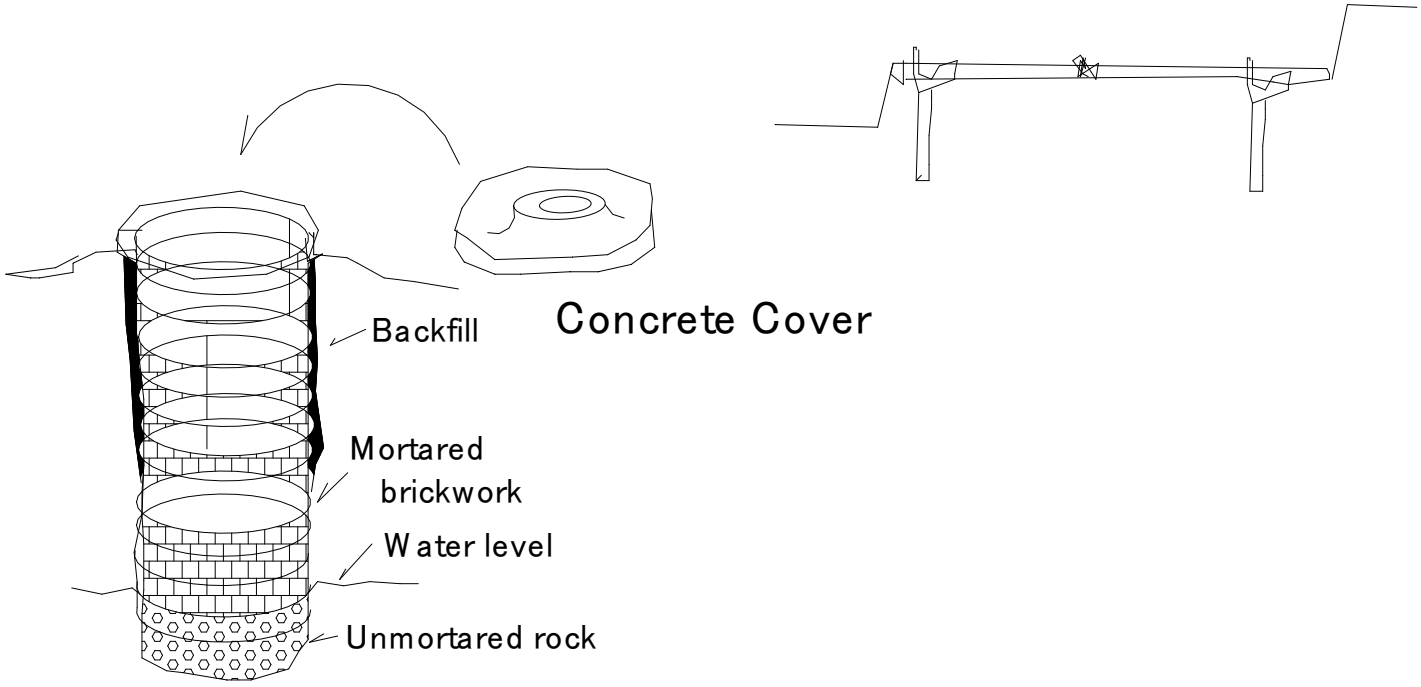
（ 588 ） Well Lined with precast concrete rings



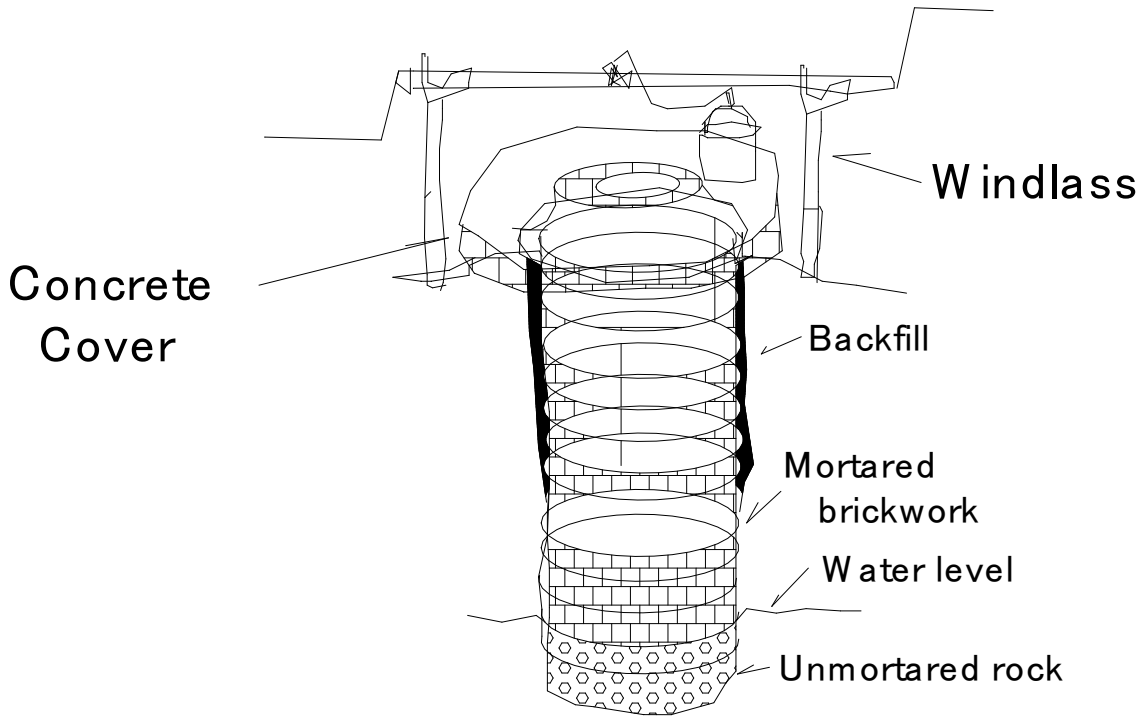
(589) Lining the well with concrete rings cast 'in situ'



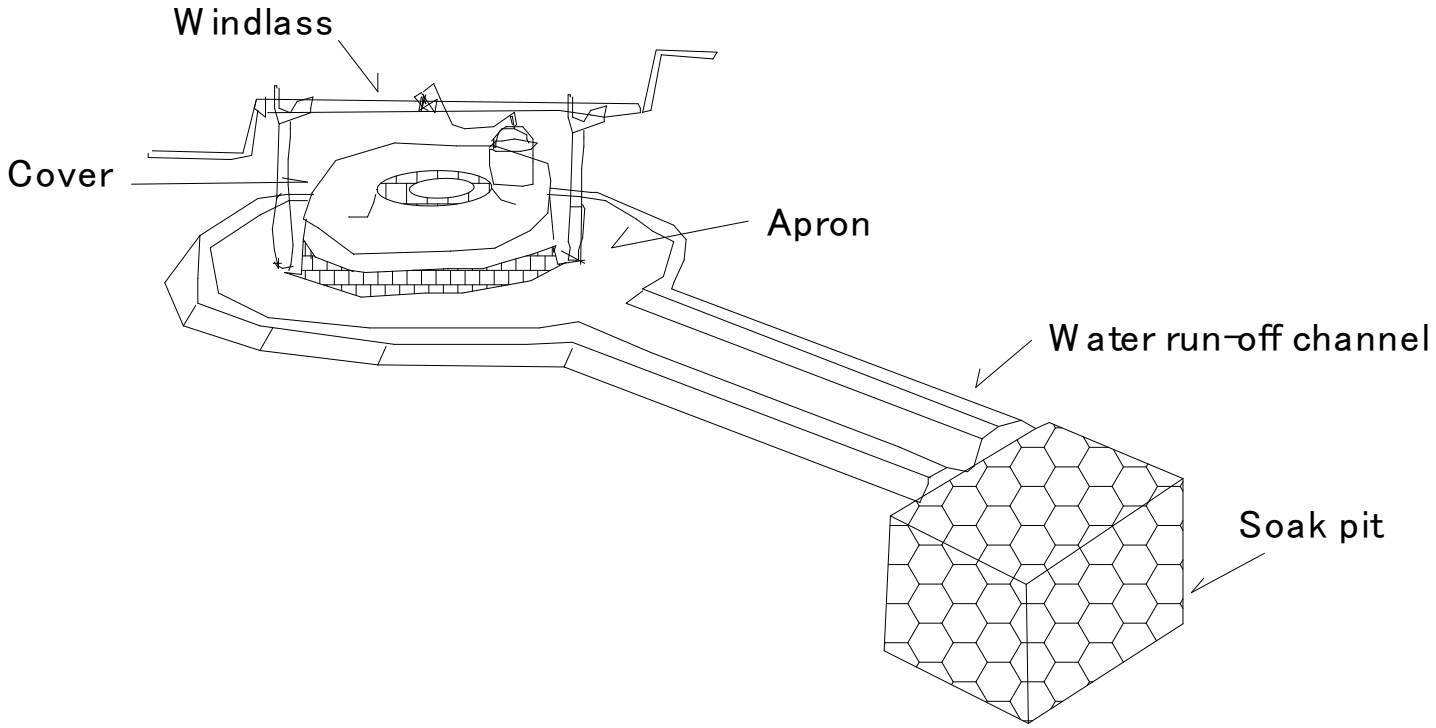
（ 590 ） Well Cover



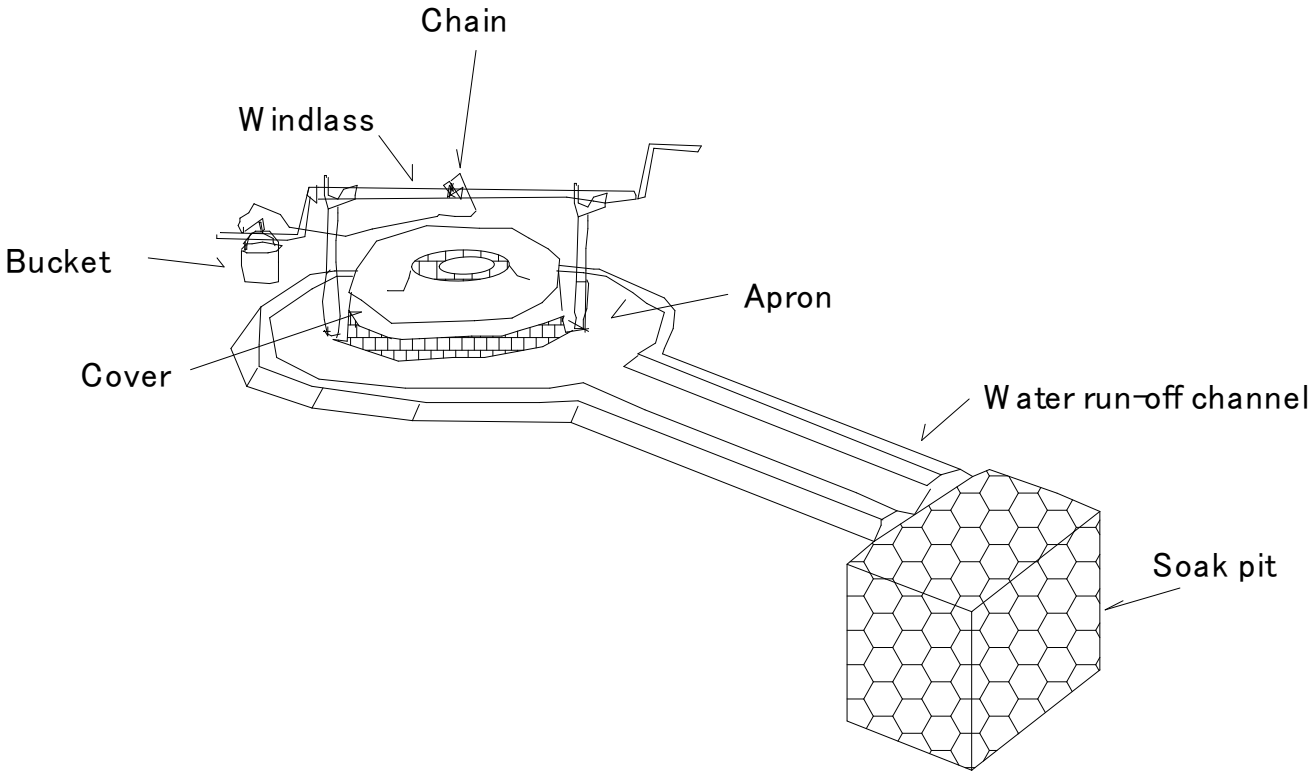
(591) Windlass



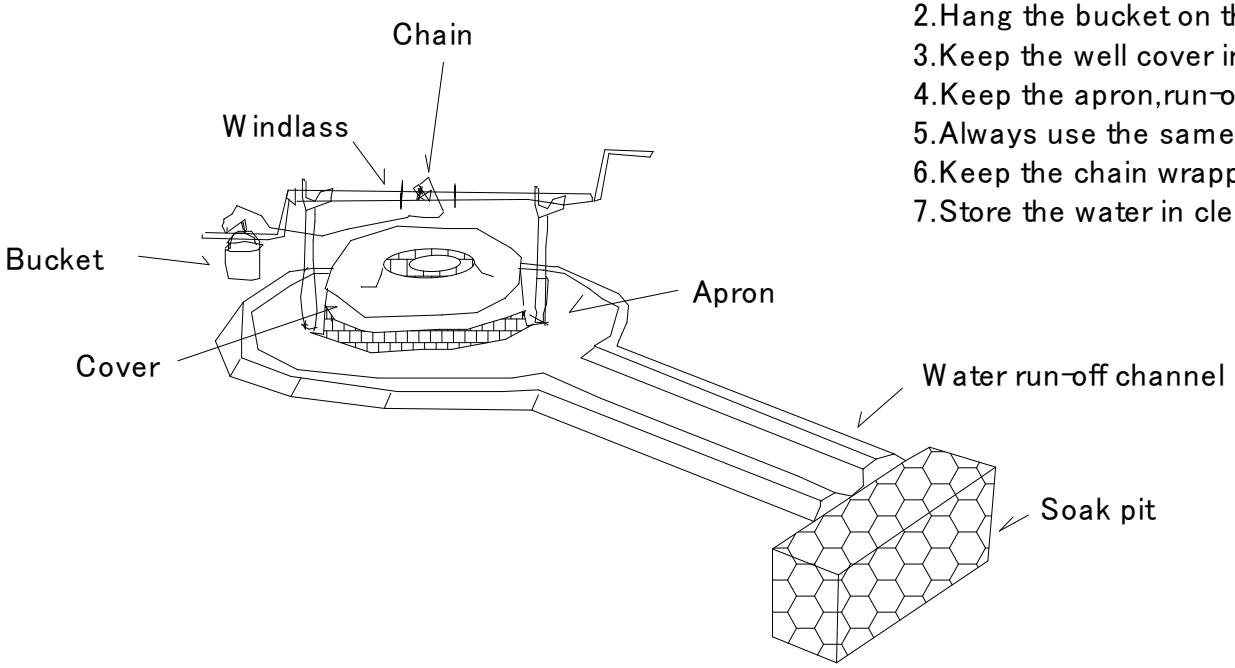
（ 592 ） Apron and water run-off channel



（ 593 ） Bucket and chain



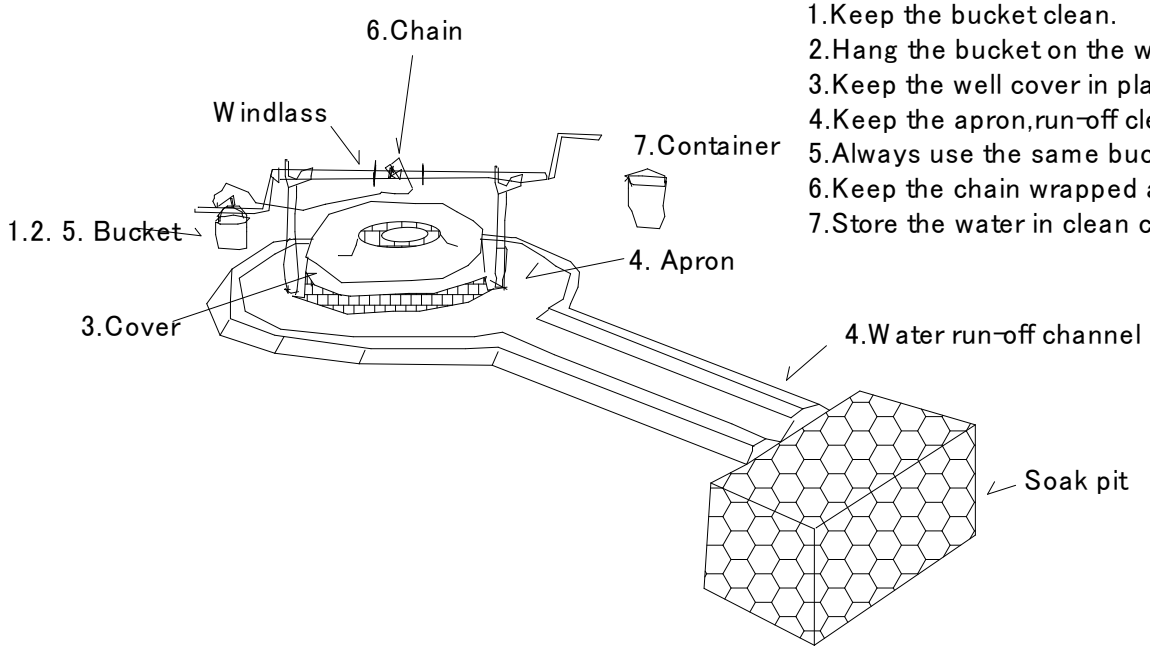
（ 594 ） Correct use of the well



1.Keep the bucket clean.
2.Hang the bucket on the windlass when not in use.
3.Keep the well cover in place.
4.Keep the apron,run-off clean.
5.Always use the same bucket in the well.
6.Keep the chain wrapped around the windlass.
7.Store the water in clean covered containers.

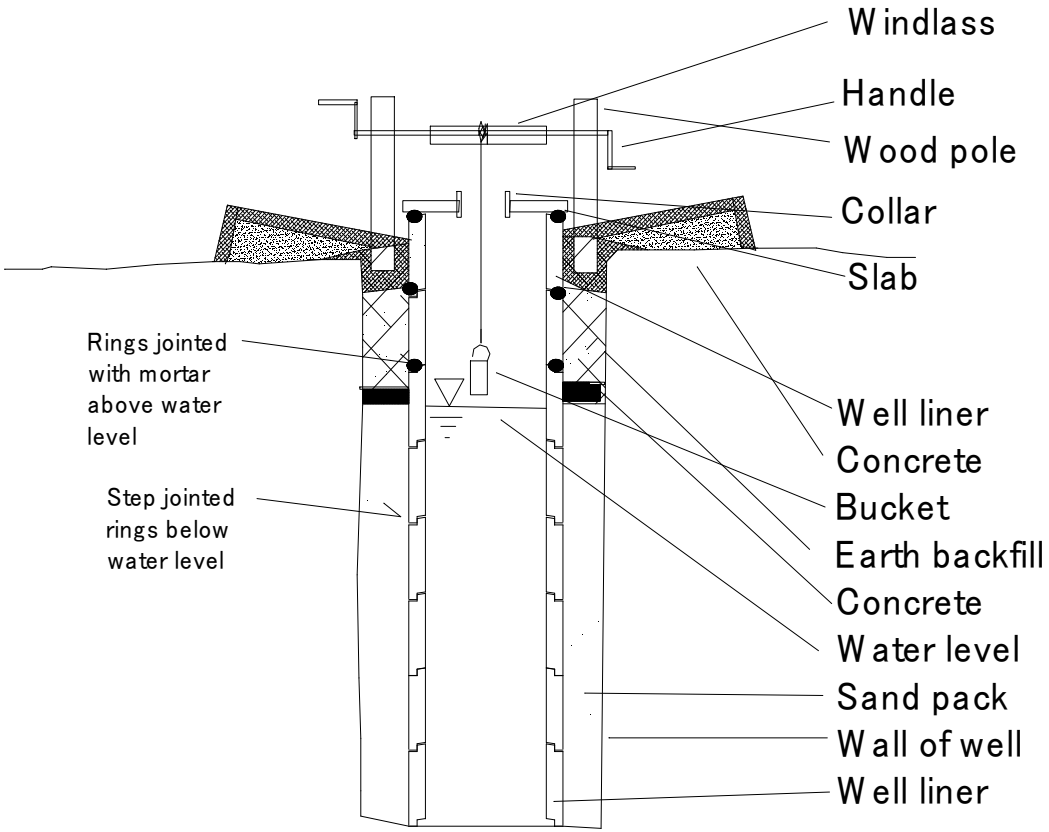
（ 595 ） How to look after your well

You can drink clean water from your well
by keeping the well and bucket clean.

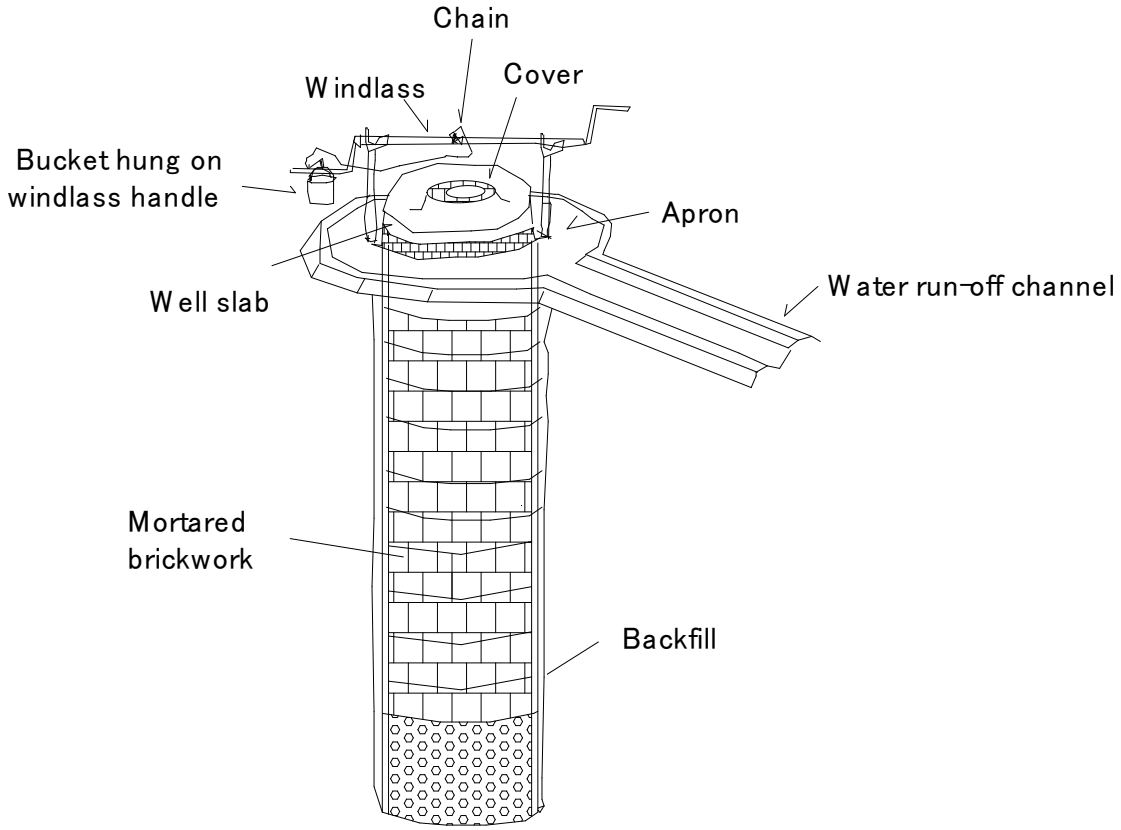


1.Keep the bucket clean.
2.Hang the bucket on the windlass when not in use.
3.Keep the well cover in place.
4.Keep the apron,run-off clean.
5.Always use the same bucket in the well.
6.Keep the chain wrapped around the windlass.
7.Store the water in clean covered containers.

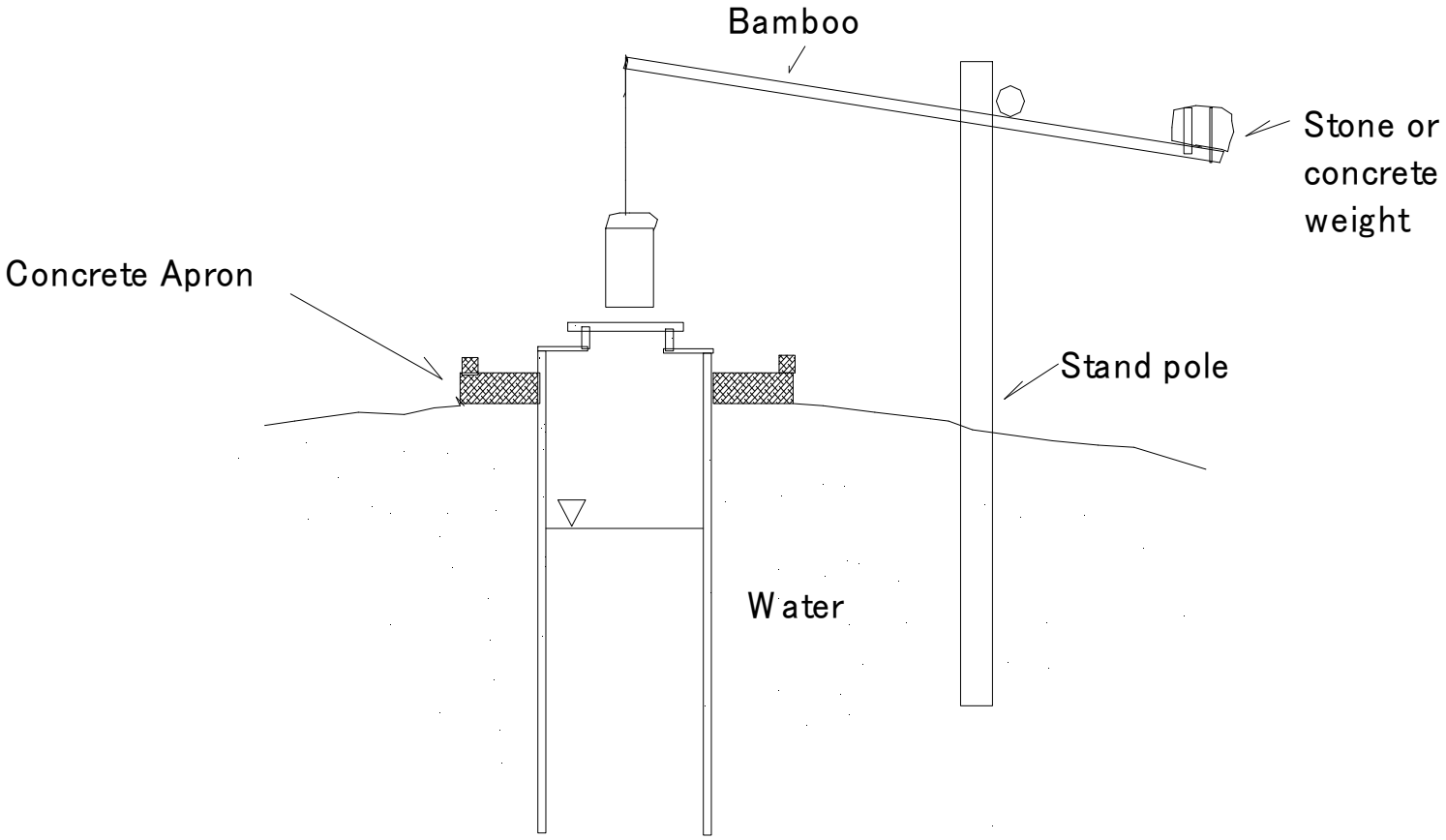
（ 596 ） Cross-section of concrete Lined Well



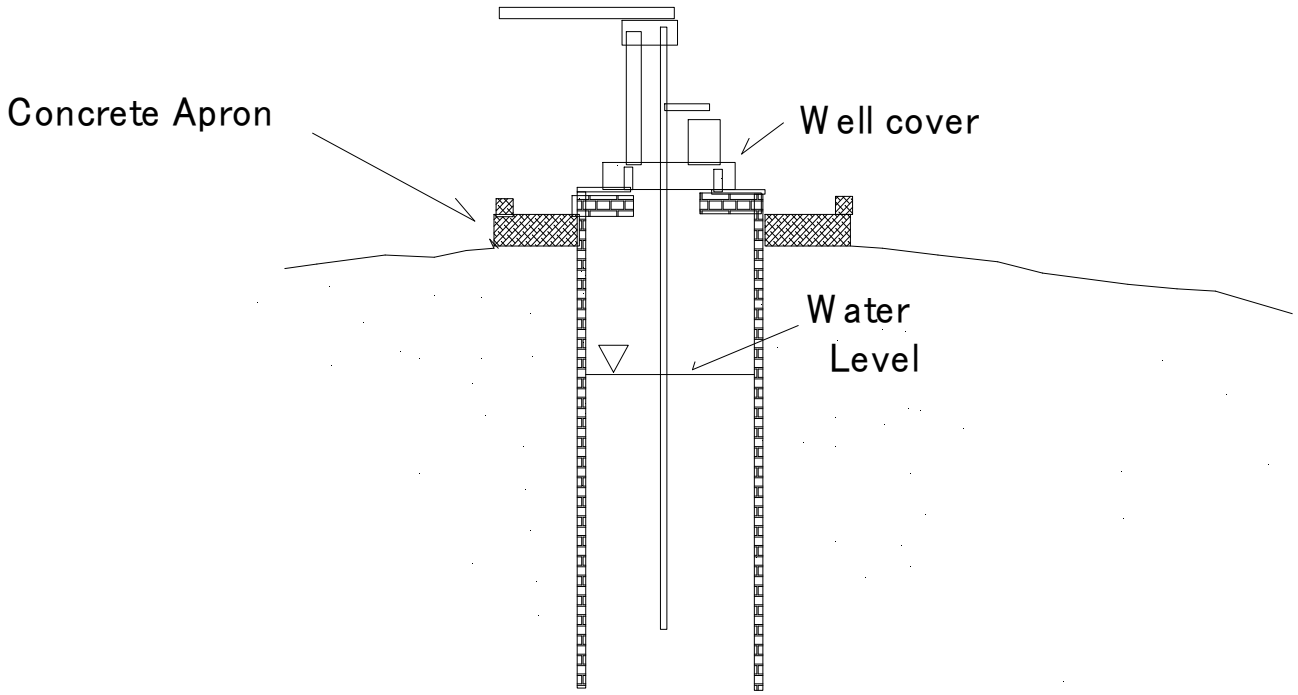
（ 597 ） Cross-section of brick lined well



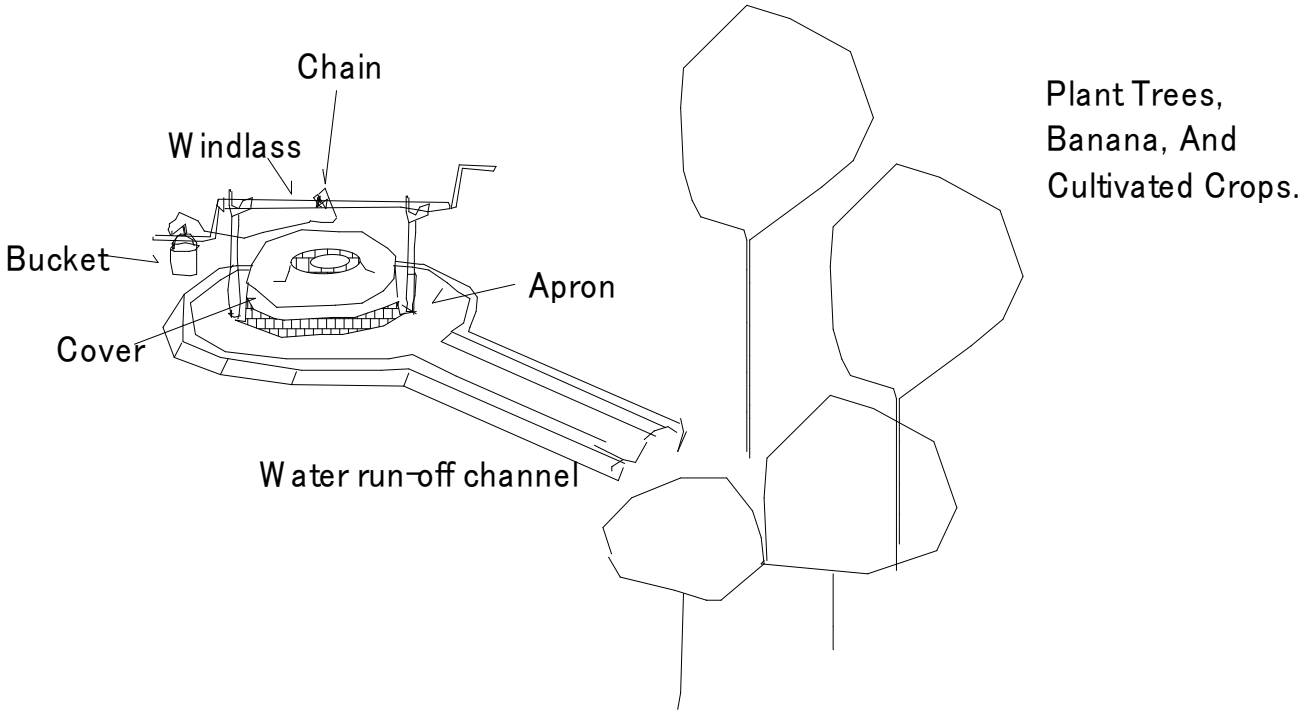
（ 598 ）Method of lifting water from shallow well



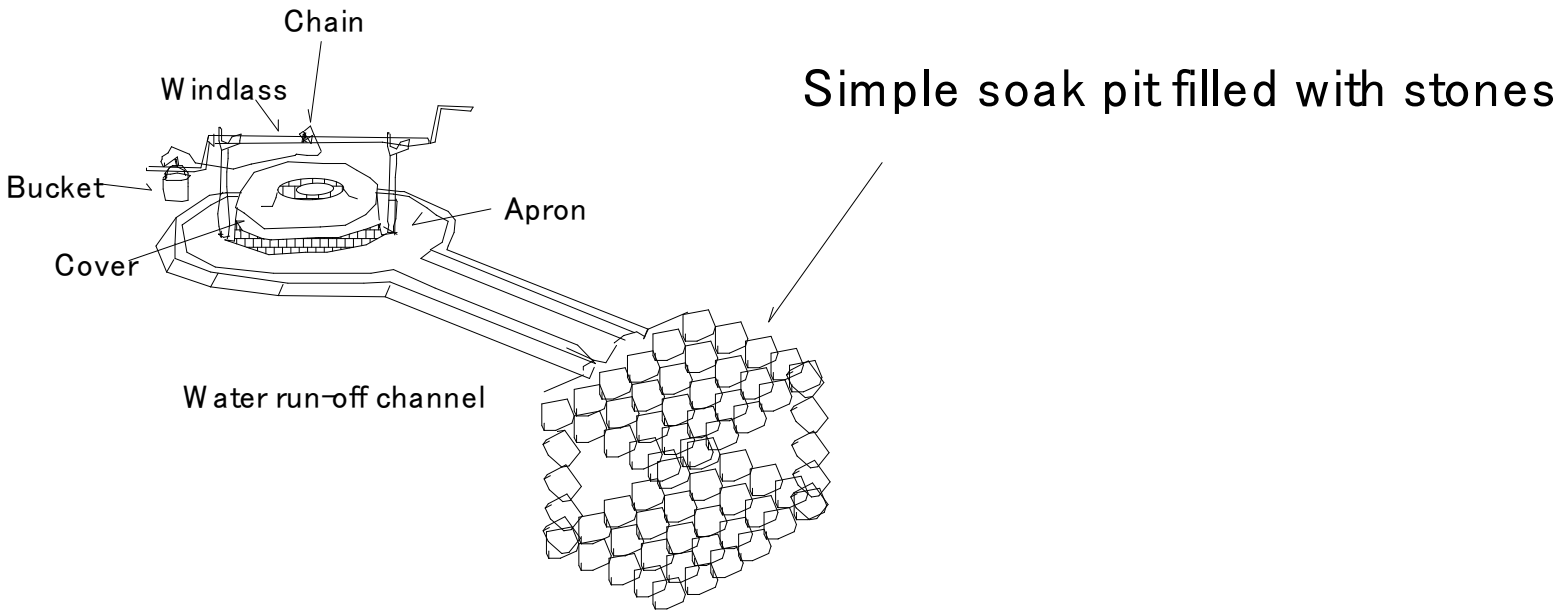
（ 599 ） Bush pump fitted on well



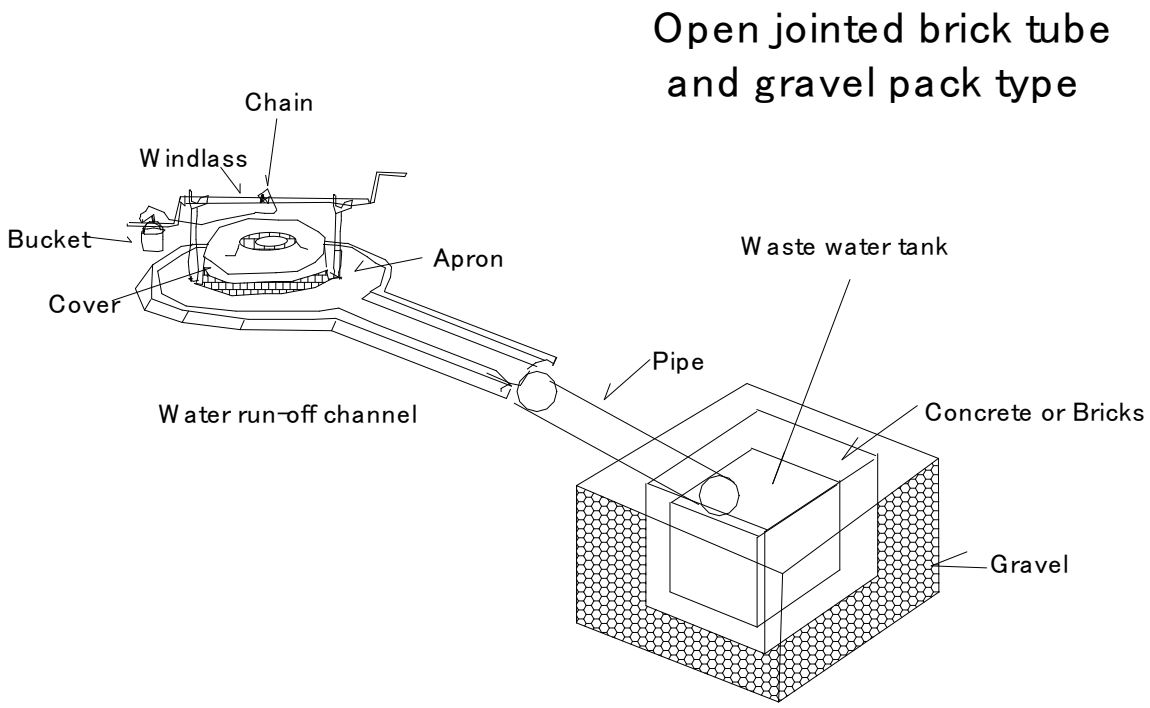
（ 600 ） Outlet of water run-off channel



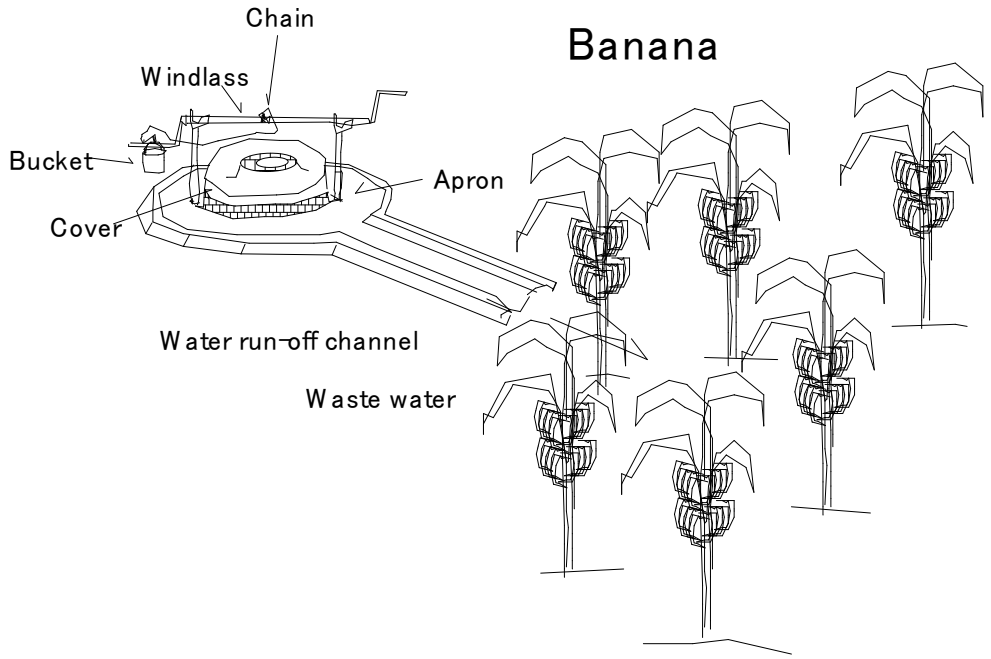
(601) Outlet of water run-off channel(2)



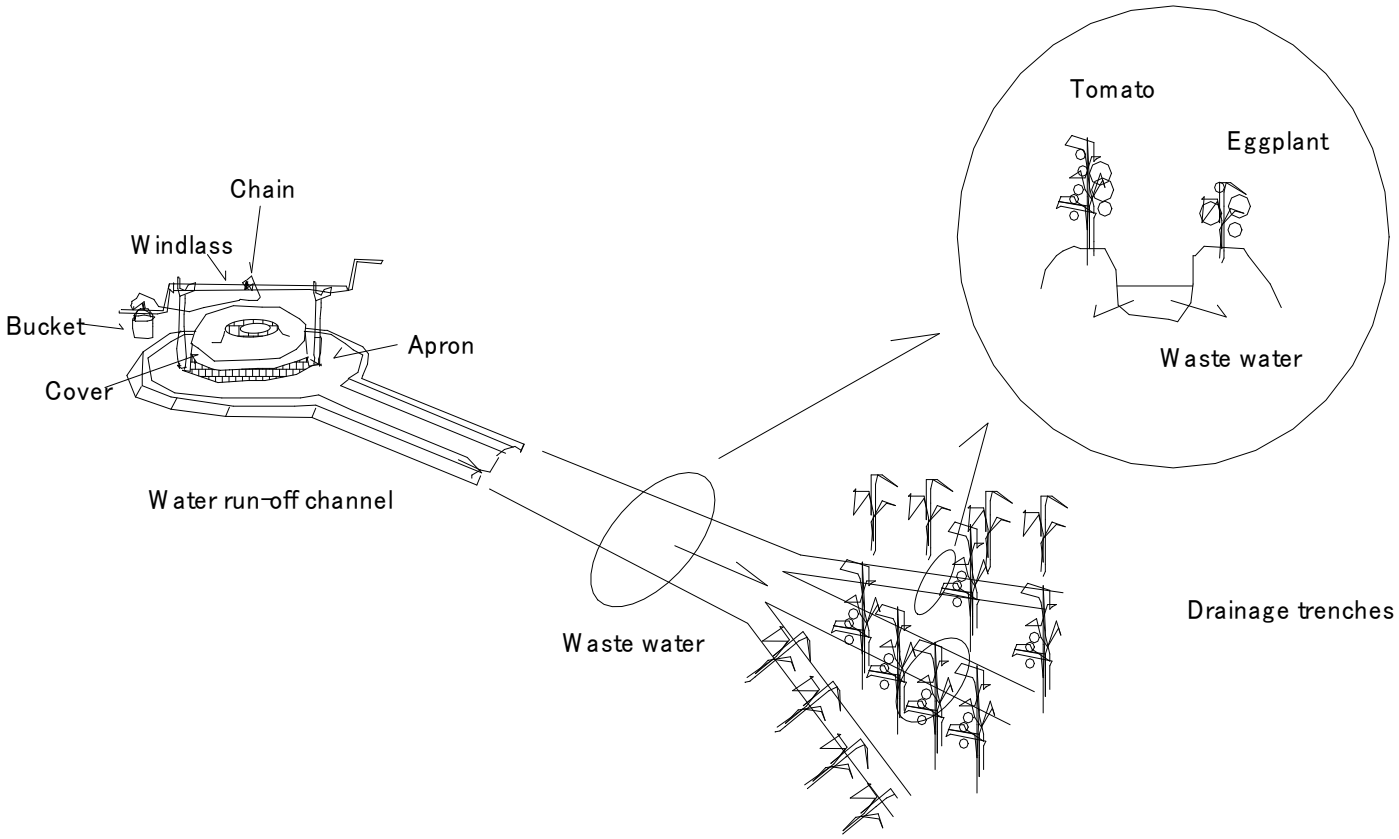
（ 602 ） Outlet of water run-off channel（ 3 ）



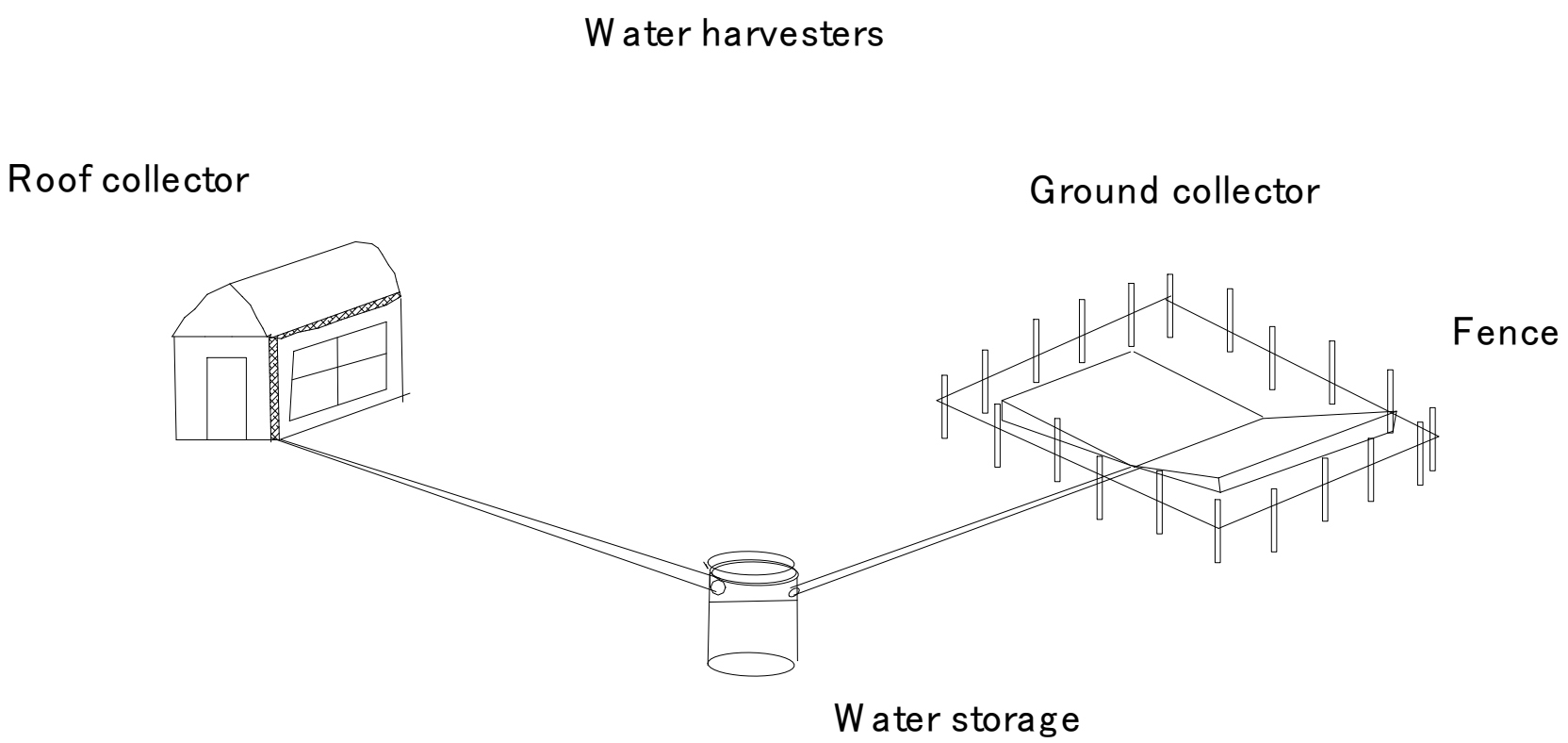
（ 603 ） Outlet of water run-off channel(4)



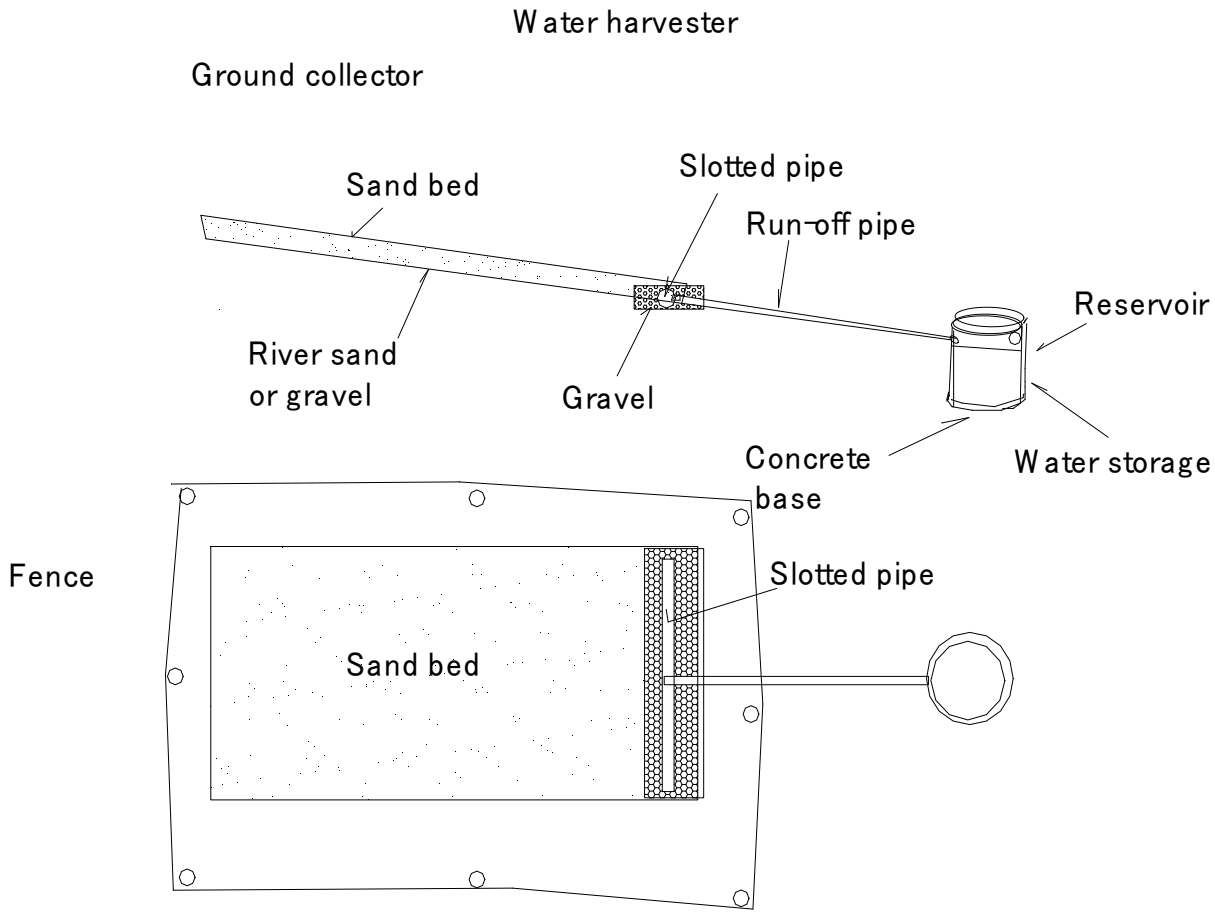
（ 604 ） Outlet of water run-off channel（ 5 ）



（ 605 ） Rainwater harvesting

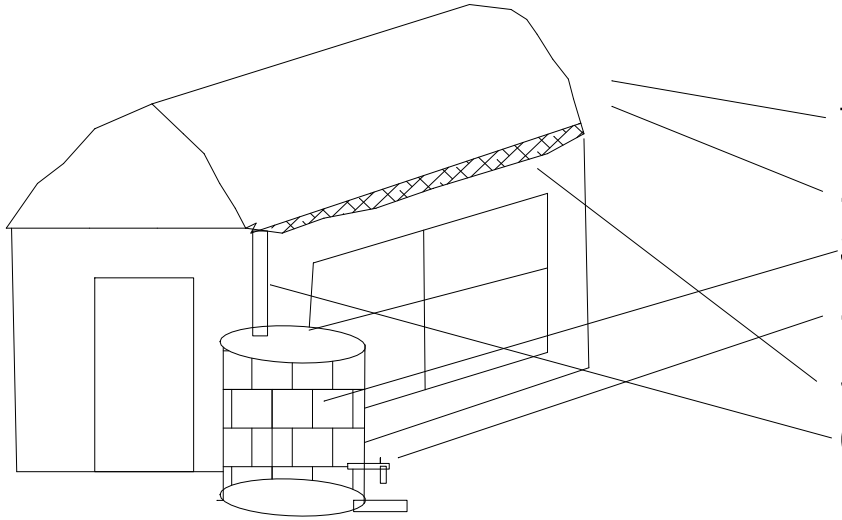


（ 606 ） Ground collector and Water storage



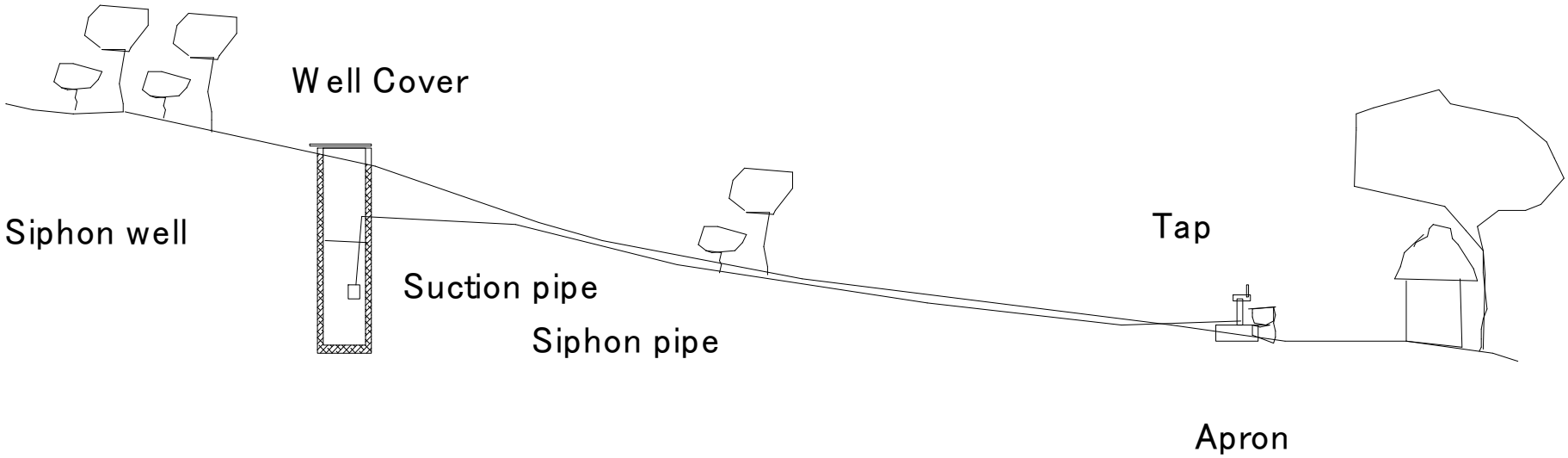
（ 607 ） Brick tanks

Water harvesters

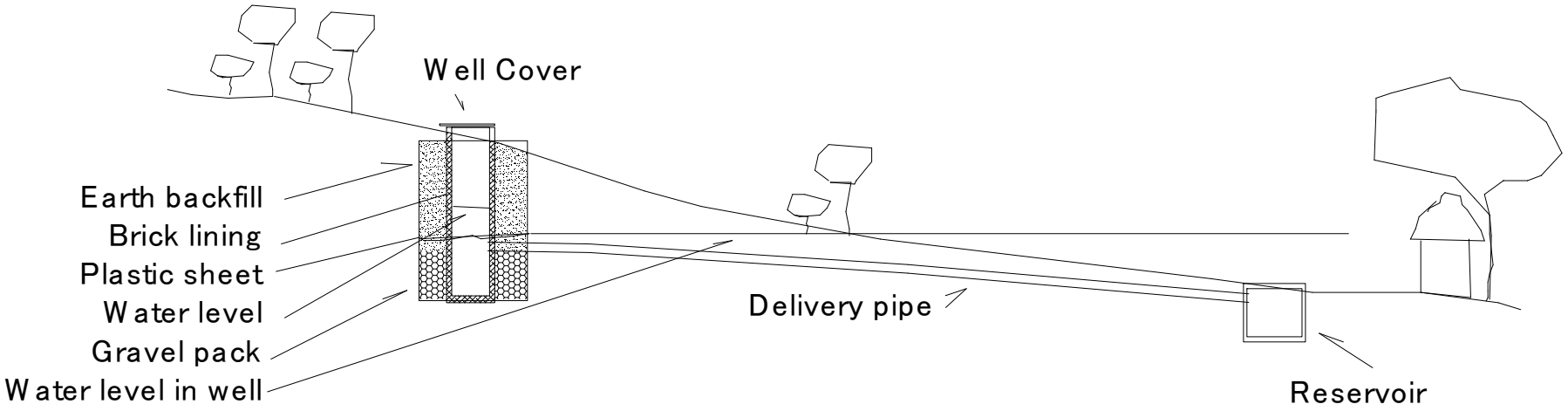


1.Roof catchment area
2.Roof collector
3.Brick tank
4.Tap
5.Gutter
6.Down pipe

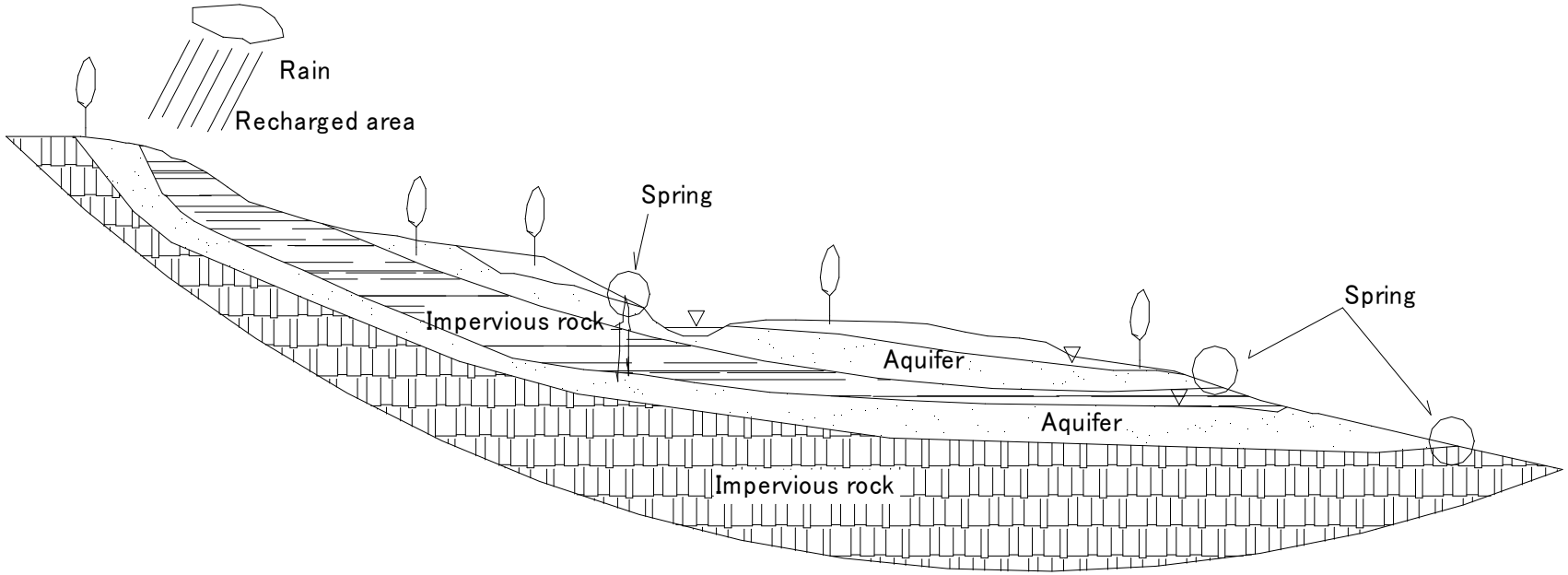
（ 608 ）Siphon well



（ 609 ） Gravity well

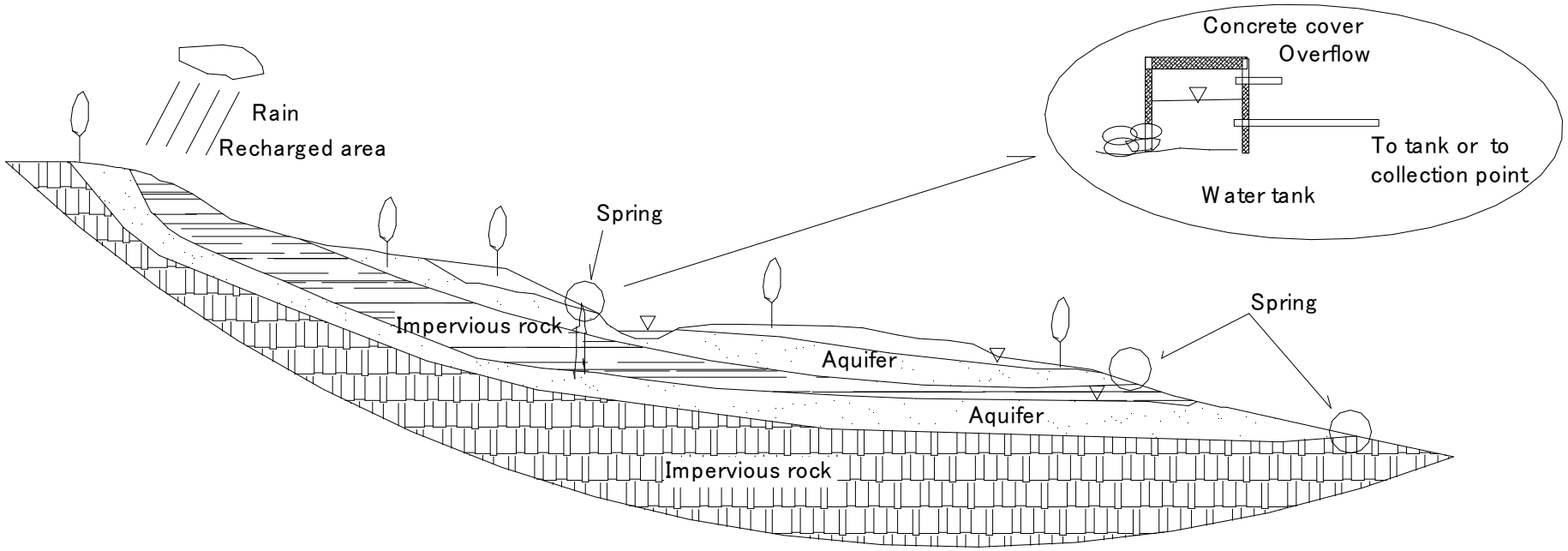


（ 610 ）Spring

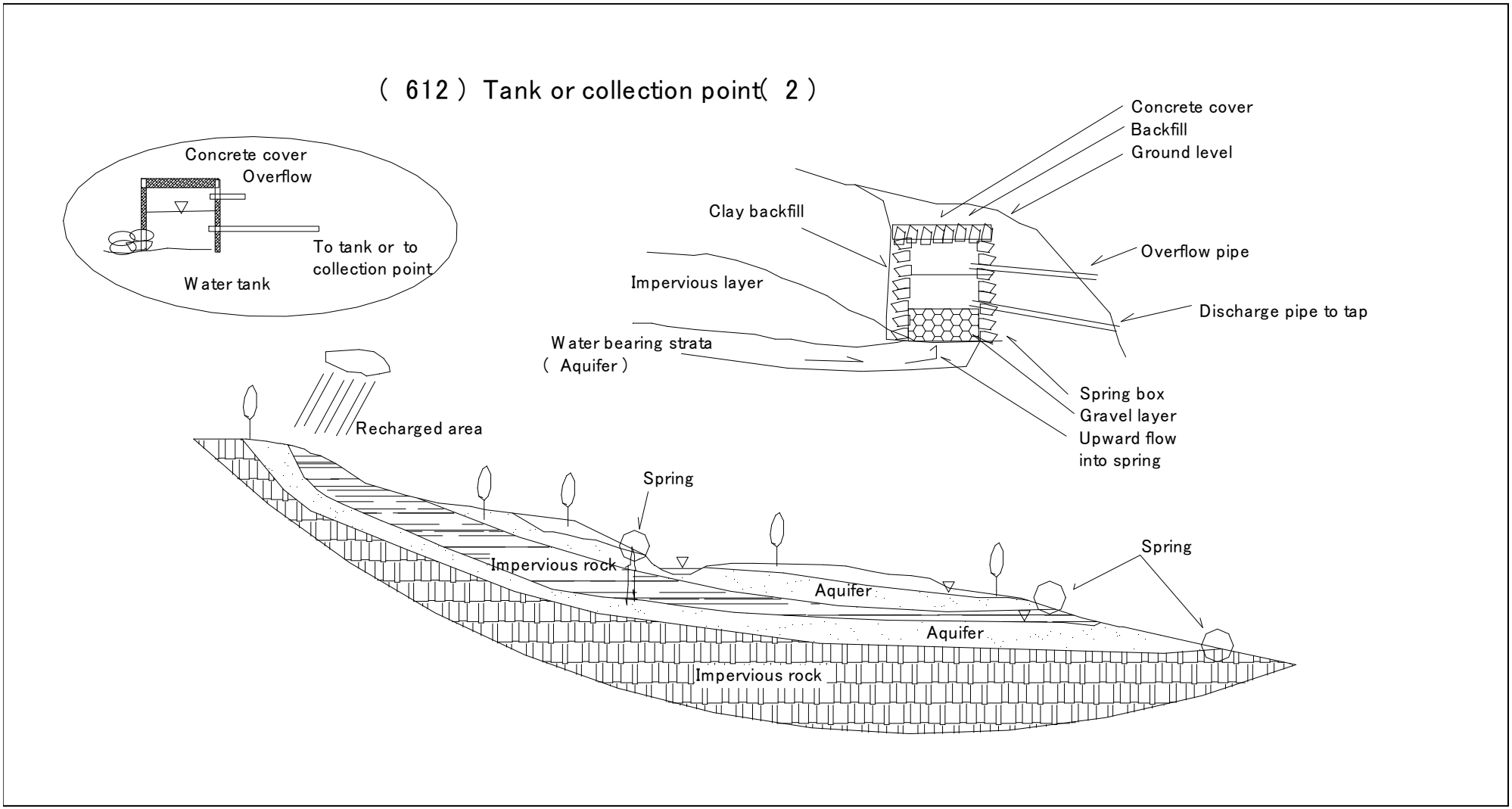

Rain
Recharged area
Spring
Impervious rock
Aquifer
Spring
Aquifer
Impervious rock

611 Tank or collection point(1)

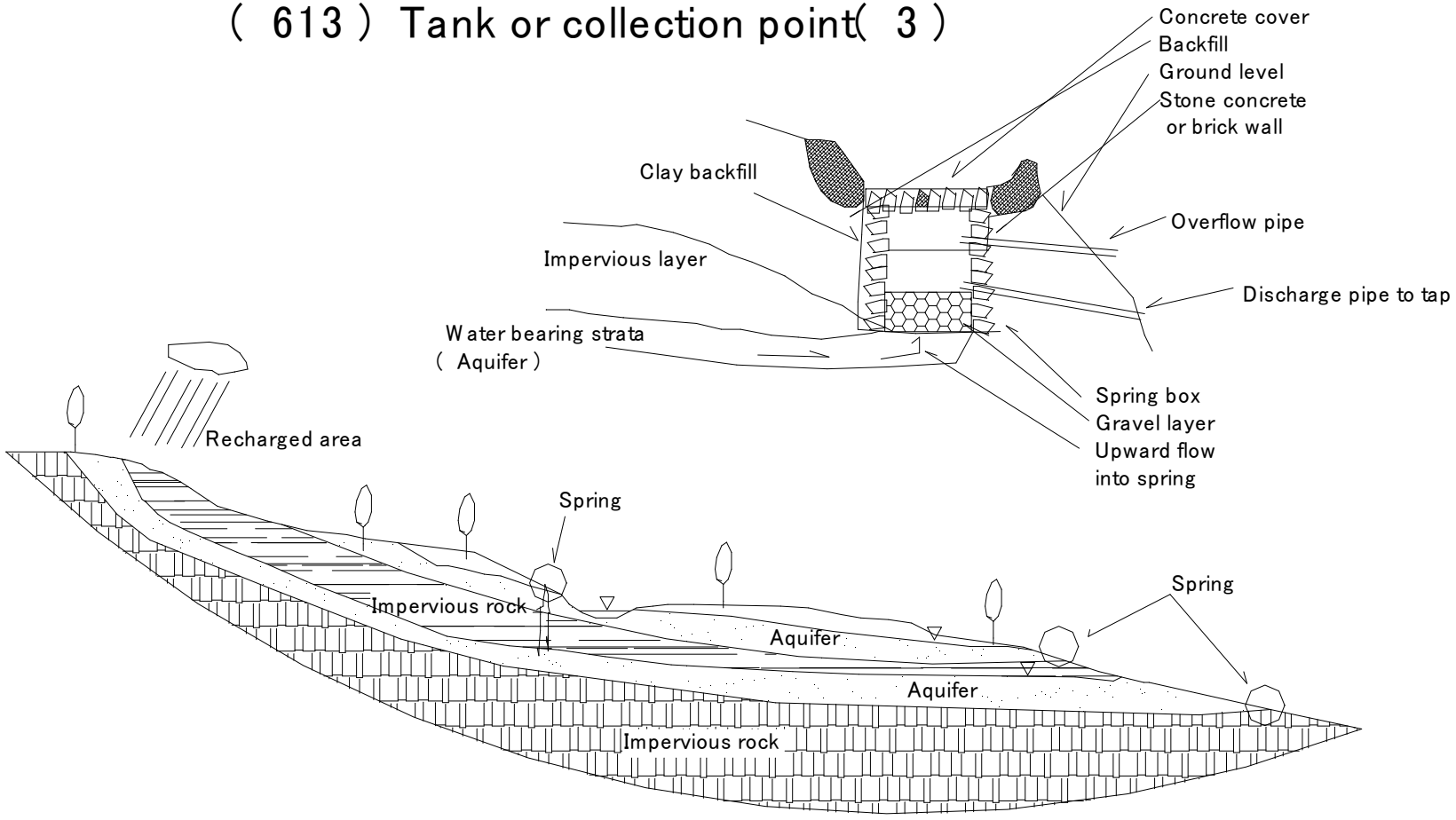
(611) Tank or collection point(1)



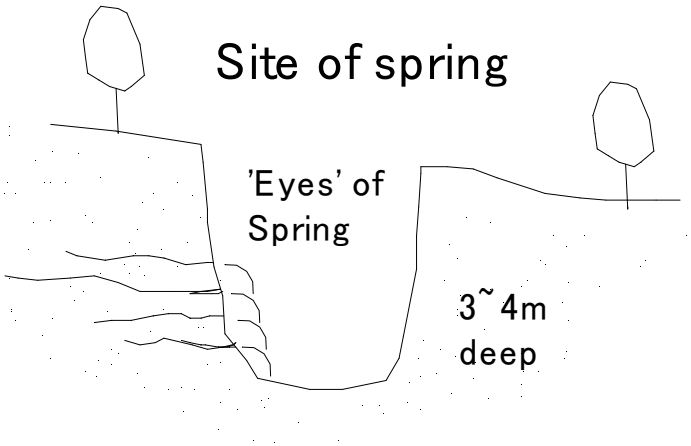
612 Tank or collection point(2)

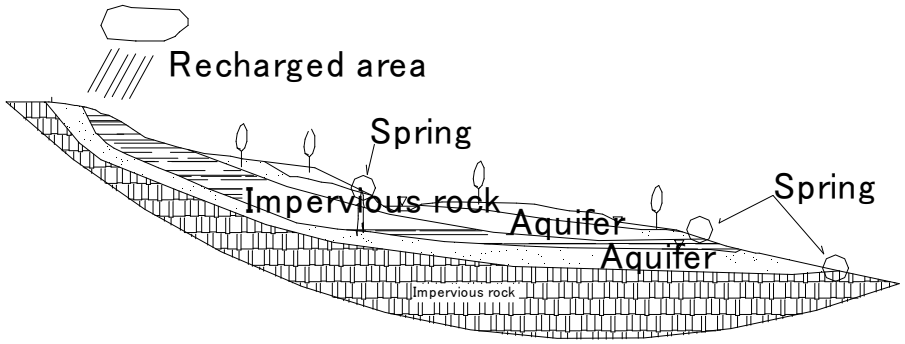


（ 613 ） Tank or collection point（ 3 ）

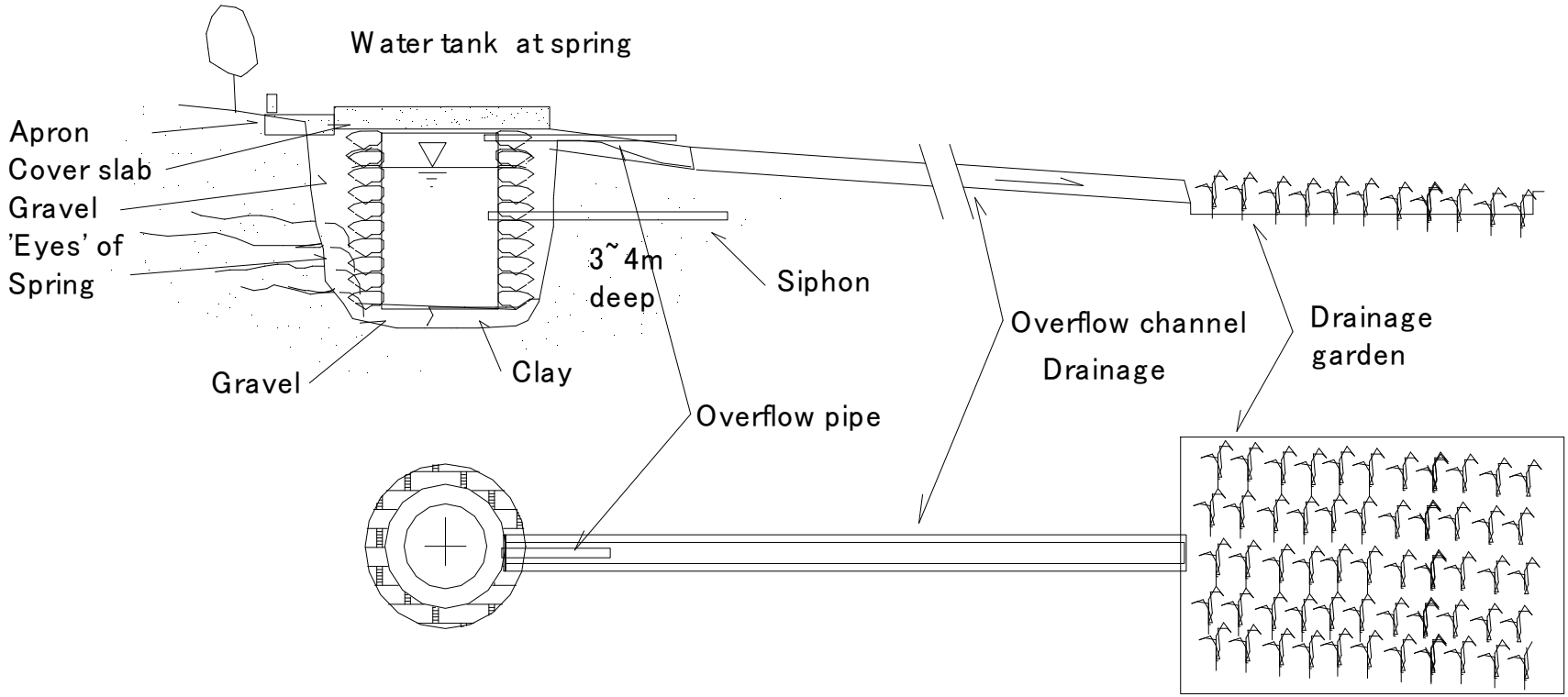


（ 614 ） Site of spring

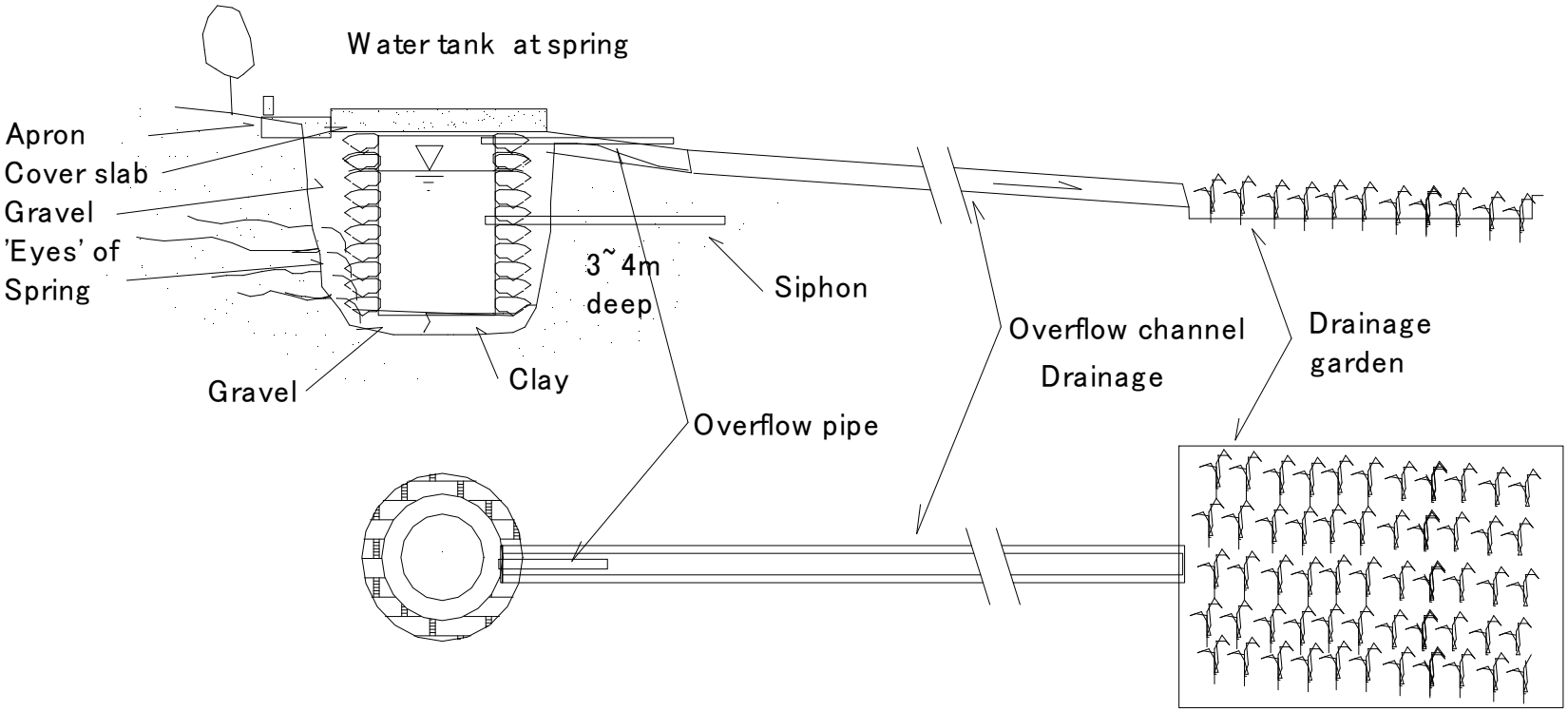




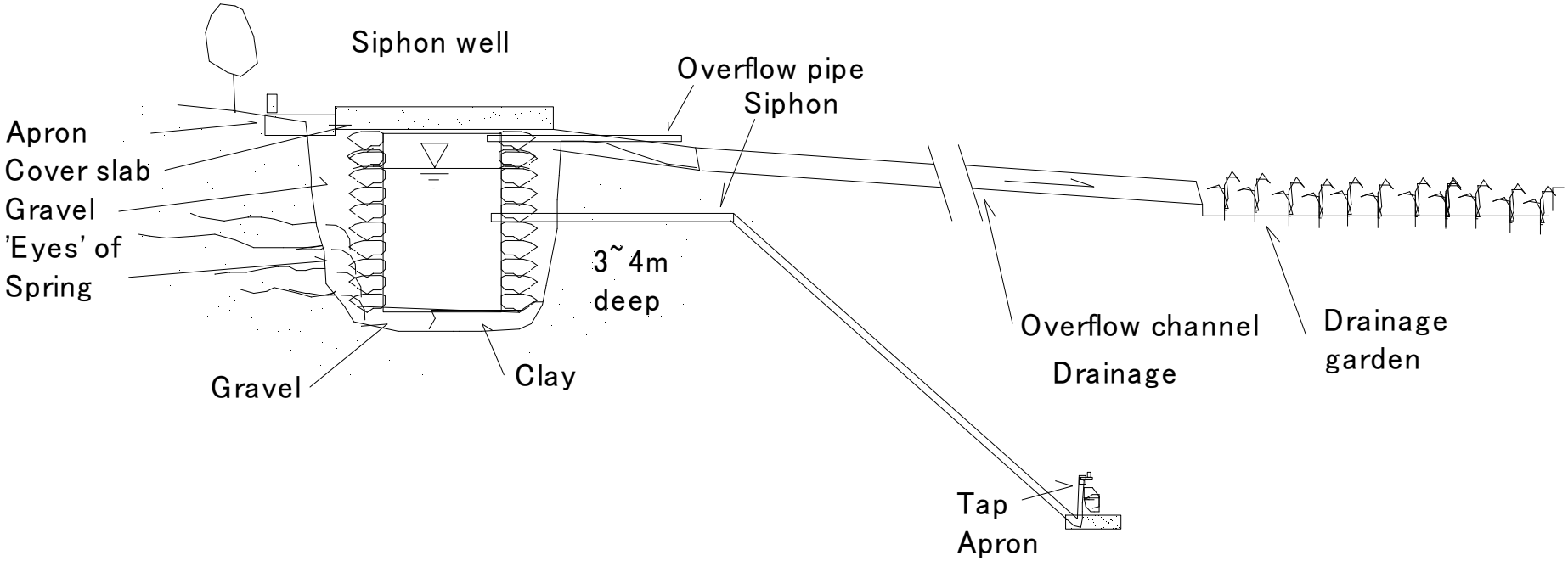
(615) Water tank at spring



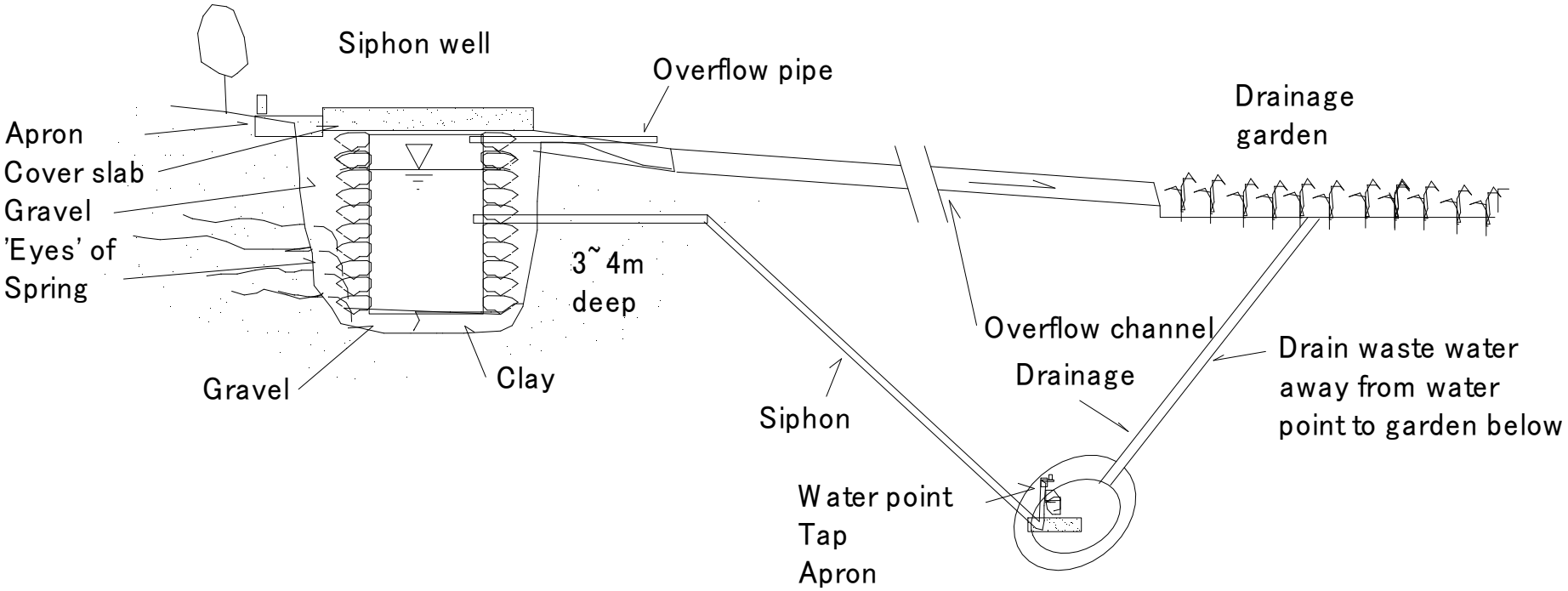
(616) Overflow channel



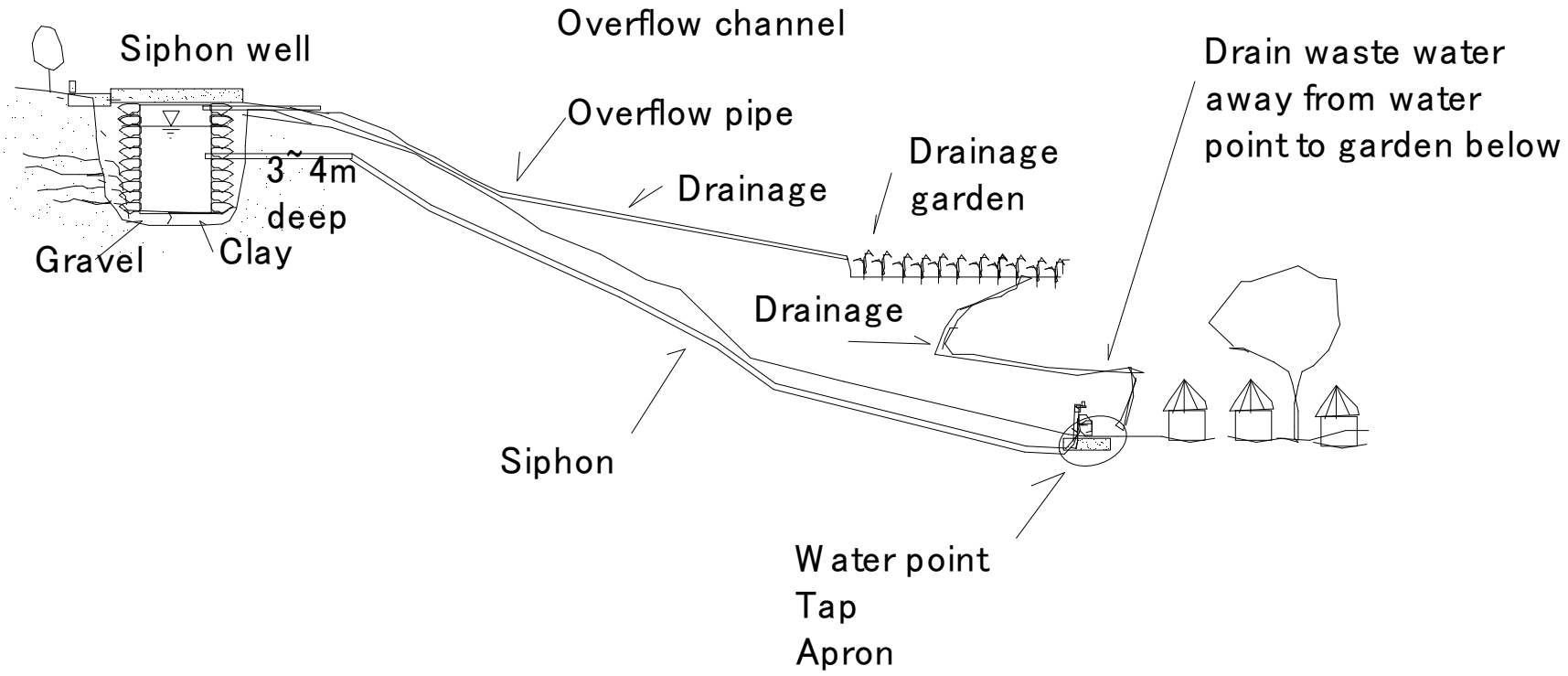
(617) Siphon pipe



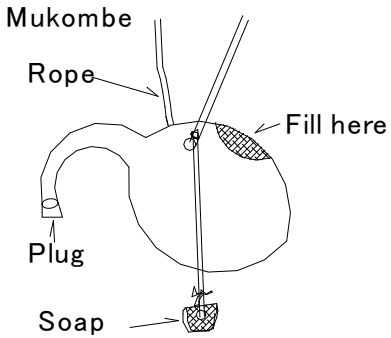
(618) Siphon well



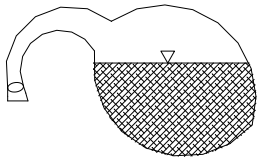
(619) Siphon well(2)



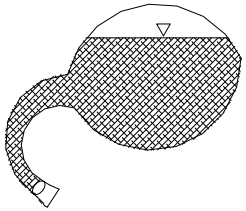
（ 620 ） Hand washing（ 1 ）



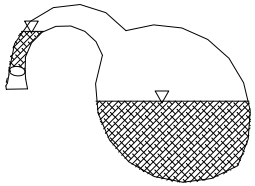
1



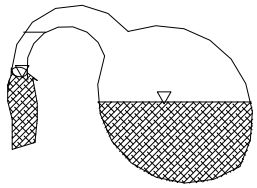
2



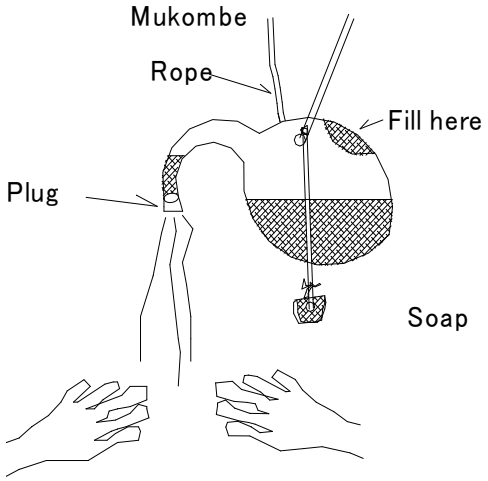
3



4



(621) Hand washing(2)

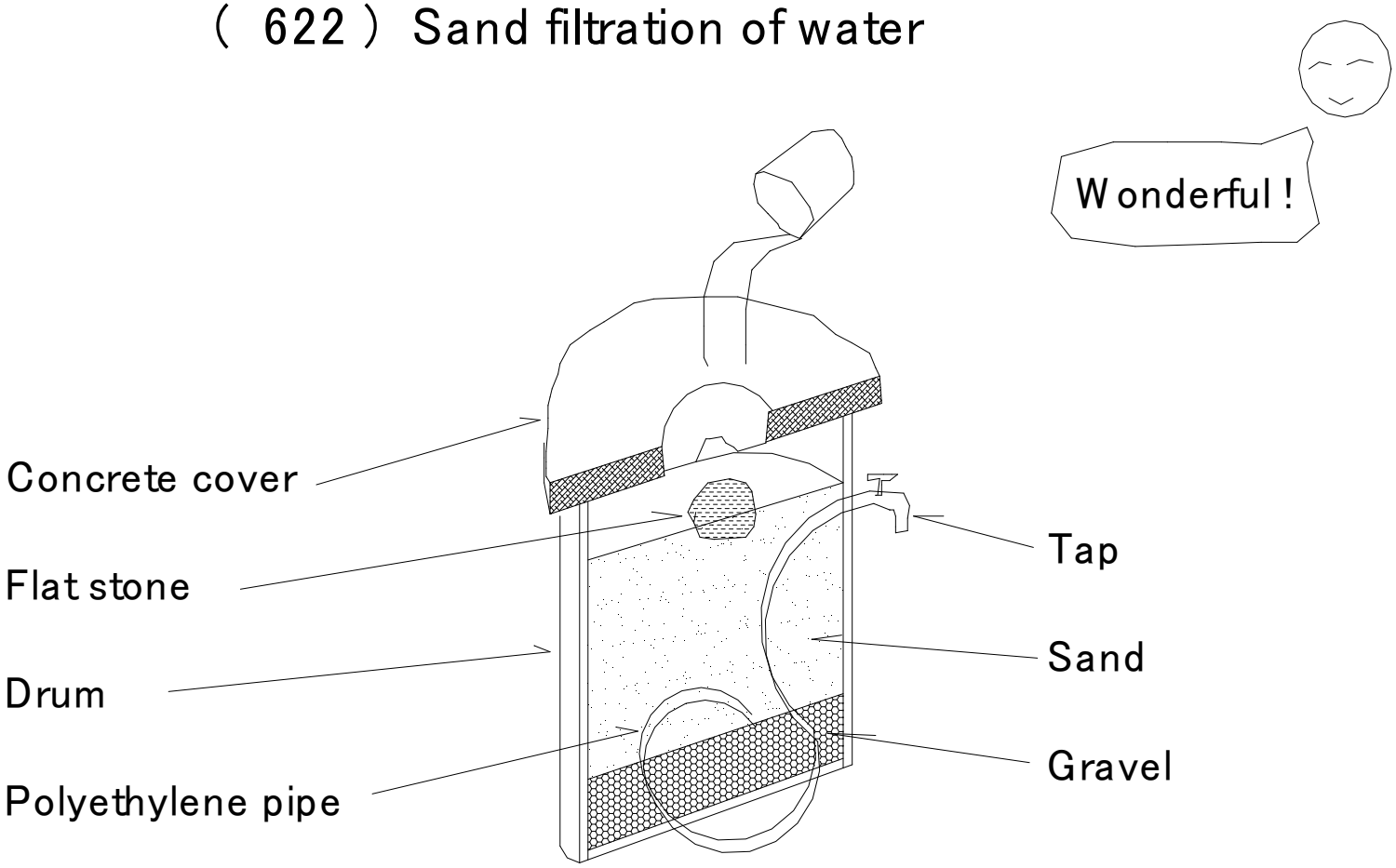


Wash your hands

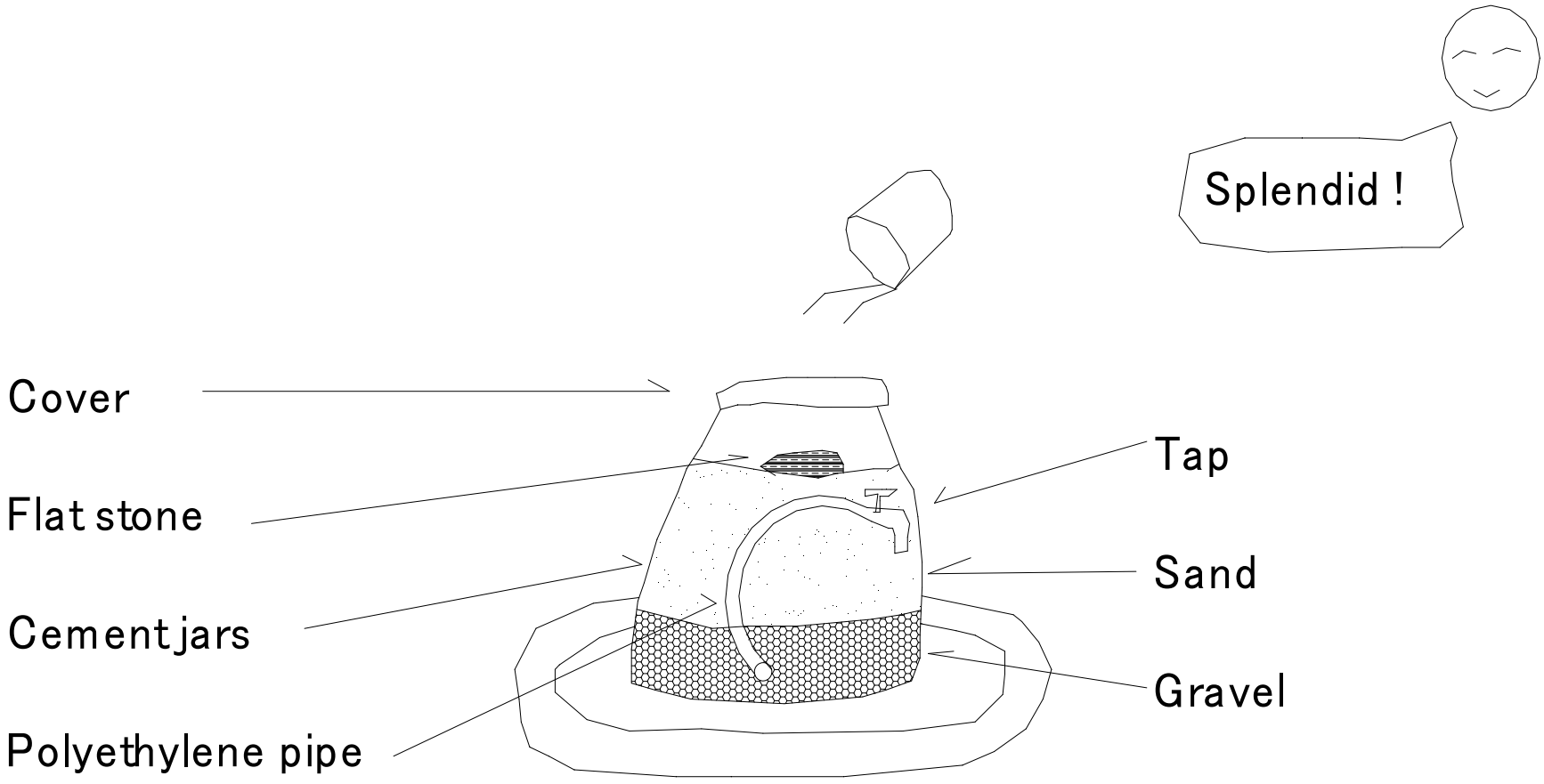
Hand washing is an important way of preventing disease.

Wash your hands:
Whenever they are dirty.
Before preparing food.
After using the toilet.
Before bathing children.
Try to use soap.

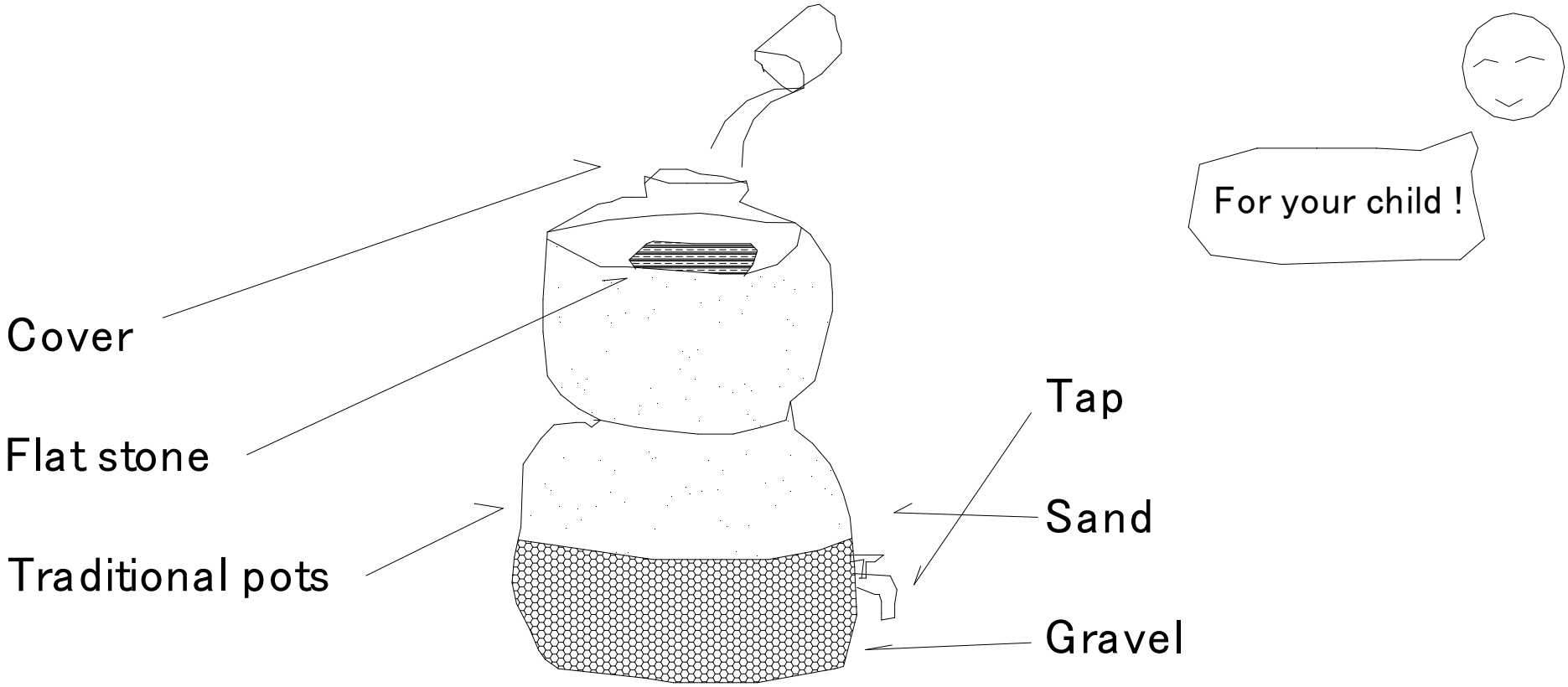
（ 622 ） Sand filtration of water



（ 623 ） Sand filtration of water（ 2 ）

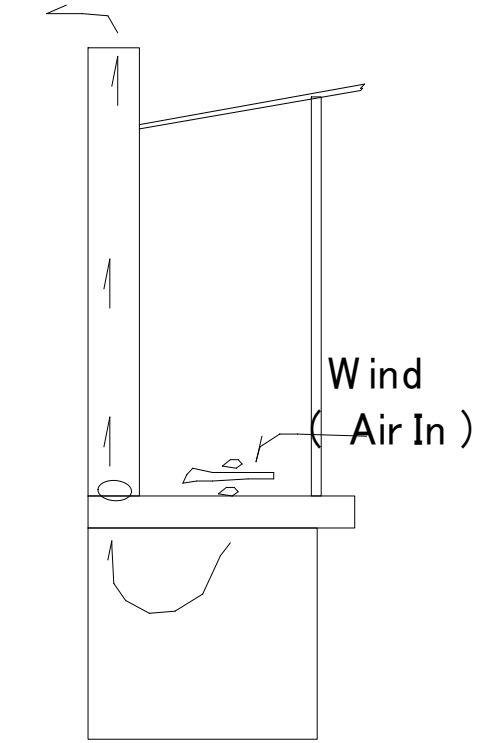


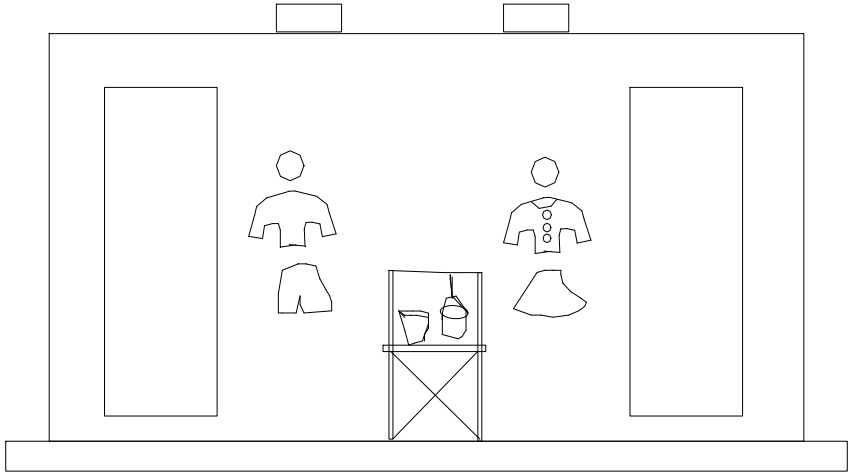
（ 624 ） Sand filtration of water（ 3 ）



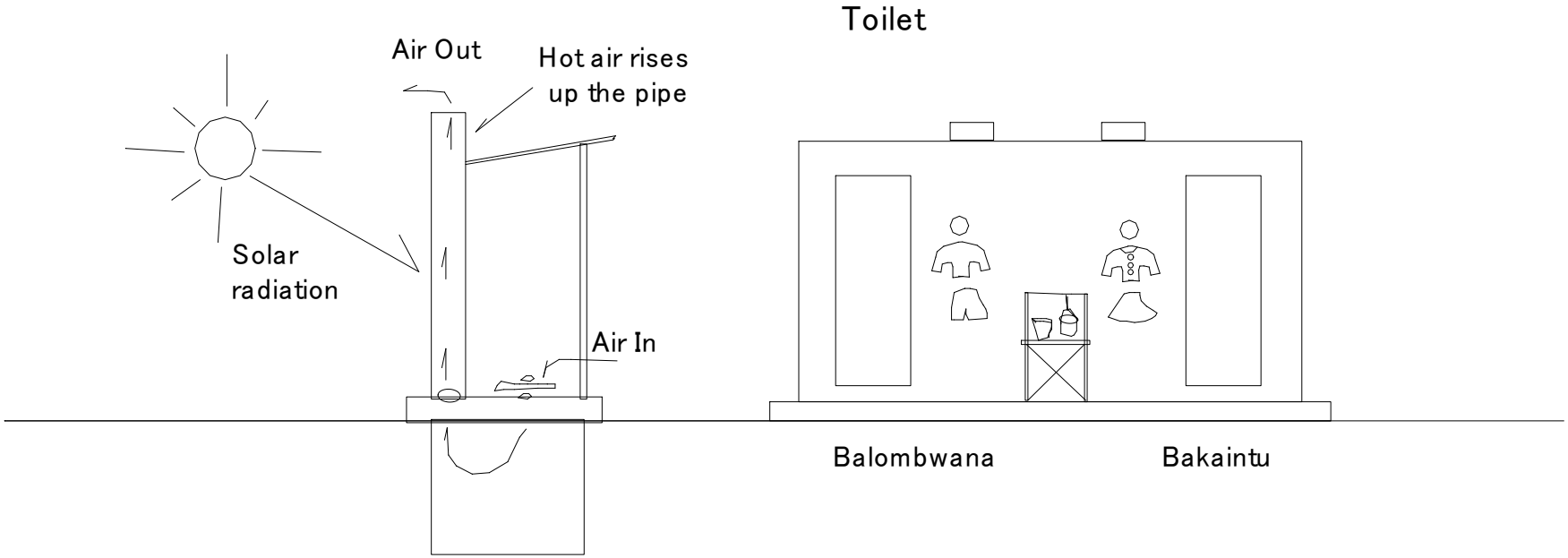
(625) Rural Sanitation (1)

Toilet





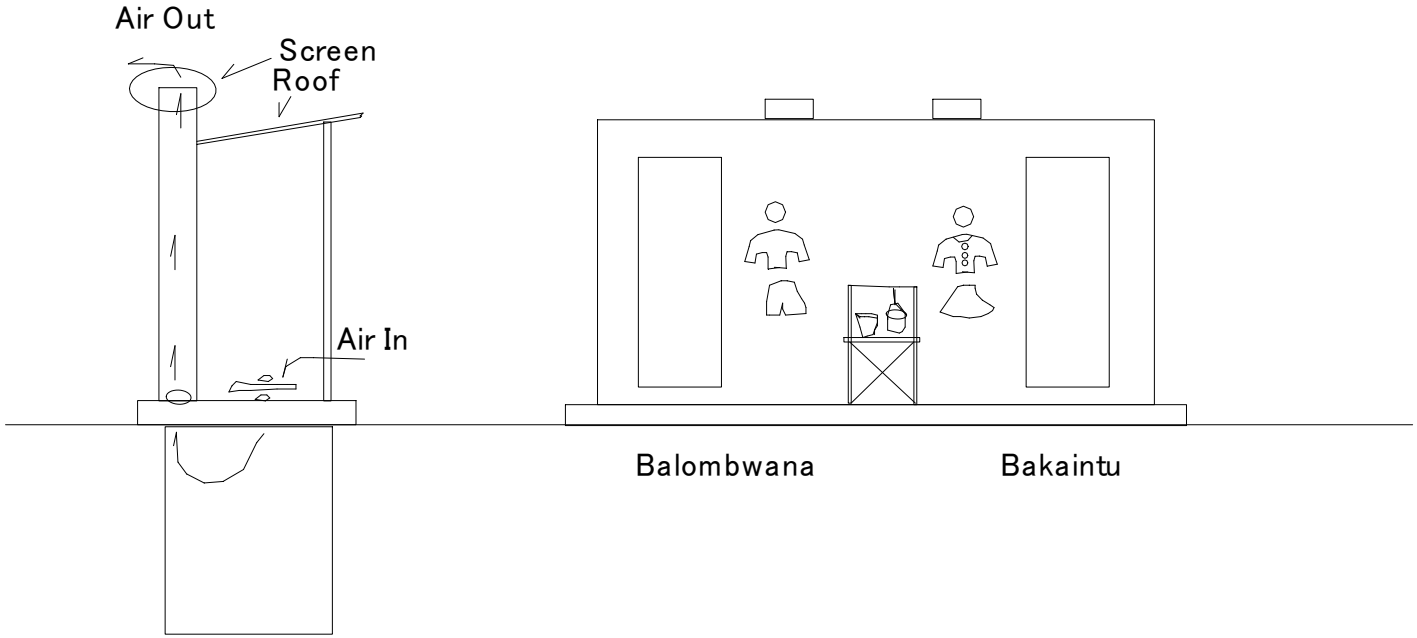
(626) Rural Sanitation (2)



(627) Rural Sanitation (3)

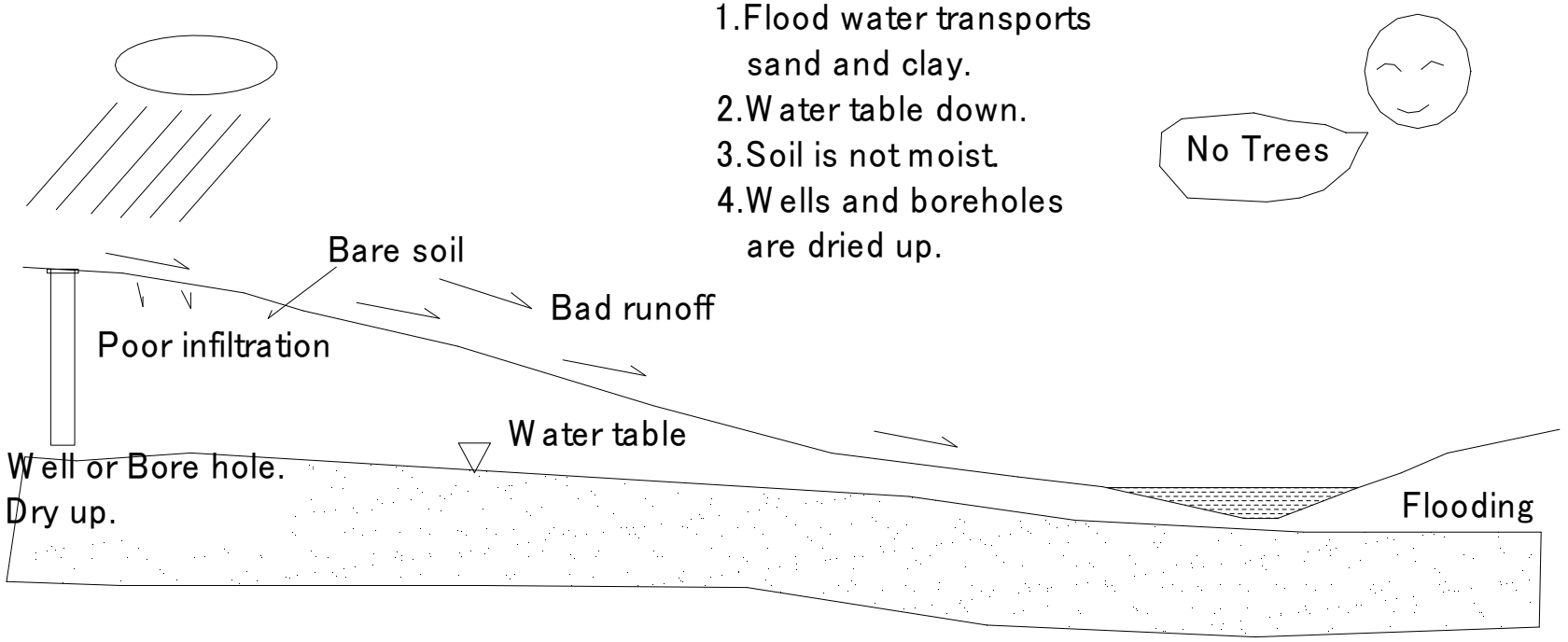
(628) Rural Sanitation (4)

Toilet



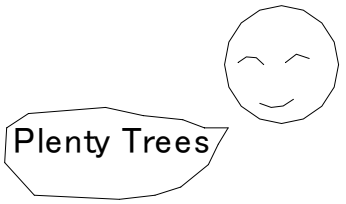
(629) Rainwater runs off

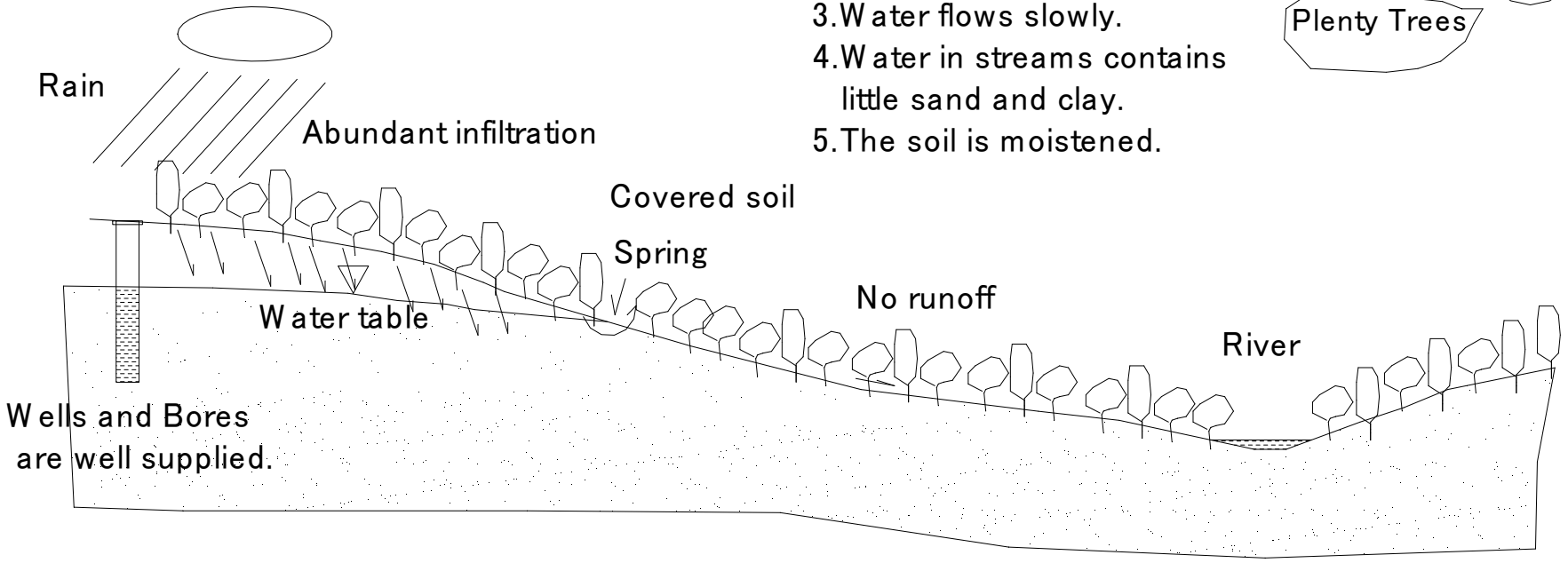
When it rains.
1.Flood water transports sand and clay.
2.Water table down.
3.Soil is not moist.
4.Wells and boreholes are dried up.



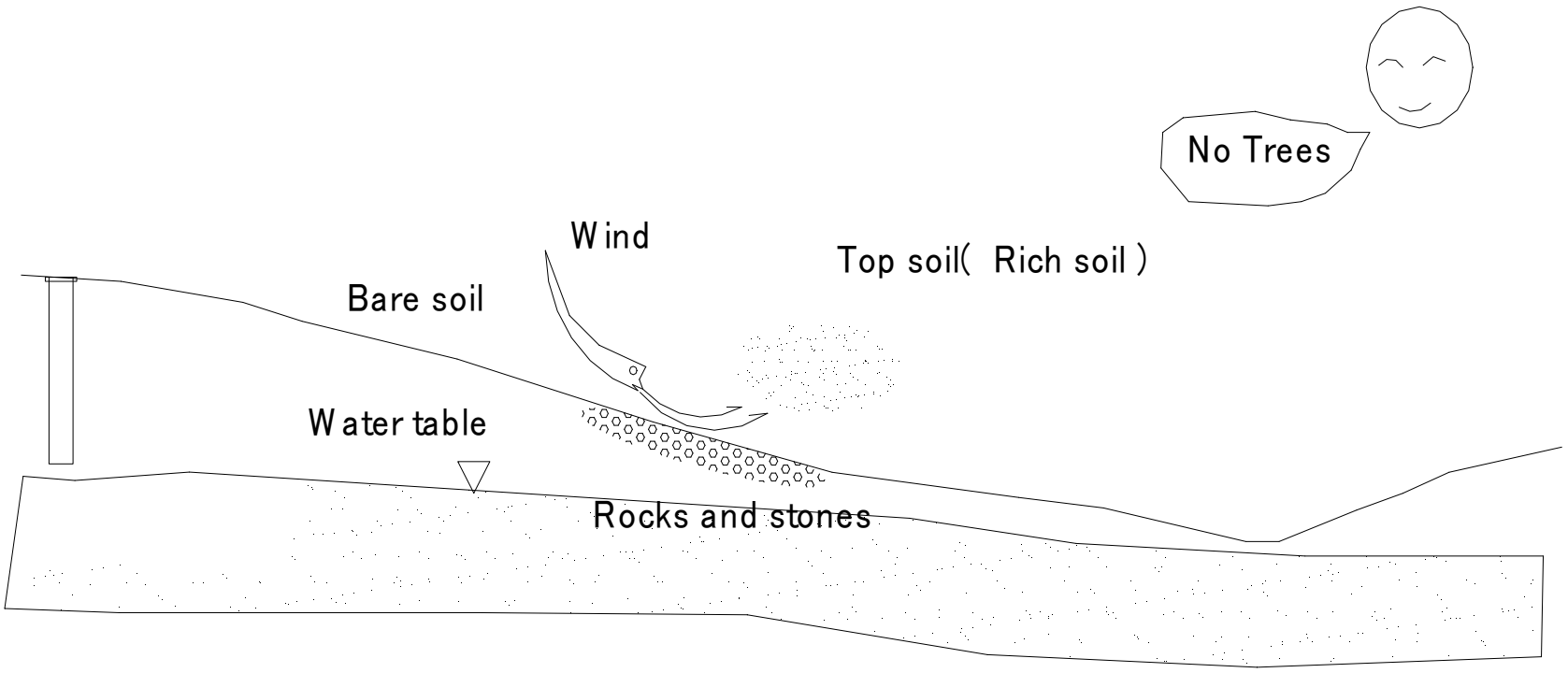
（ 630 ） Rainwater infiltrates

After heavy rain.
1.Water level does not rise.
2.No Flooding.
3.Water flows slowly.
4.Water in streams contains little sand and clay.
5.The soil is moistened.

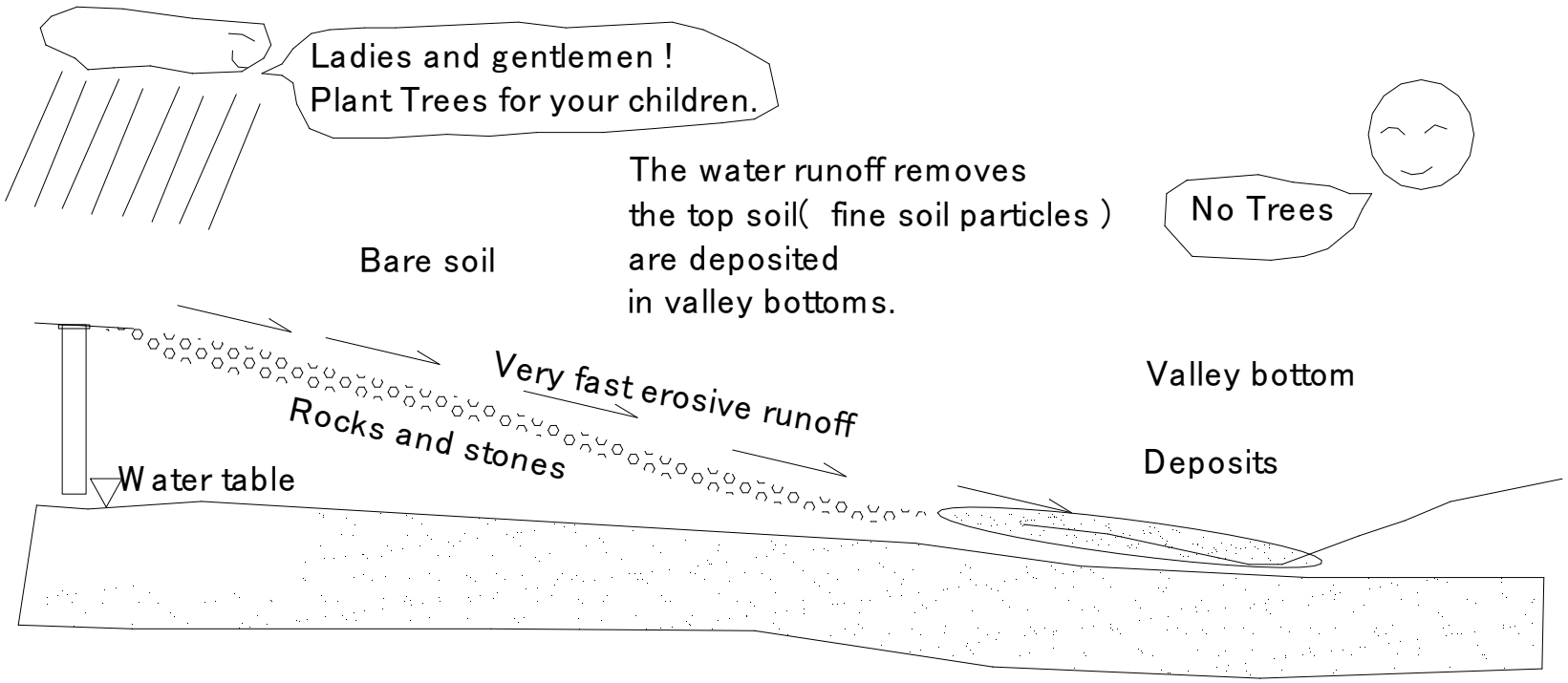




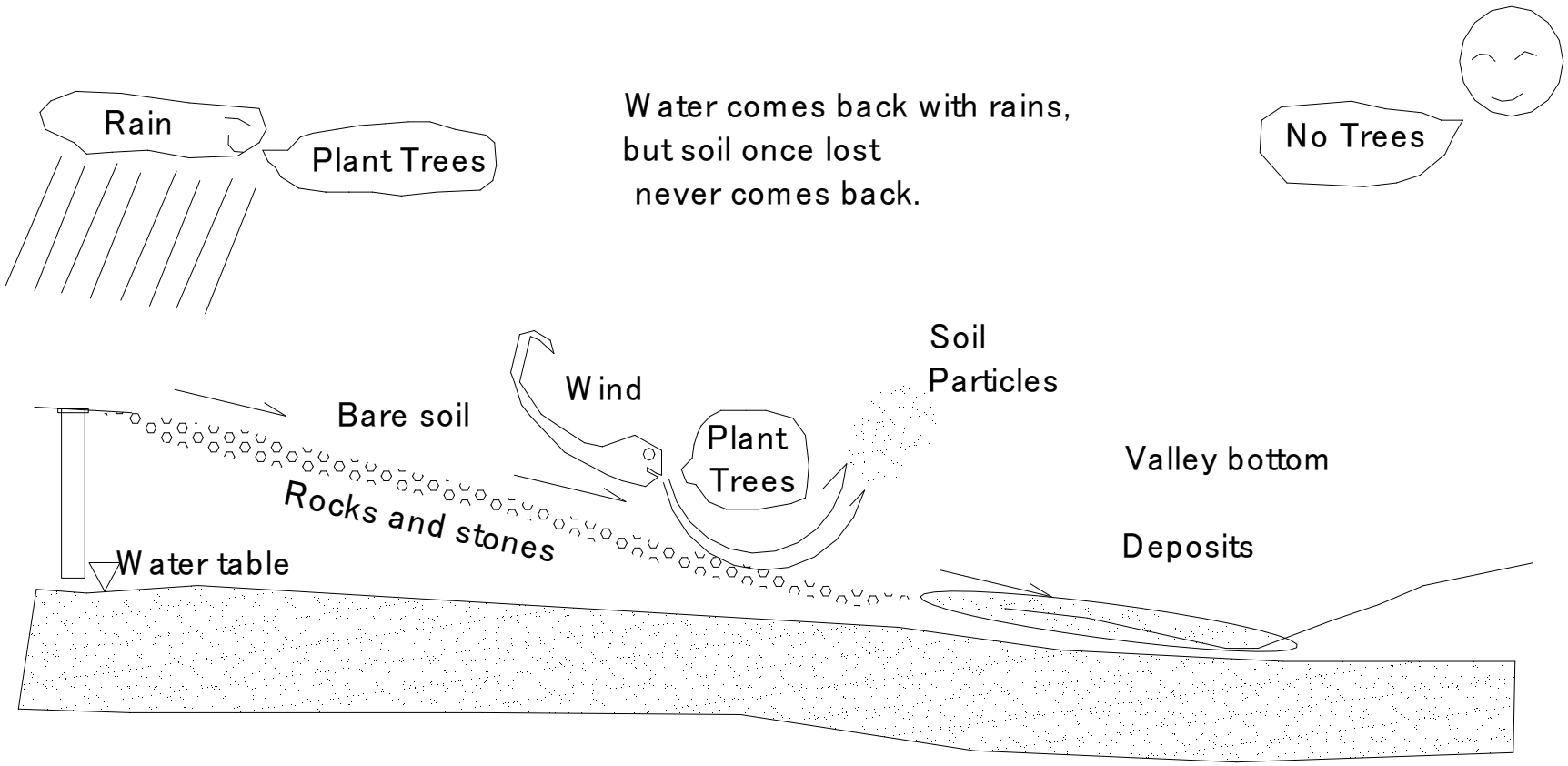
(631) Wind erosion



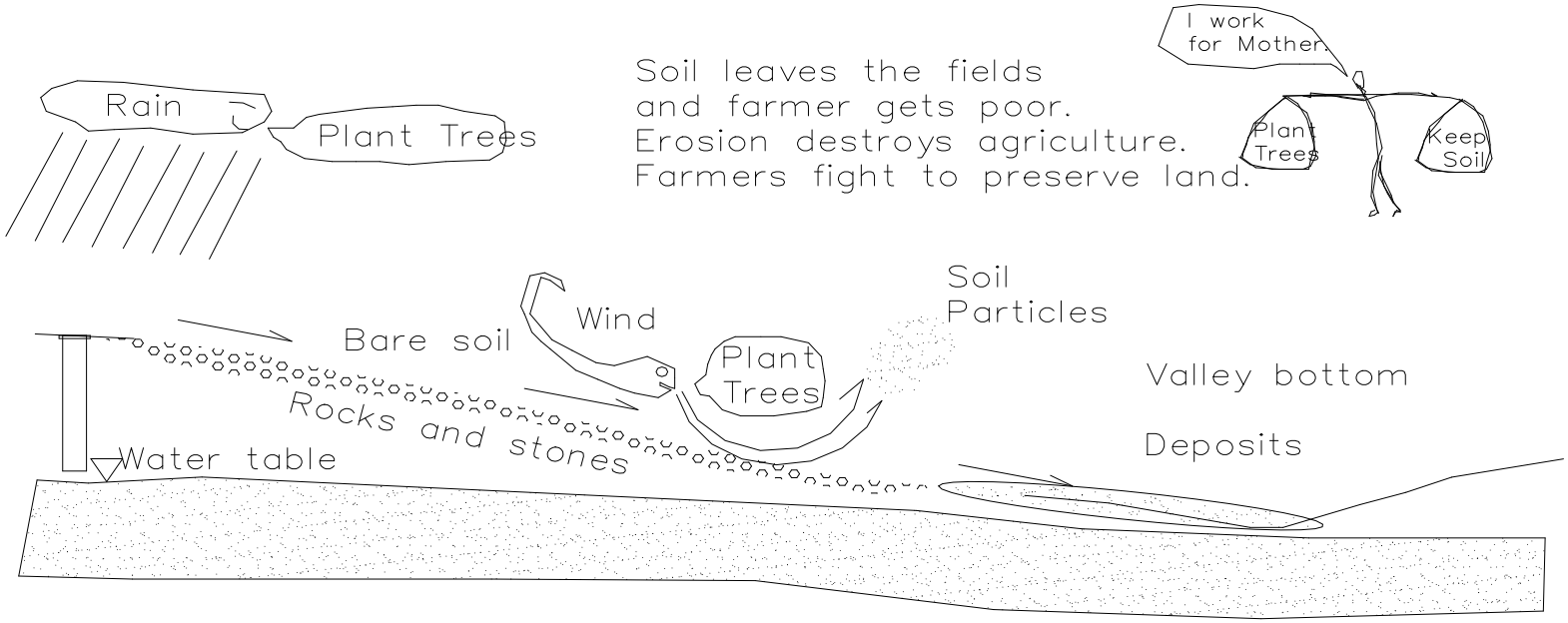
(632) Water erosion



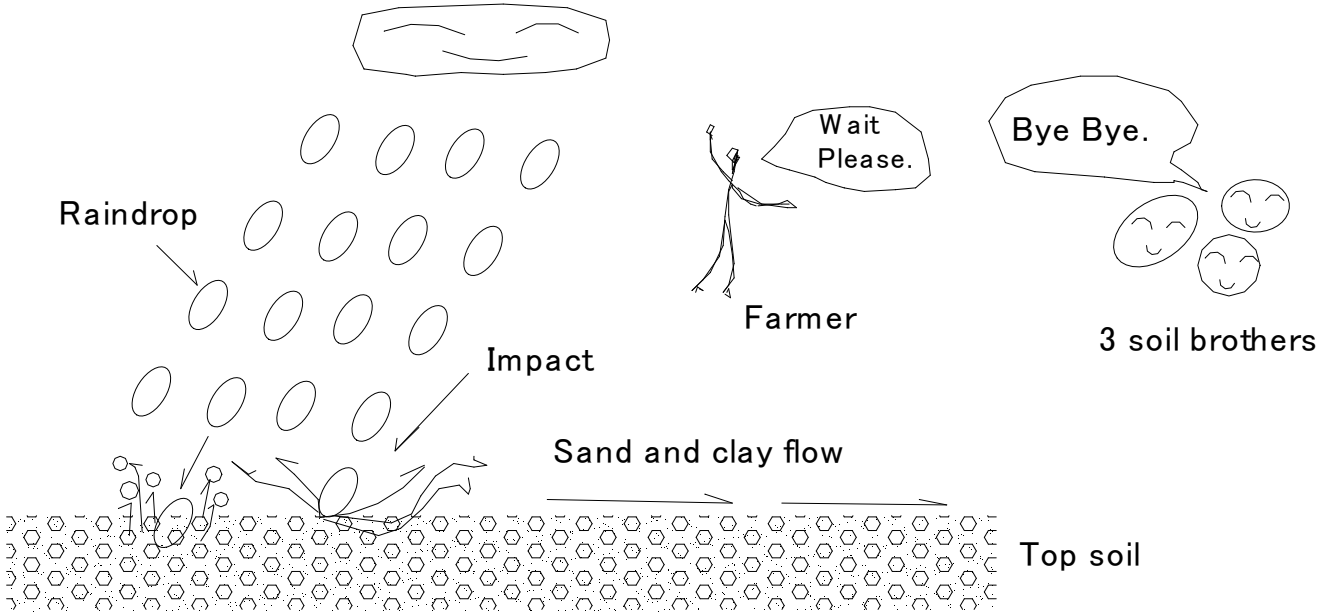
（ 633 ） Lost soil by erosion



(634)Erosion

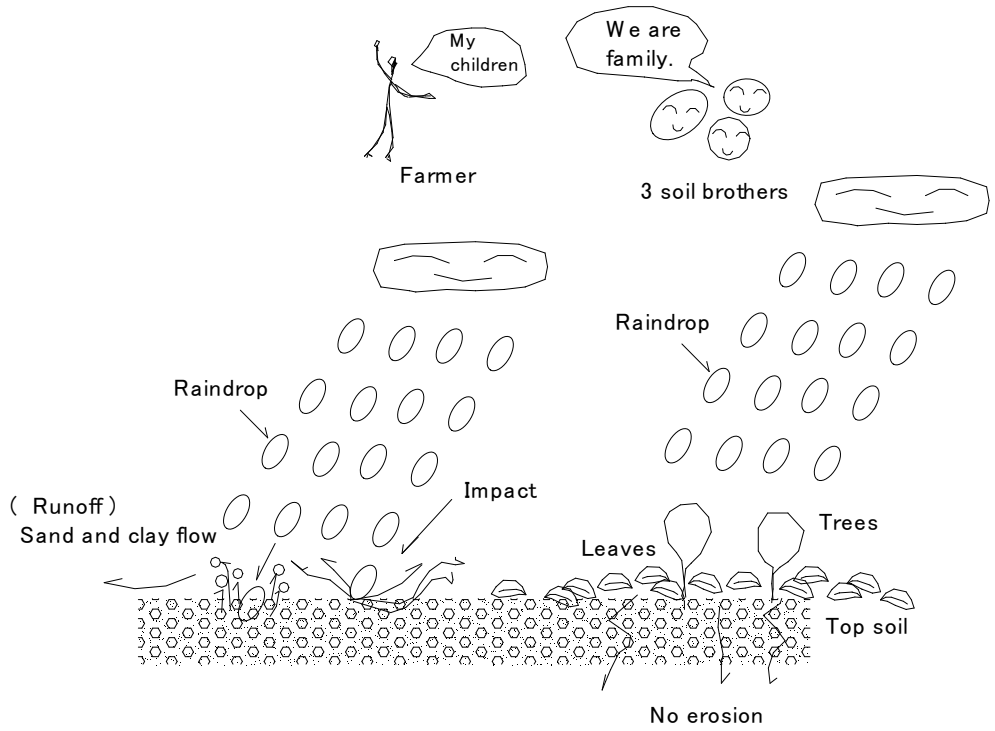

Rain
Plant Trees
Soil leaves the fields
and farmer gets poor.
Erosion destroys agriculture.
Farmers fight to preserve land.
I work
for Mother.
Plant
Trees
Keep
Soil
Soil
Particles
Wind
Bare soil
Plant
Trees
Valley bottom
Rocks and stones
Water table
Deposits

（ 635 ） Soil erosion by rainwater



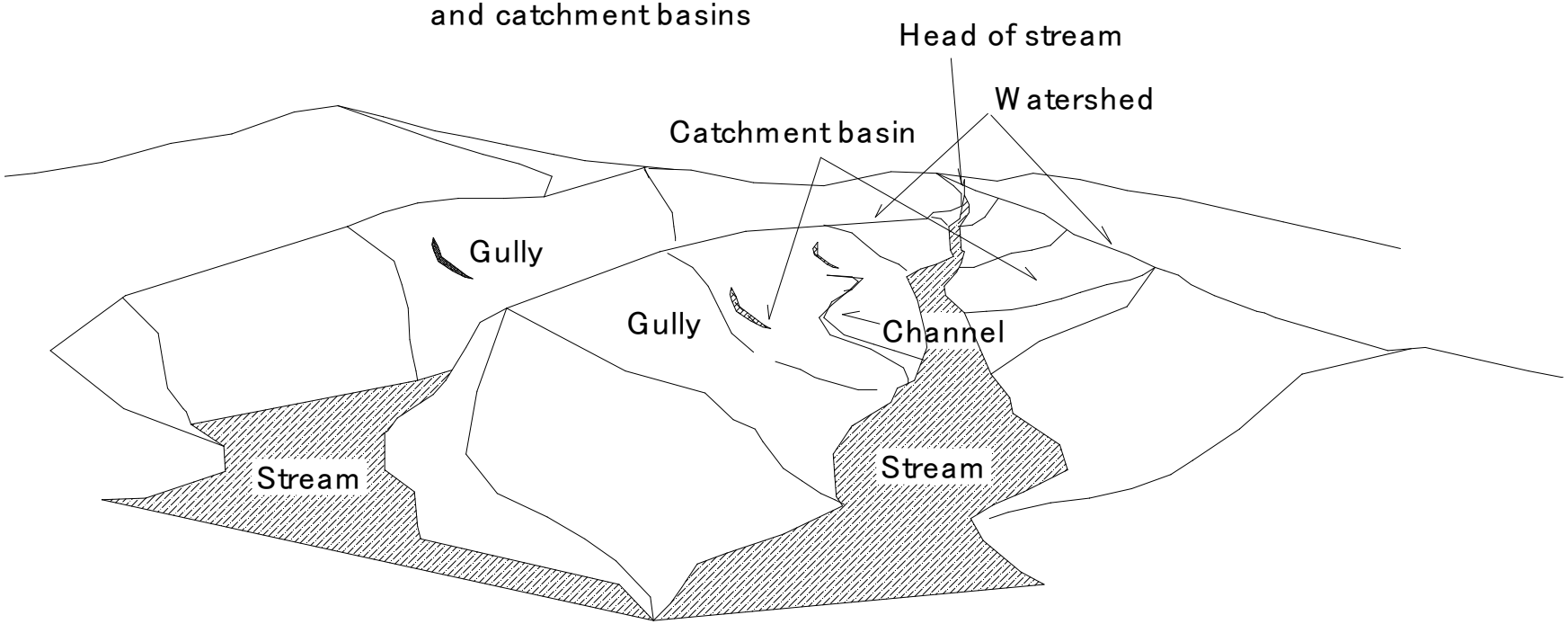
The fine soil particles were carried away by the water.
The stones and gravel were left behind.

(636) Soil covered by plants and trees



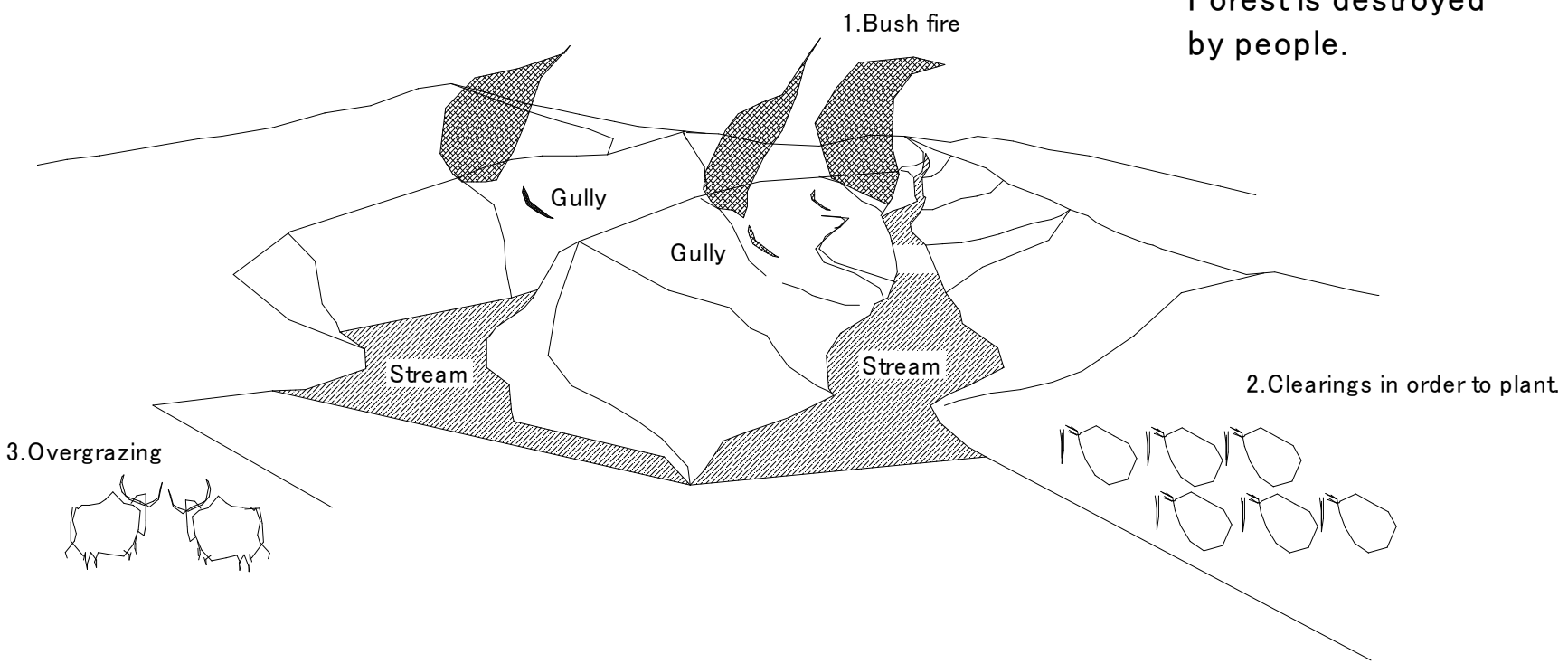
The fine soil particles were carried away by the water.
The stones and gravel were left behind.

（ 637 ） Formation of gullies:the role of watersheds and catchment basins

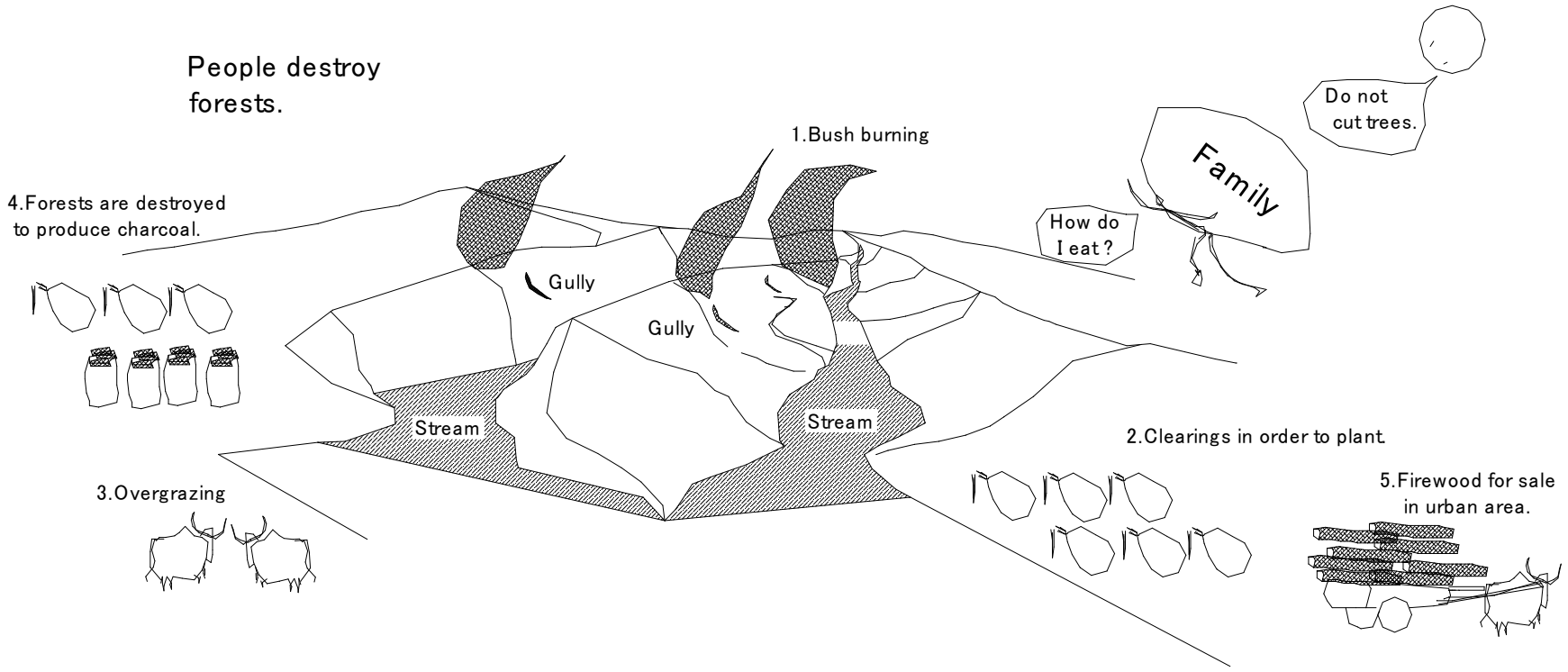


(638) Erosion is caused by bush fires and deforestation(1)

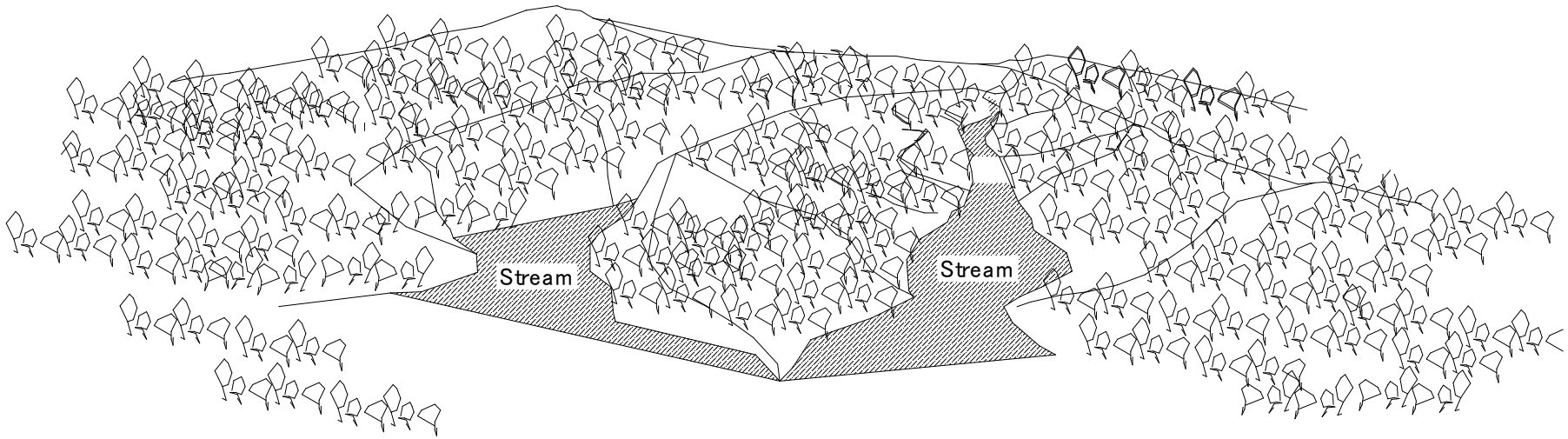
Forest is destroyed by people.



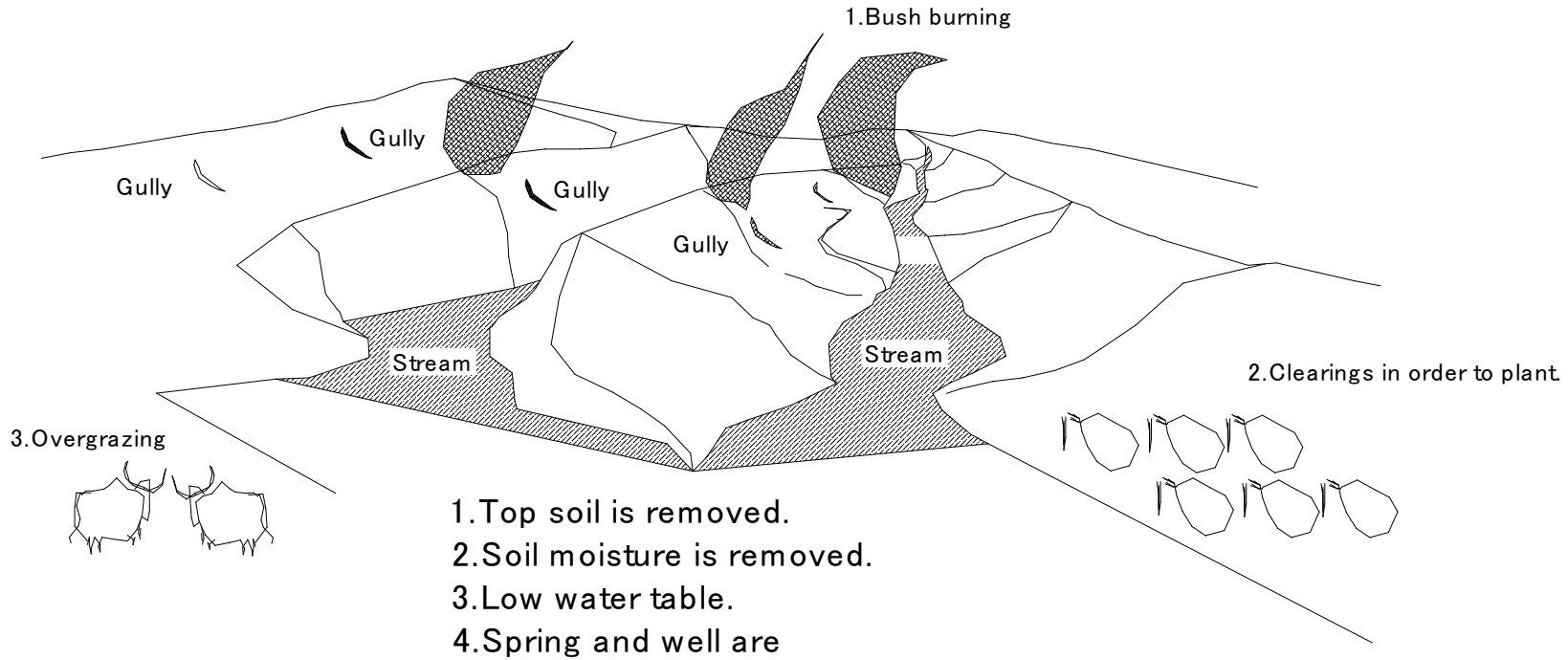
（ 639 ） Erosion is caused by bush fires and deforestation（ 2 ）



（ 640 ） Before（ Burning Trees And Cutting Trees ）

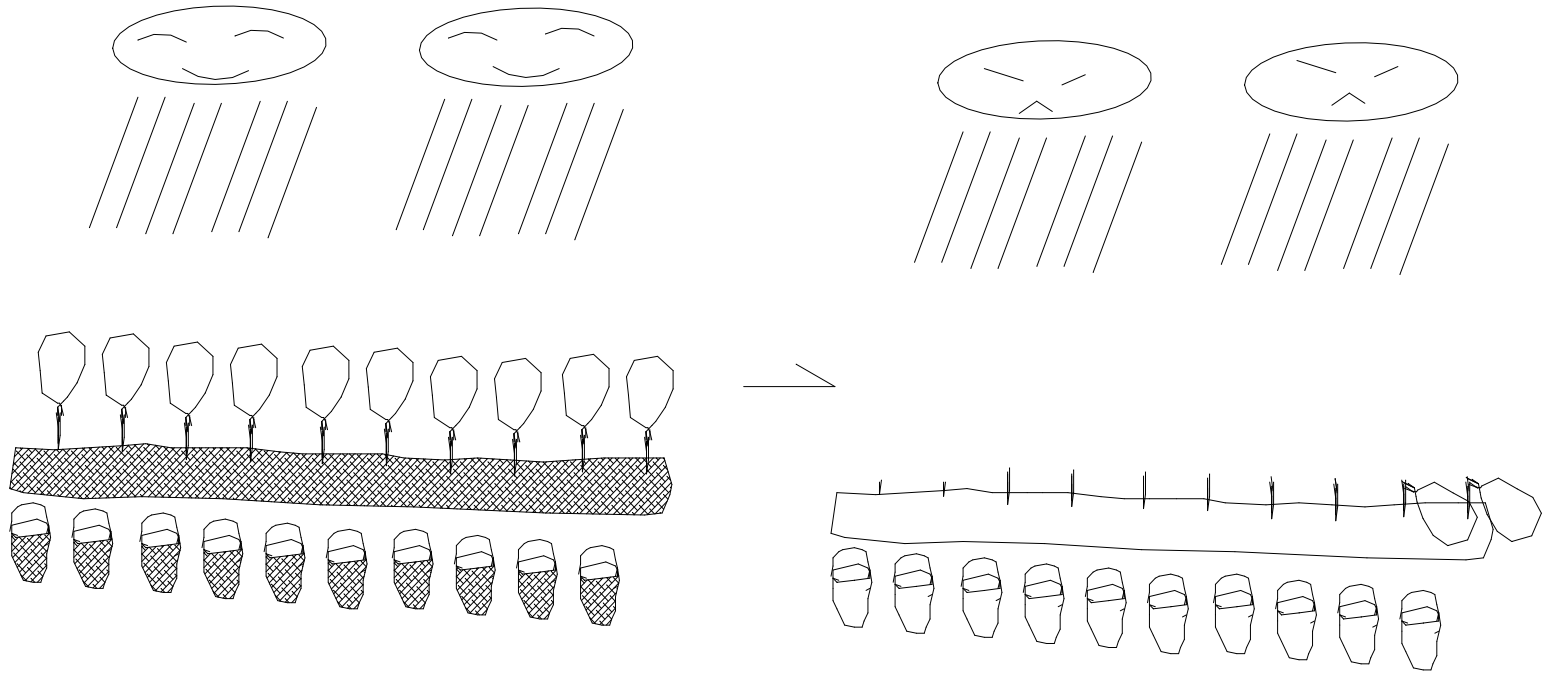


(641) After(Burning Trees And Cutting Trees)



1.Top soil is removed.
2.Soil moisture is removed.
3.Low water table.
4.Spring and well are
no longer filled with water.
5.After Heavy Rain.Flood.
6.No farming land.

（ 642 ） After（ Burning Trees And Cutting Trees）（ 2 ）



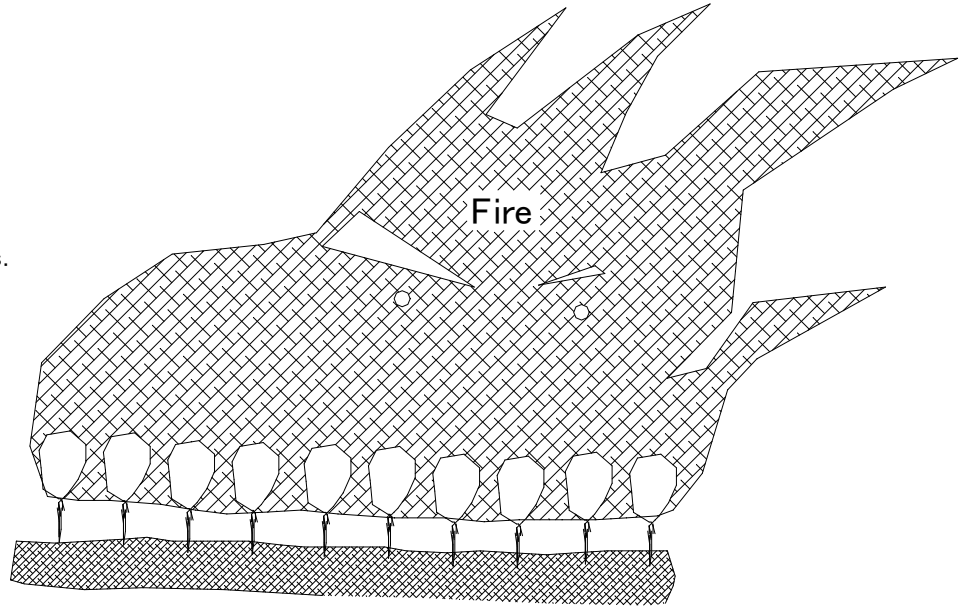
Ten buckets of water

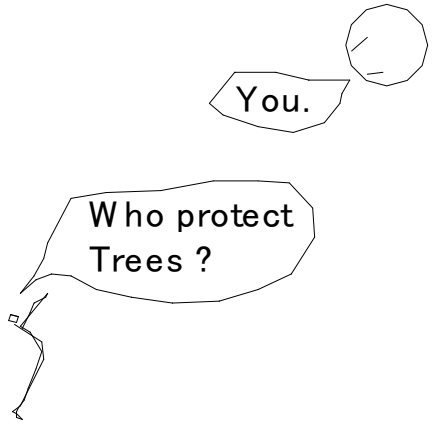
No water

(643) The need for fire wardens

Clear-cut regulations
enforced by fire wardens.

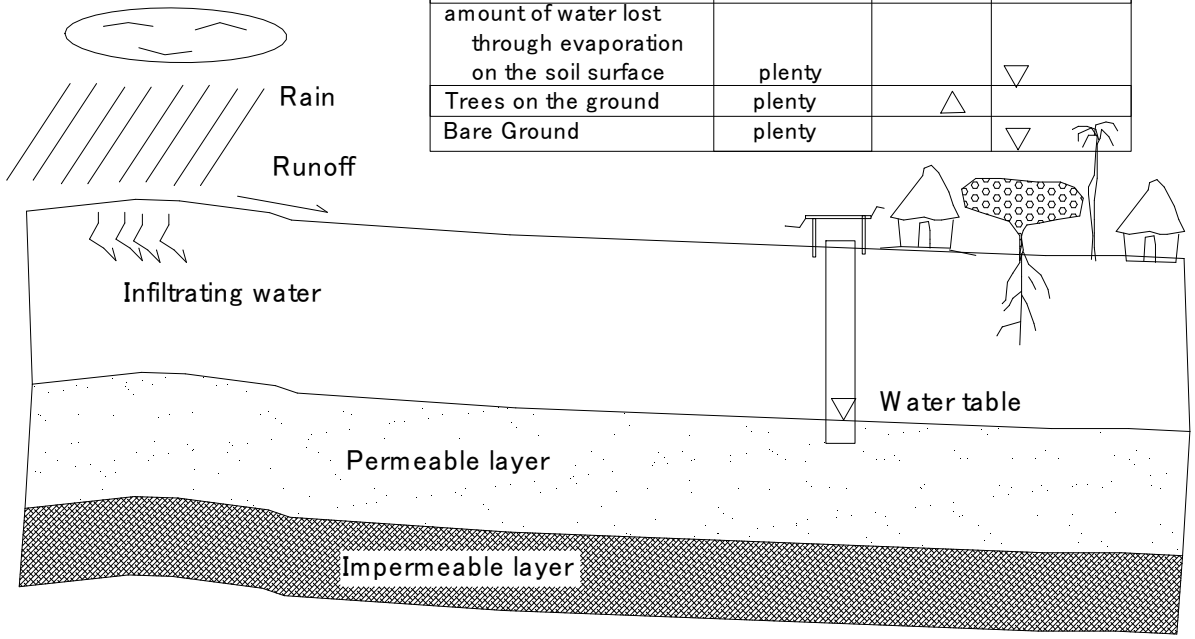
1.How to avoid burning.
  How to check.
  How to punish.
2.What useful fires.
  When and how.
3.Who gives permission for fires.
4.Protected sites.
5.Bush fire rotations for grazing lands.
  Herbs and grasses are not burnt
  at the same time every year.





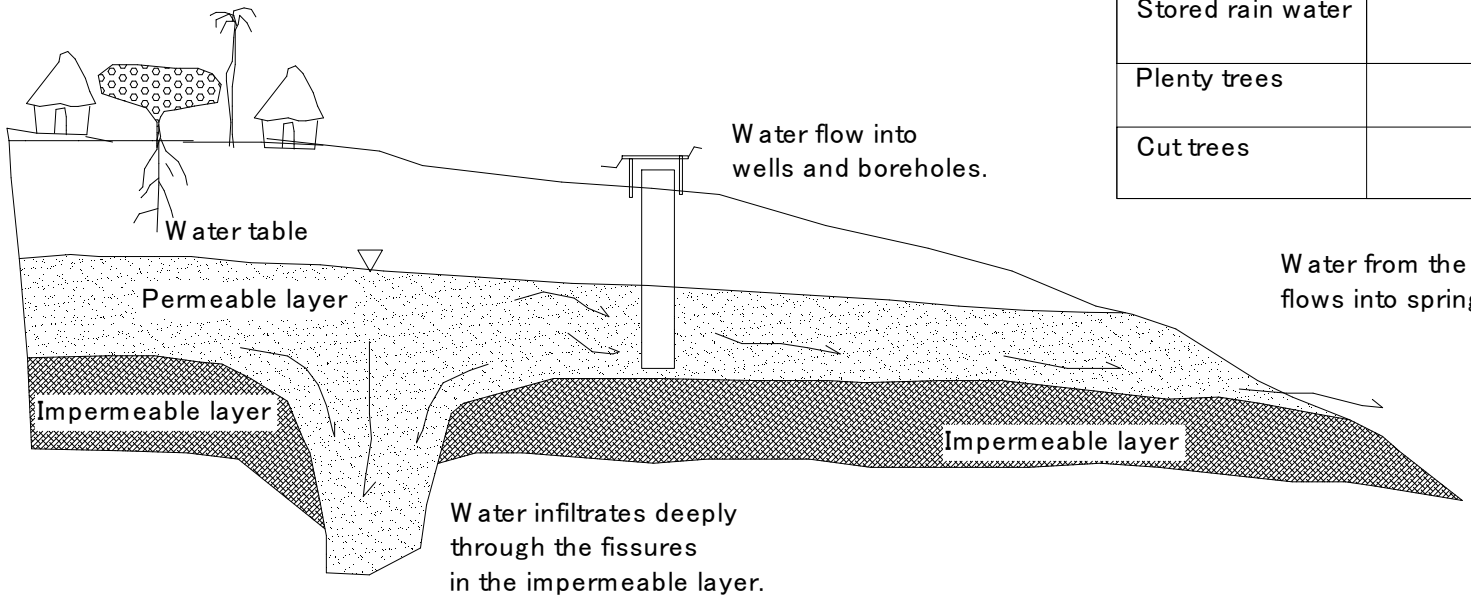
（ 644 ） Water runoff prevents the recharge of water tables

		Level of the Water Table	
Rainfall	plenty	△	
Runoff	plenty		▽
Infiltrating	plenty	△	
amount of water lifted by plants and people	plenty		▽
amount of water lost through evaporation on the soil surface	plenty		▽
Trees on the ground	plenty	△	
Bare Ground	plenty		▽

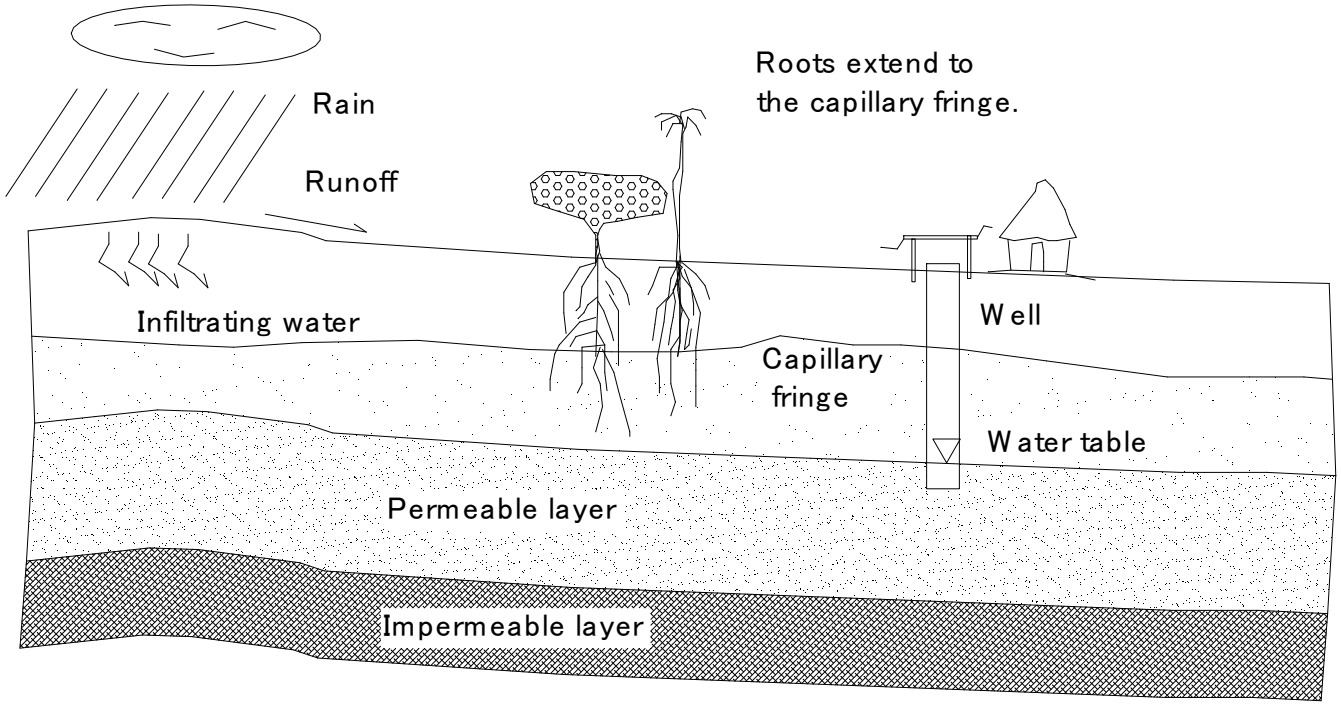


（ 645 ） Water movements in water tables

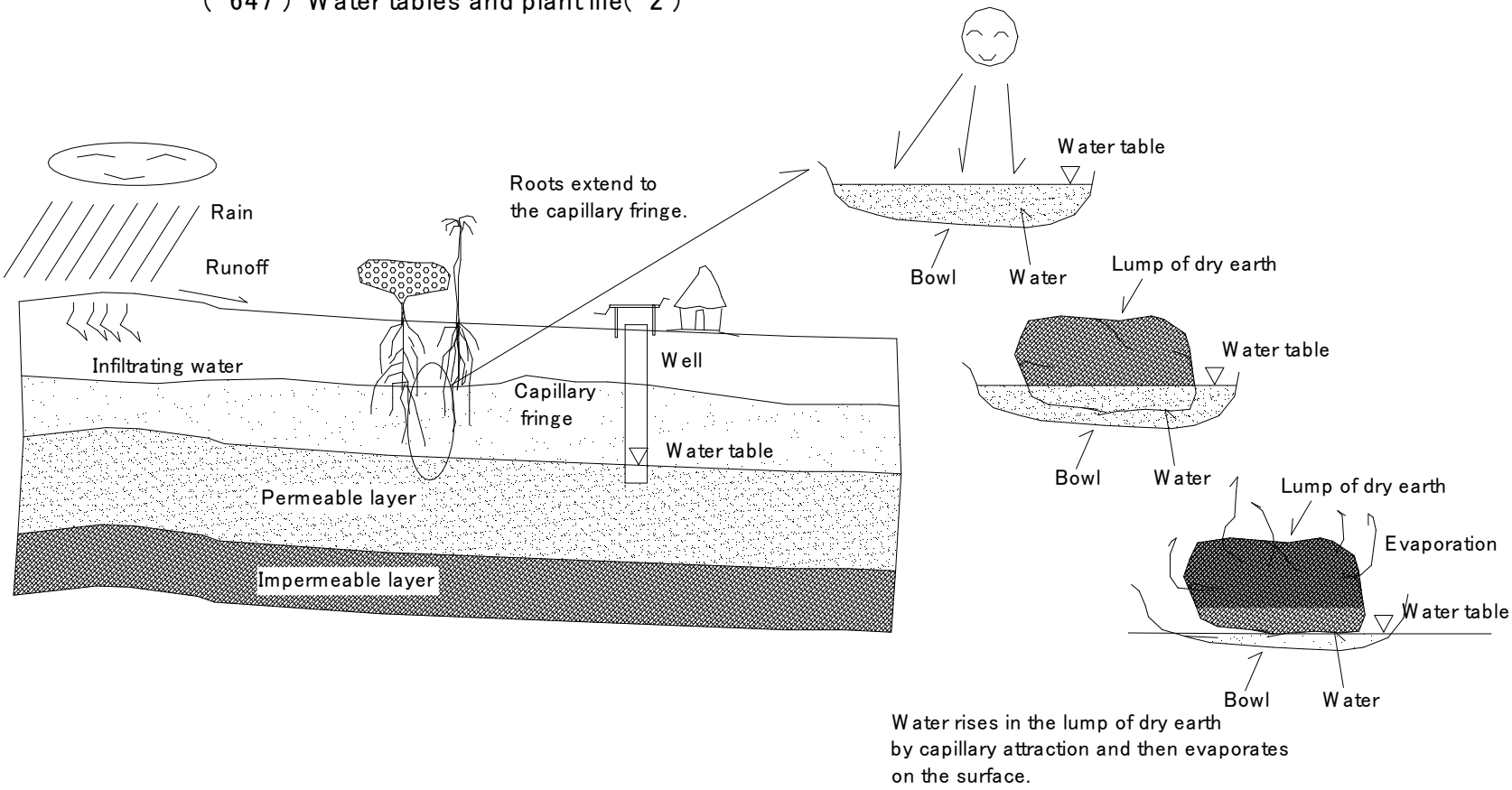
	Water table
Rainy season	△
Dry season	▽
Stored rain water	△
Plenty trees	△
Cut trees	▽



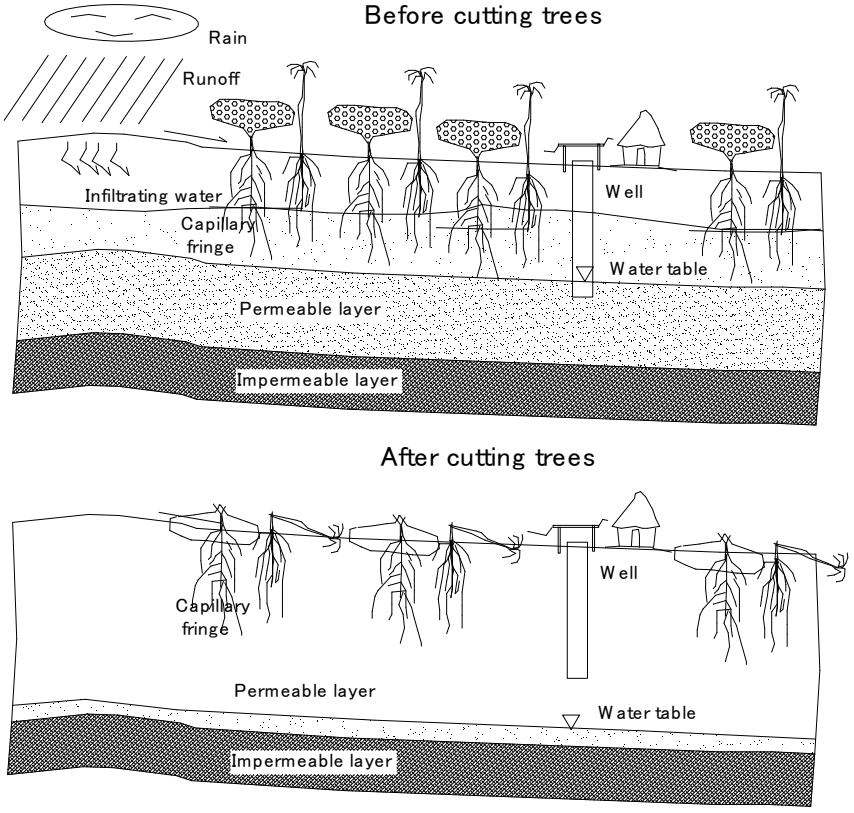
（ 646 ） Water tables and plant life（ 1 ）



(647) Water tables and plant life(2)

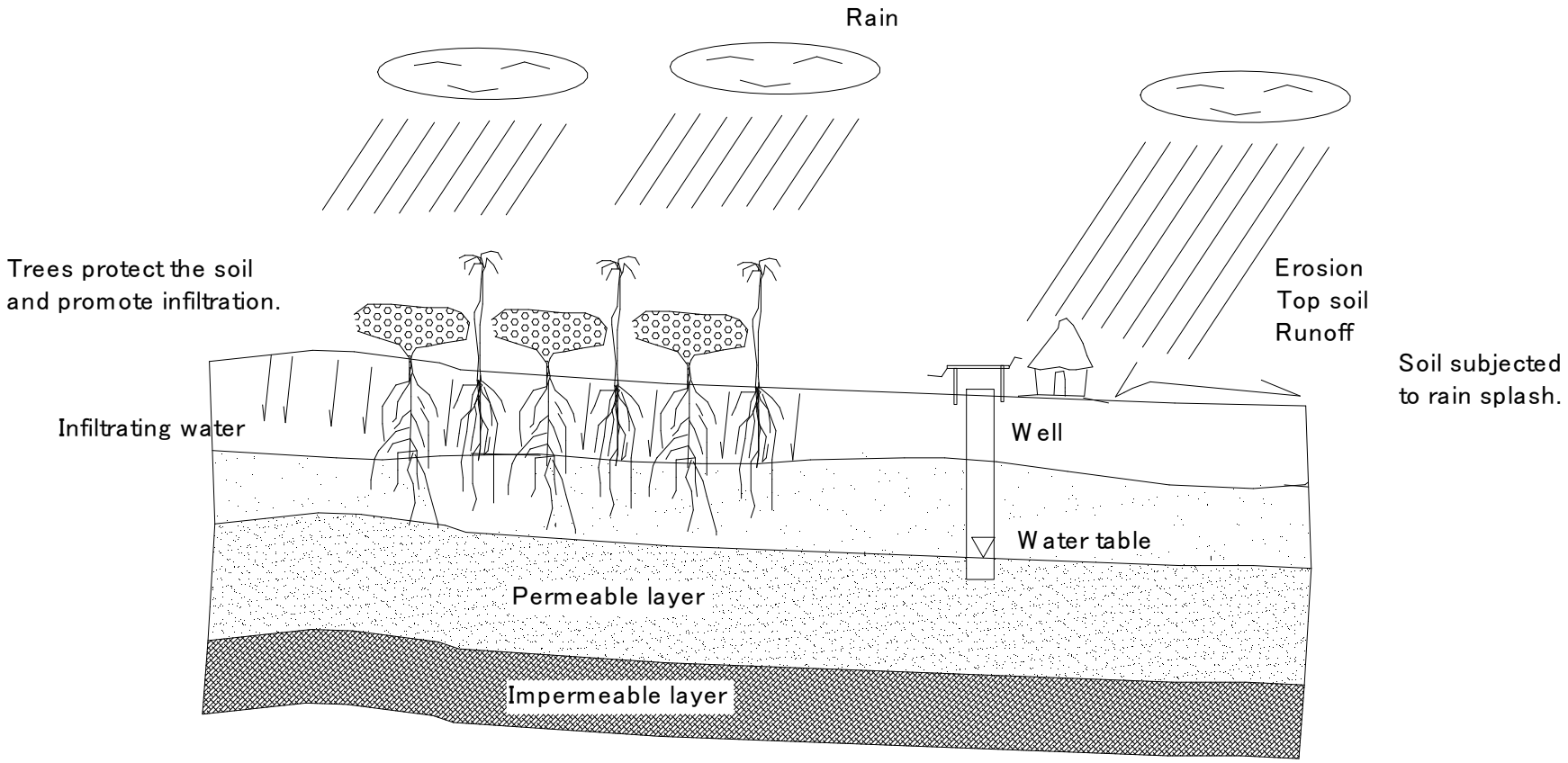


(648) Water tables and plant life(3)

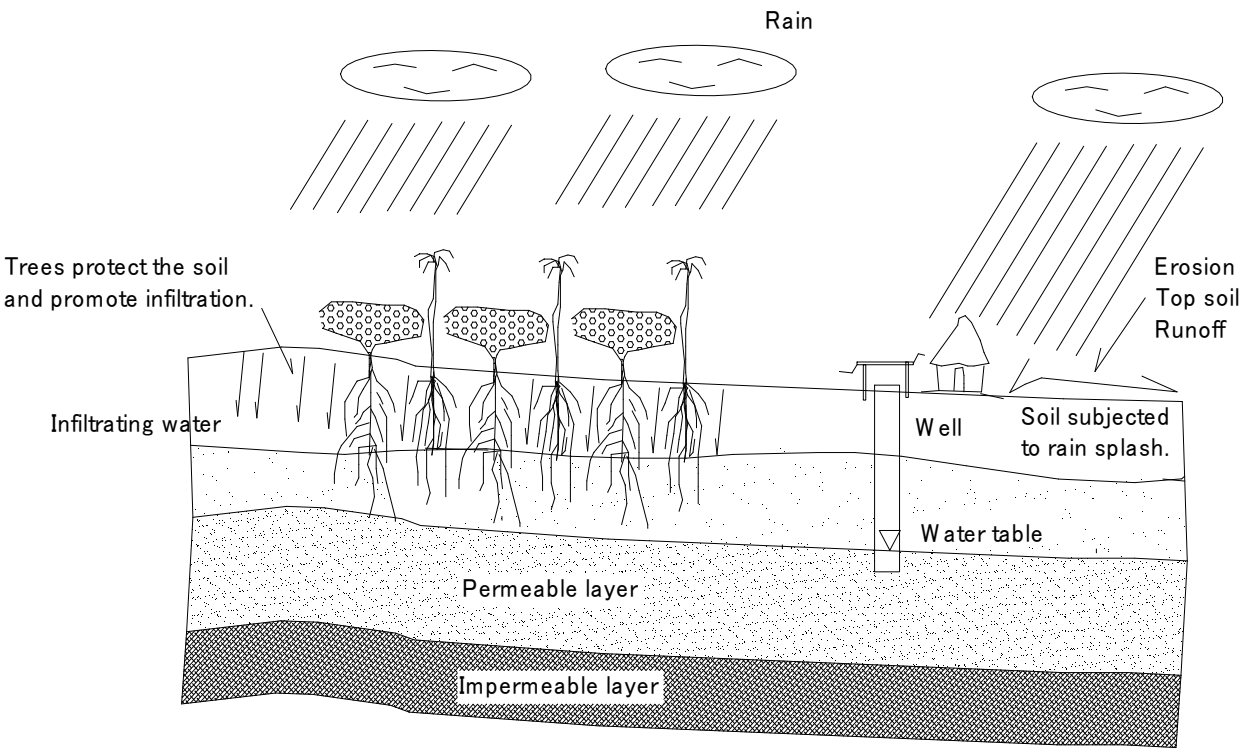


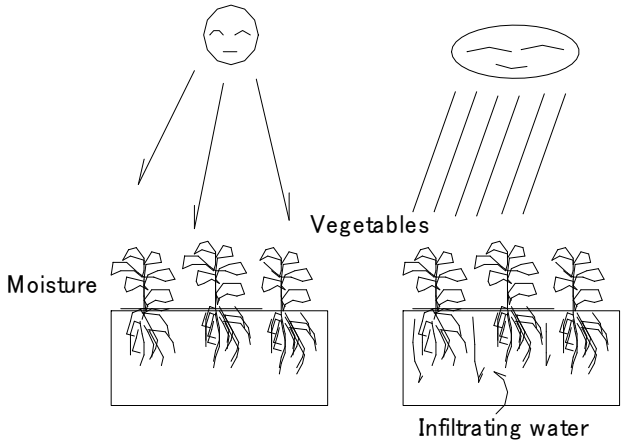
	Before cutting trees	After cutting trees
Water table	△	▽
Well or Borehole	○	×
Farming	○	×

(649) Benefits of vegetation(1)



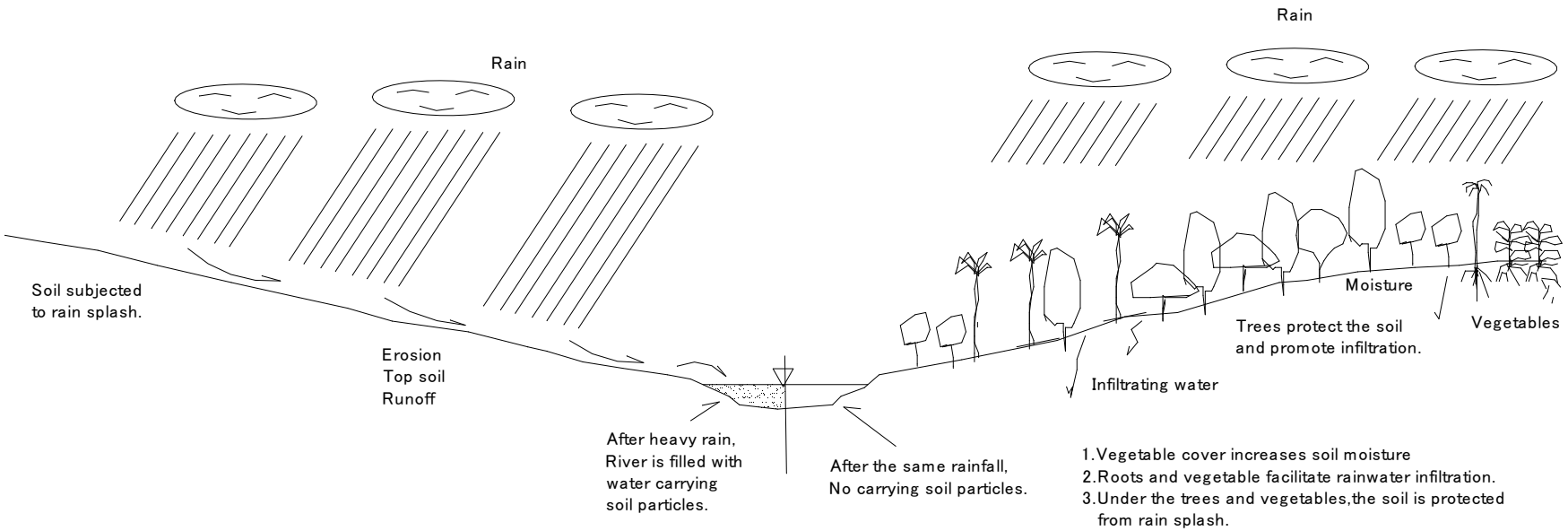
(650) Benefits of vegetation(2)



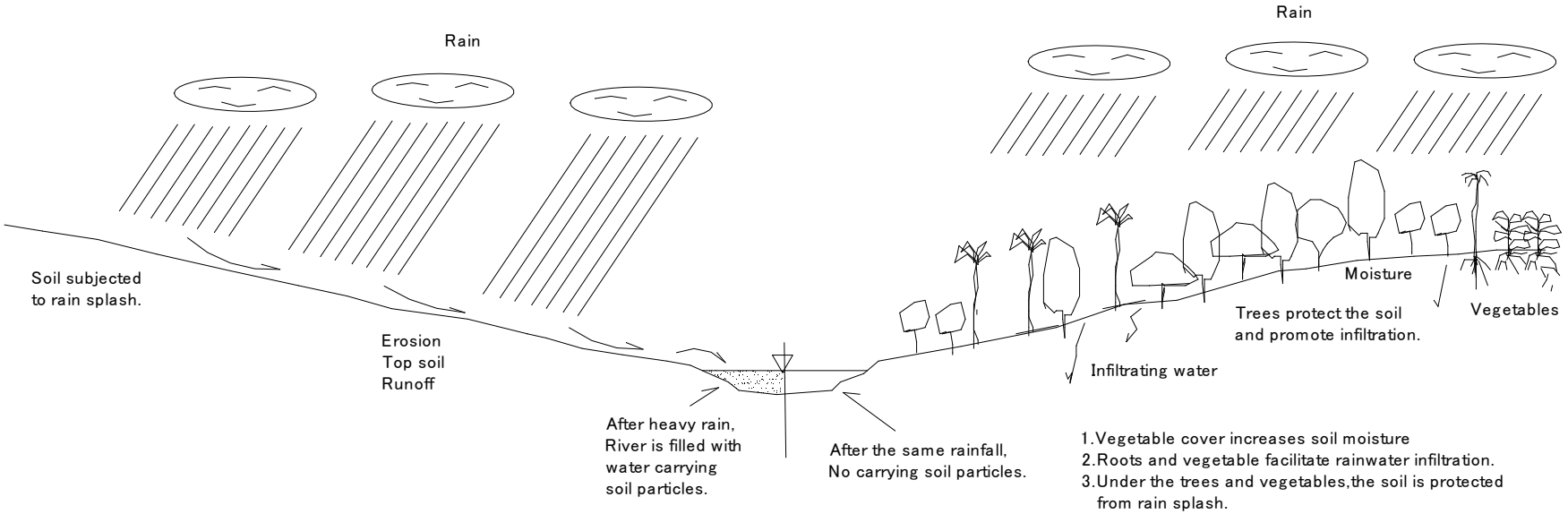


1.Vegetable cover increases soil moisture
2.Roots and vegetable facilitate rainwater infiltration.
3.Under the trees and vegetables,the soil is protected from rain splash.
4.Outside the protected area,rain splash increased, and infiltration decreased.

(651) Covered soil is not subjected to erosion and runoff(1)



（ 652 ） Covered soil is not subjected to erosion and runoff（ 2 ）

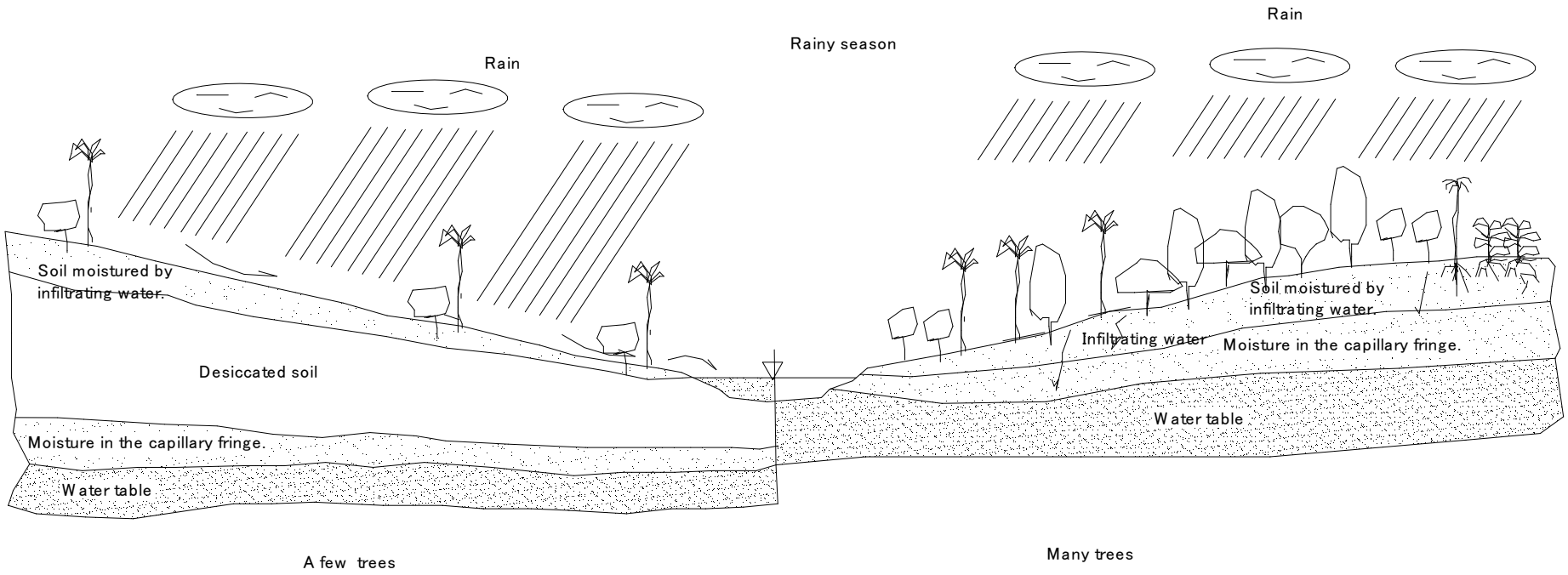


Soil removed by erosion in one year
on sloping ground.

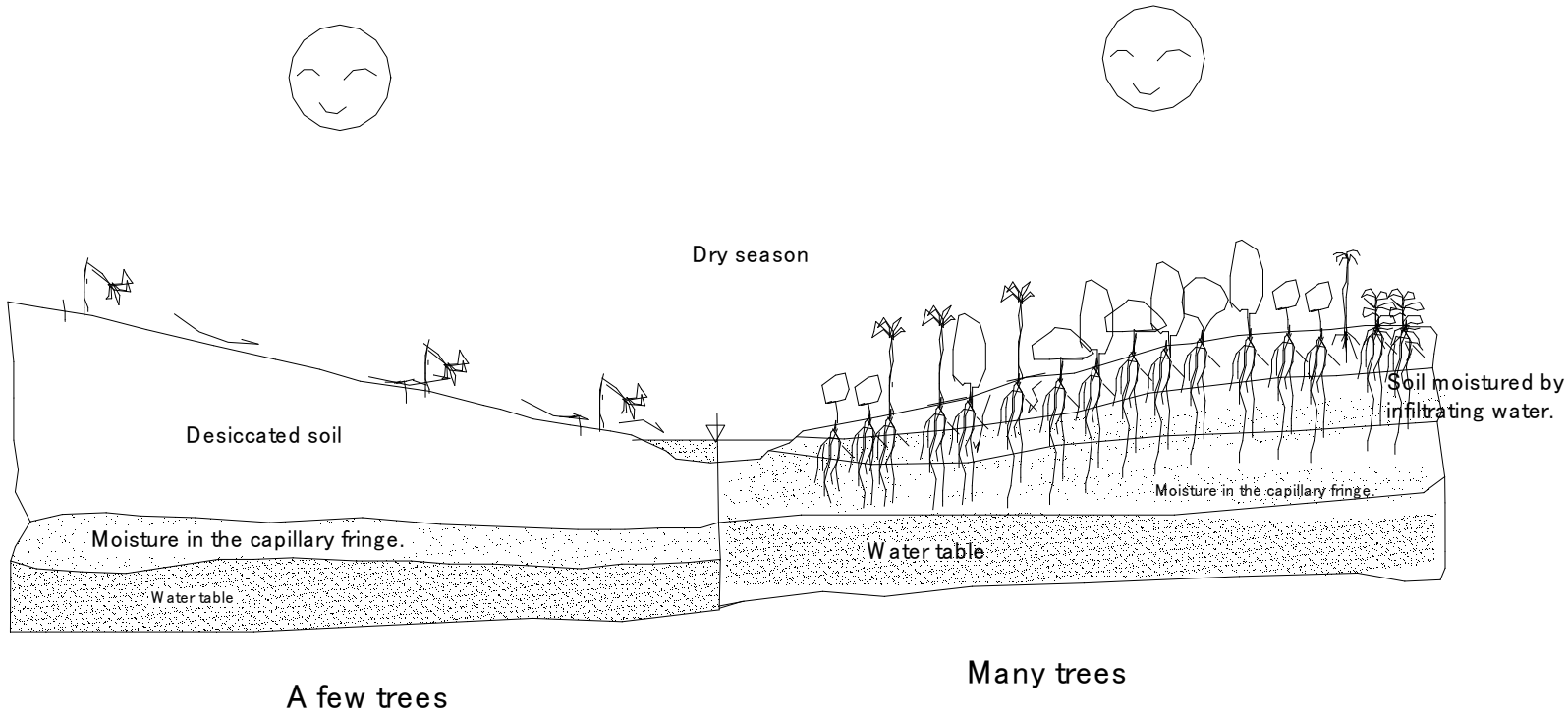
Bare soil	Soil full of trees or plants
1200	1

1.Vegetable cover increases soil moisture
2.Roots and vegetable facilitate rainwater infiltration.
3.Under the trees and vegetables,the soil is protected
from rain splash.
4.Outside the protected area,rain splash increased,
and infiltration decreased.

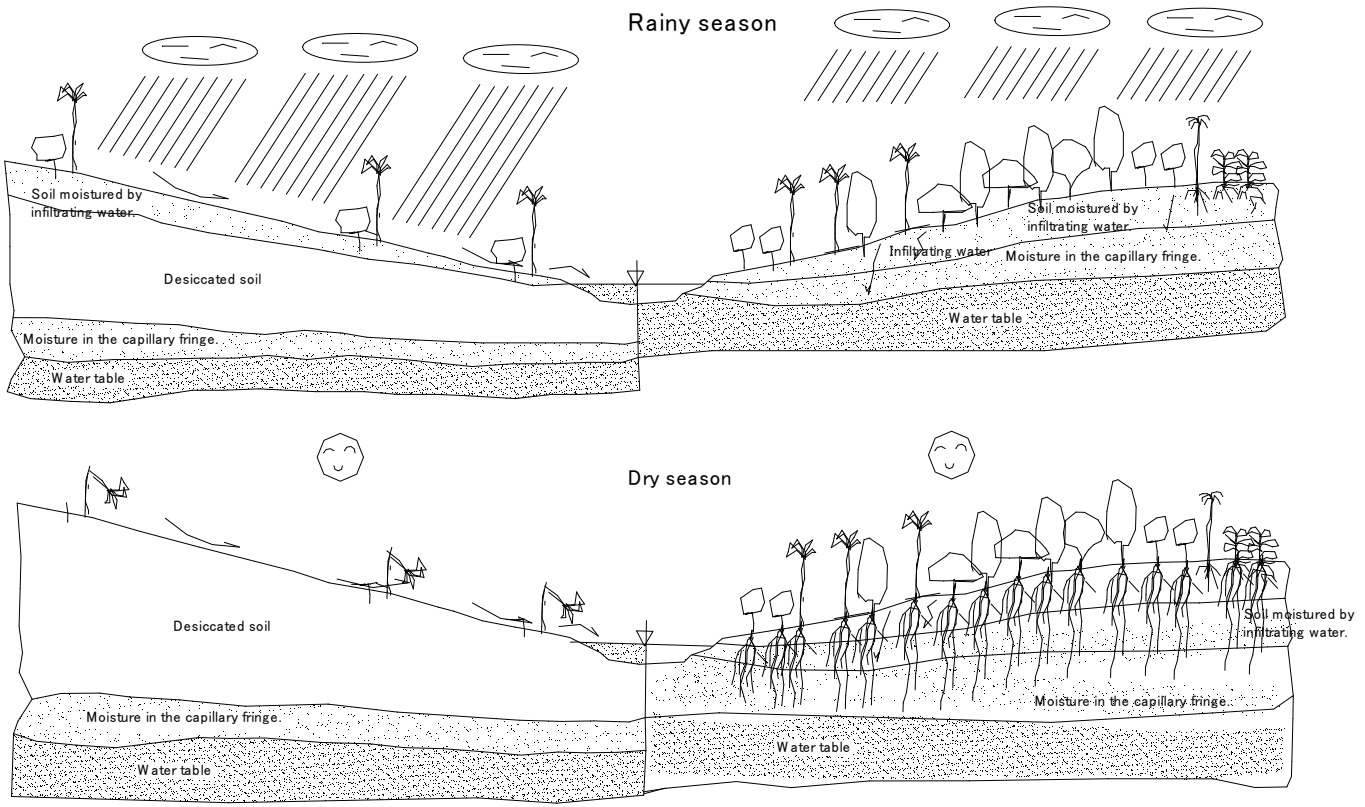
(653) The level of water table during the dry and rainy seasons(1)



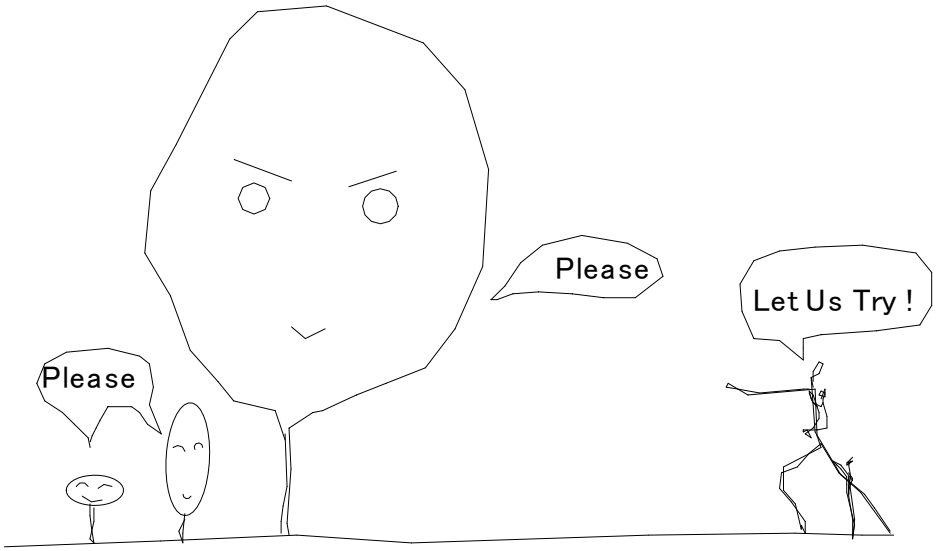
(654) The level of water table during the dry and rainy seasons(2)



(655) The level of water table during the dry and rainy seasons(3)

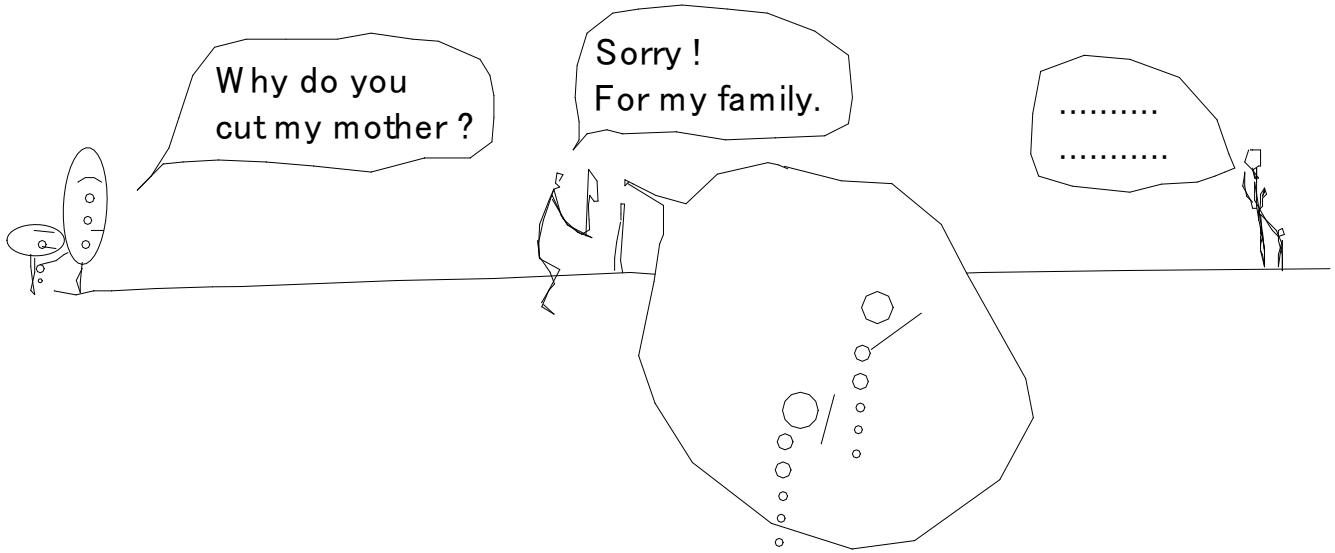


（ 656 ） The need for tree conservation regulations

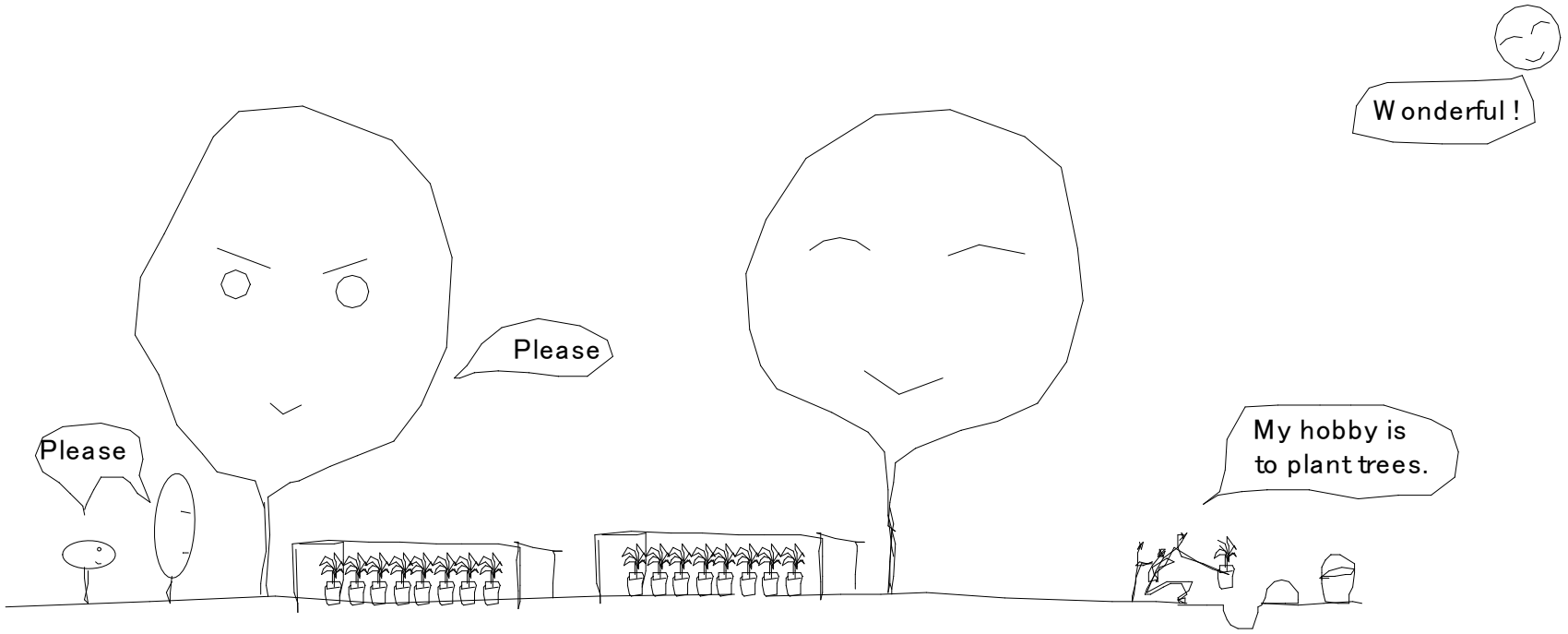


Tree conservation regulations
（ 1 ） Prevent clearing and felling.
（ 2 ） All farmers plant and maintain trees.
（ 3 ） Protect species.
（ 4 ） Teach children the function of trees .
（ 5 ） Teach children the essential role in safeguarding rural life.
（ 6 ） Reserve land for afforestation.
（ 7 ） Make peole plant a hedge.

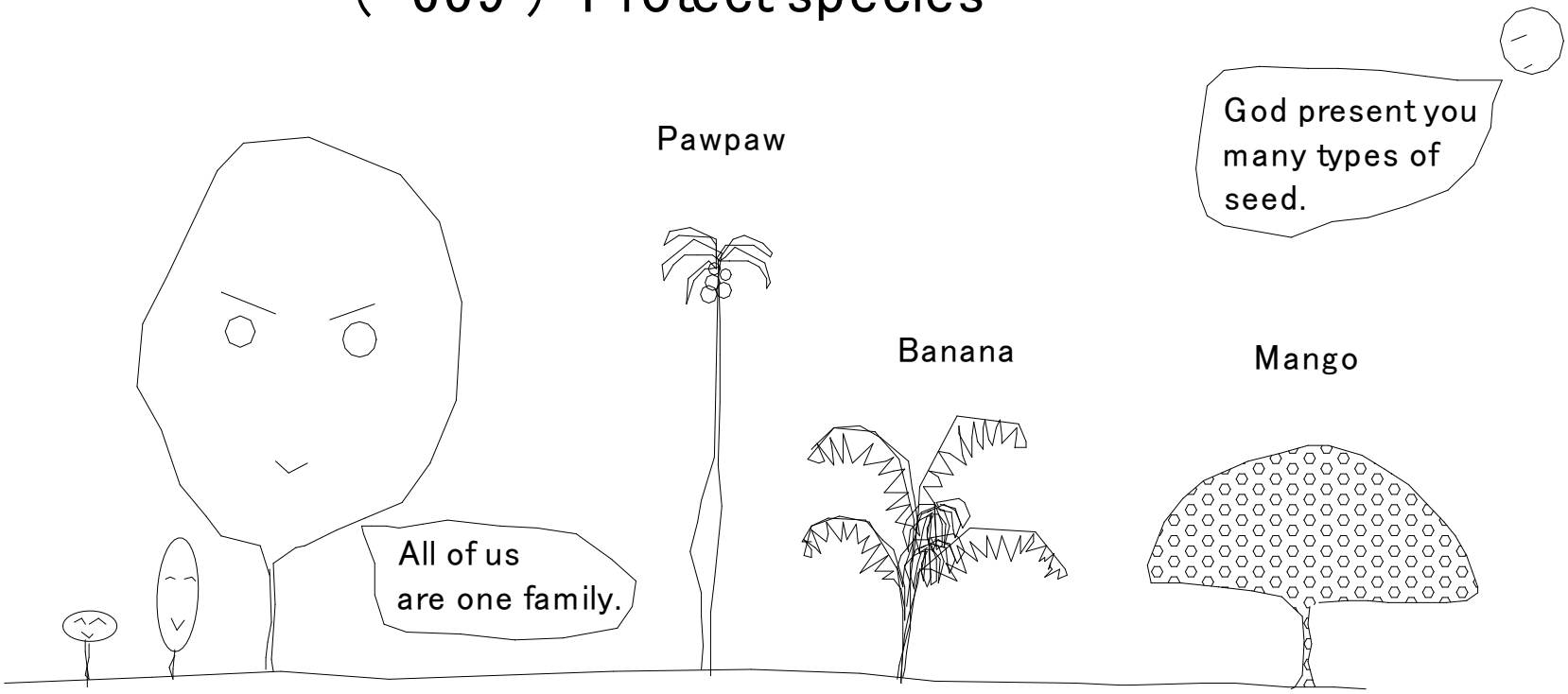
（ 657 ） Prevent clearing and felling



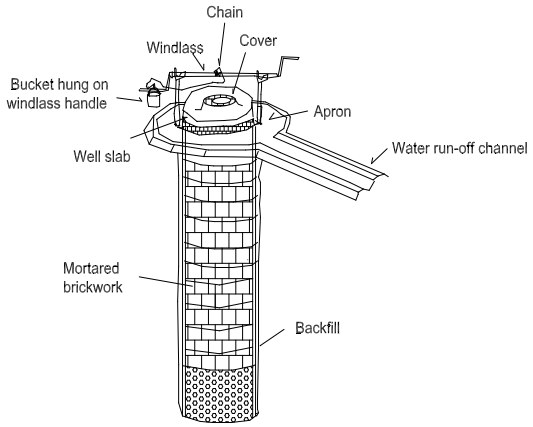
（ 658 ）All farmers plant and maintain trees.



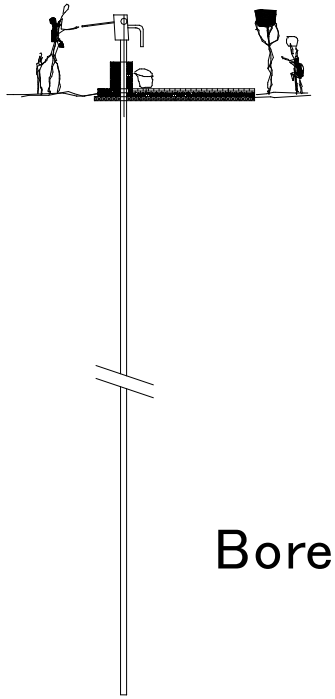
（ 659 ） Protect species



(660)The difference between a well and a borehole(1)

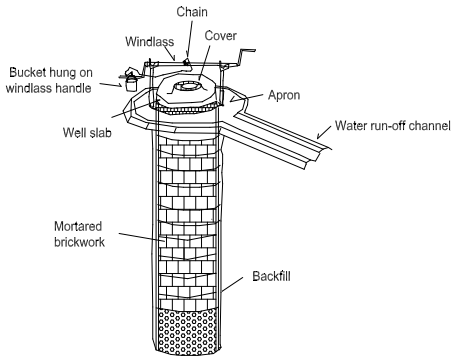


Well

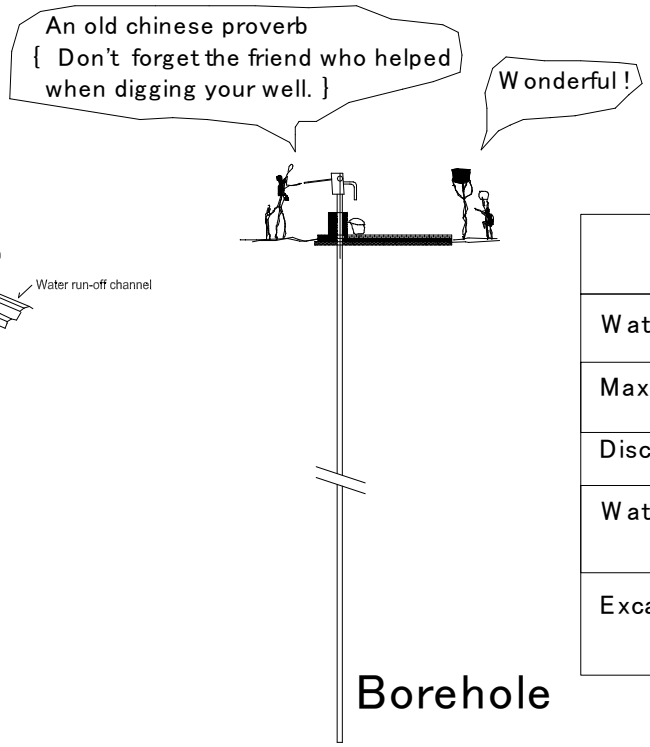


Borehole

(661)The difference between a well and a borehole(2)



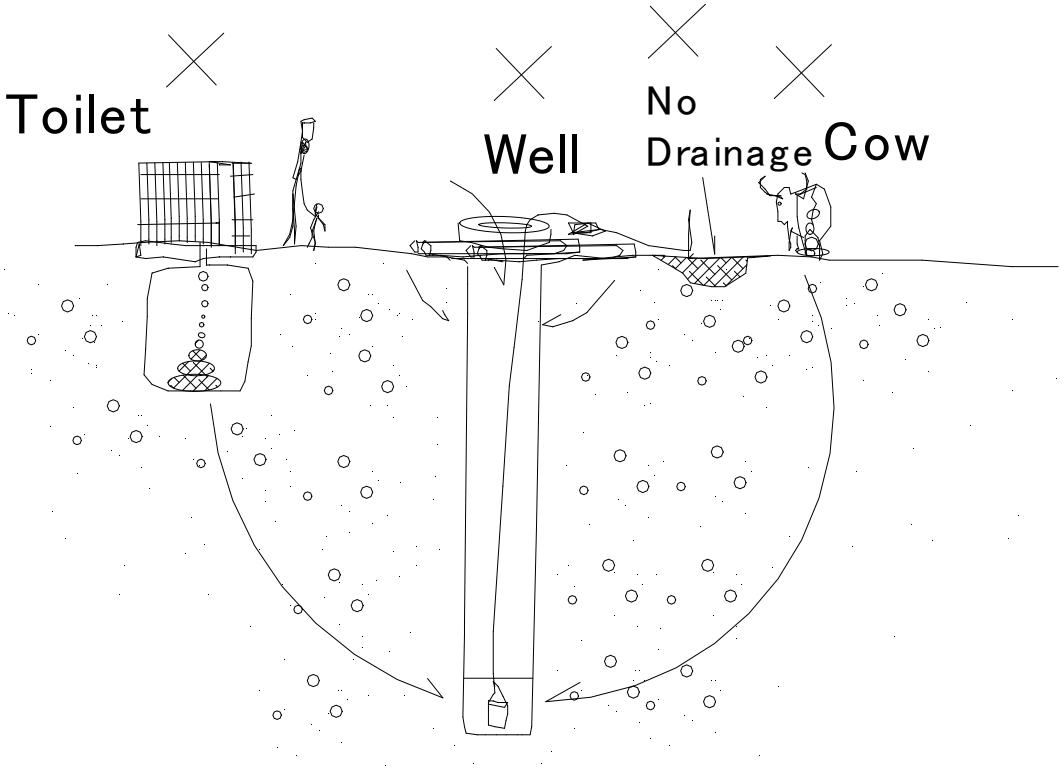
Well

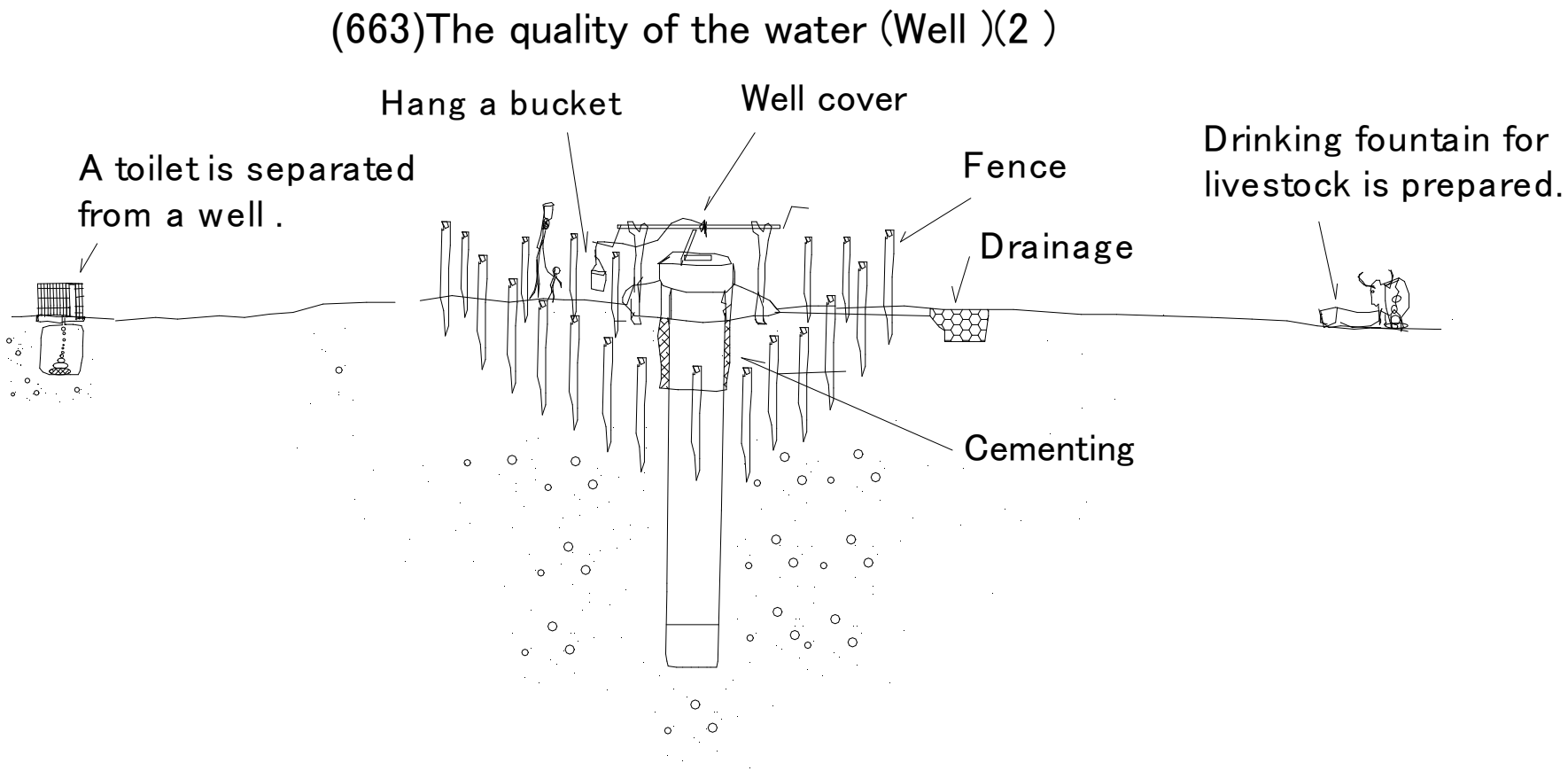


Borehole

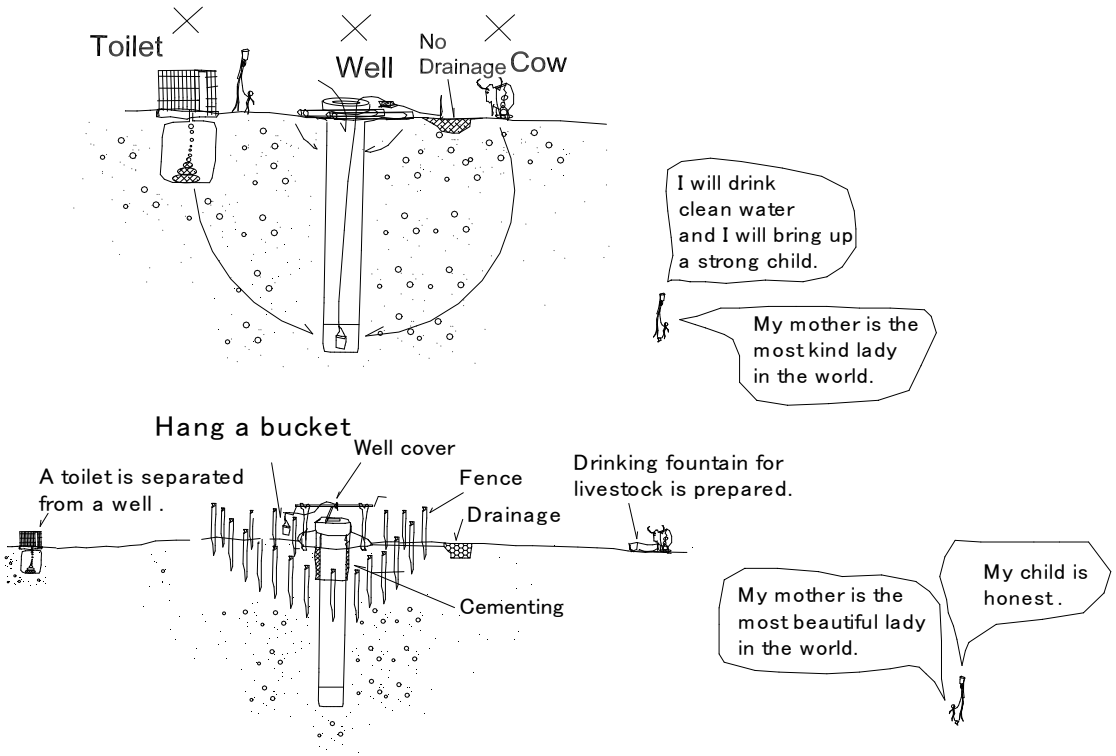
	Well	Bore
Water Table	Within 25m	Over 25m
Maximum depth		60~100m(Man~Machine)
Discharge	500~5000L/h	600~2000L/h
Water quality	A bit clean Easily polluted	Clean
Excavation	By well sinker	By using drills

(662)The quality of the water (Well)

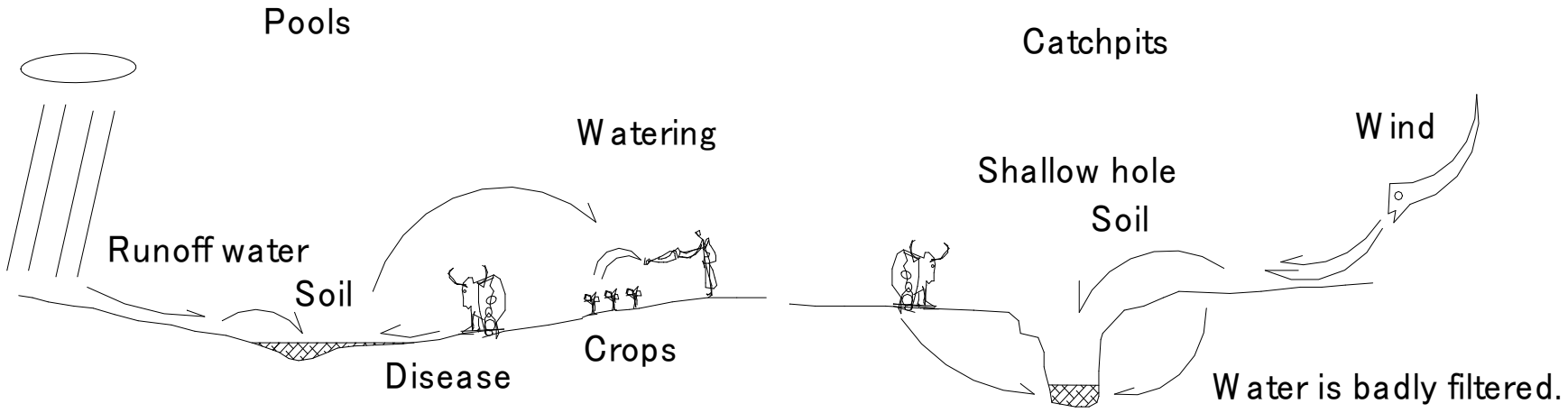



(663)The quality of the water (Well)(2)
Hang a bucket
Well cover
A toilet is separated from a well .
Fence
Drinking fountain for livestock is prepared.
Drainage
Cementing

(664)The quality of the water (Well)(3)

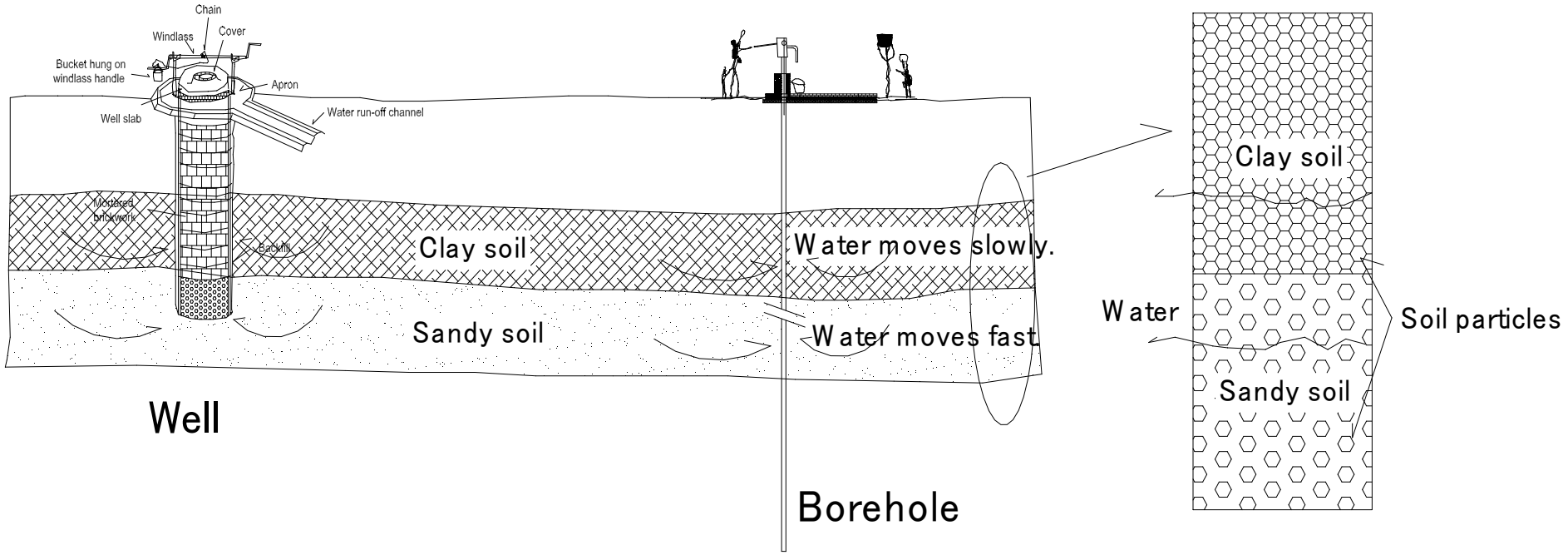


(665)Differences in the quality of water(1)



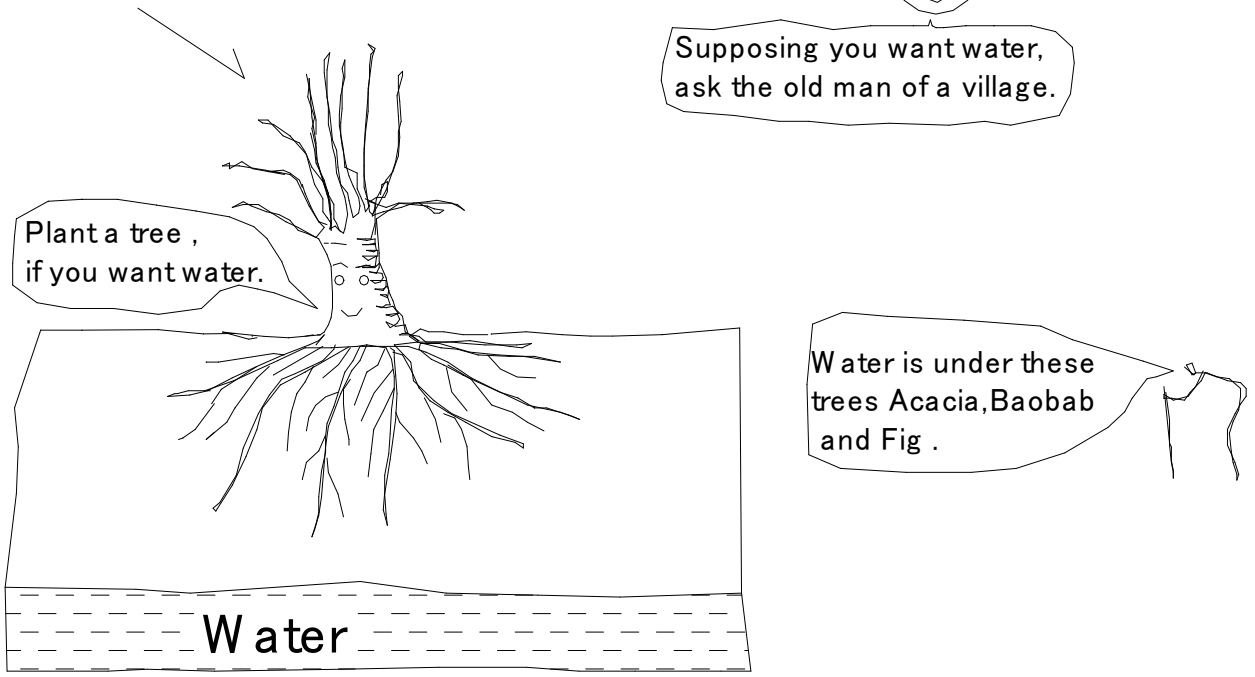
Water from pools and catch pits is not fit for drinking
but it can be used for watering crops.

(666)Differences in the quality of water(2)

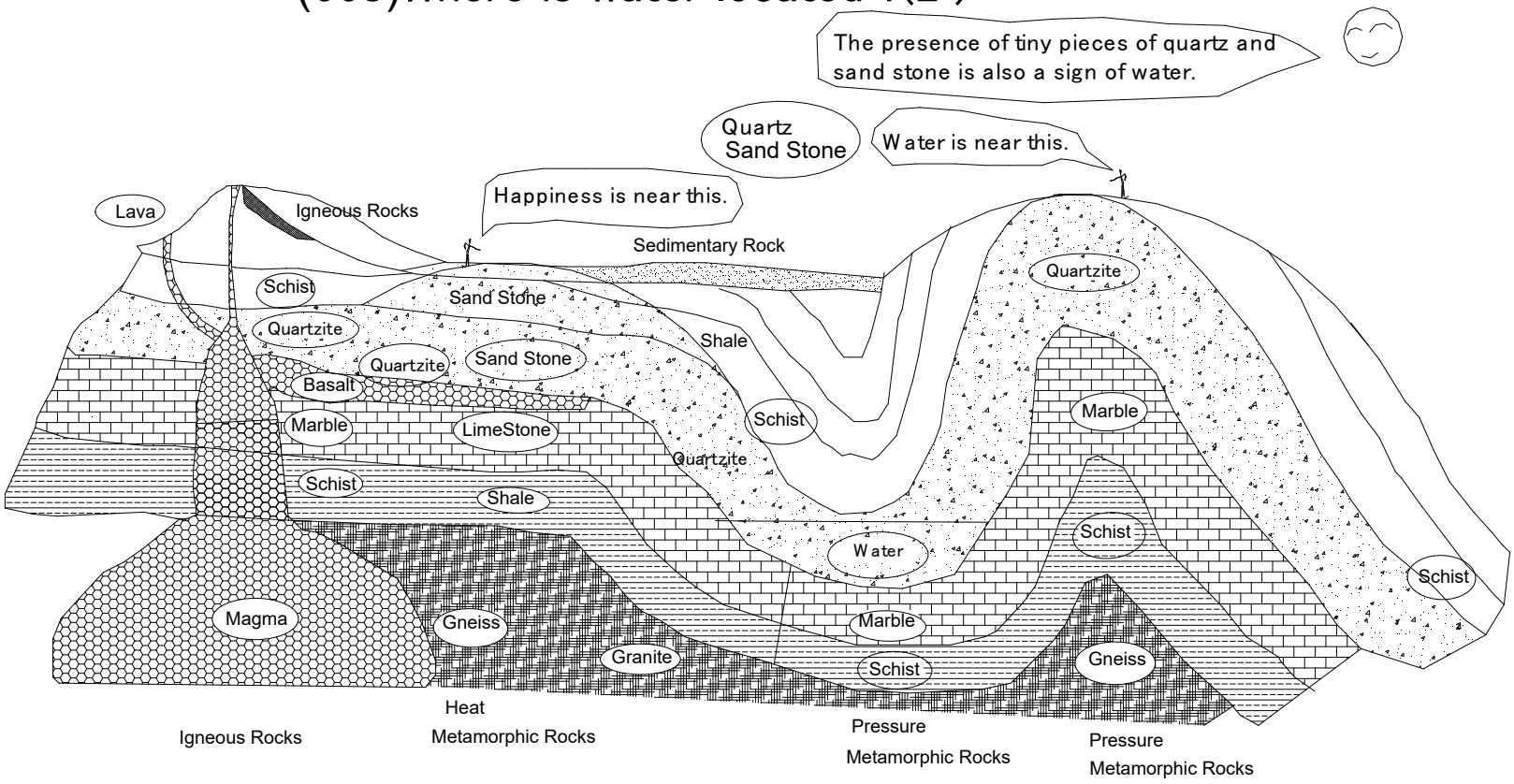


(667)Where is water located ?(1)

Acacia ,Baobab and Fig tree.

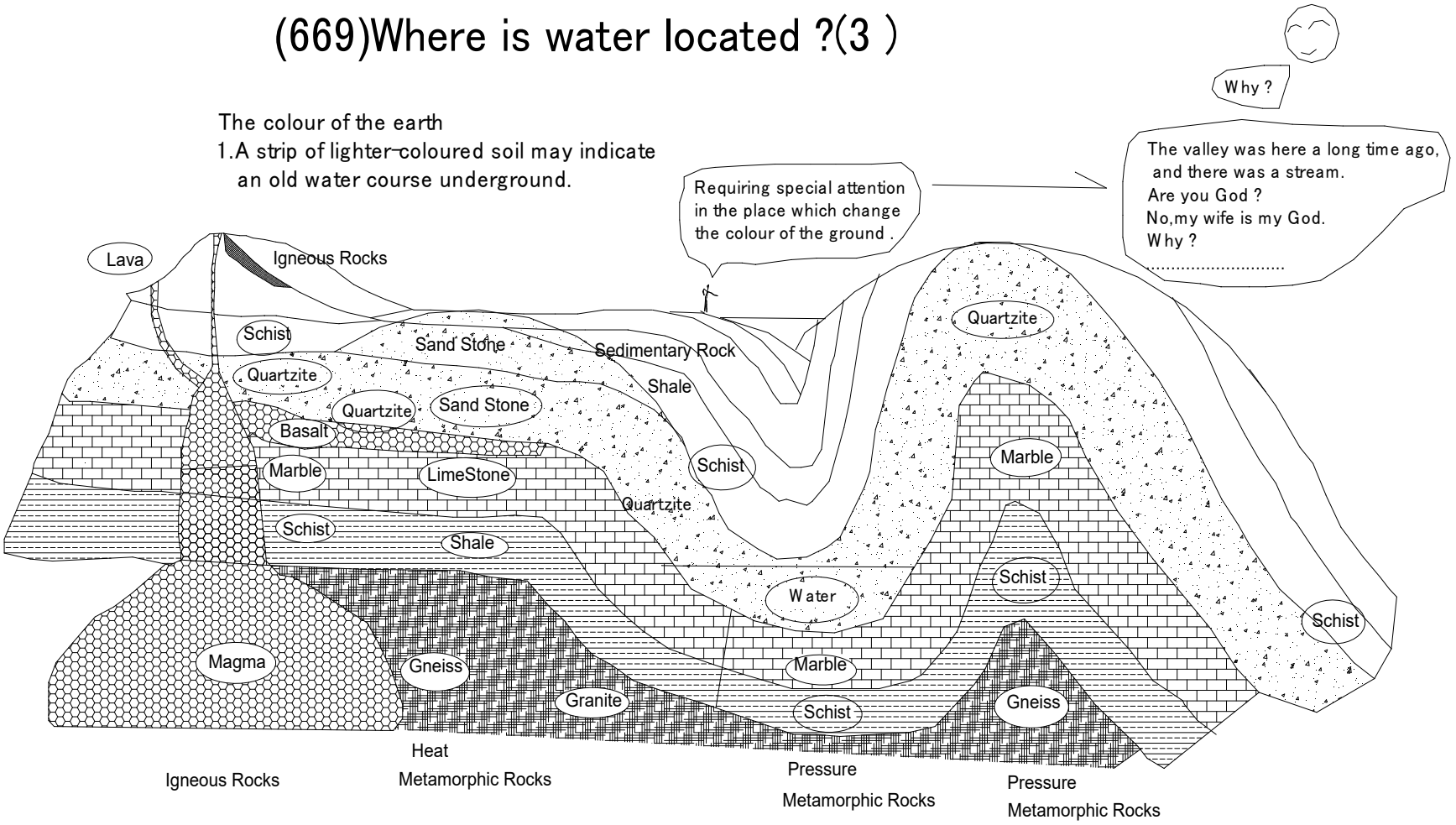


(668)Where is water located ?(2)

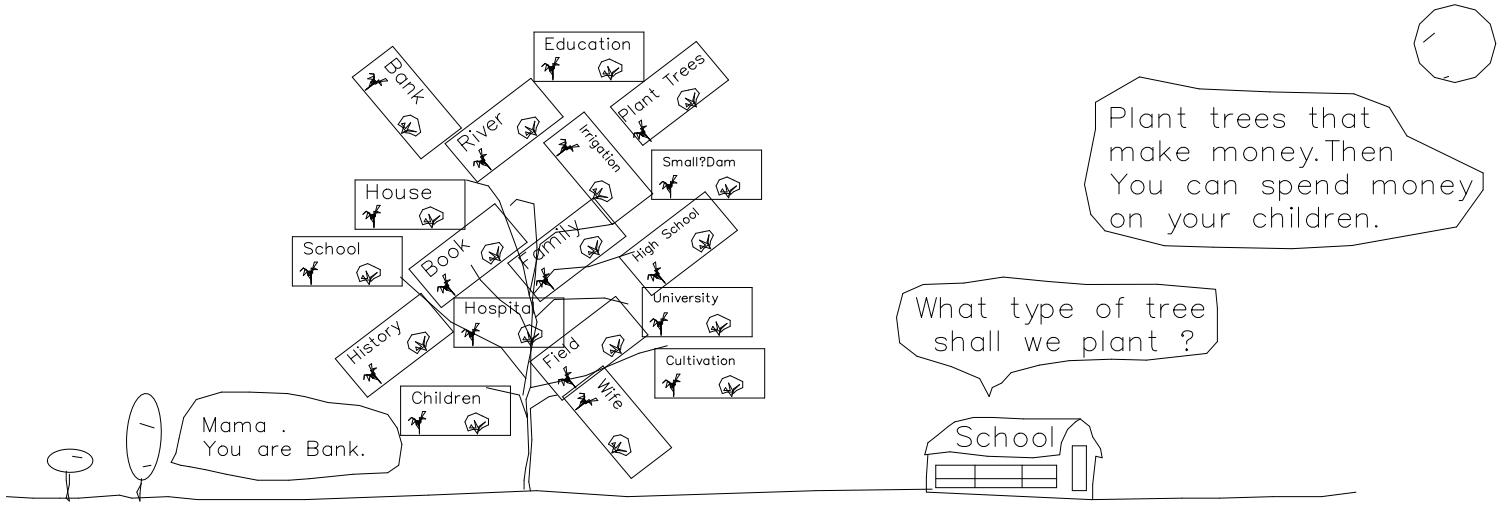


(669)Where is water located ?(3)

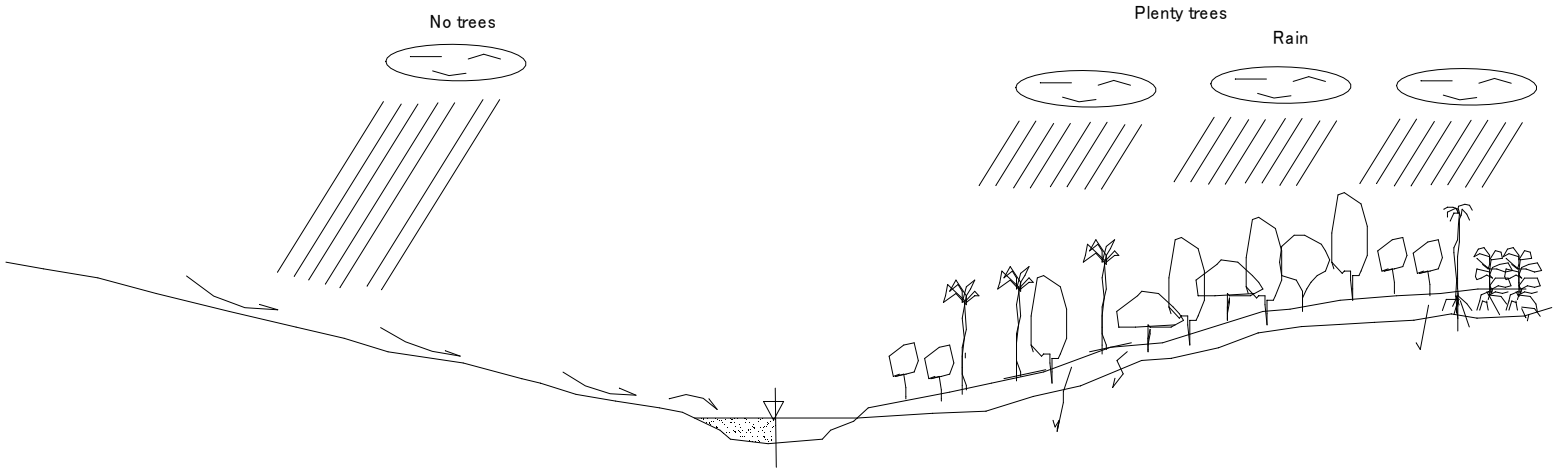
The colour of the earth
1.A strip of lighter-coloured soil may indicate an old water course underground.



(670)Teach children the function of trees

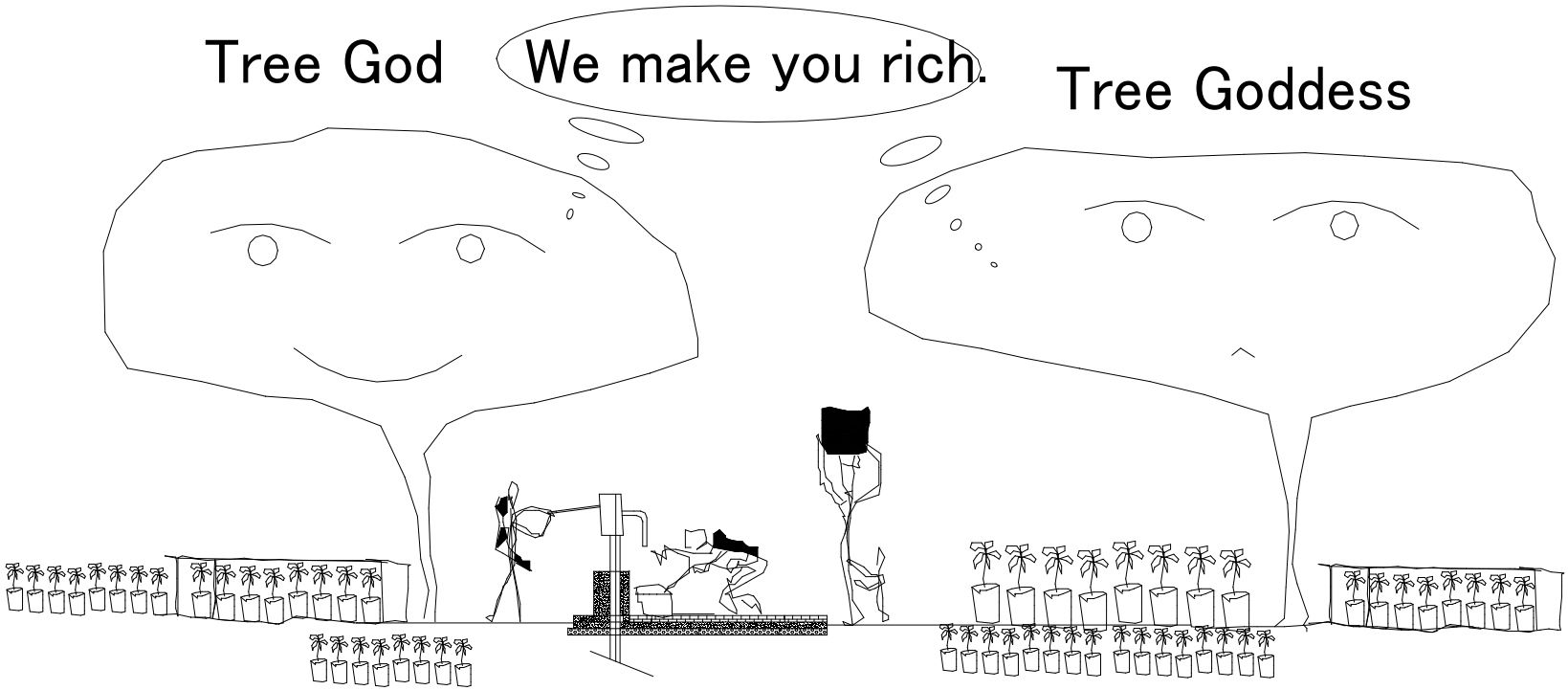


（ 671 ）Teach children the essential role of safeguarding rural life.

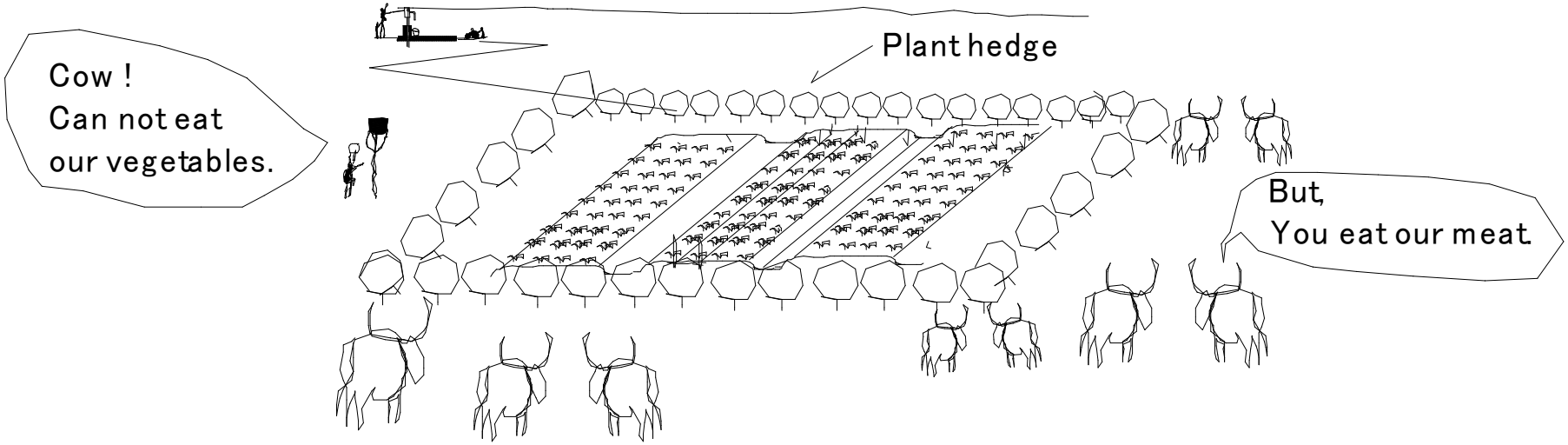


	No Trees	Plenty Trees
Rain	Less	Plenty
Erosion	Plenty	Less
Soil	Poor	Rich
Underground water	Less	Plenty
Drought	Much	Nothing
Crop	Less	Plenty
Jealousy	Plenty	None
Disaster	Many	None
Economy	Poor	Rich

(672)Reserve land for afforestation

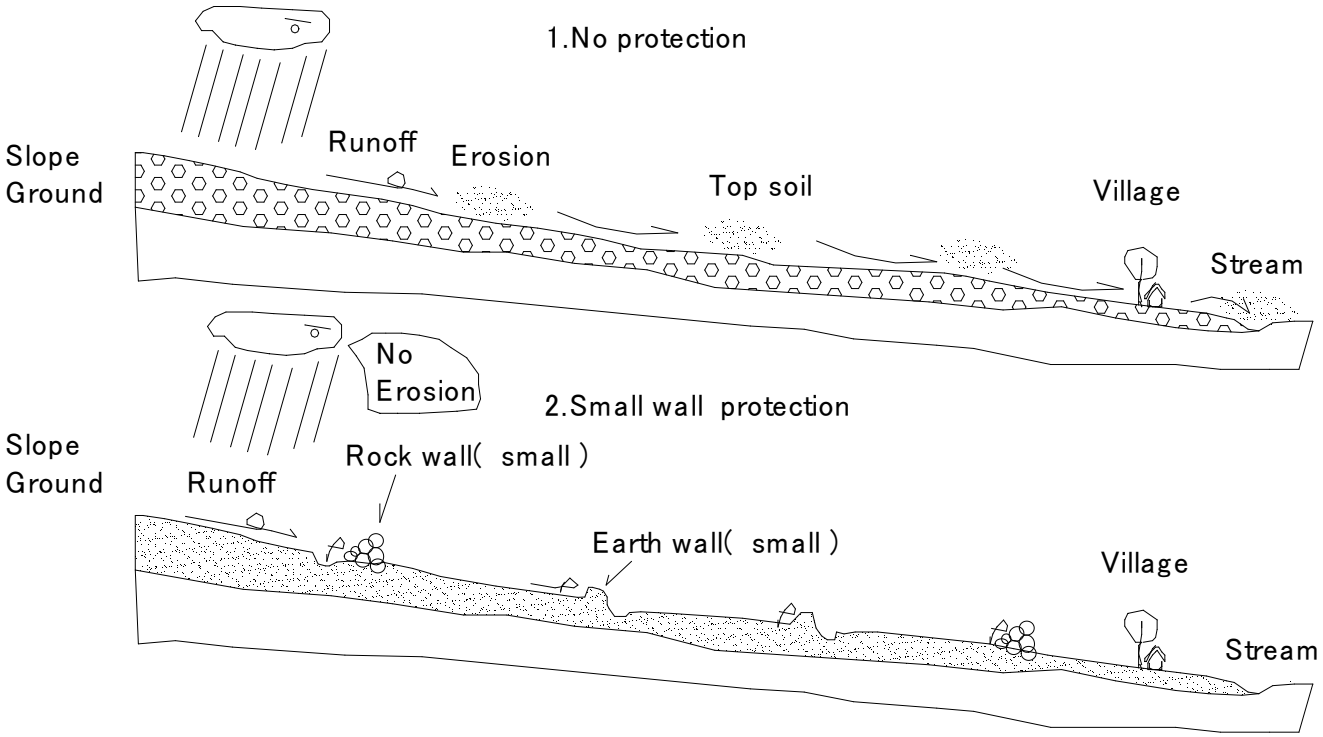


(673) Make people plant hedge

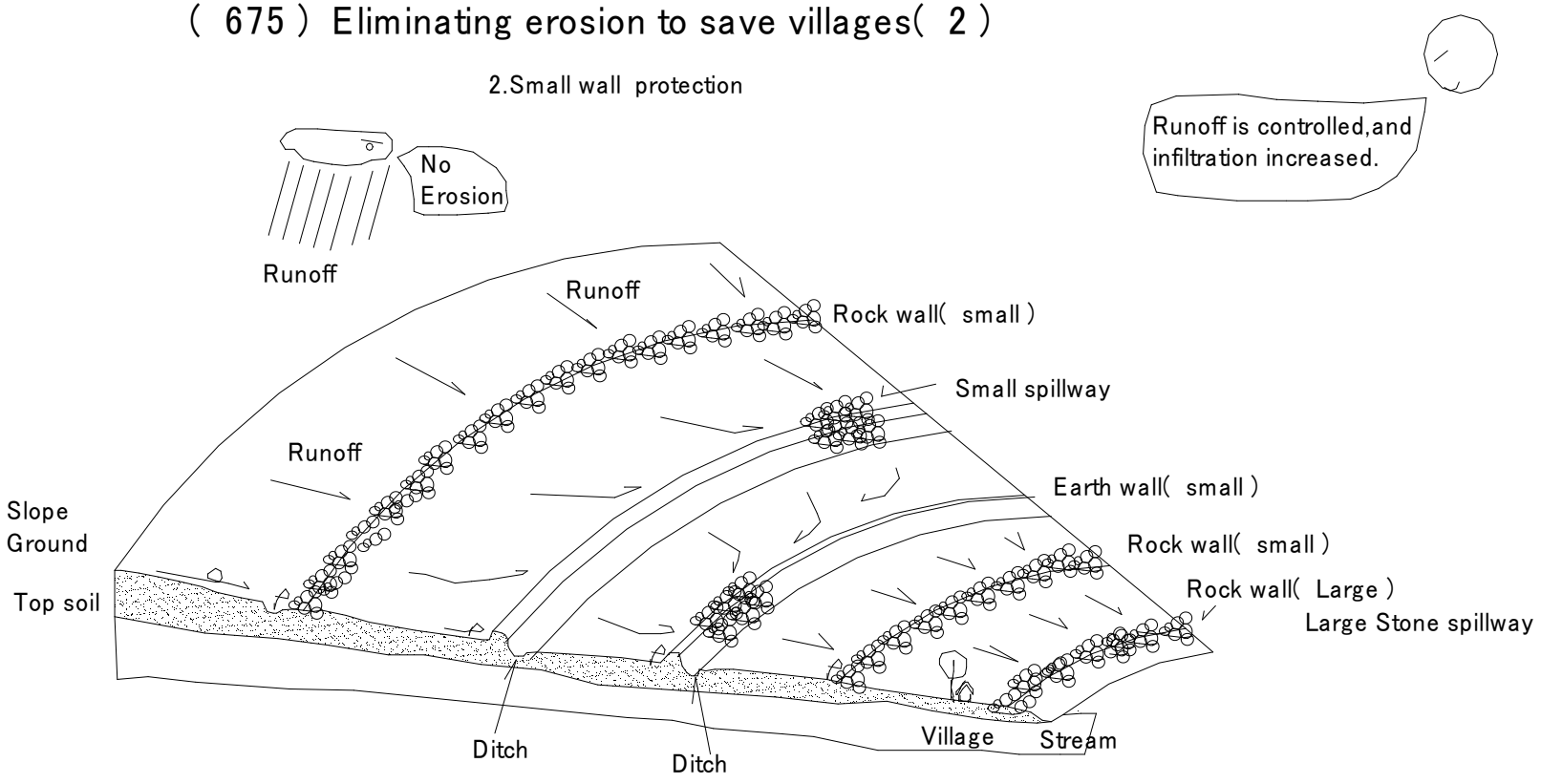


(674) Eliminating erosion to save villages(1)

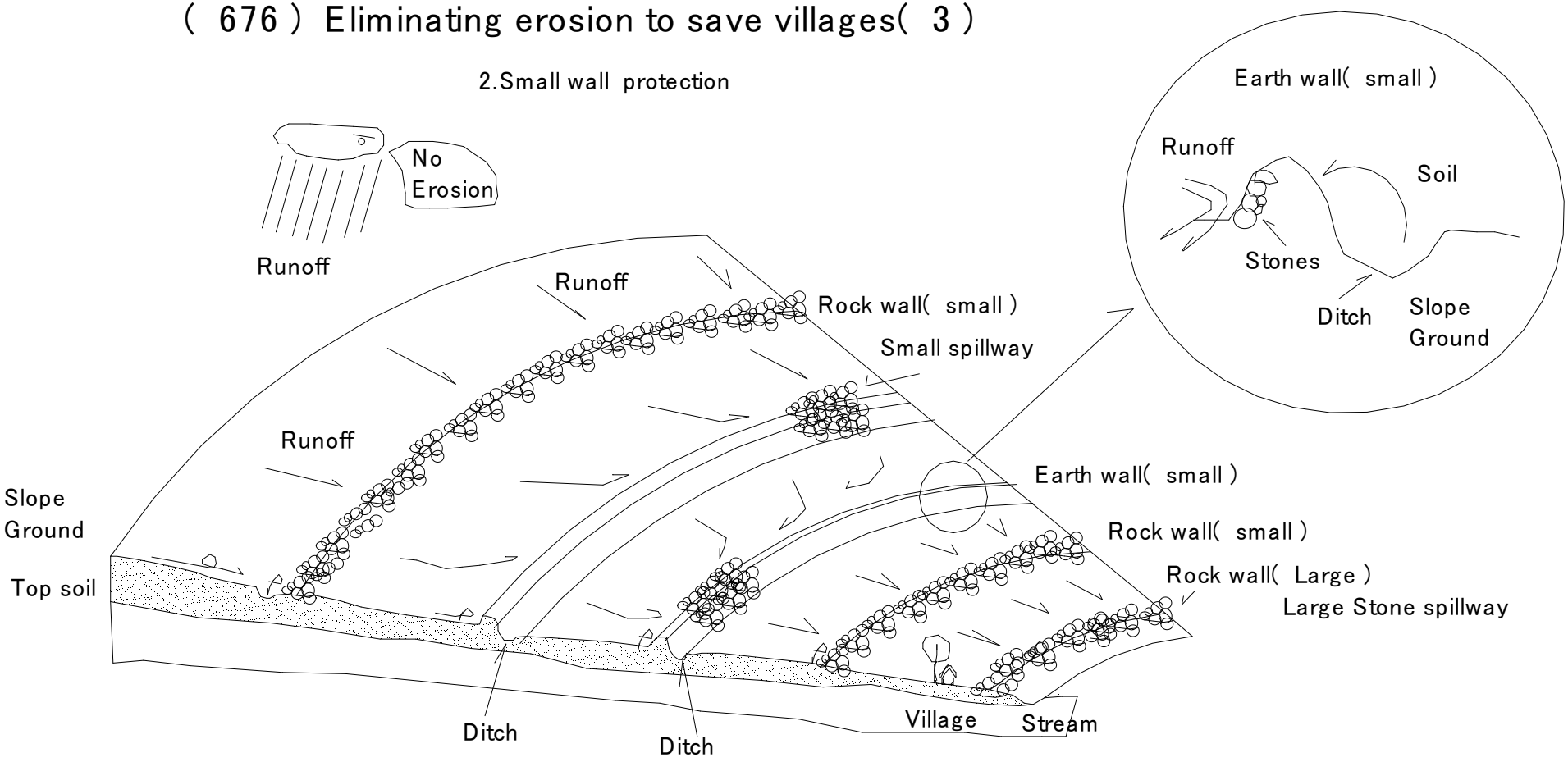
Small wall protection



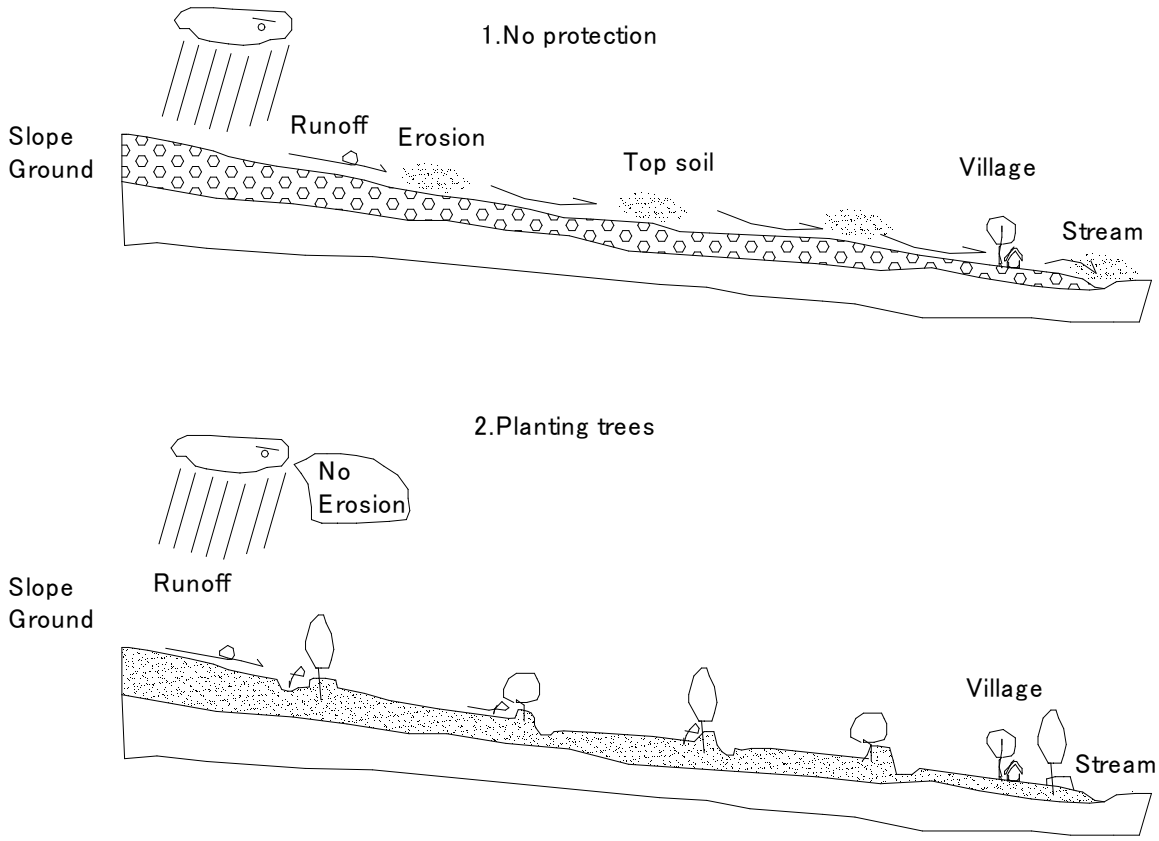
(675) Eliminating erosion to save villages(2)



(676) Eliminating erosion to save villages(3)

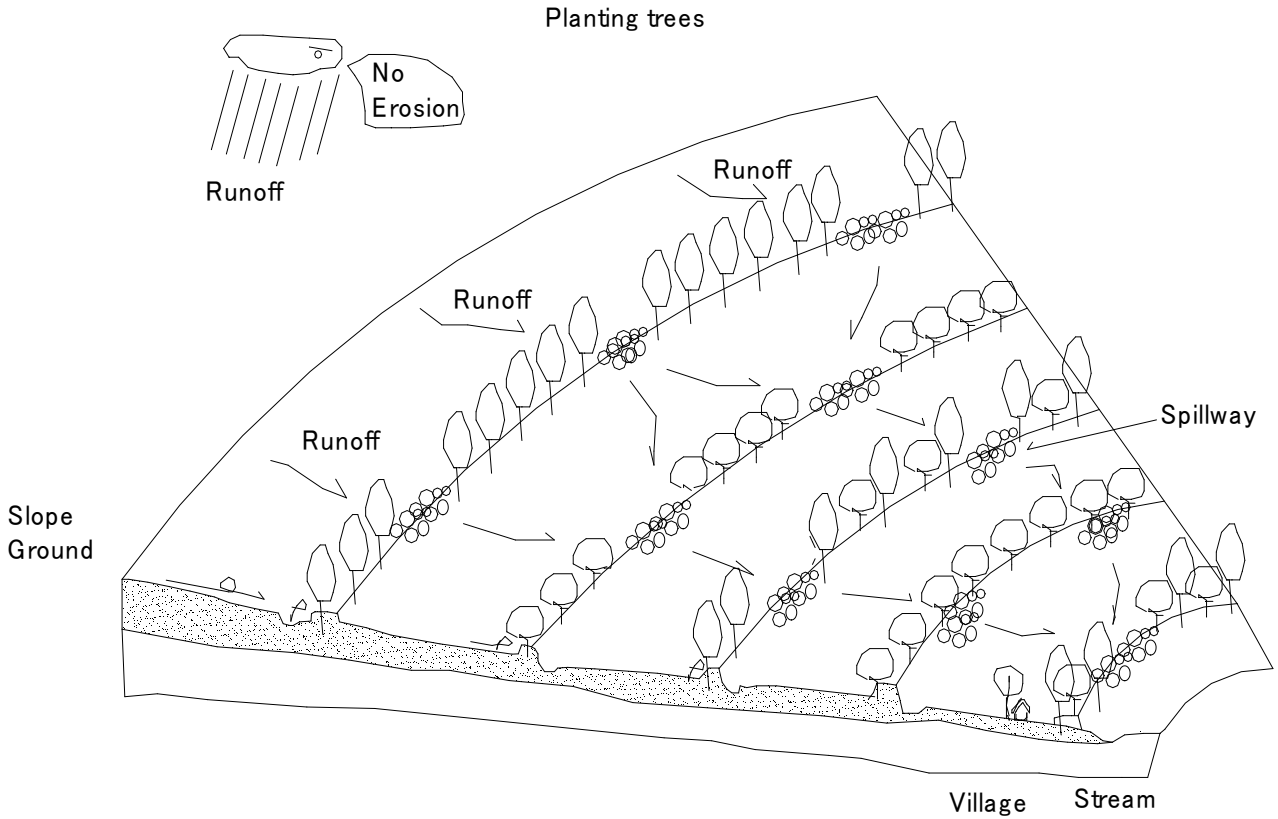


(677) Eliminating erosion to save villages(4)

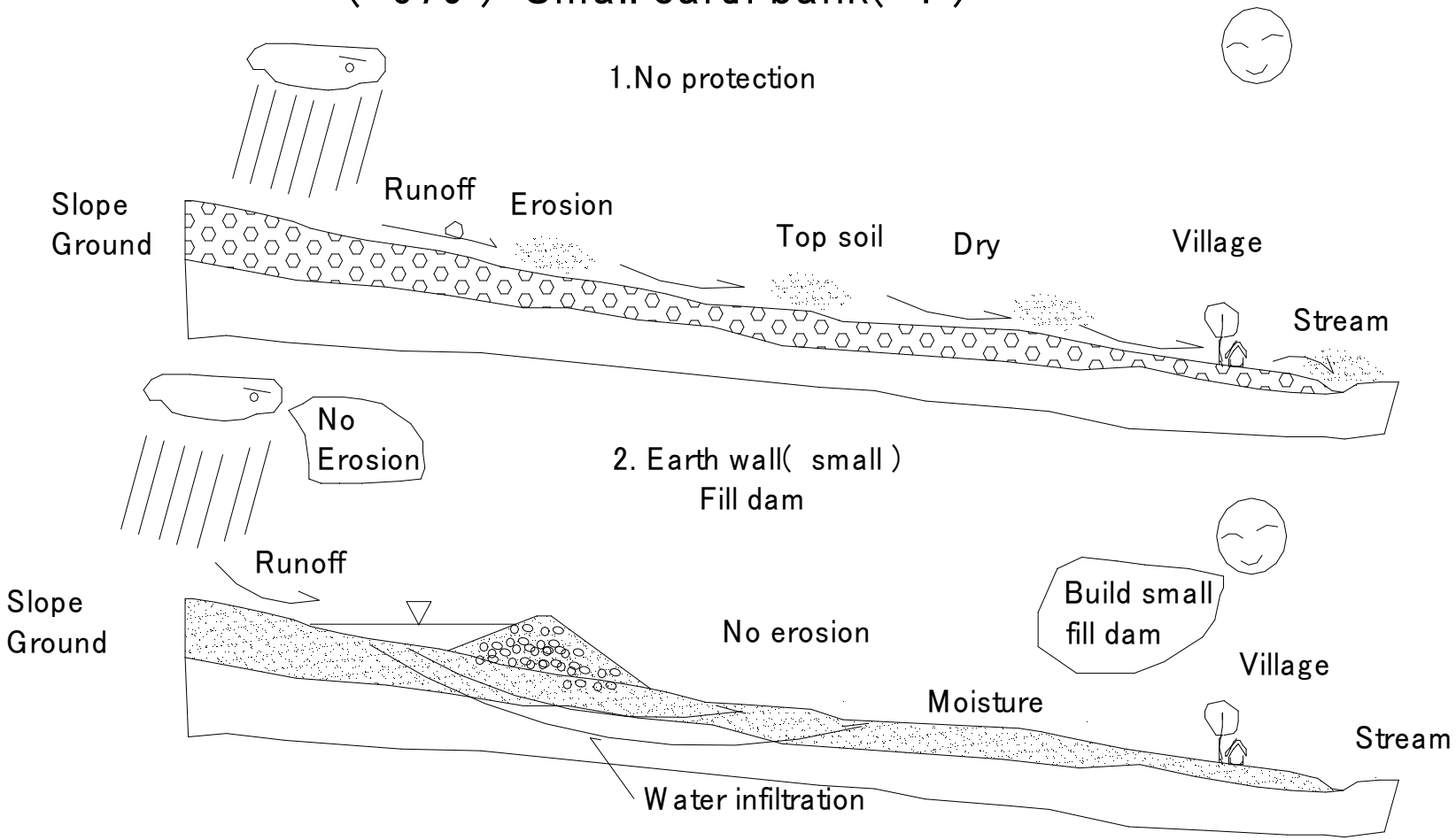


678 Eliminating erosion to save villages(5)

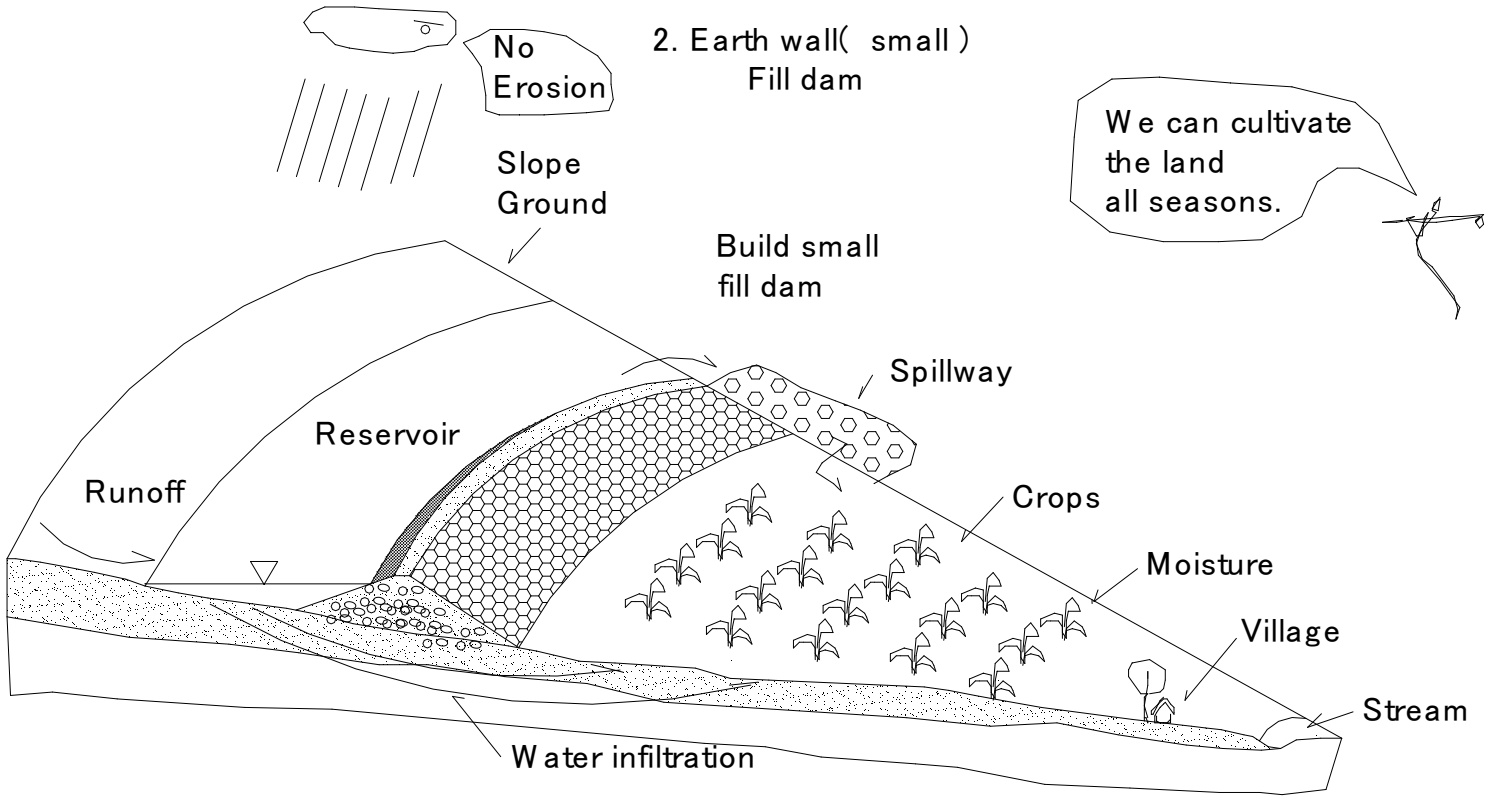
(678) Eliminating erosion to save villages(5)



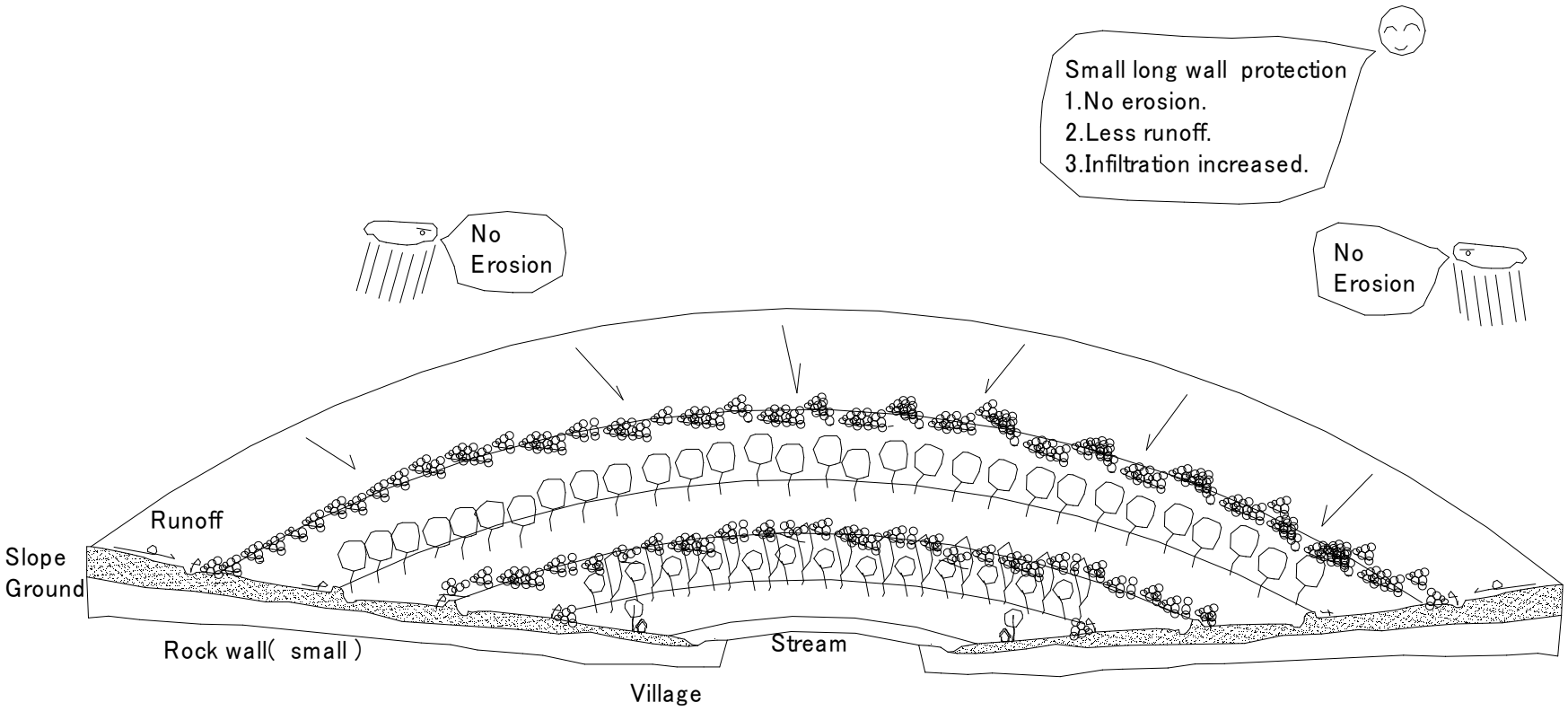
(679) Small earth bank(1)



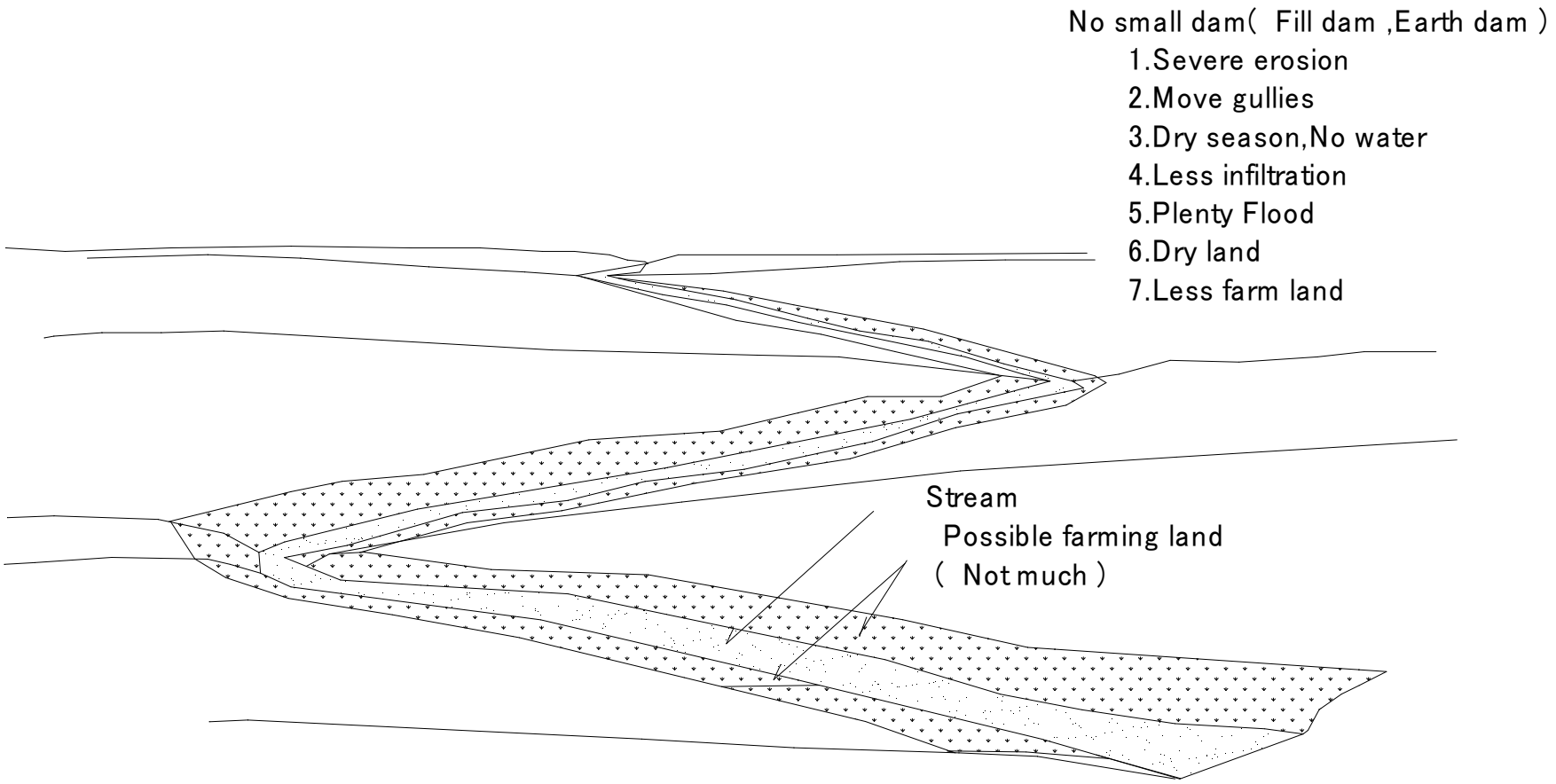
（ 680 ） Small earth bank（ 2 ）



(681) Long earth dam(1)

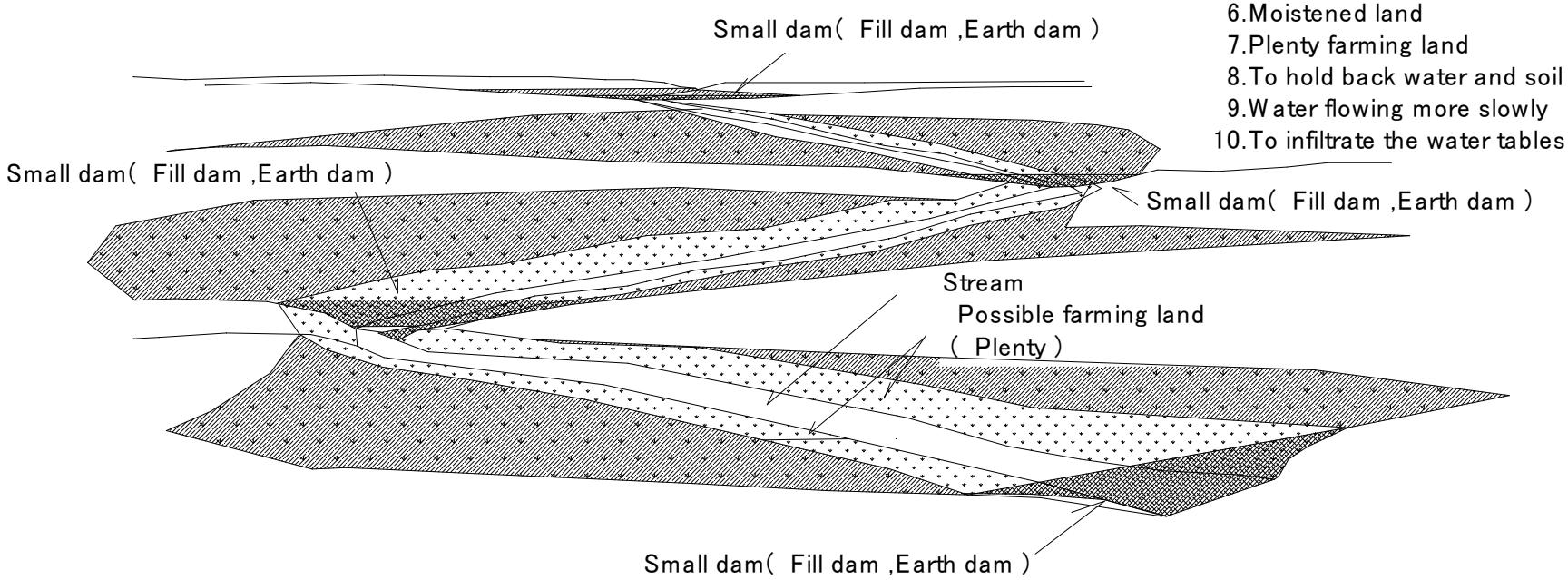


(682) Eliminating gullies and small streams(1)



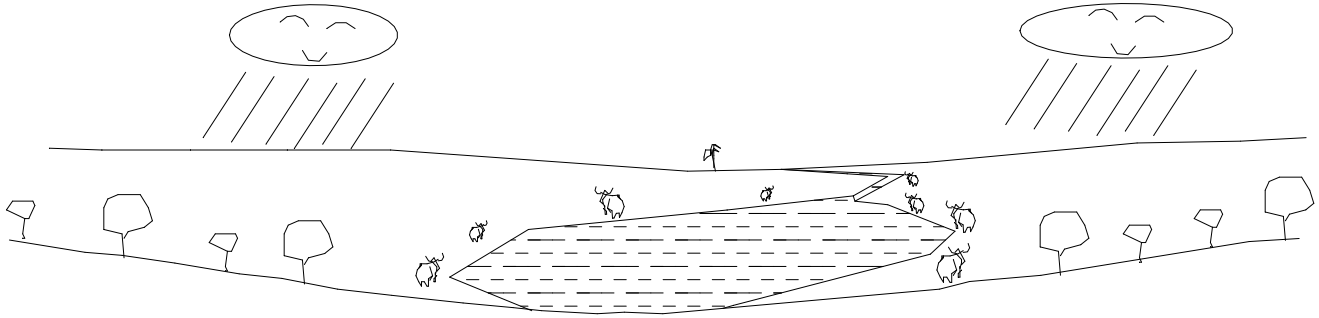
(683) Eliminating gullies and small streams(2)

Small dam(Fill dam ,Earth dam)
1.Less erosion
2.Small gullies
3.Dry season,Plenty water
4.Plenty infiltration
5.No Flood
6.Moistened land
7.Plenty farming land
8.To hold back water and soil
9.Water flowing more slowly
10.To infiltrate the water tables

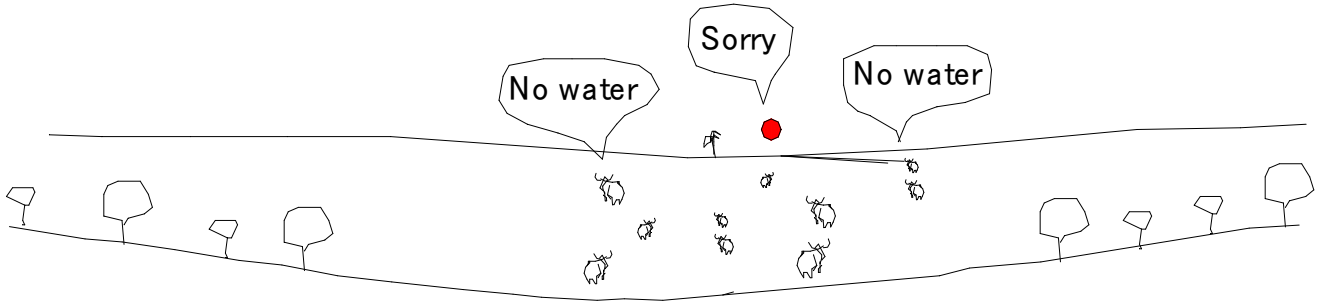


(684) Small dam (Fill Dam) On Swamp(Dambo) (1)

Rainy season

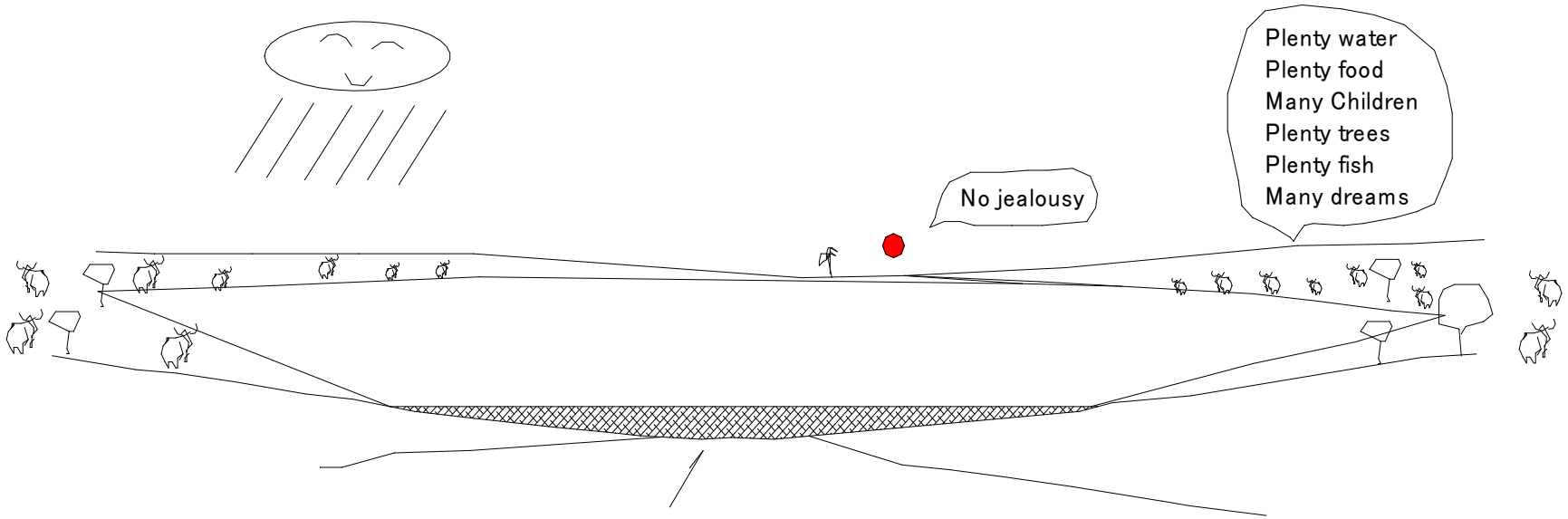


Dry season

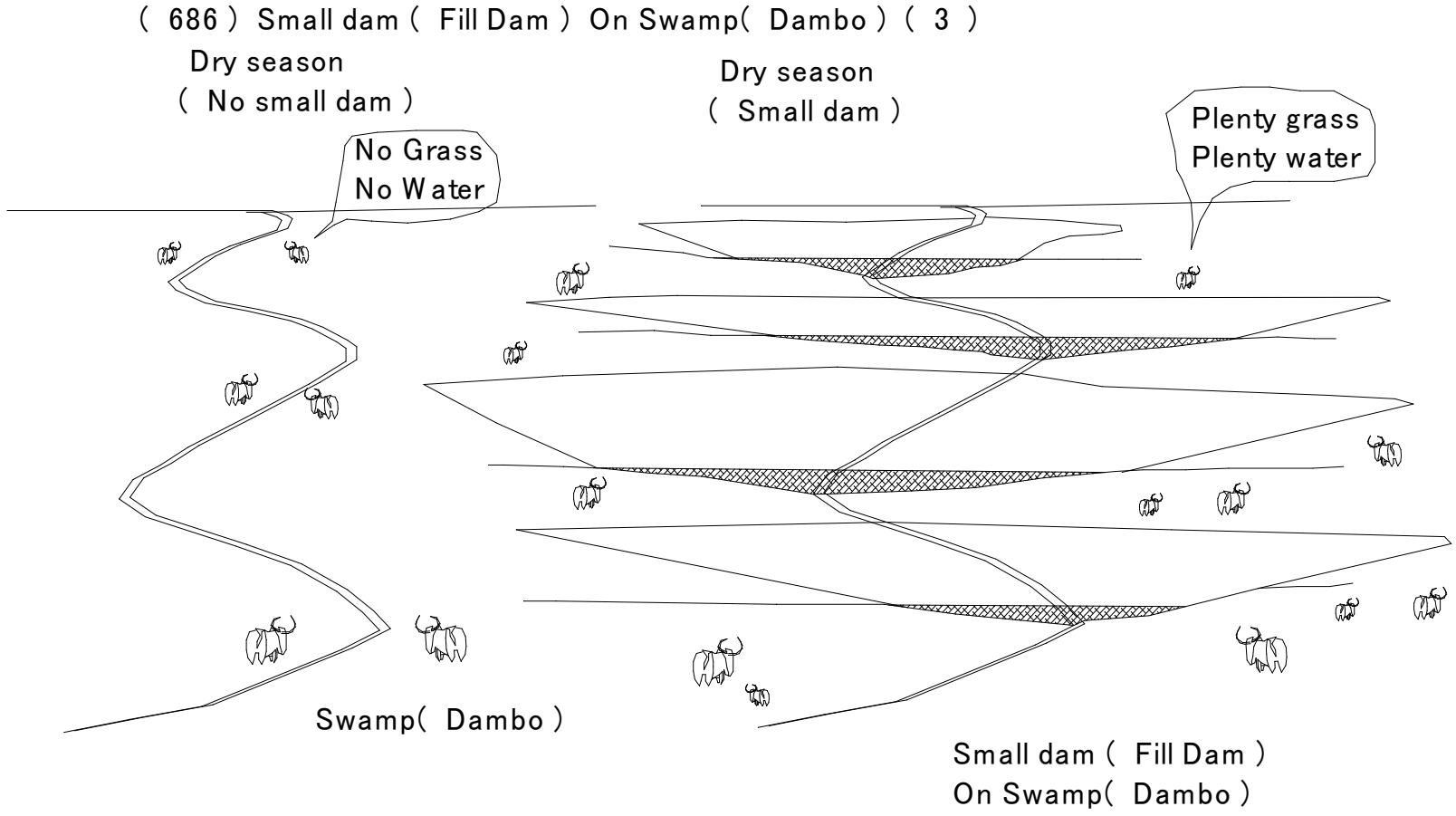


（ 685 ） Small dam （ Fill Dam ） On Swamp（ Dambo ）（ 2 ）

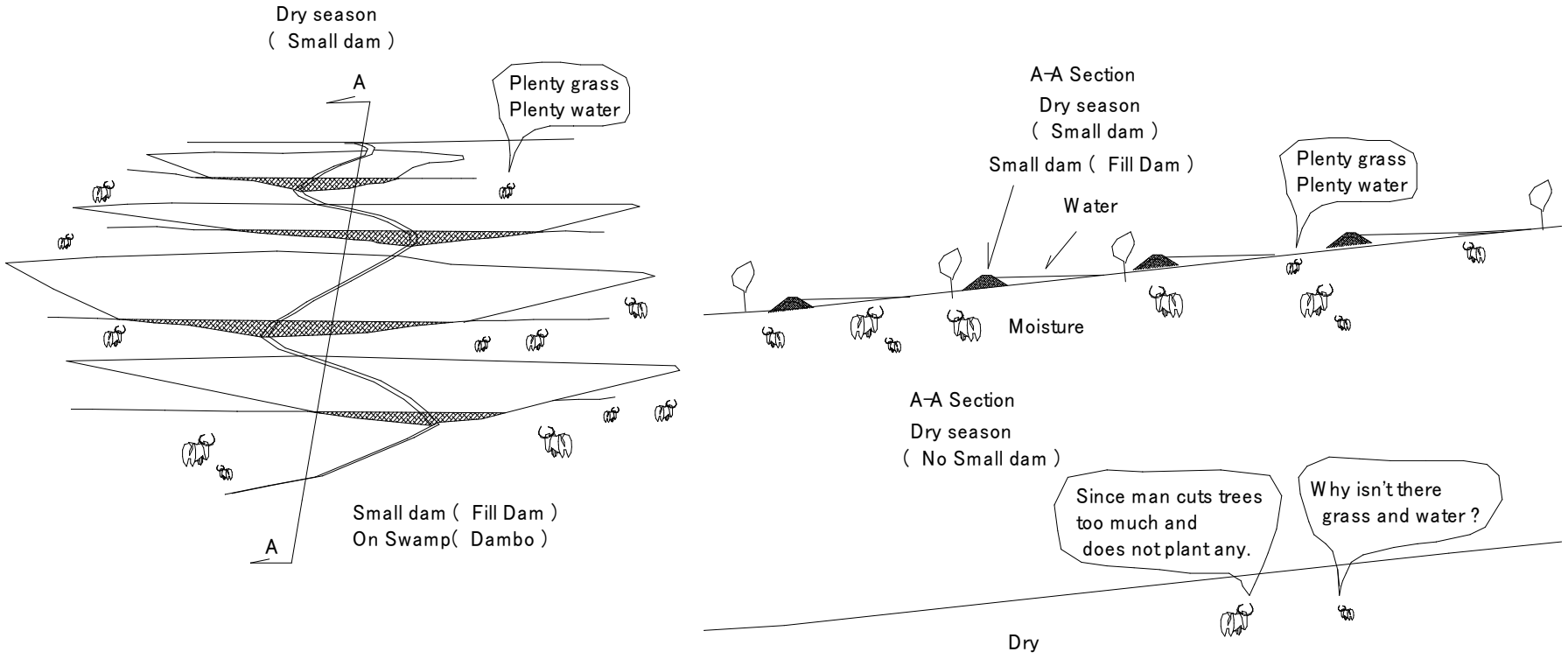
Dry and Rainy season



Small dam （ Fill Dam ）
On Swamp（ Dambo ）

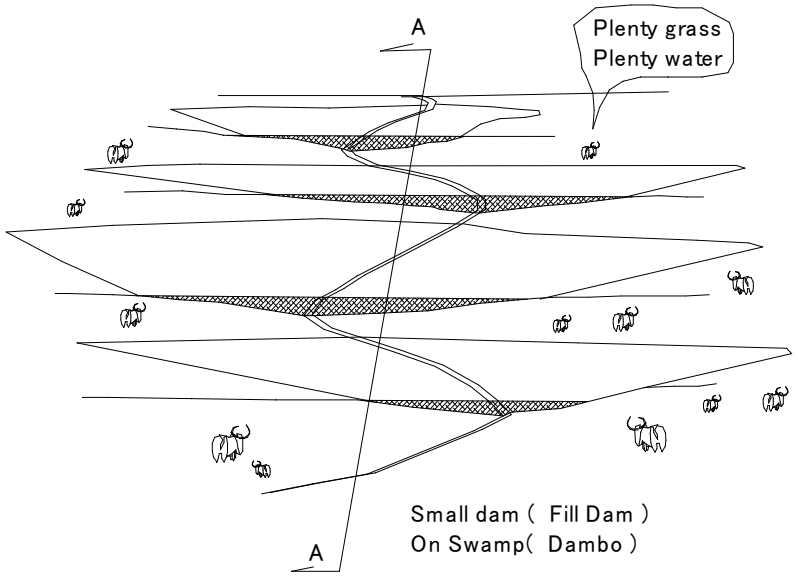

(686) Small dam (Fill Dam) On Swamp(Dambo) (3)
Dry season
(No small dam)
No Grass
No Water
Dry season
(Small dam)
Plenty grass
Plenty water
Swamp(Dambo)
Small dam (Fill Dam)
On Swamp(Dambo)

(687) Small dam (Fill Dam) On Swamp(Dambo) (4)



(688) Small dam (Fill Dam) On Swamp(Dambo) (5)

Dry season
(Small dam)

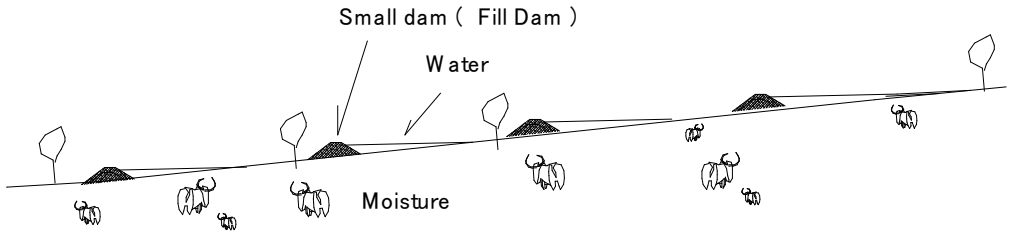


Small dam (Fill Dam)
On Swamp(Dambo)

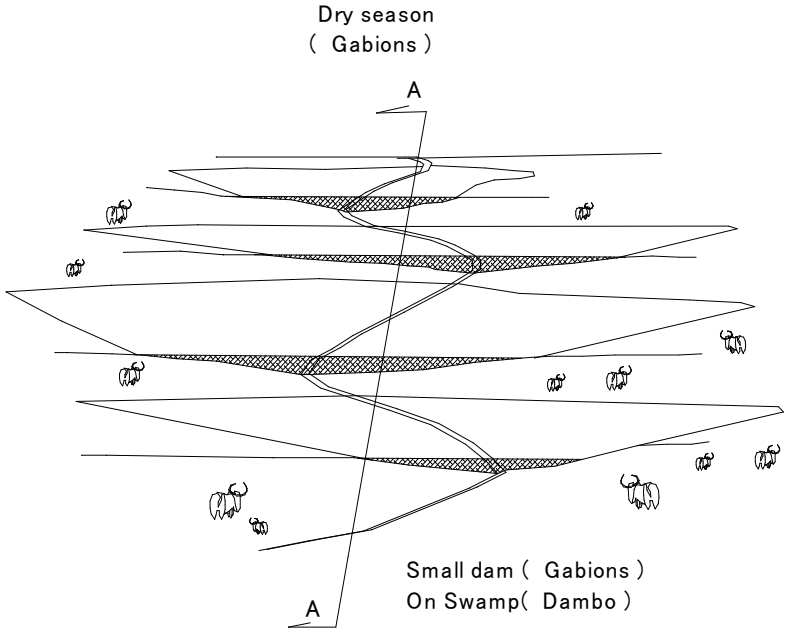
A-A Section
Dry season
(Small dam)

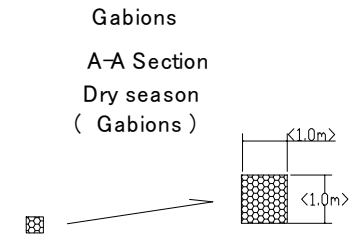
1.The amount of water the dam would have to hold back.
2.Water flowing much more slowly.
3.Plenty infiltration.
4.Moist land.
5.A little of runoff.

A-A Section



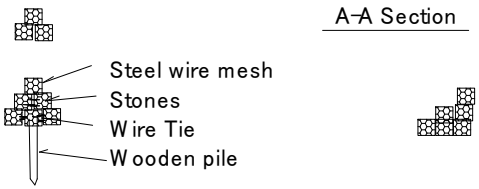
(689) The construction and use of gabions

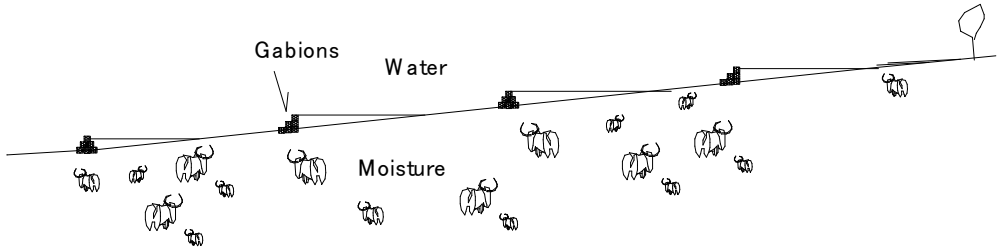




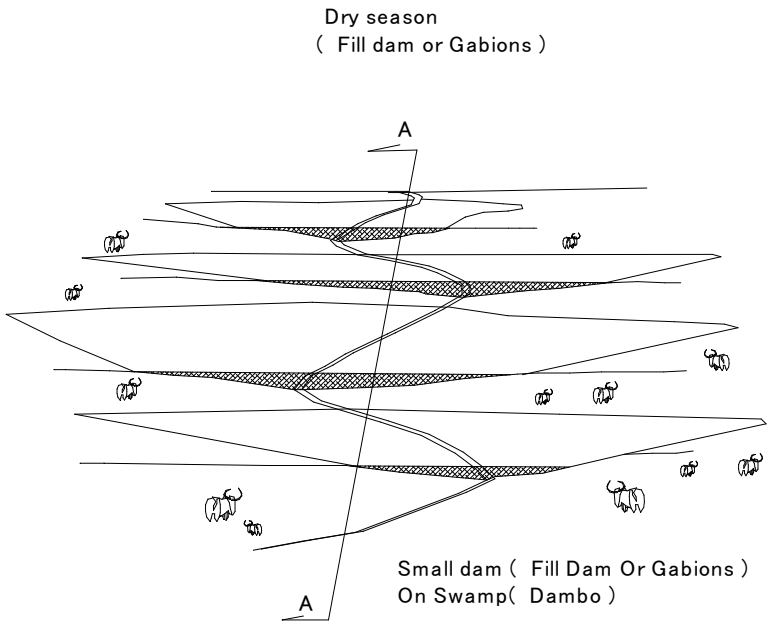
Gabions

1.Not easily shifted by water.
2.Gabions are wire mesh filled with stones.
3.The use of gabions is small-scale dams.
4.Making gabions is much cheaper than cement works.

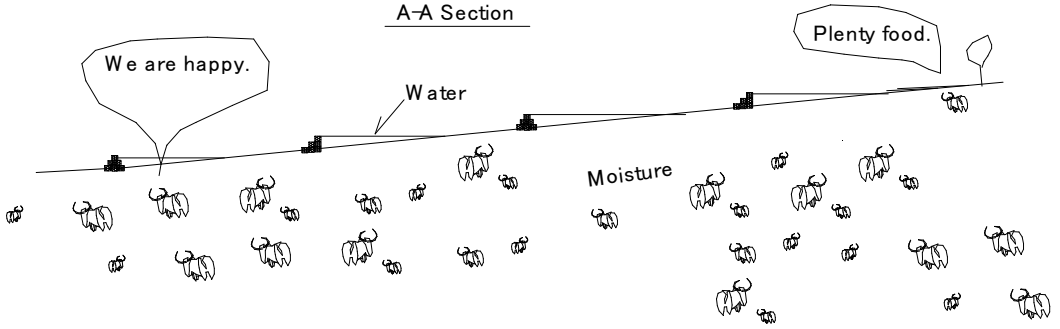




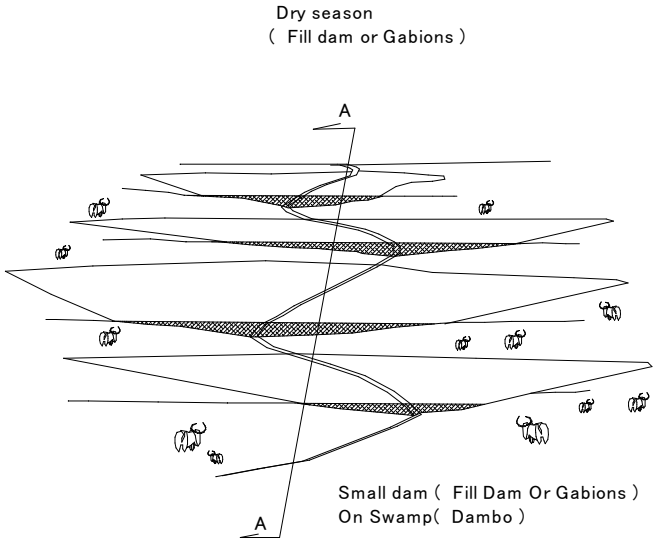
（ 690 ）The effects of small dams



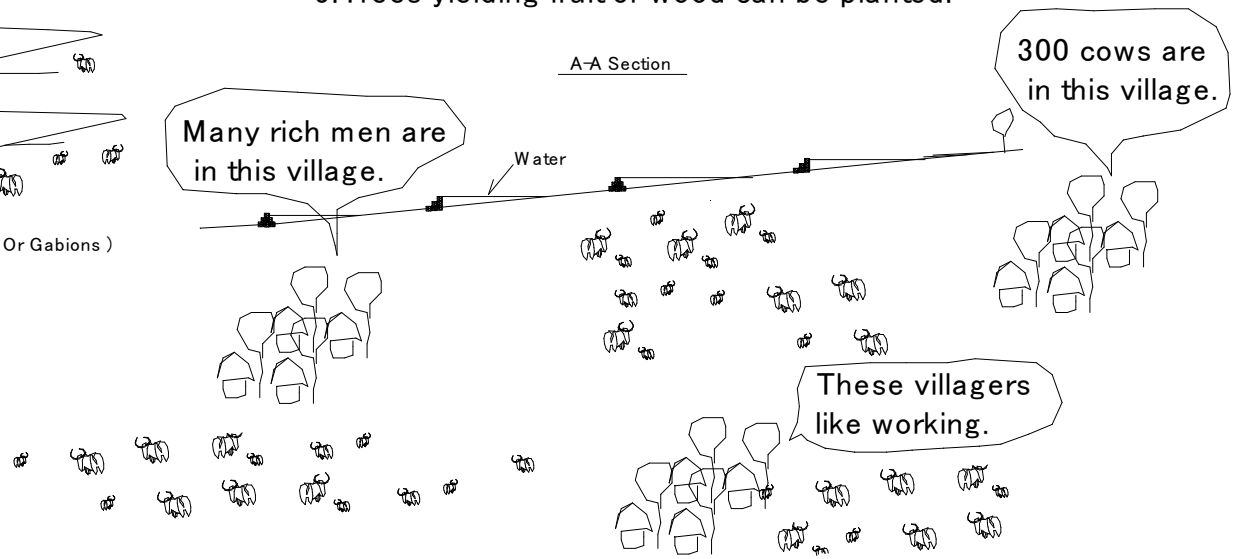
1.The layer of soil moistened by infiltrating water.
2.It is easy for trees to dig holes .
3.Soil is enriched.
4.The water table is high during the dry season.
5.Cattle manure will fertilize the soil.
6.Plenty vegetable gardens.
7.The village becomes rich.
8.There is much food for animals.



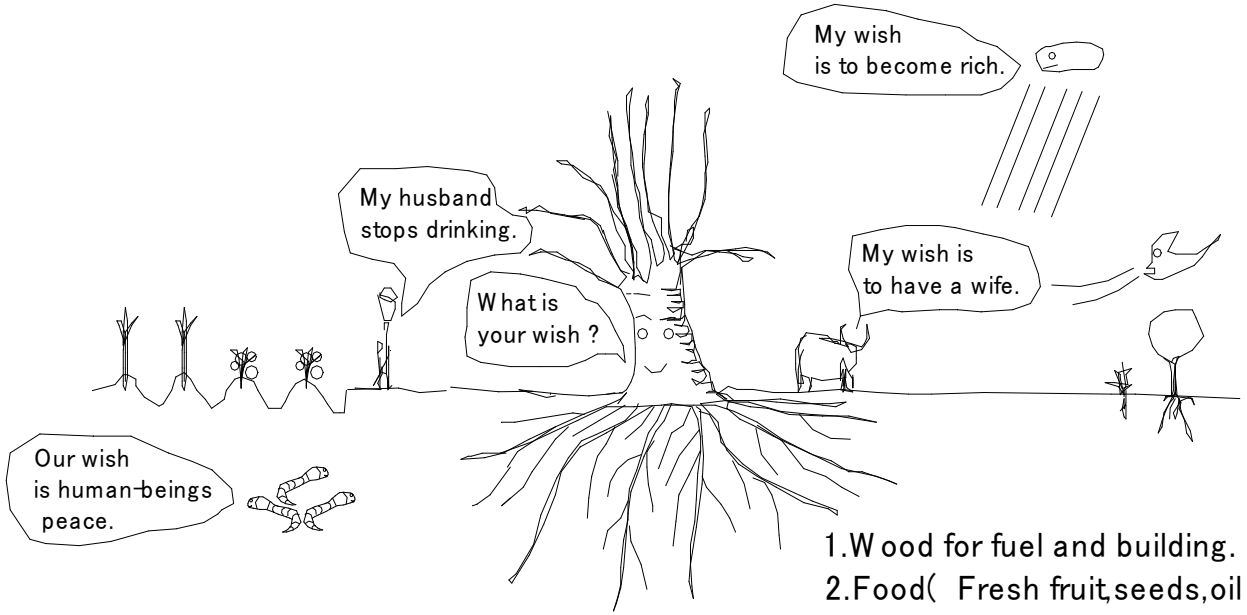
（ 691 ） The effects of small dams（ 2 ）



The economy of village
1.Millet yields increase.
2.Men and women have more work.
3.Villagers earn more money.
4.Raising livestock.
5.Trees yielding fruit or wood can be planted.

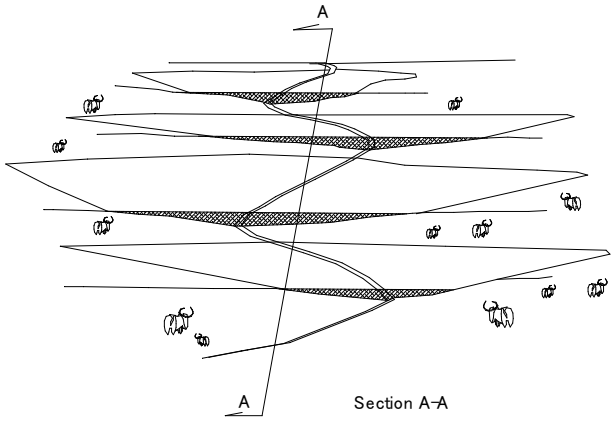


(692)How important it is to plant a variety of trees



1.Wood for fuel and building.
2.Food(Fresh fruit,seeds,oil seeds,etc)
3.Animal feed especially during the dry season.
4.Remedies.
5.Fibres.
6.Environmental improvements.
Shade,wind interception to protect water sources and villages.

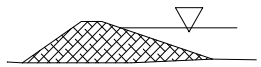
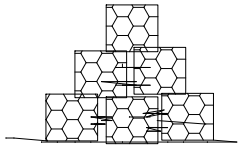
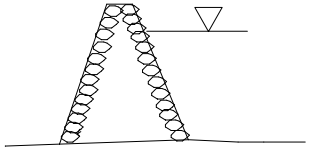
（ 693 ） The small dams



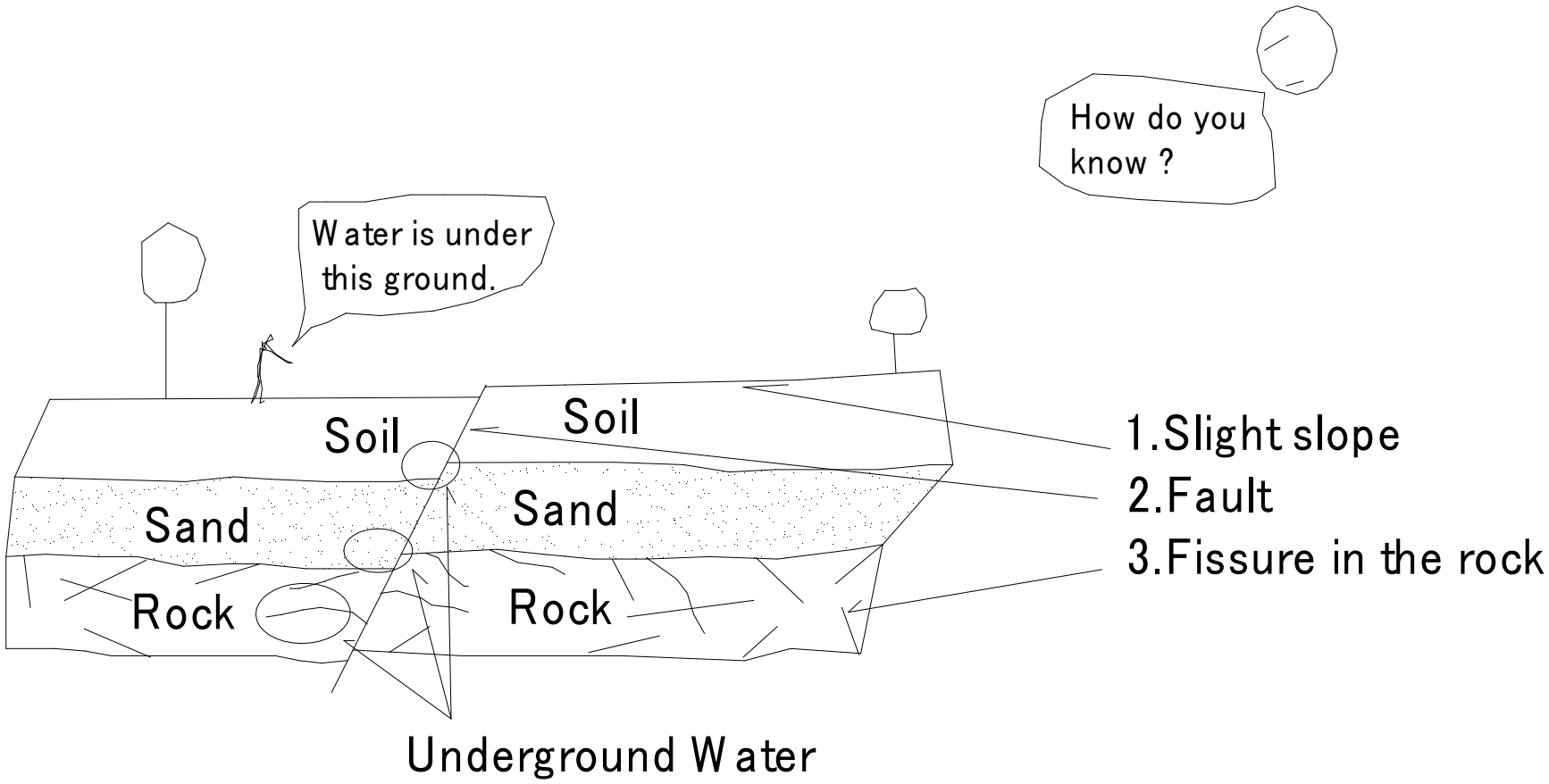
Section A-A

Small dam (Fill Dam Or Gabions)
On Swamp(Dambo)

Small dam

	Fill(Earth dam)	Gabion dam	Compound dam
Material	Soil +Rock	Rock+Mesh wire	Concrete+Cobble stone
Cost	Cheap	Cheap	A bit expensive
Construction	Easy	Easy	A bit difficult
Height	1~3m	1~3m	3~5m
Section			

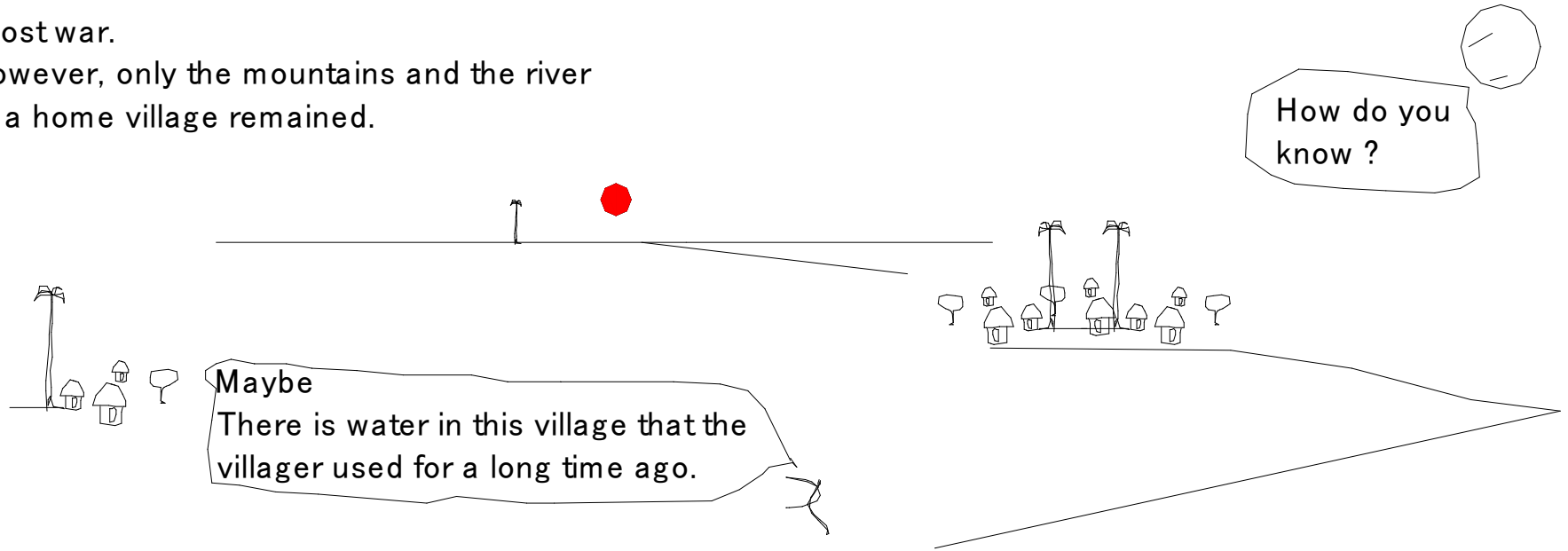
(694) Where is water located ? (4)

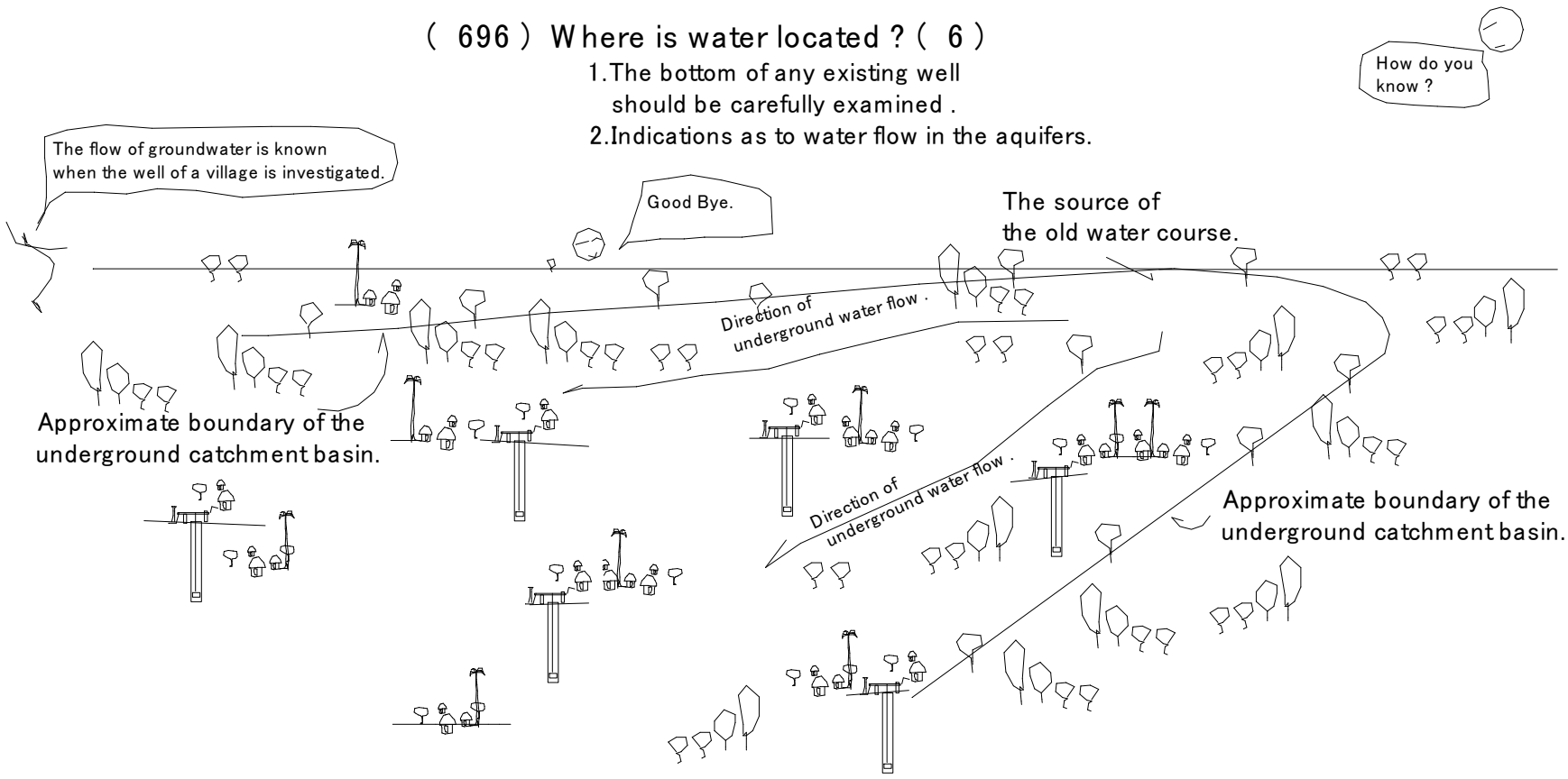


（ 695 ） Where is water located ?（ 5 ）

1.The site for former villages.

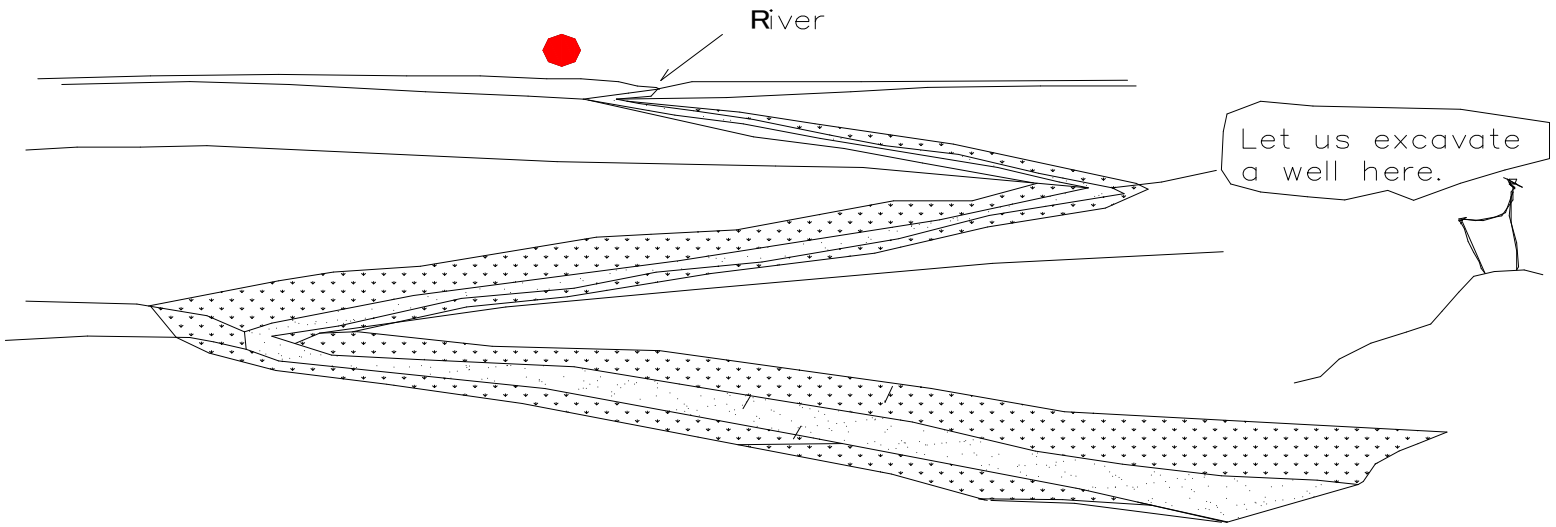
It lost war.
However, only the mountains and the river
of a home village remained.




(696) Where is water located ? (6)
1.The bottom of any existing well
should be carefully examined .
2.Indications as to water flow in the aquifers.
How do you know ?
The flow of groundwater is known when the well of a village is investigated.
Good Bye.
The source of the old water course.
Direction of underground water flow .
Approximate boundary of the underground catchment basin.
Direction of underground water flow .
Approximate boundary of the underground catchment basin.

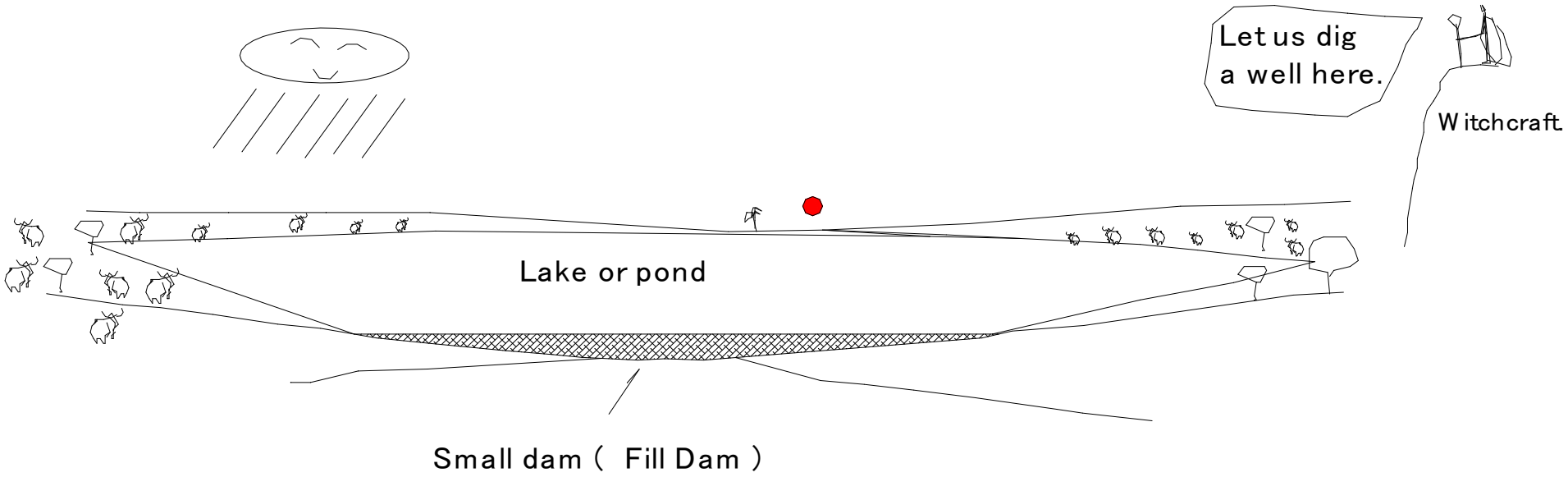
(697)Where is water located ?(7)

1.To investigate a site near
a river or a valley bottom.



(698) Where is water located ? (8)

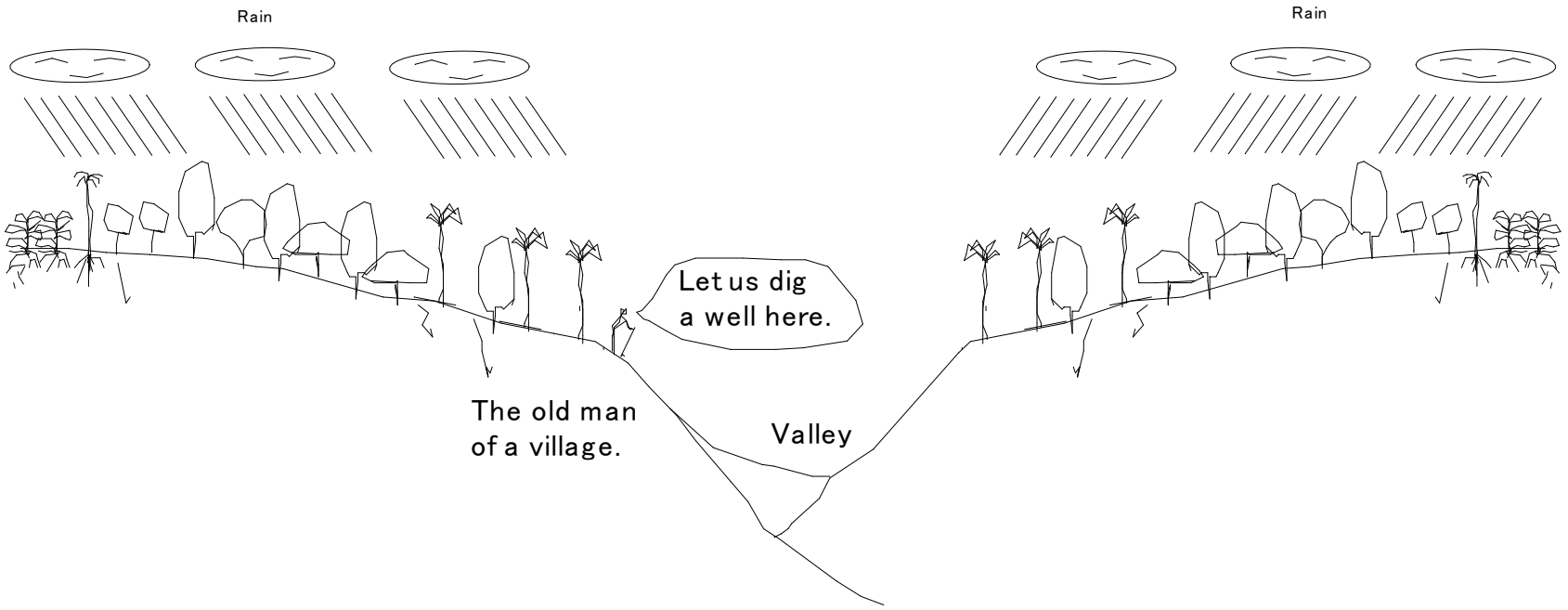
1.To investigate a site near dam or a lake(pond)



699 Where is water located ?(9)

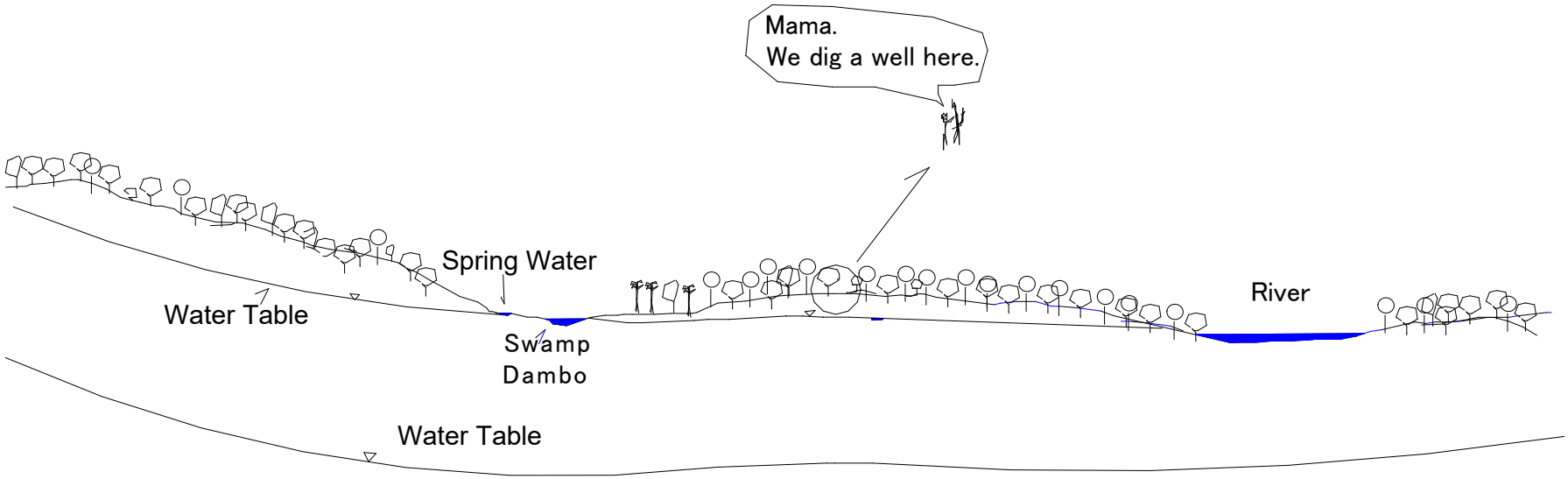
(699) Where is water located ? (9)

1.To investigate a site near a valley.

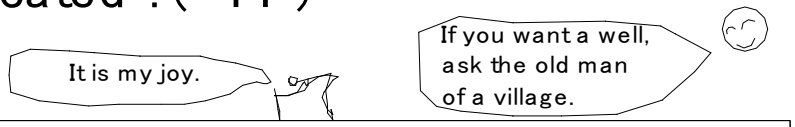


(700) Where is water located ?(10)

1.To investigate a site near Swamp(Dambo)

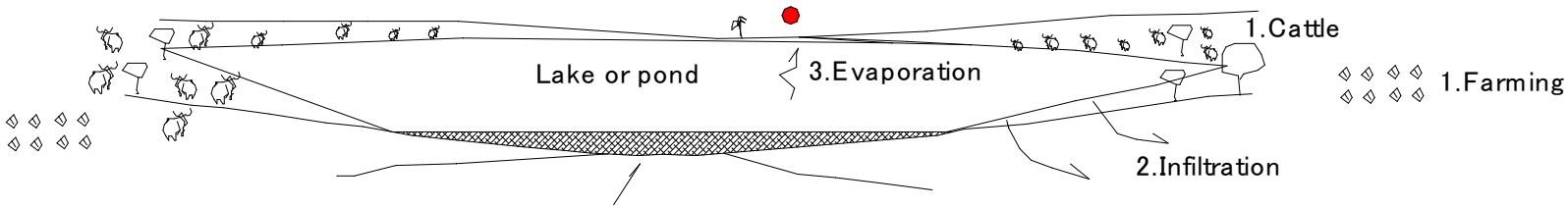


(701) Where is water located ?(11)

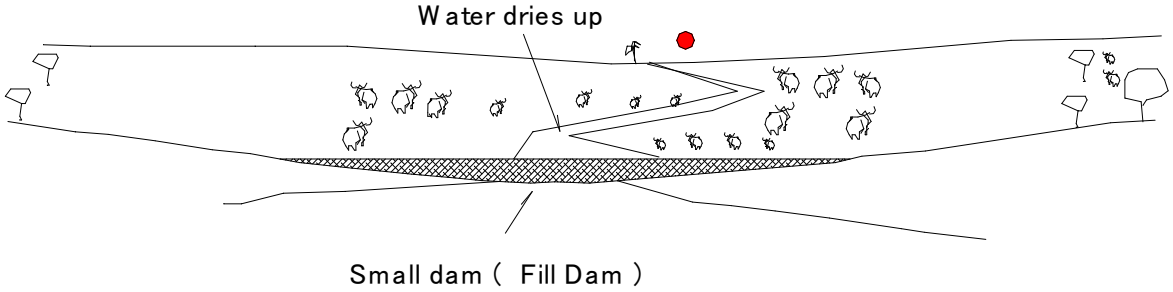


	Investigated Item	Figure
1.	Acacia,Baobab and Fig trees	Villagers. Dig a well around me.
2.	Quartz or sand stone	This stone is a Quartz.
3.	The colour of the earth	Soil colour is changed.
4.	Fault or Fissure on the ground	Fault, Fissure, Ground
5.	Former Village	Former Village
6.	Existing Well(Groundwater flowing direction)	Existing Well
7.	Near rivers	River
8	Near Dams or Ponds	Fill Dam
9.	Near Valleys	Valley
10.	Near Swamps(Dambo)	Swamp(Dambo)

（ 702 ） Surface water storage（ 1 ）

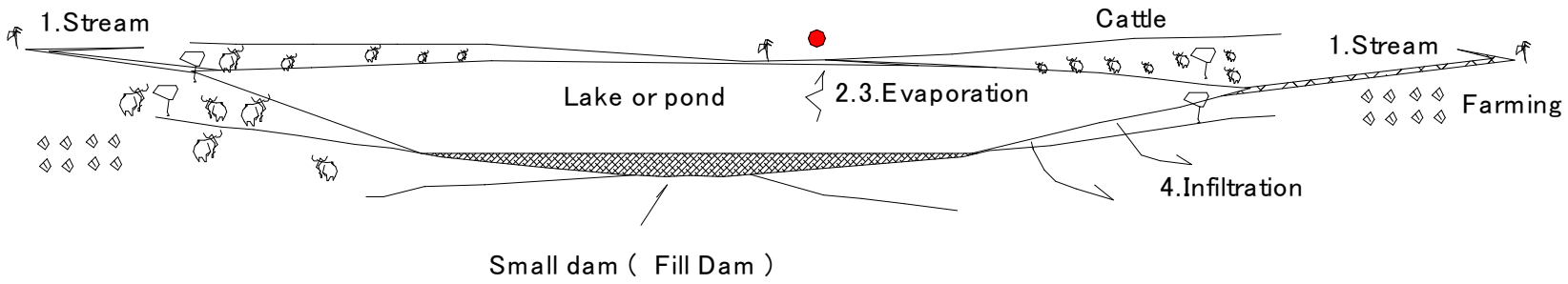


Water dries up for three reasons
1.Water is drawn off for domestic use, livestock and farming.
2.Water infiltrates into the ground.
3.Water evaporates into the air.



（ 703 ） Surface water storage(2)

To prolong the life of surface water.

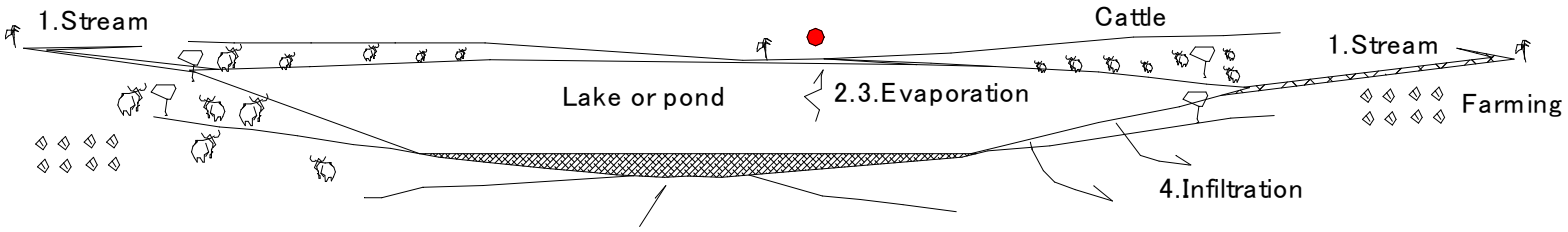


To prolong the life of surface water.

1.Increasing the total volume of collected water.
2.Reducing the water surface exposed to evaporation by sun and wind.
3.Limiting evaporation.
4.Reducing water infiltration into the ground.

(704) Surface water storage(3)

Small scale dam and Large scale dam

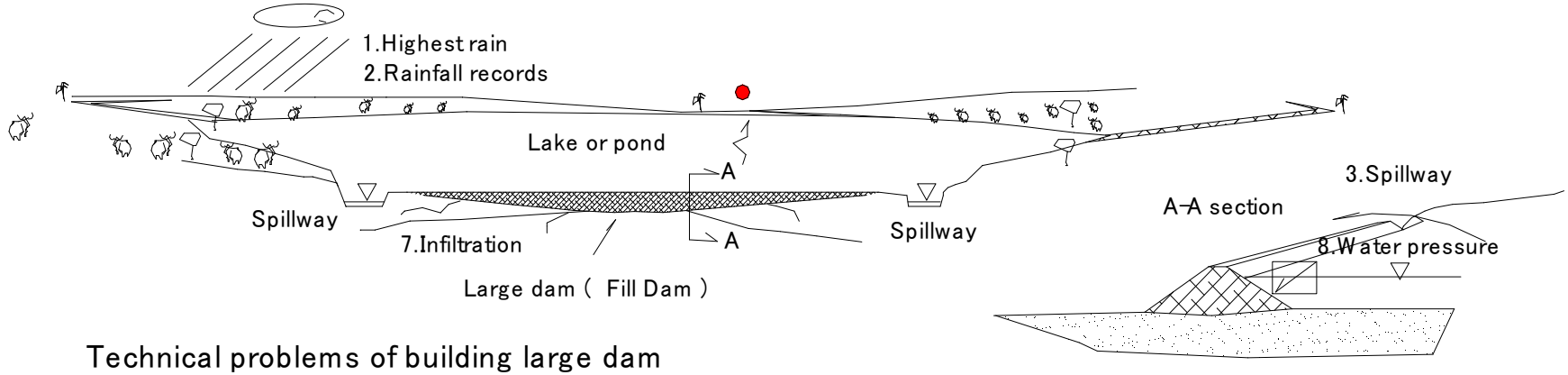


Small scale dam and Large scale dam

Objectives

Small scale dam	1. To increase surface reserves of water. 2. To stop soil erosion. 3. To promote infiltration. 4. To form cropping terraces.
Large scale dam	1.To increase surface reserves of water. 2.To collect water during the dry season

（ 705 ） Many technical problems of building large dam

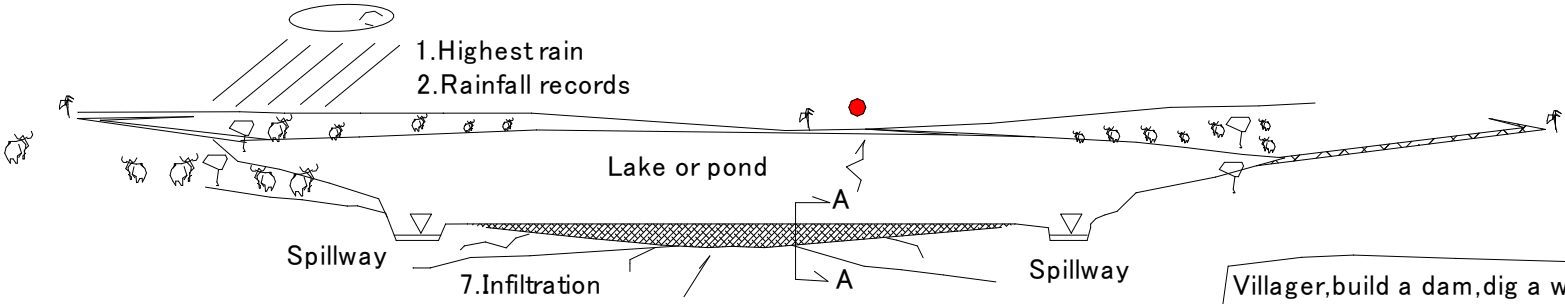


Technical problems of building large dam

1.To take account of the highest rainfall and runoff in the catch basin of the future dam.
2.To confirm rainfall records , estimates of accumulation at the dam, and rain cycle.
3.To calculate the size of the spillway to prevent overtopping by flood water.
4.To calculate the stability of dam.
5.To survey the ground or rock of the dam site.
6.To confirm if foundations are loose soil or not.
7.To confirm if foundations have infiltrating water or not.
8.To confirm if water pressure makes dam slide down or not.

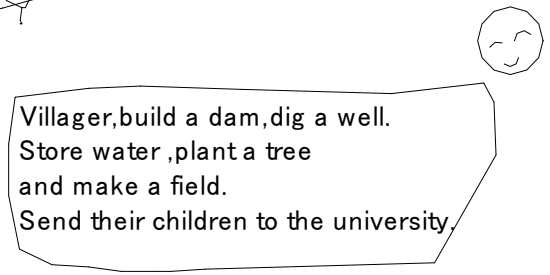
Foundation
4.Stability
5.Ground
6.Loose soil
7.Infiltrating water

（ 706 ） Many technical problems of building large dam（ 2 ）



Large dam（ Fill Dam ）

Spillway



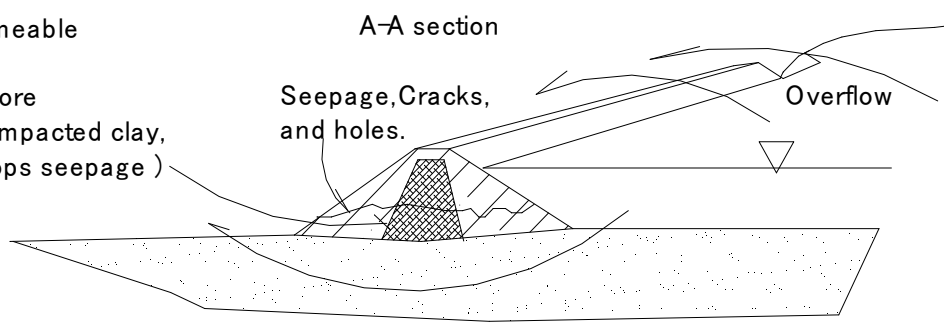
Impermeable

Dam core
（ Compacted clay,
stops seepage ）

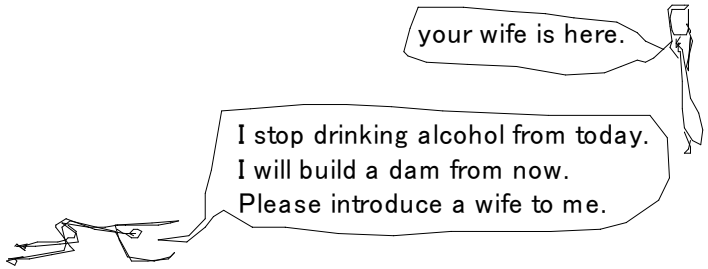
A–A section

Seepage,Cracks,
and holes.

Overflow



Large dam（ Fill Dam ）

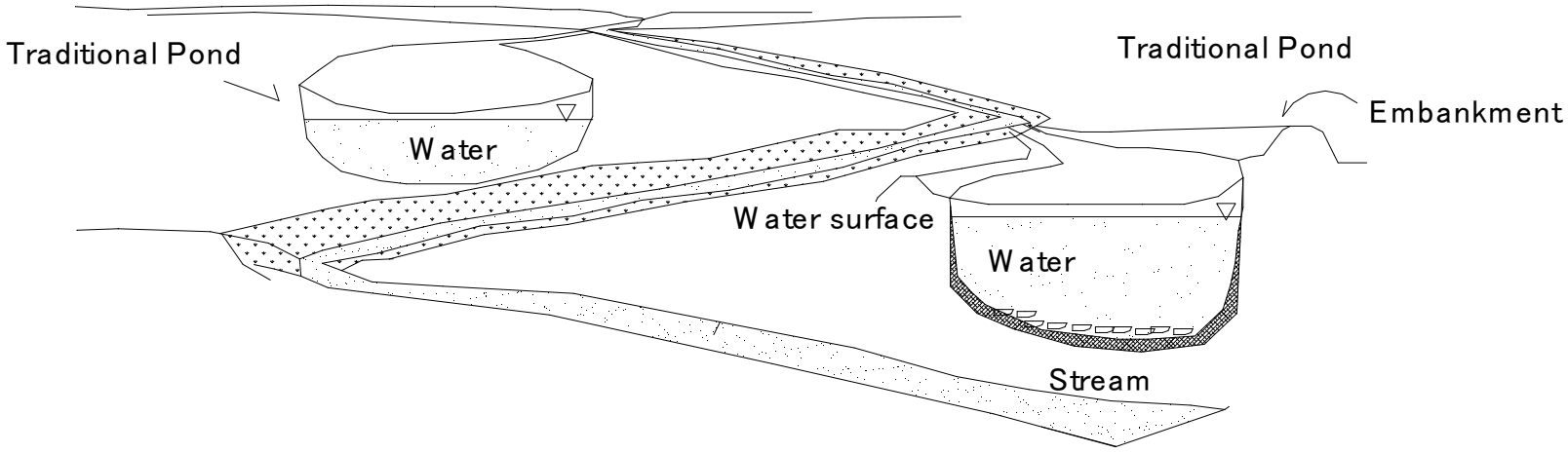


（ 707 ） Traditional Pond（ 1 ）

Traditional Pond Techniques

1.A traditional pond is a deep circular pond.

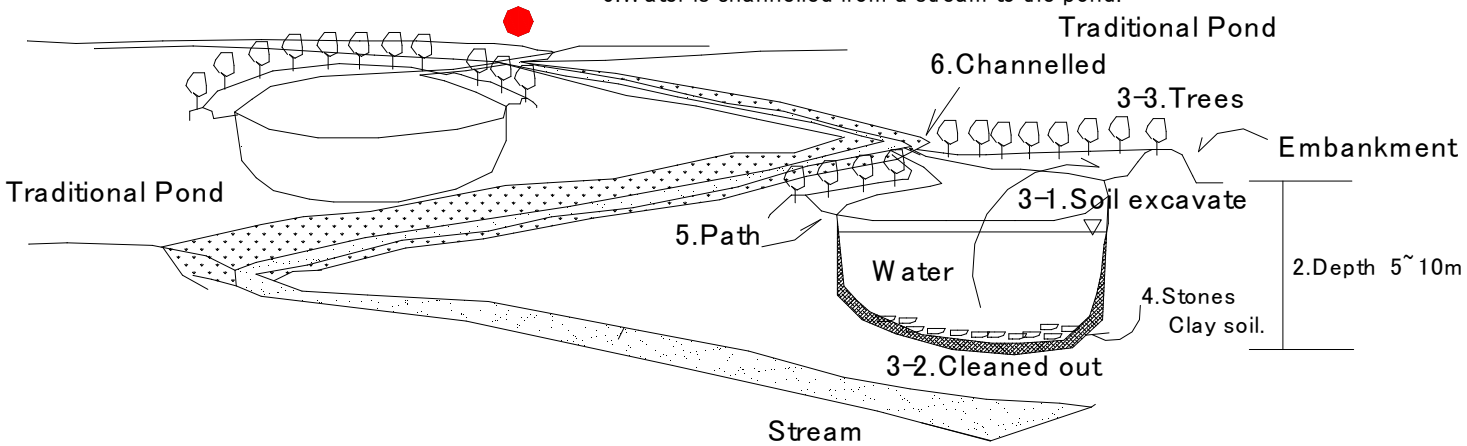
2.A traditional pond supplies water for villagers in the dry season.



（ 708 ） Traditional Pond（ 2 ）

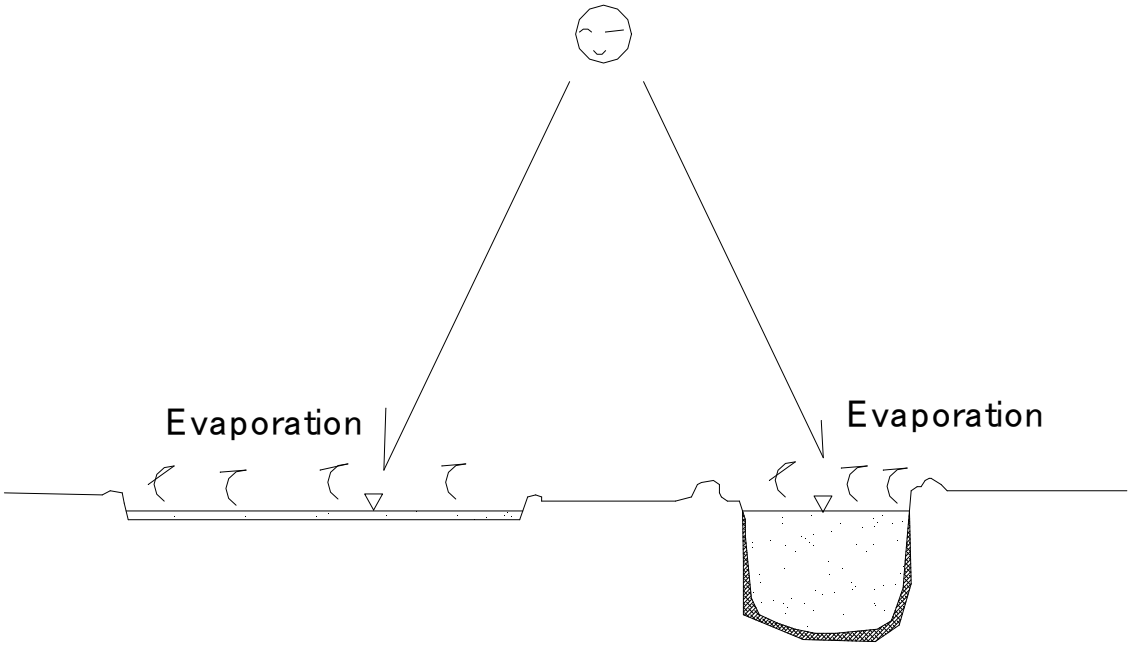
Traditional Pond Techniques

1.Reduce the surface exposed to evaporation（ Wide 20 to 50 metres）.
2.Dig out the pond（ Depth between 5 and 10 metres ）
3.Lessen the action of the wind.
  1.Soil excavated from the pond bottom.
    pile soil on the embankment.
  2.The bottom of the pond is cleaned out.
  3.Plant trees on the embankment to act as windbreaks.
  4.Establish shade zones over the surface of the water.
  5.Reduce overheating during the day.
4.The bottom of the pond is paved with stones and clay to make
  it impermeable.
5.A circular path allows people to go round the pond on foot.
6.Water is channelled from a stream to the pond.



（ 709 ） Traditional Pond（ 3 ）

1.Reduce evaporation from water surface.

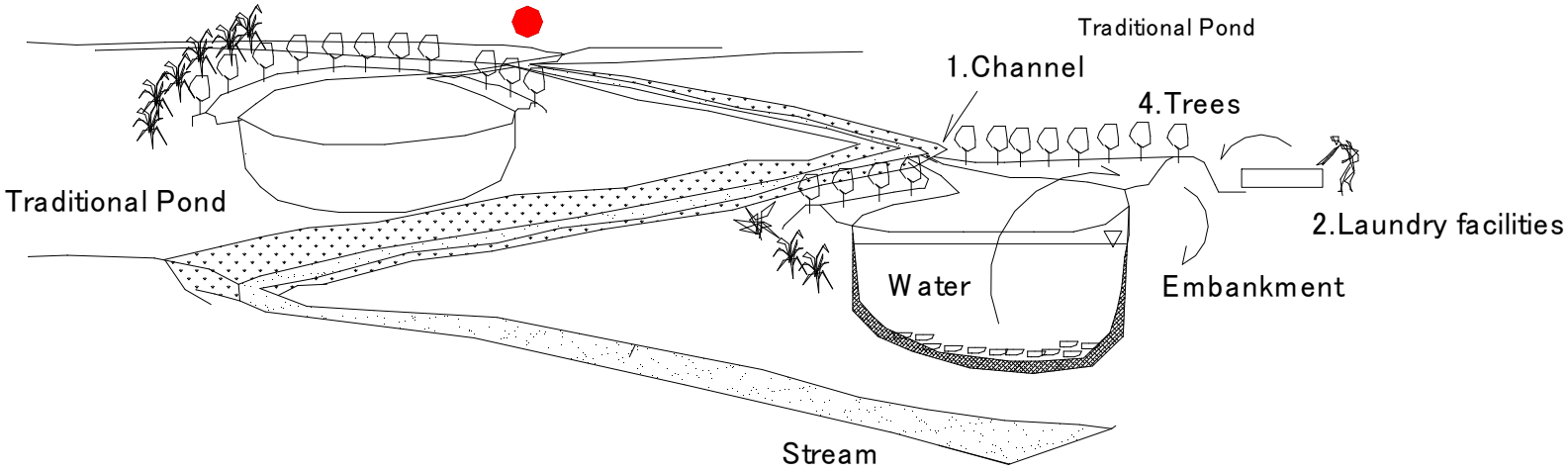


1.Water will have evaporated in a few hours.

2.Water left after several days.

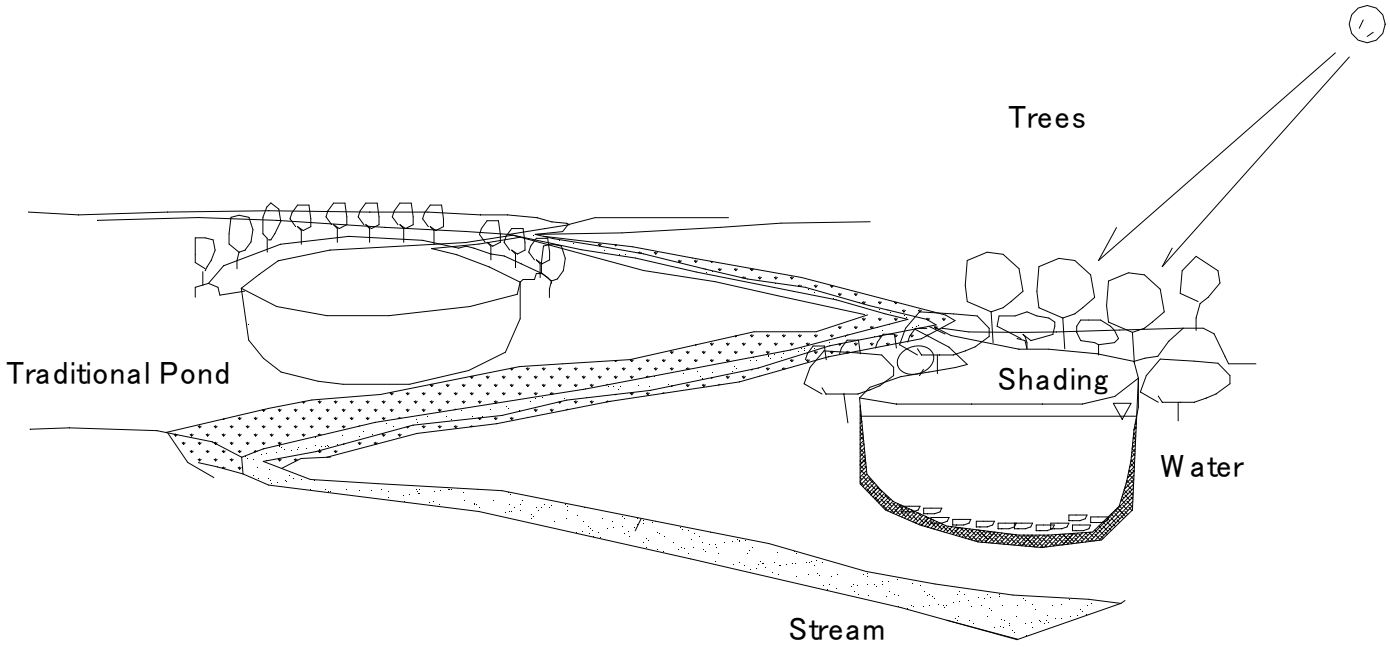
（ 710 ）Traditional Pond（ 4 ）

Some improvements on the traditional pond.
1.The entry channel to the pond could be developed.
Gabion,Small dam.
2.Polluting activities should be banned inside the pond enclosure.
1.A watering place and laundry facilities could be built outside the embankment if a handpump and piping were installed.
3.Thorny species could be planned on the sides of the embankment so as to form a barrier round the pond.
4.Useful trees planted on the inside face of the embankment would increase the shelter belt and establish a cool zone above the water.

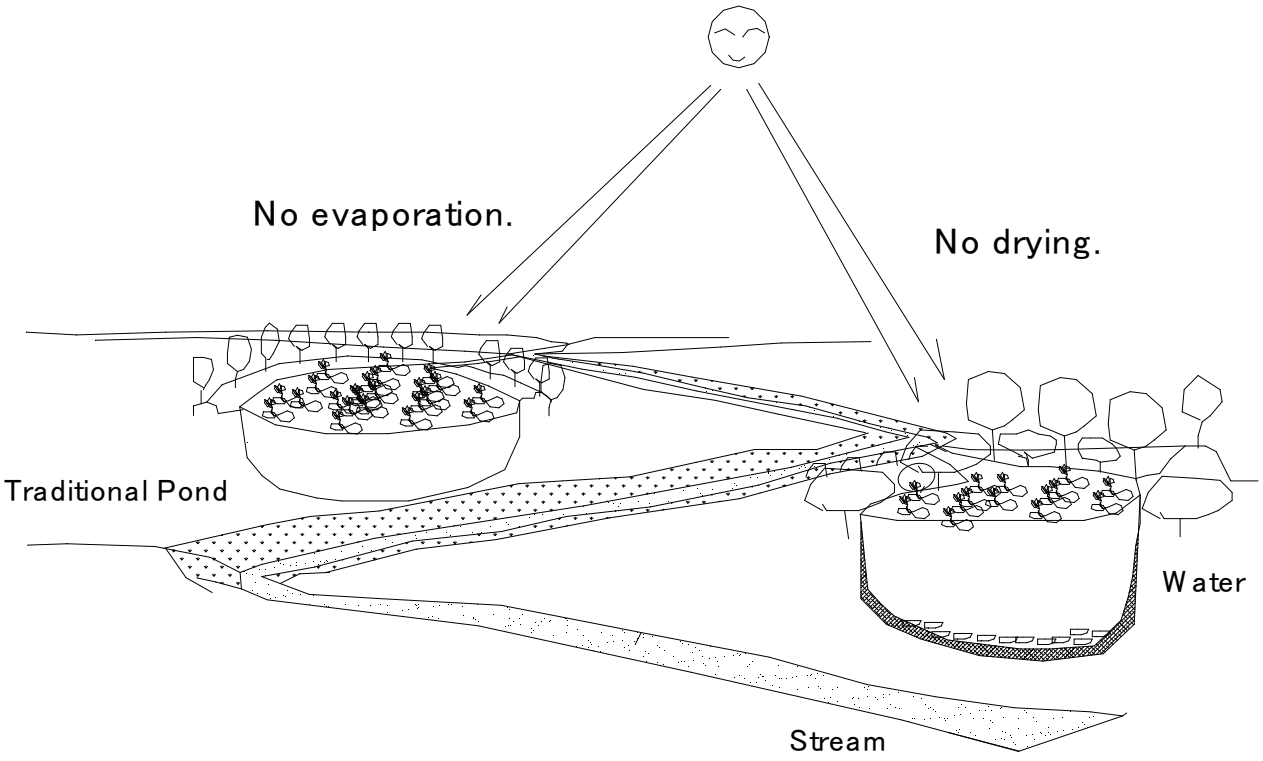


（ 711 ） Traditional Pond（ 5 ）

Evaporation is reduced by shading the surface of the pond.

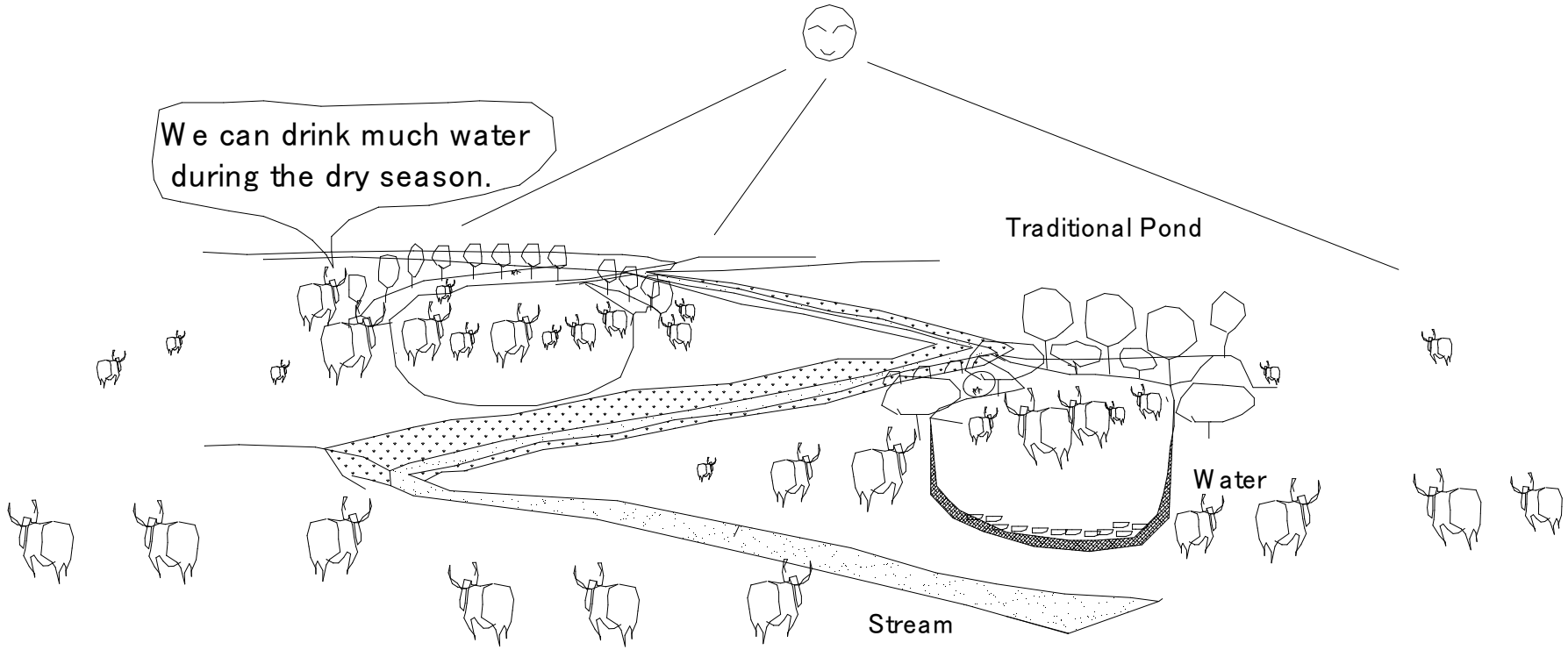


（ 712 ） Traditional Pond（ 6 ）



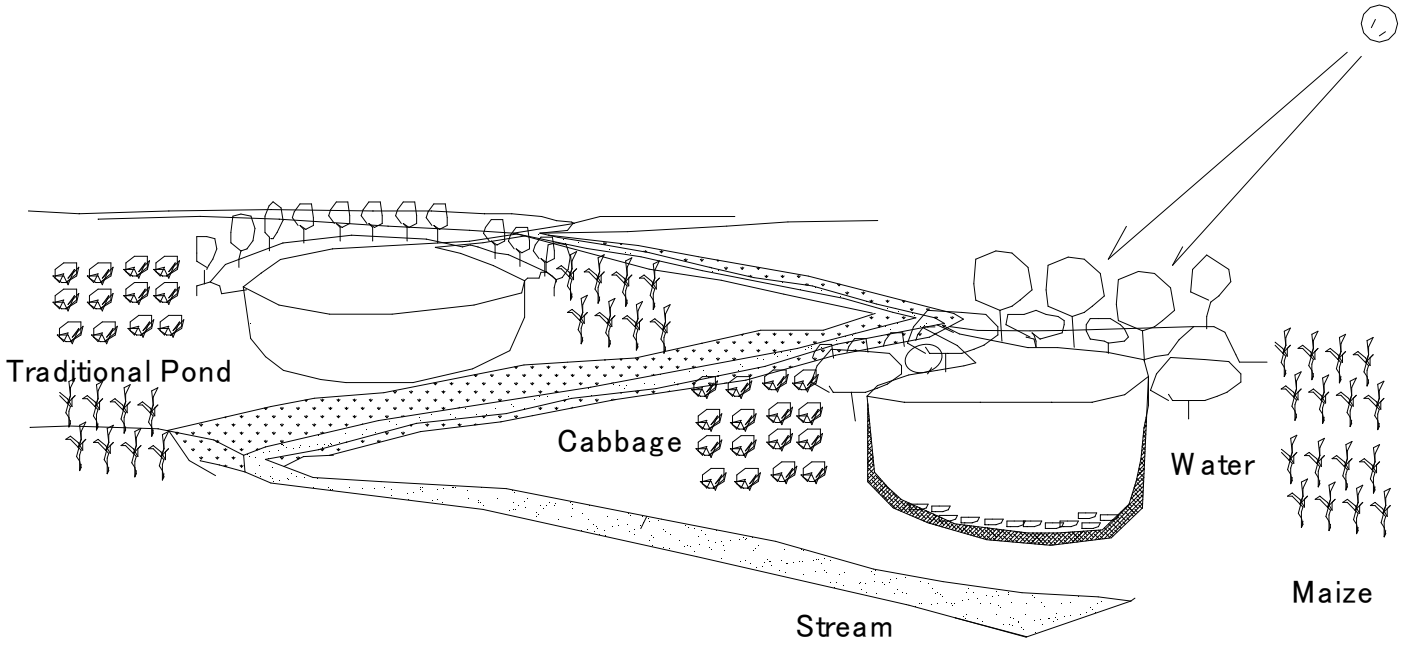
（ 713 ） Traditional Pond（ 7 ）

Ponds are useful for watering cattle.



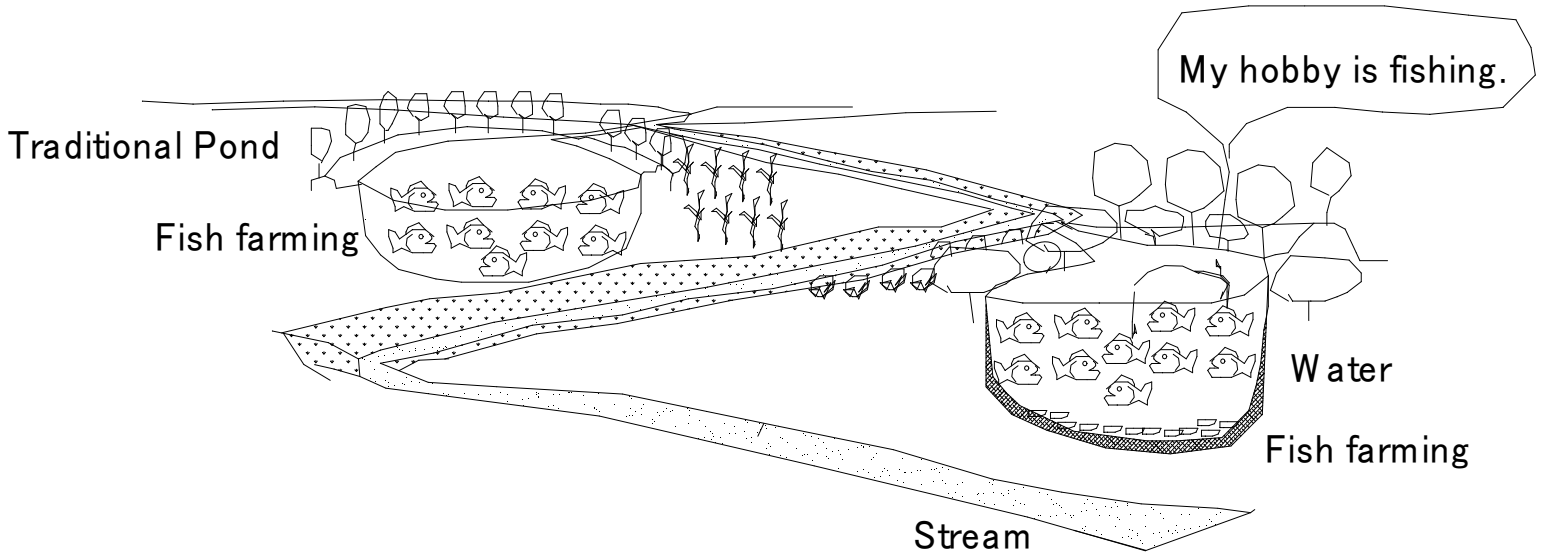
（ 714 ） Traditional Pond（ 8 ）

Ponds are useful for irrigating small gardens during the dry season.



（ 715 ） Traditional Pond（ 9 ）

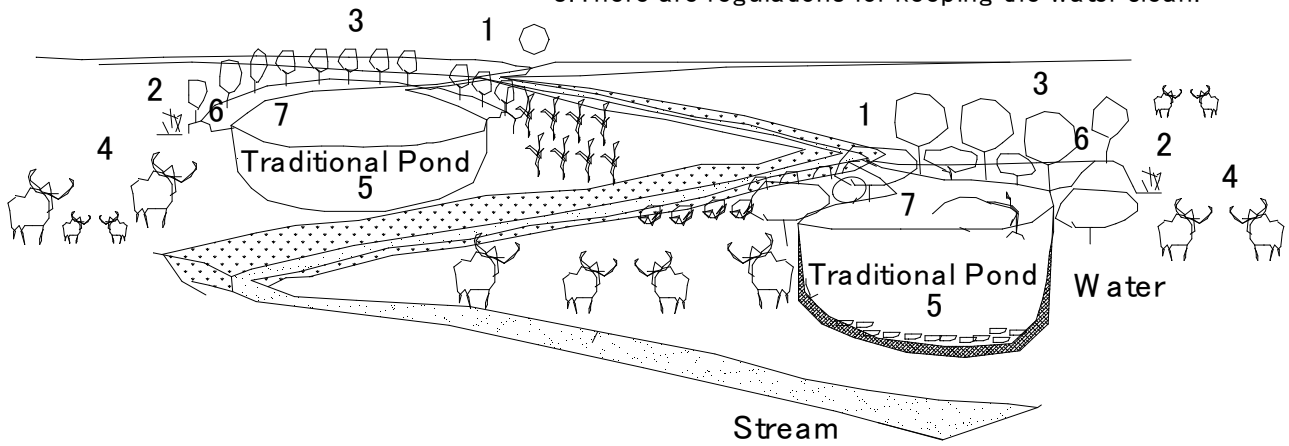
Ponds could be established in order to develop fish farming.



(716) Traditional Pond(10)

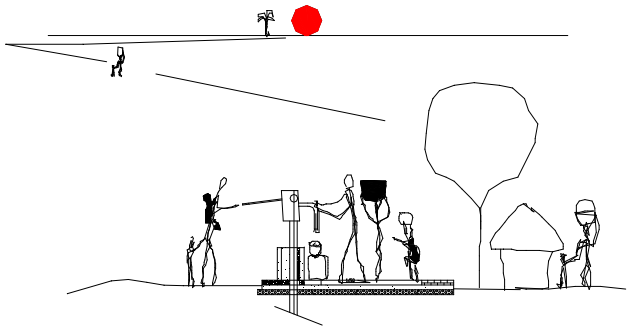
Ways of improving a pond

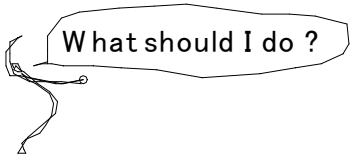
1.The supply channel is paved.
(Small gabion dams)
2.The embankment is surrounded by
a thick hedge of thorny shrubs or a fence.
3.Trees are planted on the embankment .
(Trees provide fruits,animal feed and wood)
4.Cattle are kept in an enclosure.
5.The pond is deepened.
6.The embankment is raised.
7.The waterfront is cleaned.
8.There are regulations for keeping the water clean.

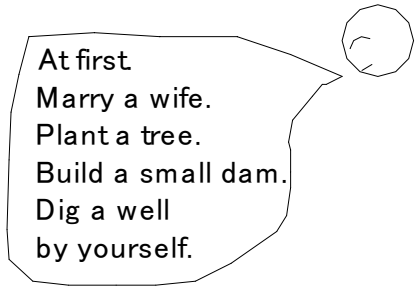


（ 719 ） The problem of villagers(3)

During the dry season,the youth migrate
to distant cities in the hope of finding work,
leaving the aged and the children behind.



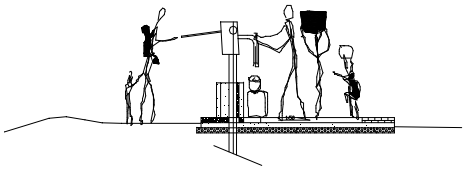




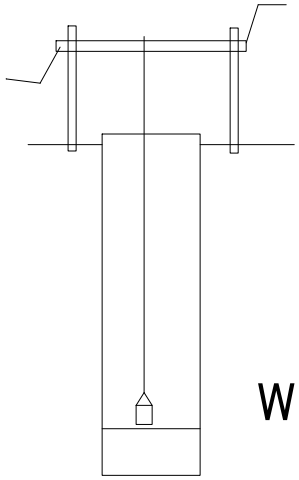
One of the ways of helping young men find gainful employment in villages,
especially during the dry season.

1.Development of the water management .
2.Young people and women can be trained in villages .
(on water needs of agriculture and livestock)
3.They can earn income during the dry season.

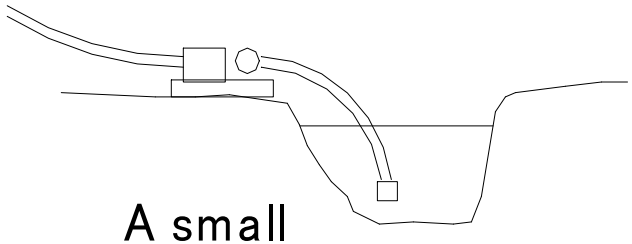
(720) Water lifting system(1)



Borehole



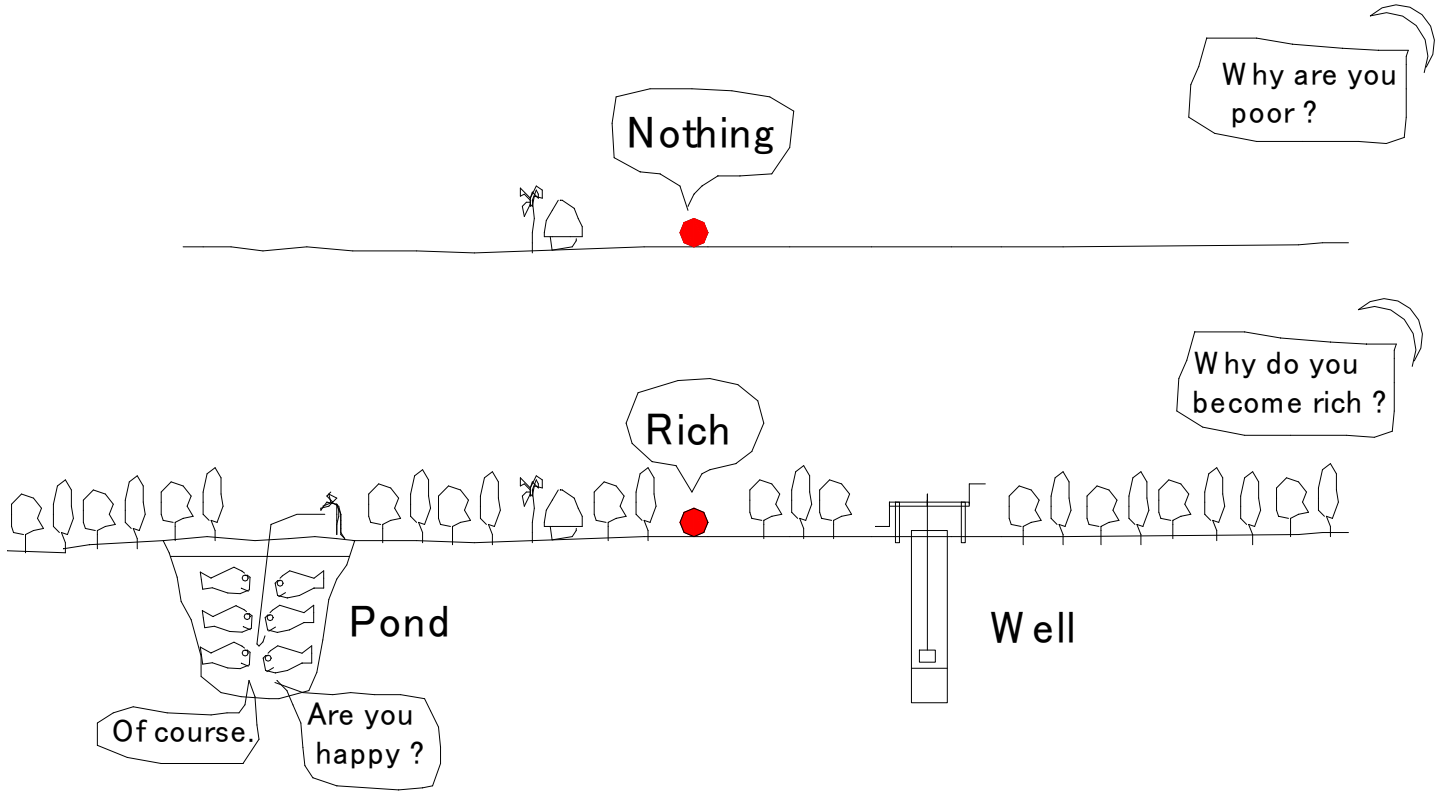
Well



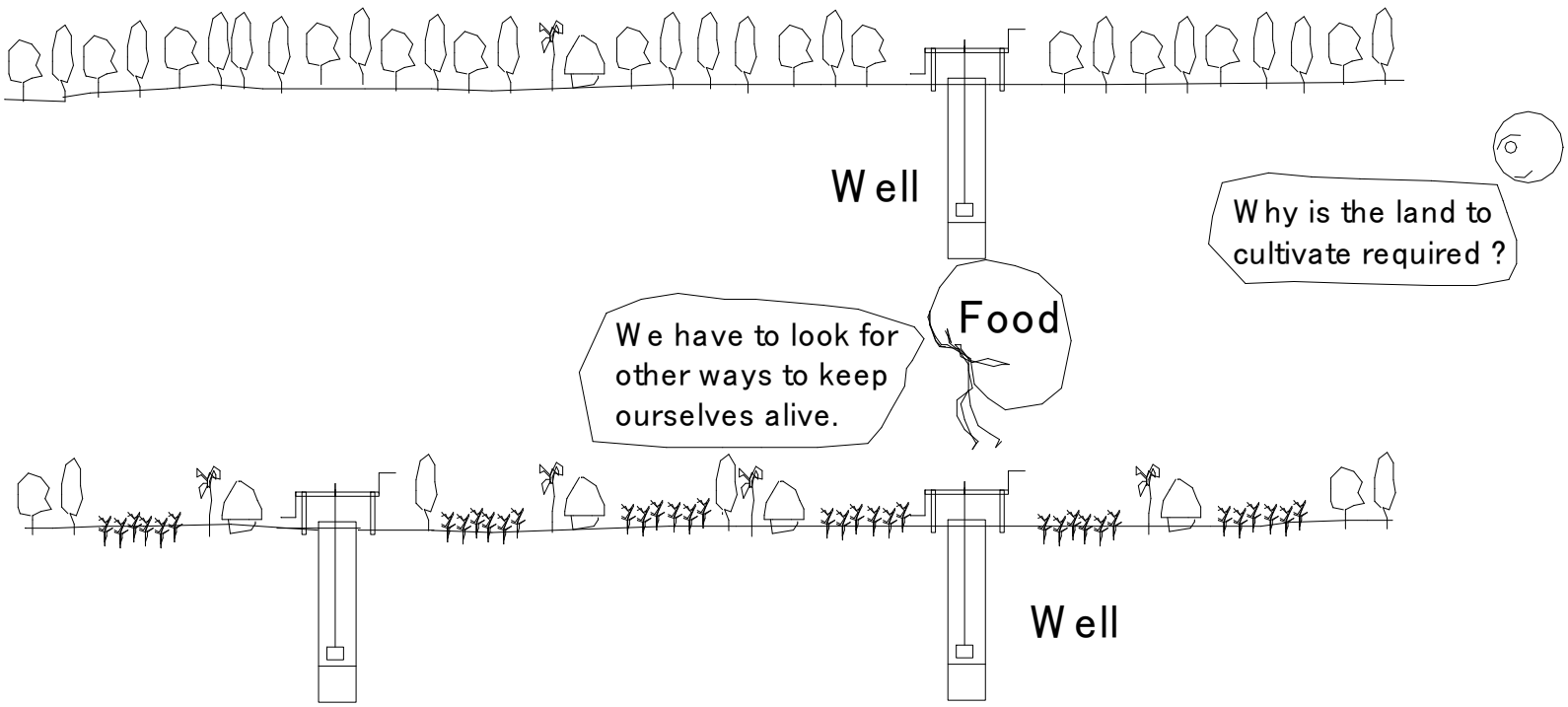
A small pump

1 Equipment costs.
2.Cost of servicing and repair.
3.Local craftsmen for repairs.
4.A supply of spare parts.
5.Management.
6.Rules in order to prevent pollution.

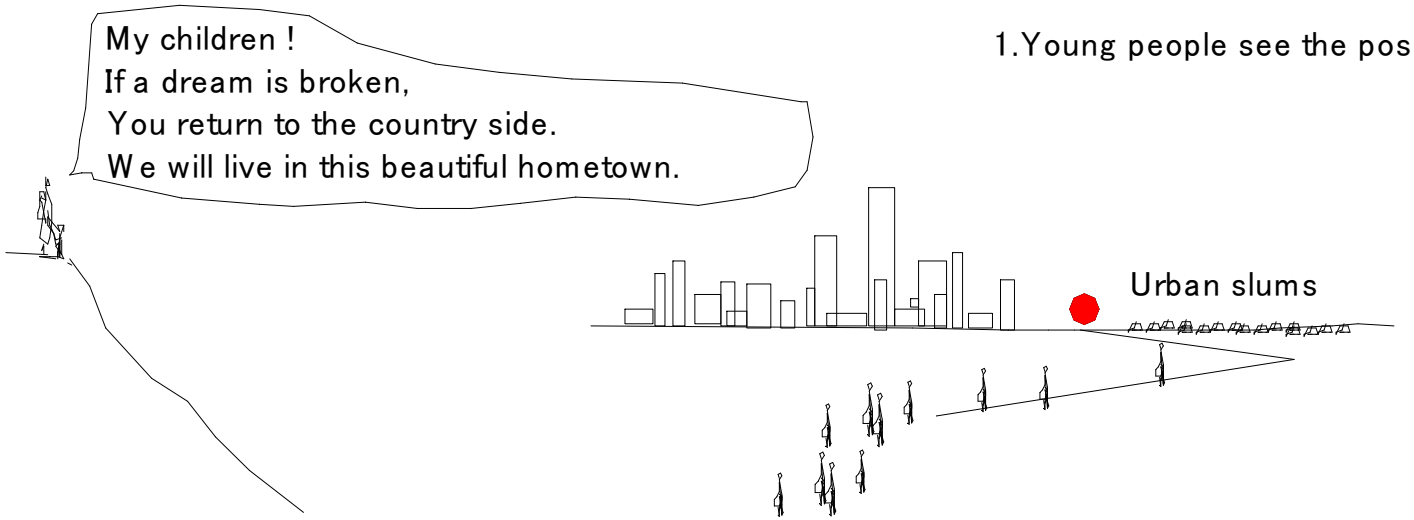
（ 721 ）Why do you become rich



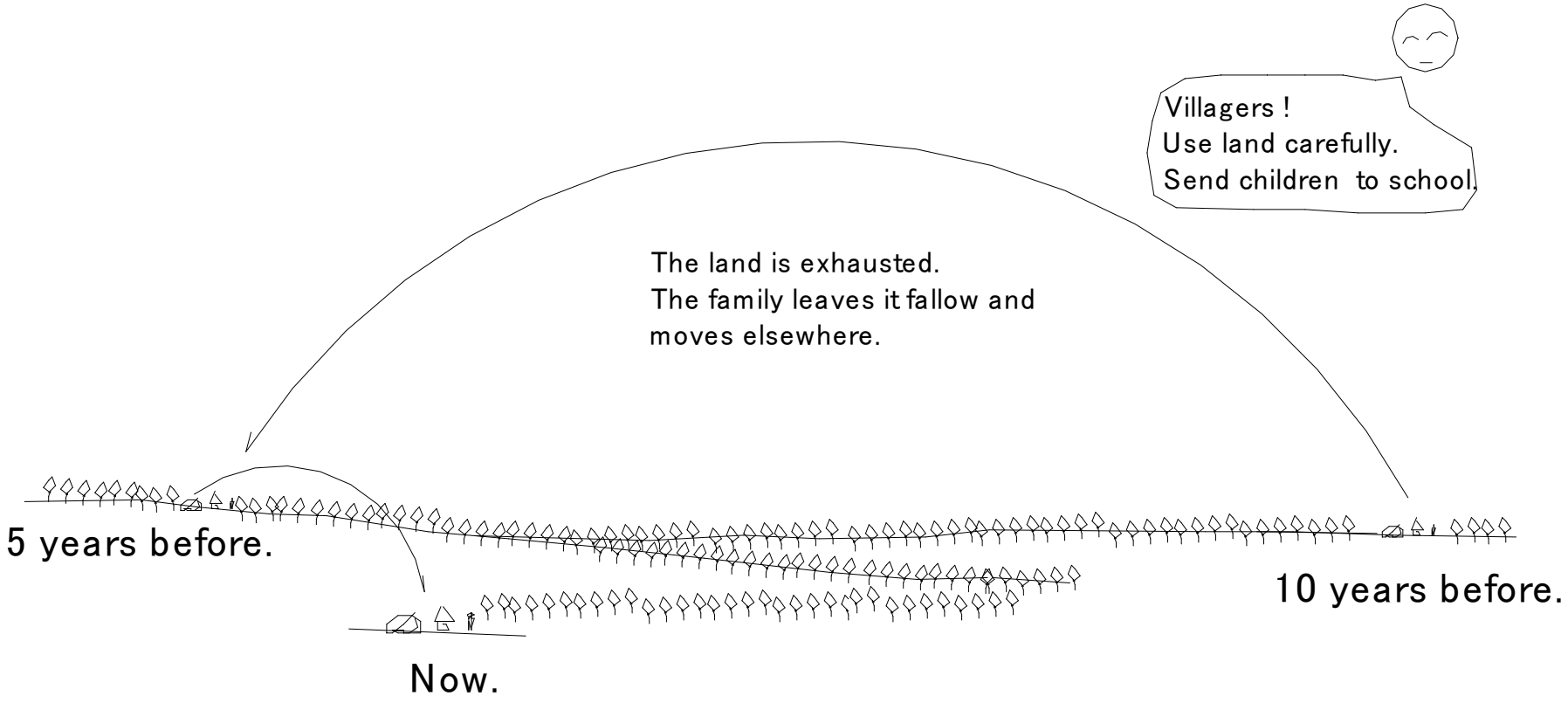
（ 722 ）Population is growing



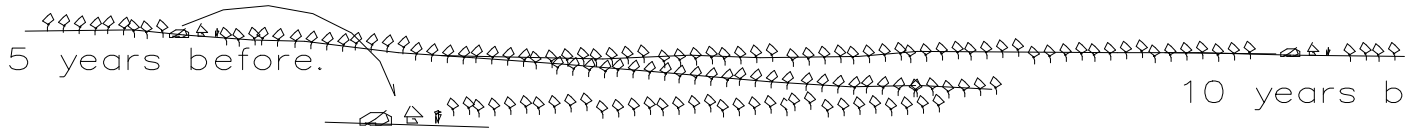
（ 723 ）Endless expansion of urban areas



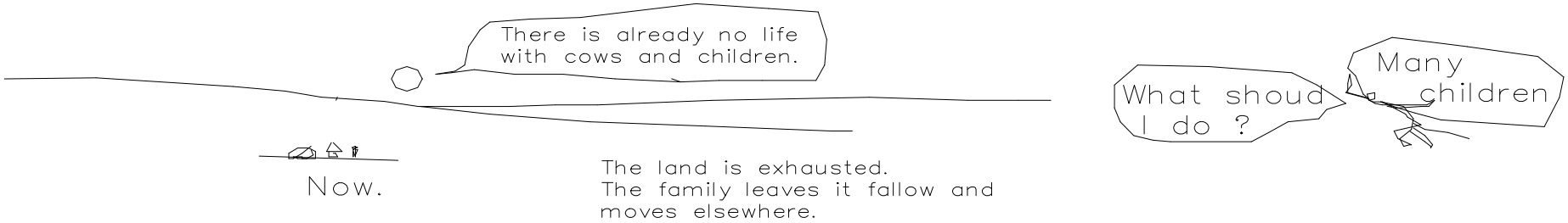
(724) A family is living by shifting cultivation(1)



(725)A family is living by shifting cultivation(2)

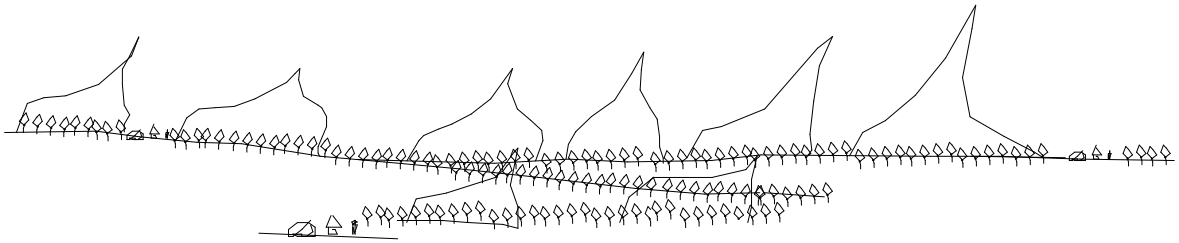


Most of the trees are gone.
There is no protection left
against erosion by the trees which are gone.

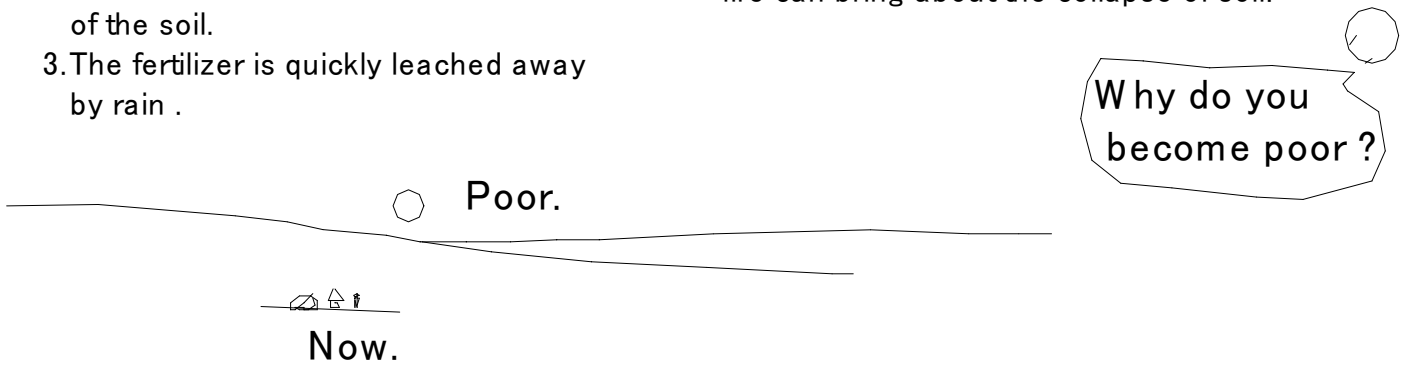


The land is exhausted.
The family leaves it fallow and
moves elsewhere.

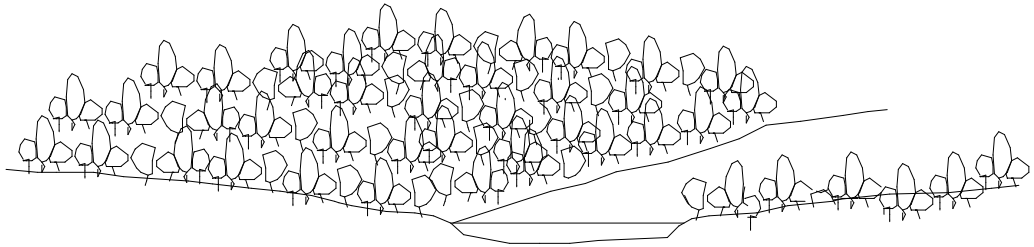
（ 726 ） Clearance by fire



1. The ashes from trees,bushes and other vegetation act as a fertilizer.
2. Excessive burning also destroys the humus content and the structure of the soil.
3. The fertilizer is quickly leached away by rain .
4. Vegetation cannot restore the fertility of the soil.
5. Unless it is used with great care, fire can bring about the collapse of soil.

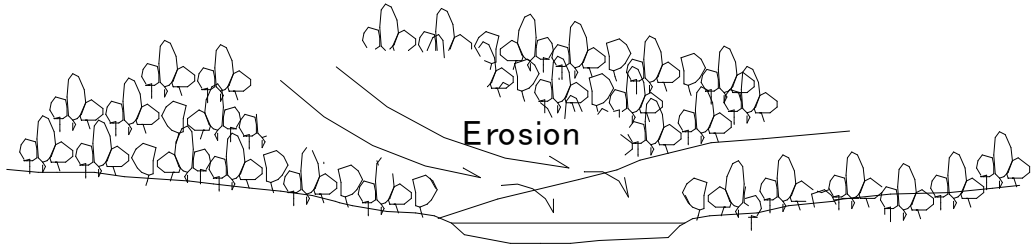


（ 727 ） Loss of forest rivers



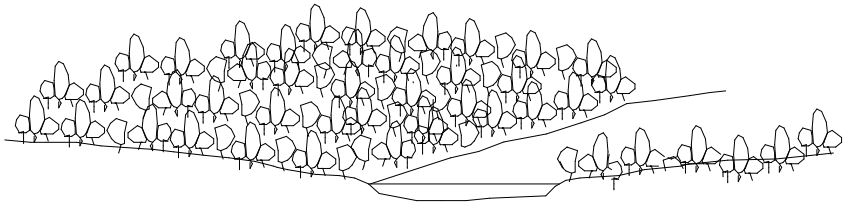
After cutting trees　　River

1.Forests bind the soil with their roots and
protect it against erosion.
2.Forests are important habitat for a wide variety of wildlife.
3.The trees have been removed.
4.There is a major erosion problem in the making.

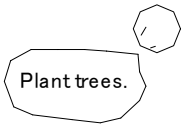


728 Deforestation

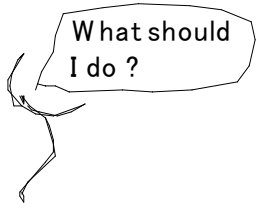
（ 728 ）Deforestation



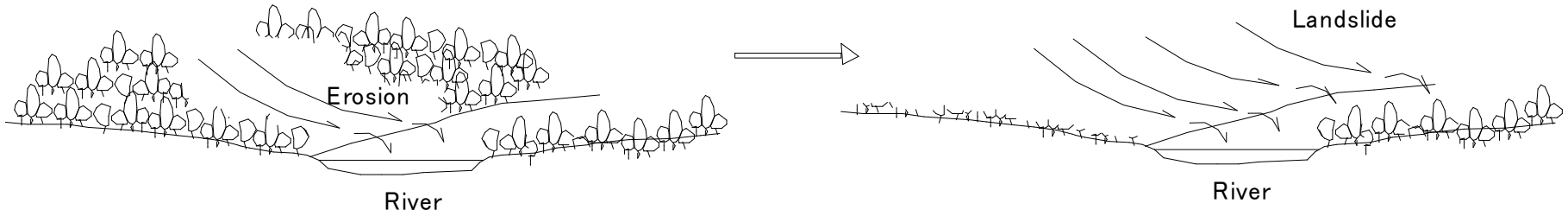
River



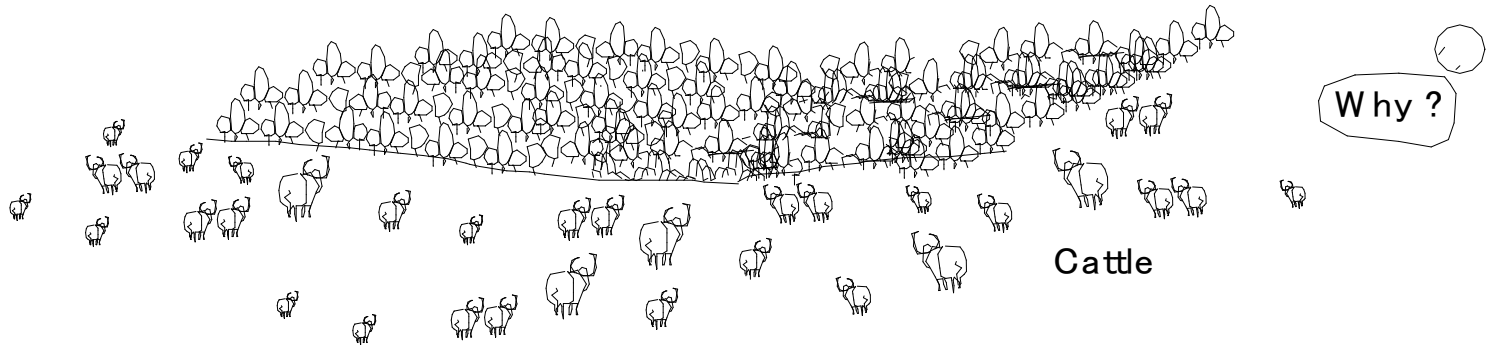
1.Steep slopes need the protection by forests and natural woodlands.
2.The forest cover (natural vegetation has been stripped away by erosion)
3.The exposed slopes are scoured with gullies and landslides.
4.The hill soils are lost forever.
5.Without trees and vegetation in uplands,river floods more easily.
6.The soils are deposited behind the dams and irrigation projects.
7.Where erosion is so advanced that natural regeneration is impossible.
8.Planting trees and other vegetation will be needed to restore the landscape.



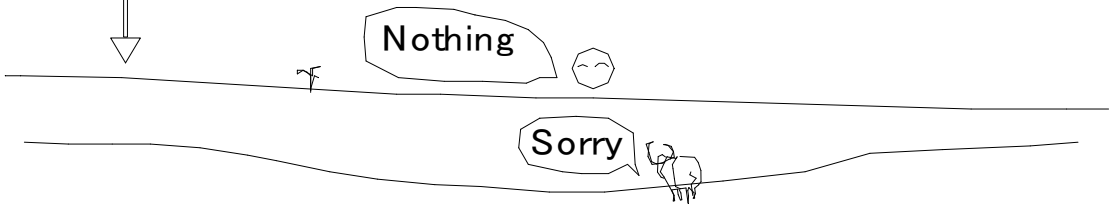
After cutting trees



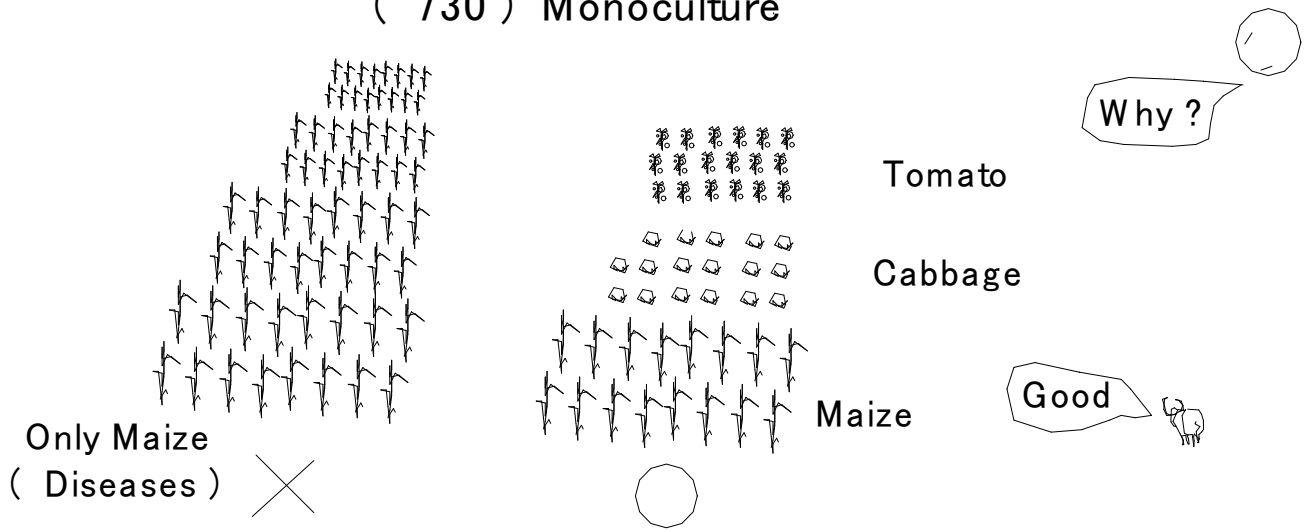
（ 729 ） Ill planned development projects



1. Inadequately planned agricultural development projects can lead to disaster.
2. The woodland ,trees,shrubs,and undergrowth have been eaten by cattle and goats.

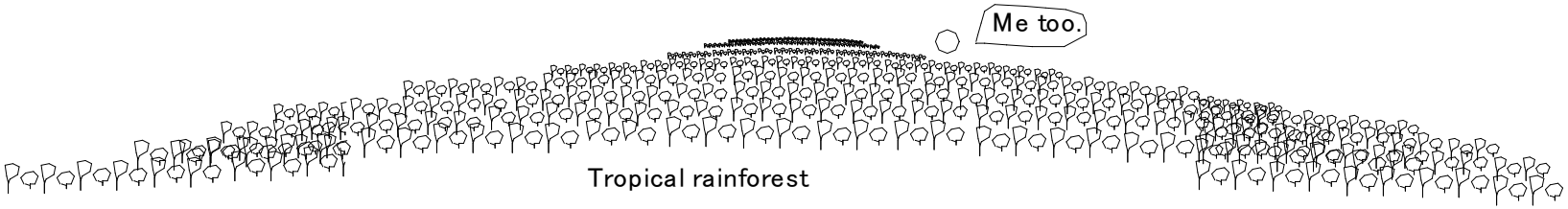


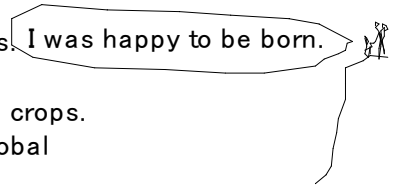
（ 730 ）Monoculture



1.The cultivation of single crop over a large area.
2.Same techniques have been introduced and continued.
3.These farming methods provide higher crop yields.
4.But these farming methods use more fertilisers and pesticides.
5.Without these inputs yields quickly fall.
6.Soils are more easily exhausted.
7.Pests and plant diseases can't be controlled completely.
8.The most effective protection against such risks is
to grow a wide range of crop varieties.

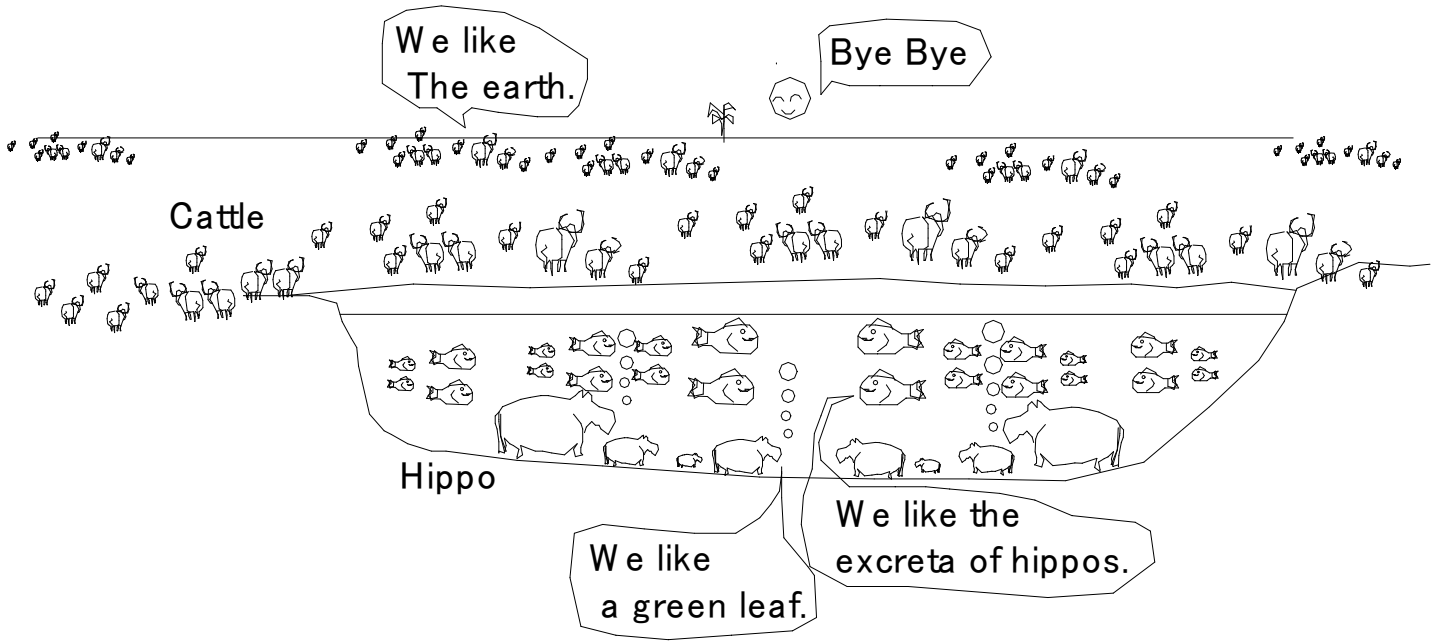
（ 731 ）Biodiversity





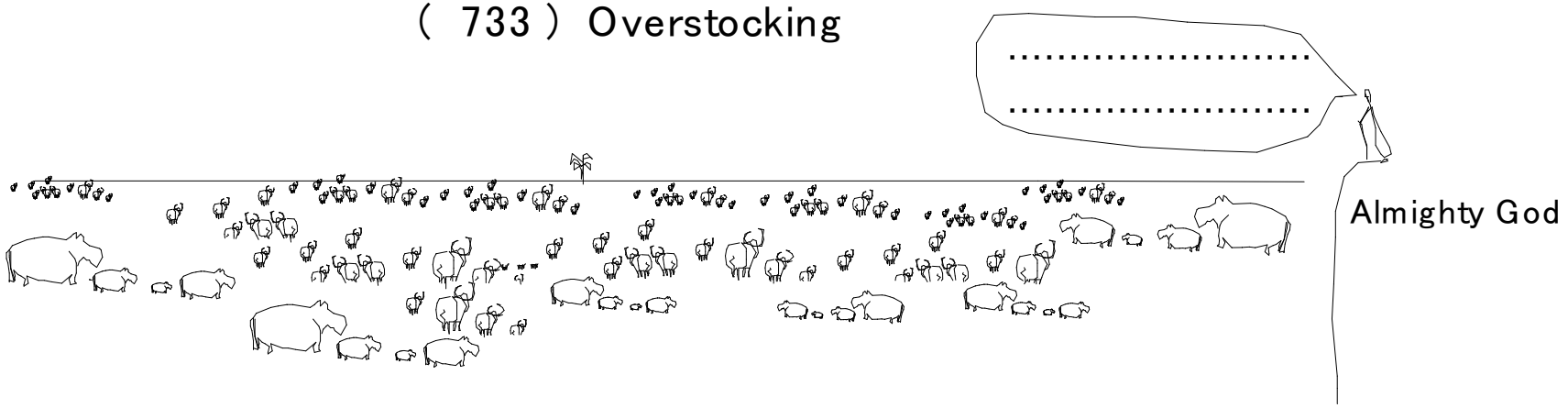
1.The tropical rainforests are the richest and most complex of the world's living systems.
2.They are the habitat of an extraordinary variety of animals and plants.
3.They have already shown themselves as the source of medicines and improved food crops.
4.They act as a huge natural carbon store,playing an essential part in stabilising the global temperature and climate.
5.The tropical rainforests are being destroyed.
6.Over 200,000 m2 are cut down for timber or cleared for agriculture every year.
7.In the process,a multitude of biological species are being lost for all time.
8.The destruction of the rainforests is one of the greatest tragedies of the modern world.
9.Their loss may be putting the global climate and rainfall patterns at risk.
10.Protecting of this common human heritage is not only the developing world but also whole human race.

（ 732 ） Livestock and wildlife



1. The animals are adapted to survive on what their native environment provides.

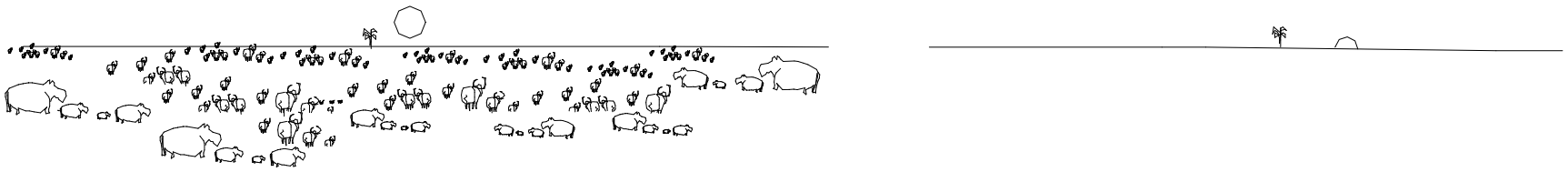
（ 733 ） Overstocking



1.Disease and climatic hazards used to keep the numbers of livestock small and within the capacity of the environment.
2.But now ,thanks to medicine and deep wells which tap into underground water resources.
3.The numbers of livestock have greatly increased.
4.At the same time,the grazing lands are being reduced as farmers expand the area under crops.
5.In many areas,the pastoral system has collapsed.
6.The vegetation is so overgrazed.
7.The only way to save it is to reduce the number of cattle.
8.The areas to be set aside in rotation so that they have a chance to regenerate.

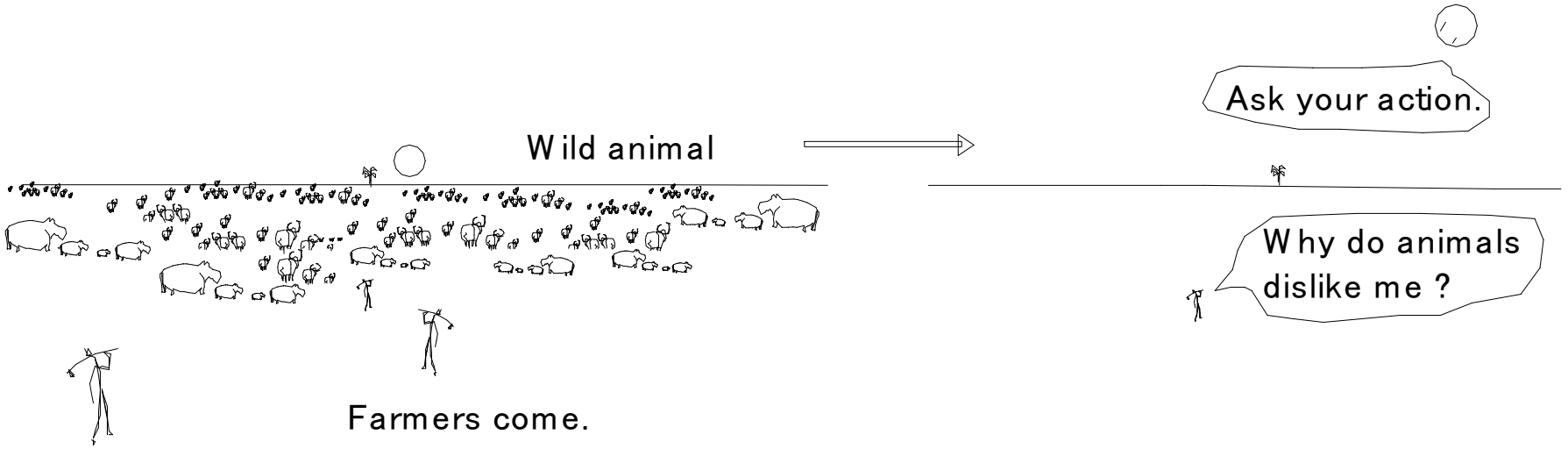
（ 734 ） Overgrazing

Nothing



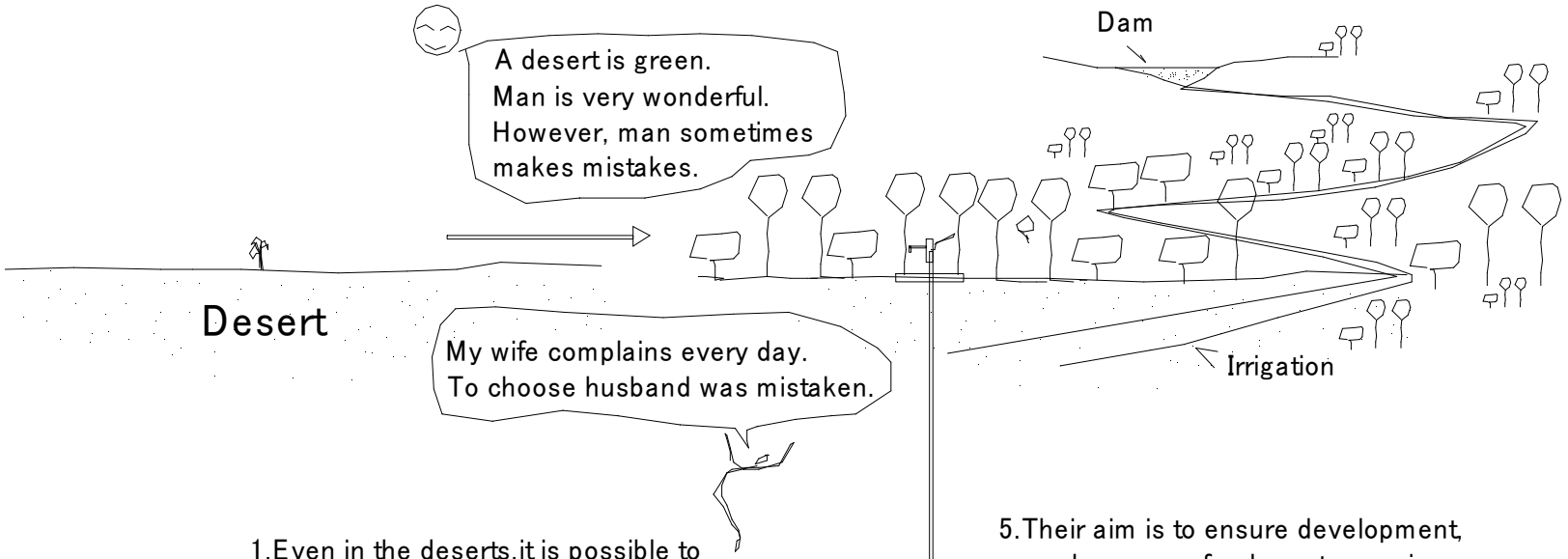
1.Drought is one of the greatest hazards in the arid regions.
2.A major investment has been made in providing permanent water supplies for cattle.
3.The numbers of animals have increased.
4.The surrounding pastures are being over-exploited.
5.As a result ,plants are unable to regenerate and the only vegetation cover is provided by annual plants.
6.When the dry years come,these will not be able to produce enough seeds to replace themselves and the land will be left bare.
7.Near the water hole there is a large patch where the plant cover has been completely lost.
8.Damage is also beginning to show in other areas.
9.All these will join to form a huge sterile zone if the number of grazing animals is not controlled.
10.When water supplies are being provided.
11.Making a fair charge for the water supply and involving the local community in its management,is the best way of ensuring that the numbers of cattle are in balance with the availability of fodder.

（ 735 ） Wildlife



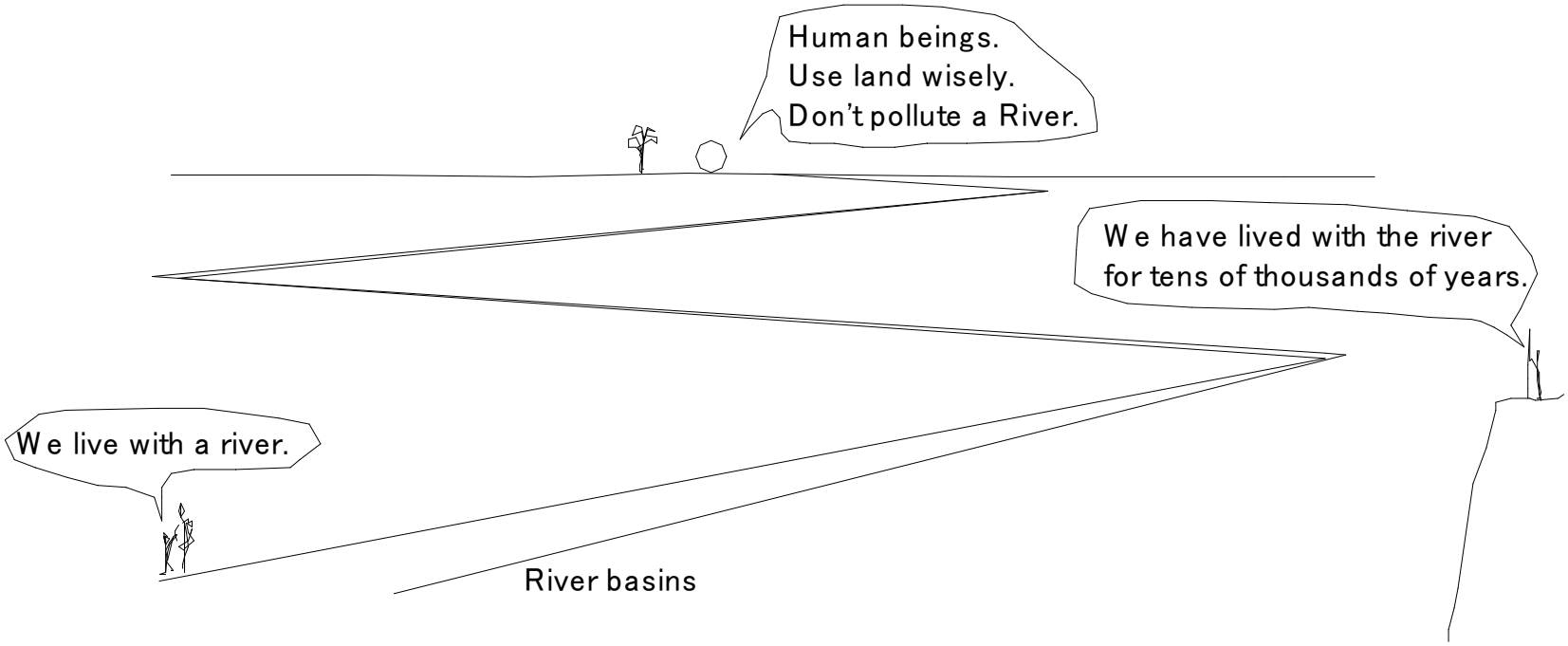
1.Farmers in search of new lands for cultivation
are driving wild animals from their traditional rangelands.

（ 736 ）Water resources

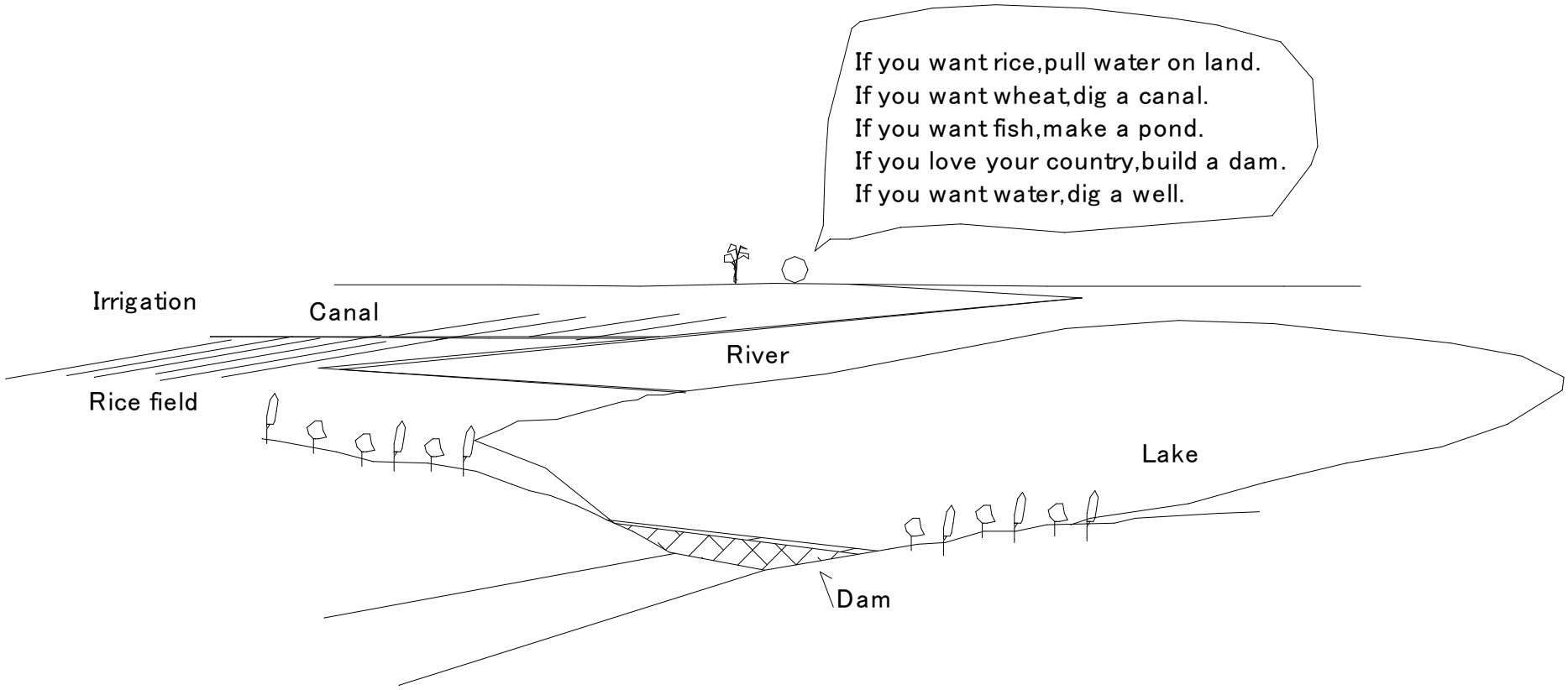


1.Even in the deserts,it is possible to provide a water supply.
2.Deep wells are being dug to exploit underground water reserves.
3.Dams are being built to regulate river flows.
4.Irrigation schemes are being constructed to bring new land areas under cultivation.
5.Their aim is to ensure development, produce more food,create new income.
6.But,pollution,waste and over-exploitation are increasingly putting the world's water resources at risk.

（ 737 ）River basins

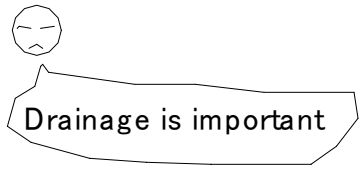


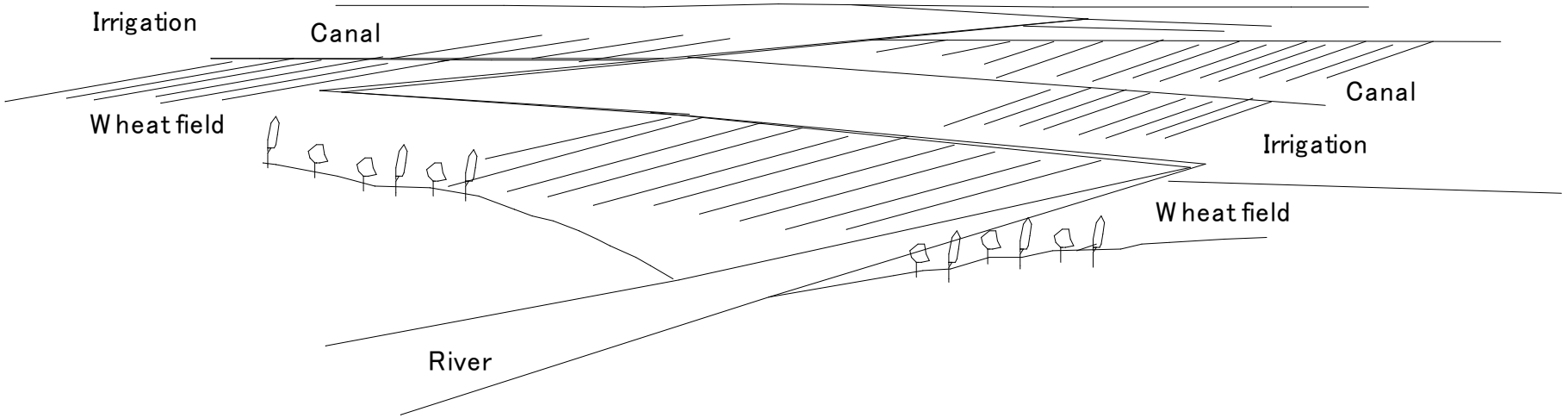
(738) Irrigation



（ 739 ）Salinisation

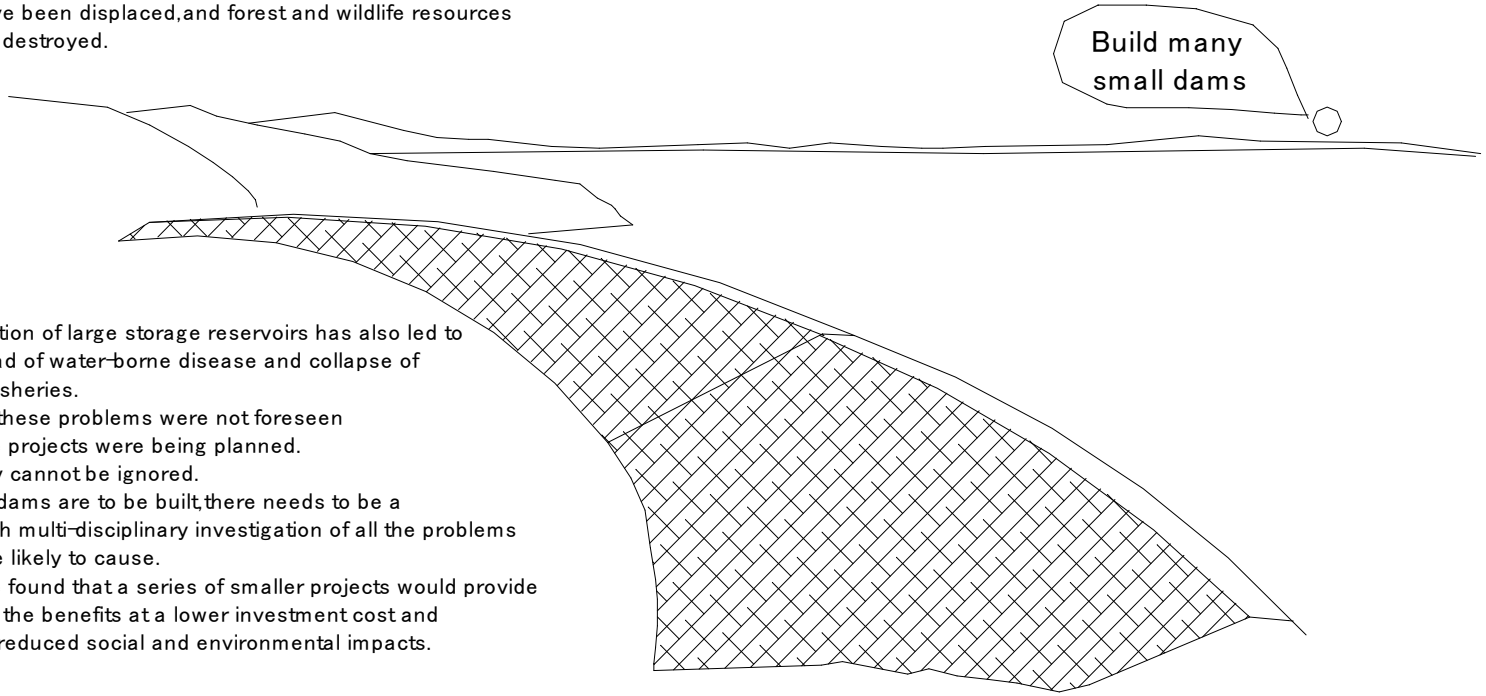
1. Salinisation also happens when poorly designed irrigation programmes are carried out.
2. Salinisation occurs when there is poor drainage and the salty water rises to the surface and evaporates.
3. This natural distillation process leaves the salt behind on the topsoil.
4. It cannot support agricultural crops.
5. The soils are no longer fit for cultivation.





（ 740 ）Large dams

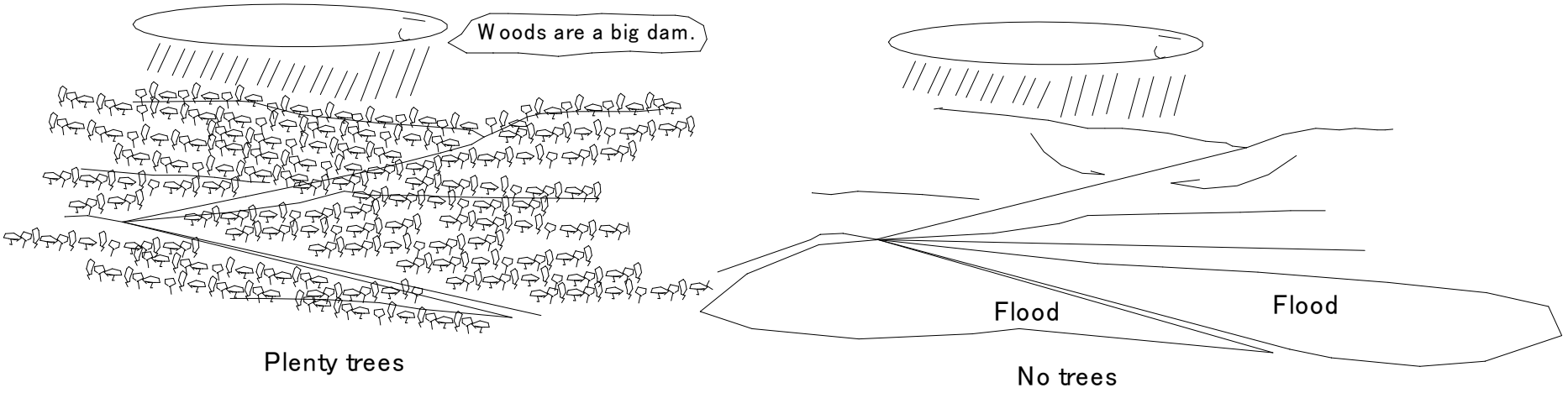
1.Large dams are used for power generation or irrigation during the dry seasons.
2.Large dams also permit better flood control in river basins.
3.Large dams sometimes cause major financial and environmental problems.
4.One needs the debts to build large dams.
5.Vast of land has been flooded for storage reservoirs.
6.People have been displaced,and forest and wildlife resources have been destroyed.



7.The creation of large storage reservoirs has also led to the spread of water-borne disease and collapse of coastal fisheries.
8.Many of these problems were not foreseen when the projects were being planned.
9.Now they cannot be ignored.
10.If large dams are to be built,there needs to be a thorough multi-disciplinary investigation of all the problems they are likely to cause.
11.It will be found that a series of smaller projects would provide most of the benefits at a lower investment cost and greatly reduced social and environmental impacts.

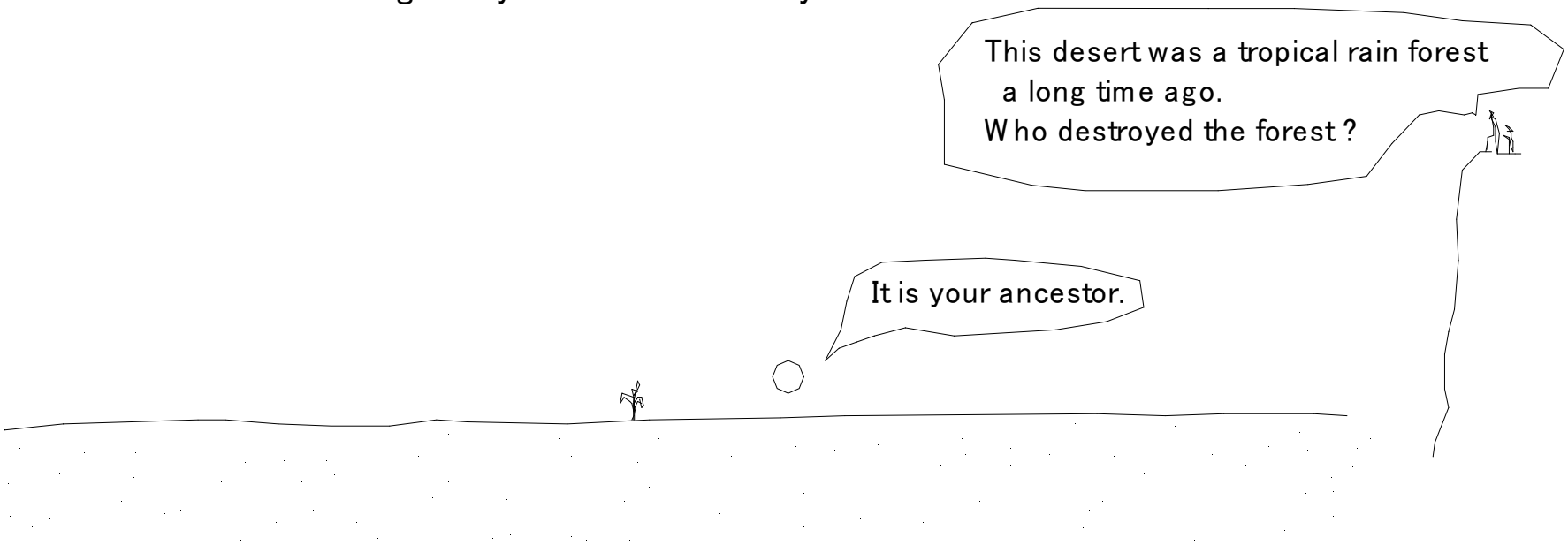
（ 741 ） Flood hazards

1.A flood threatens human beings' activities.
2.If the trees on mountain slopes are cut,Rainwater flows at once,and flood will occur.
3.It is the same as building a big dam as to plant trees on mountains.
4.Cutting trees on mountain slopes causes big losses due to erosion.

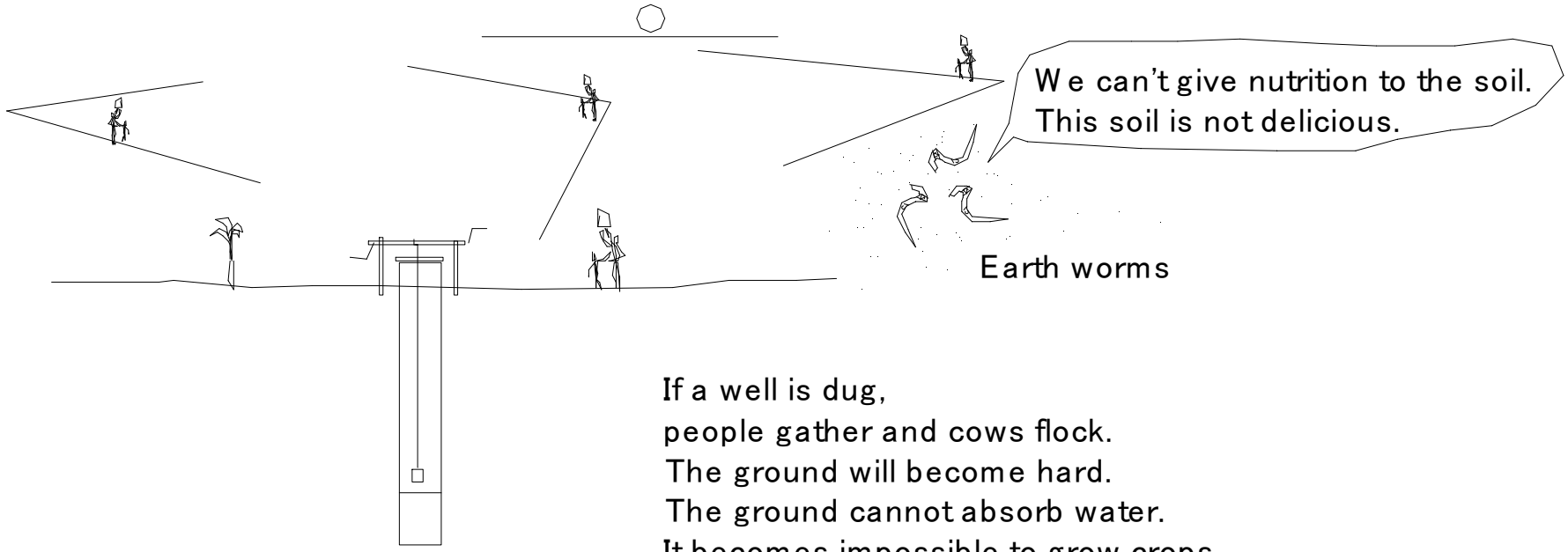


（ 742 ）Erosion and land degradation

Human beings may be natural destroyers.

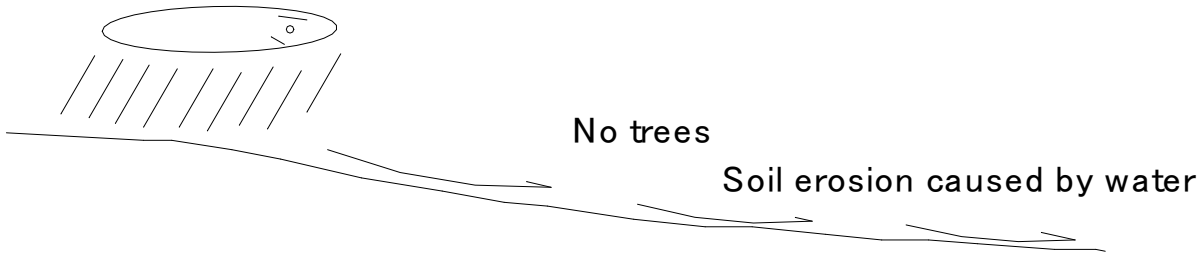


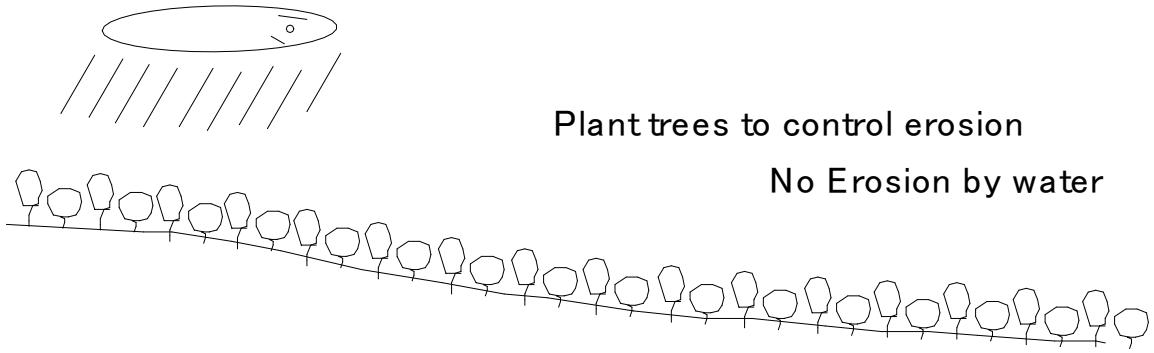
（ 743 ） Soil compaction



If a well is dug,
people gather and cows flock.
The ground will become hard.
The ground cannot absorb water.
It becomes impossible to grow crops.

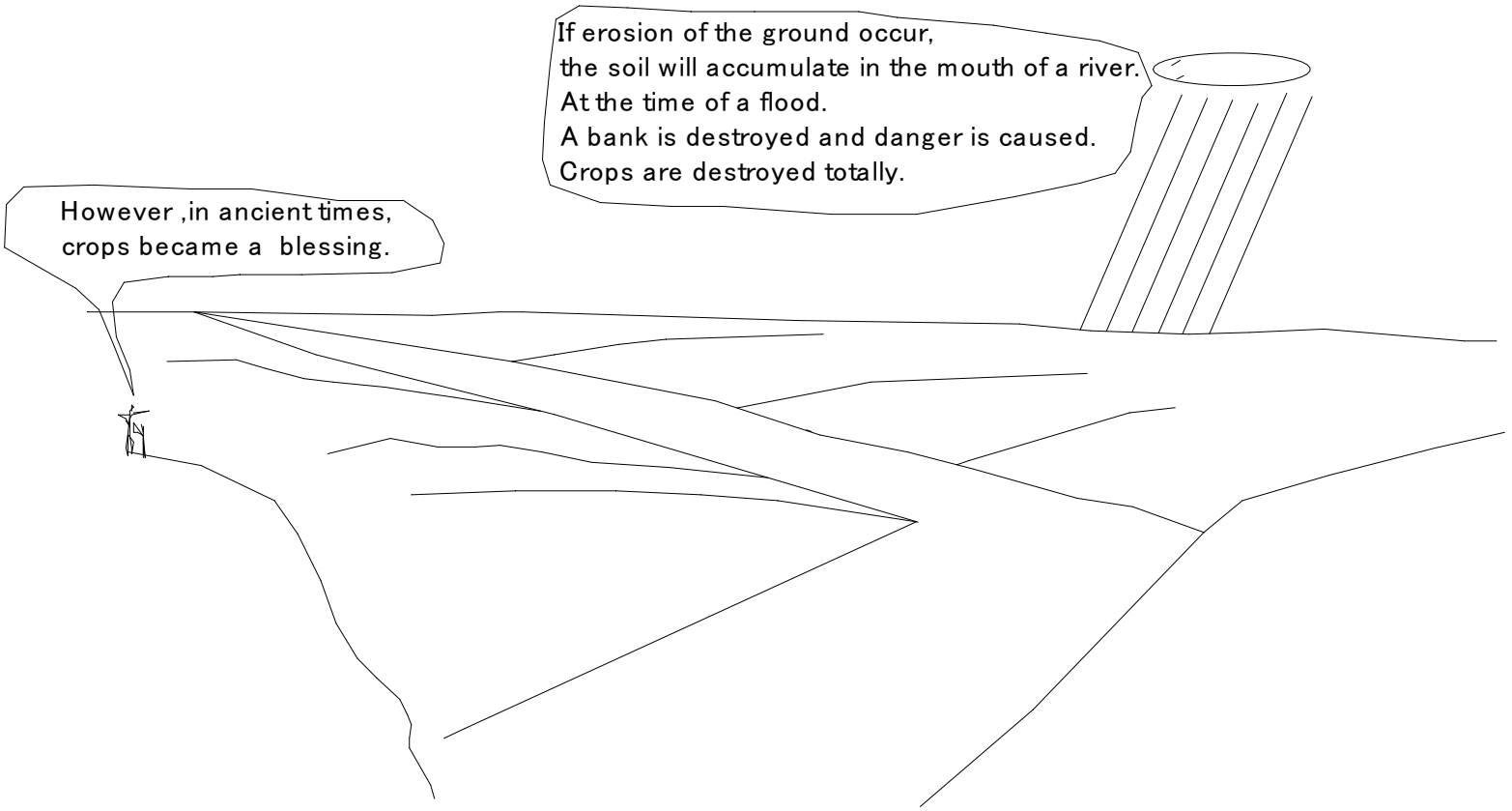
（ 744 ） Erosion by water



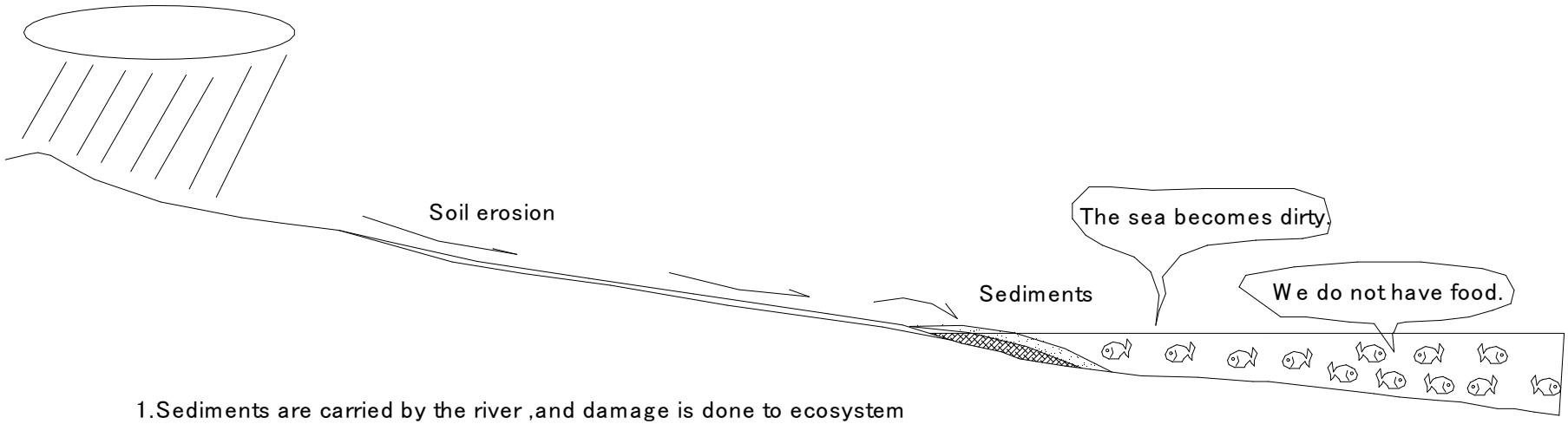


1.Water is nature’s most effective erosion agent.
2.The erosion has killed the surrounding vegetation
and is preventing new growth.

（ 745 ） Sediment deposition



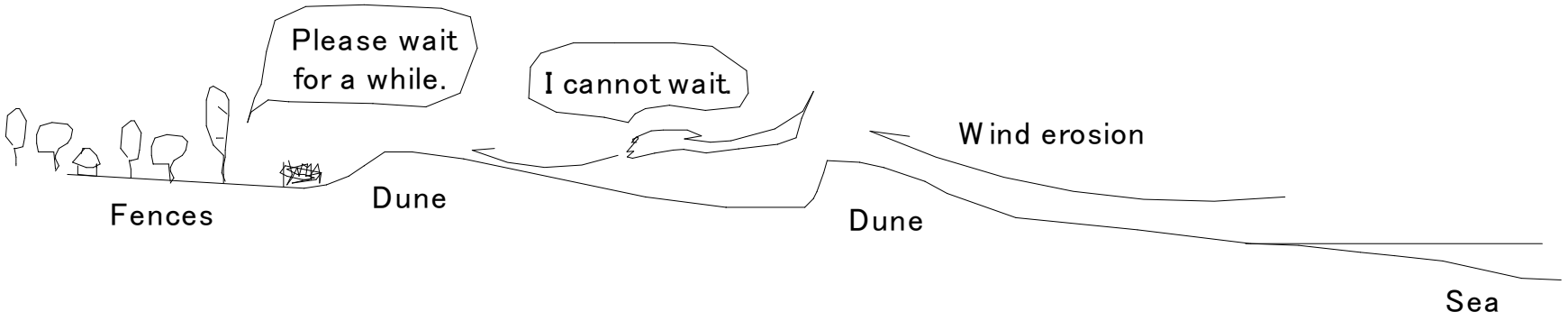
（ 746 ） Coastal pollution



1.Sediments are carried by the river ,and damage is done to ecosystem of the seashore.
2.Pollutants are also carried to the sea due to uncontrolled erosion and water pollution from industrial waste.

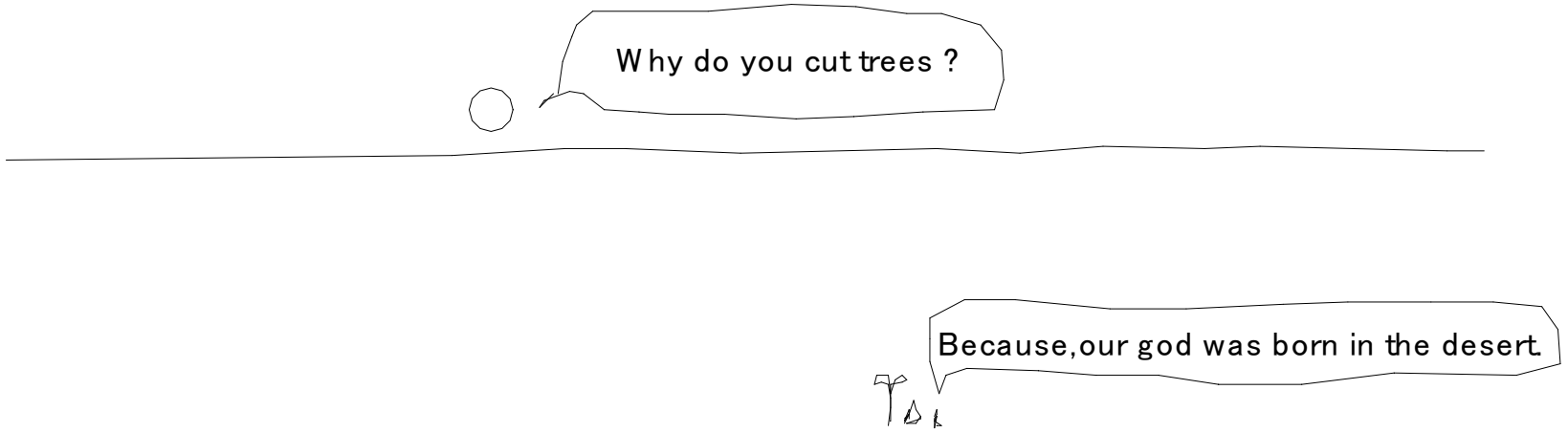
747 Dune invasion

(747) Dune invasion

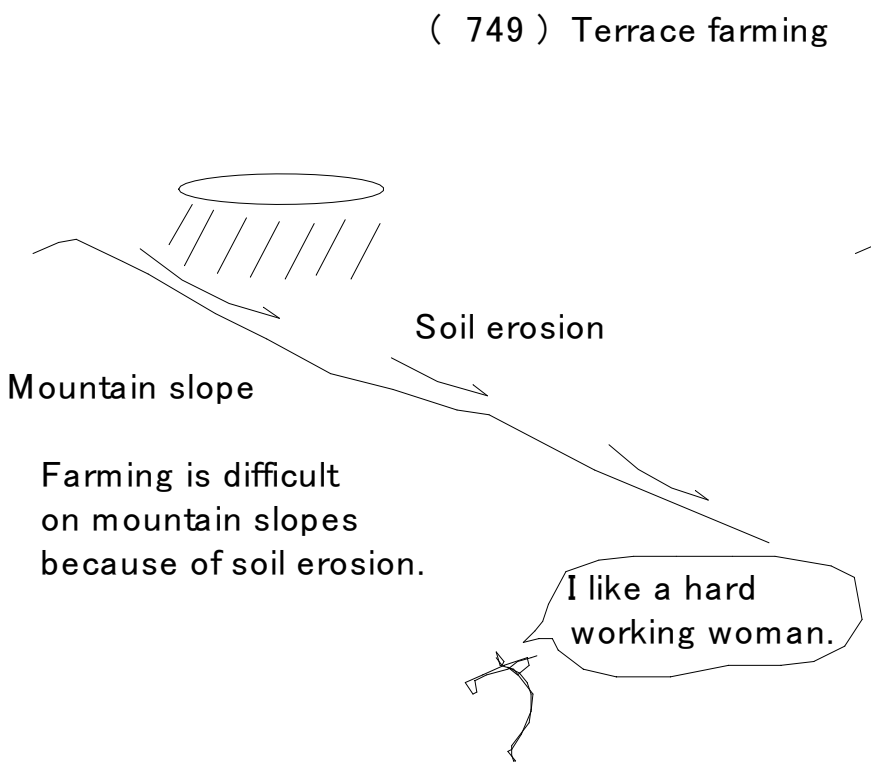


1.Dune is made by grazing animals or over-cultivation.
2.Many methods(To stabilise the dunes) have been tried,
  1.Planting with grass,shrubs and bushes.
  2.Using fences and plastic sheeting and spraying with heavy oils or latex.

(748) Desert region

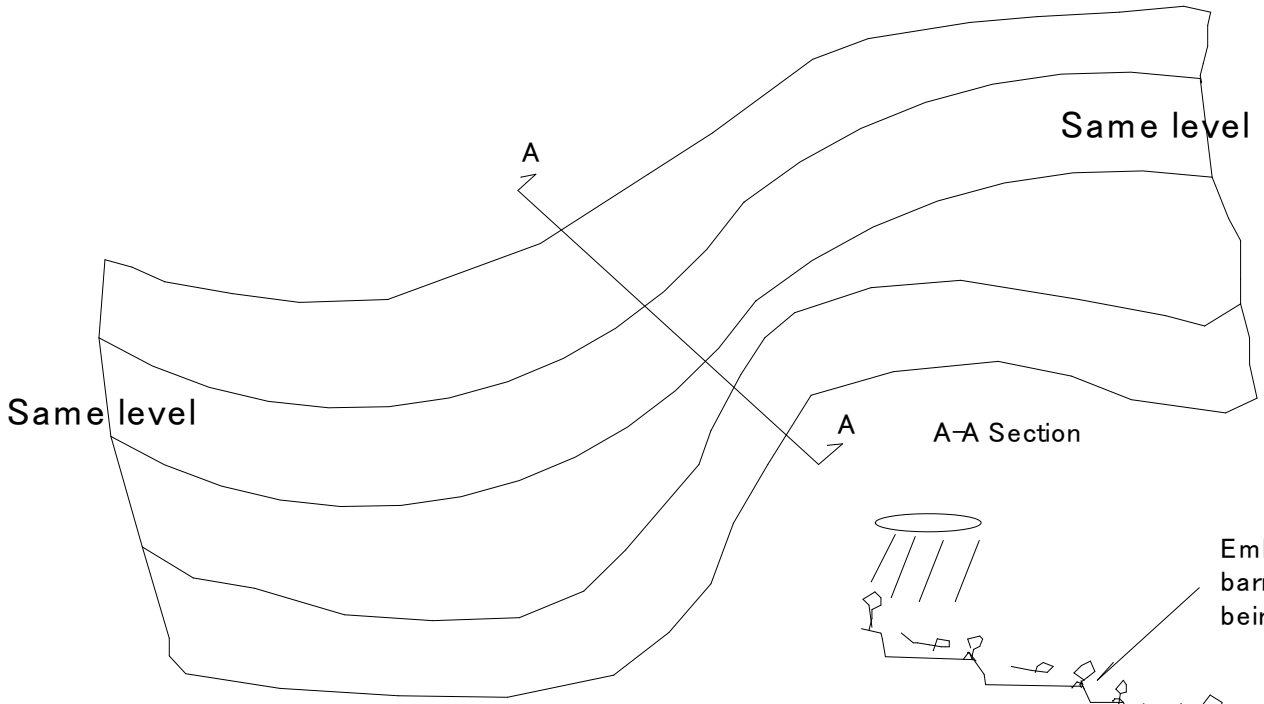


（ 749 ） Terrace farming



Labour and cooperation of a village
required for construction and maintenance.

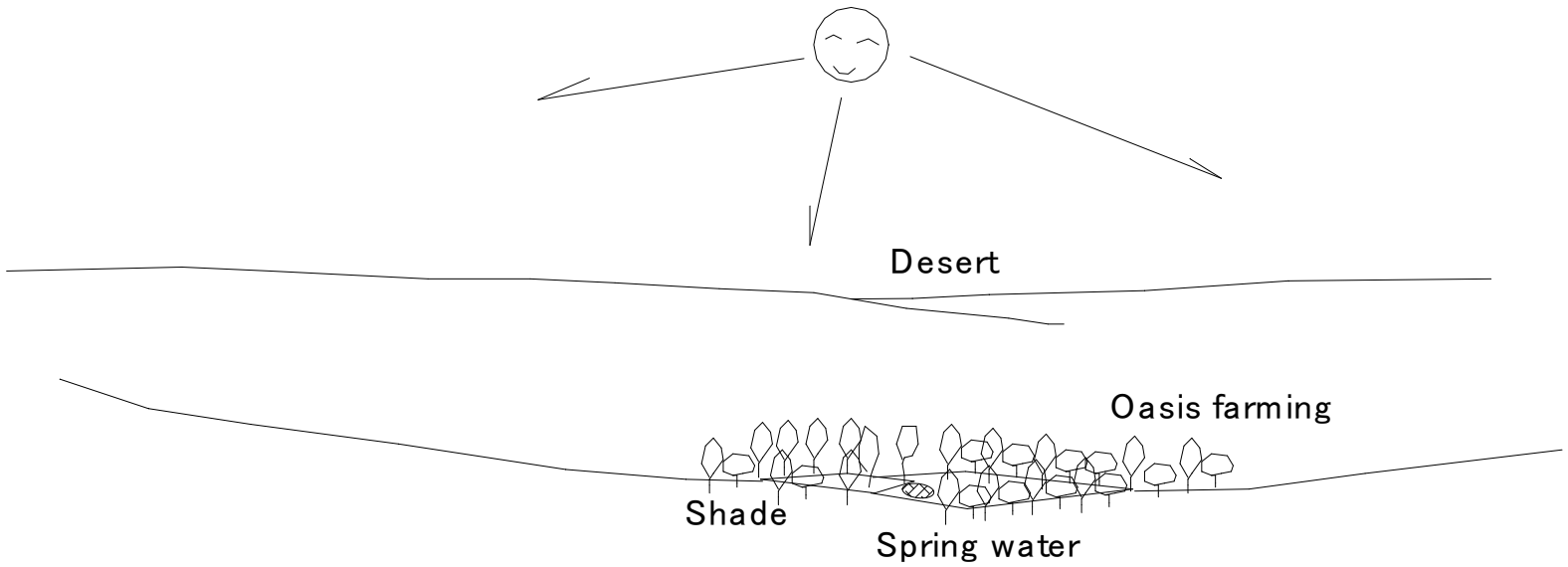
（ 750 ） Contour farming



Contour farming is one of the most effective ways of minimising the risk of water erosion.

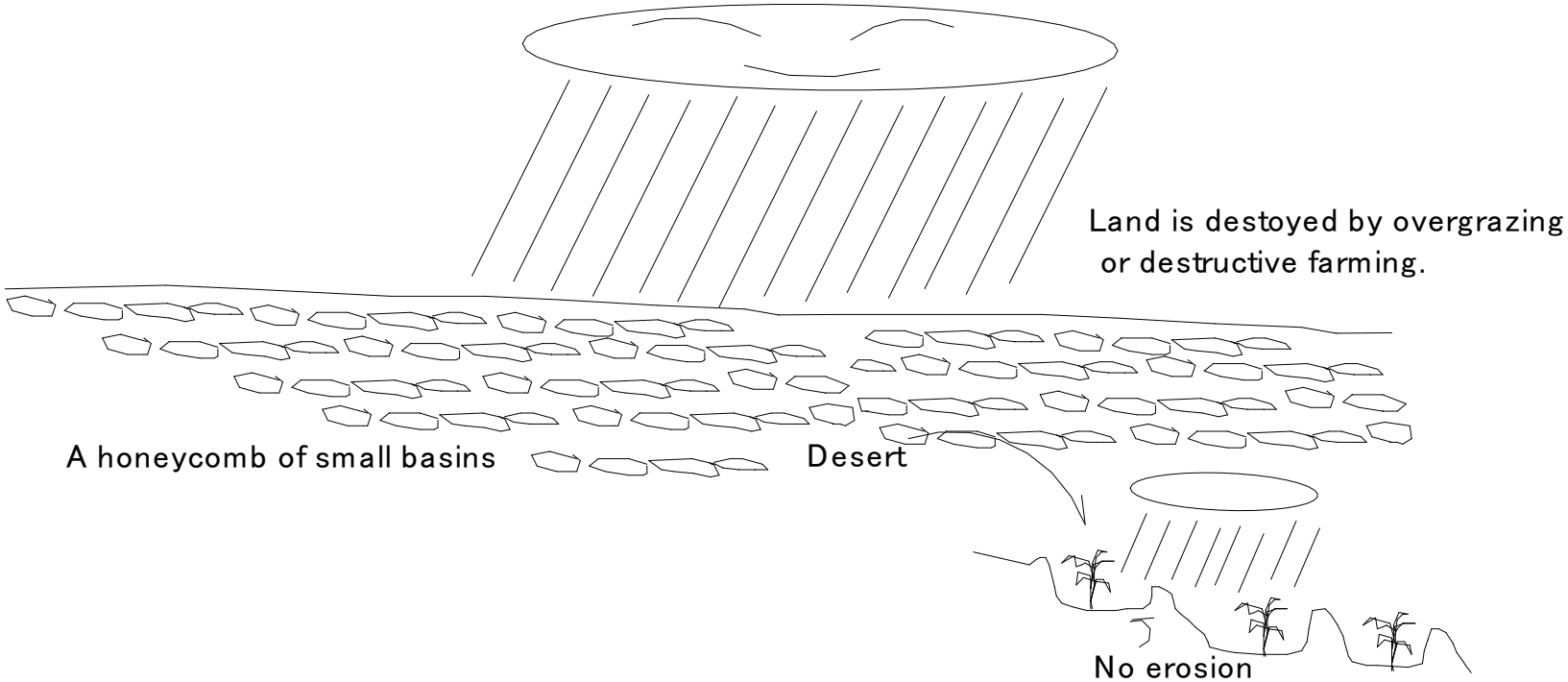
（ 751 ）Oasis farming

1.Fertile oasis can be created in the desert
by pumping or drawing water from groundwater.
2.The trees are also an essential element in oasis farming.



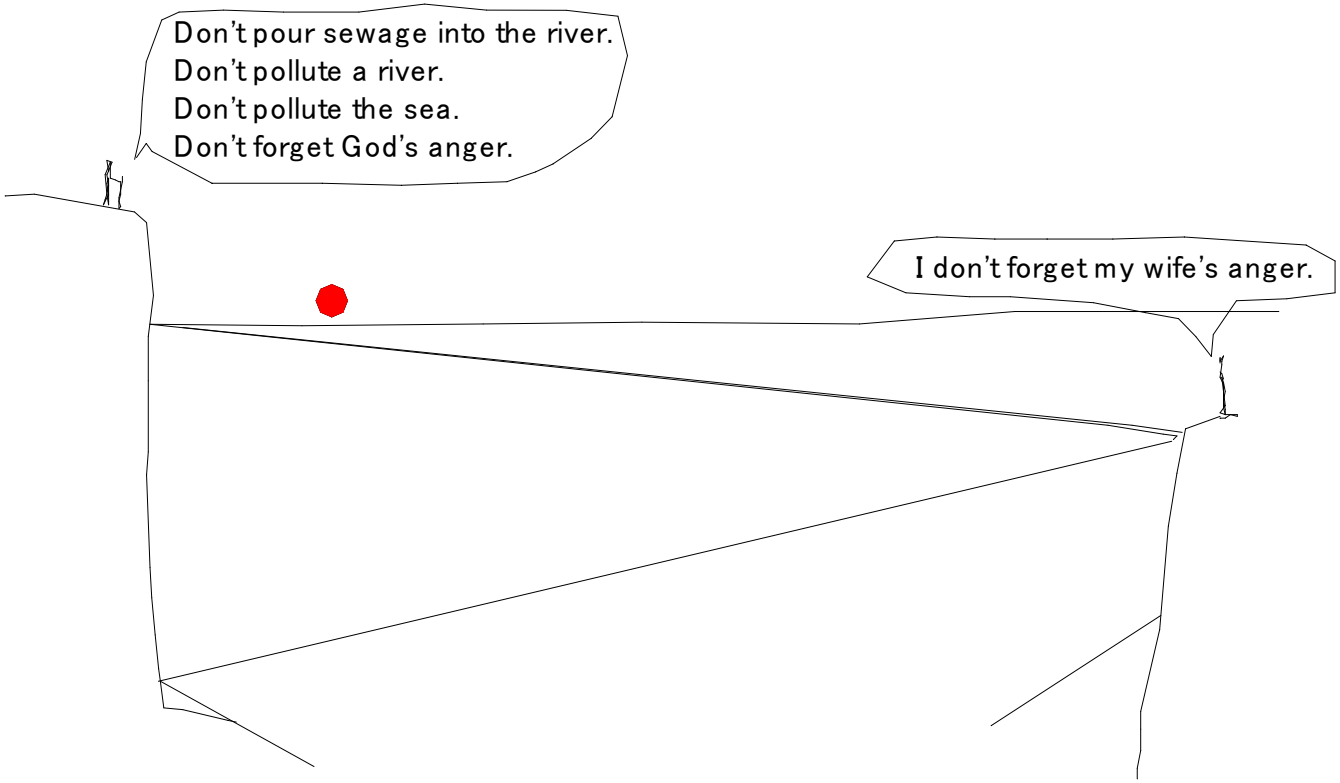
（ 752 ） Dune stabilization

1.A honeycomb of small basins has been constructed to protect erosion.



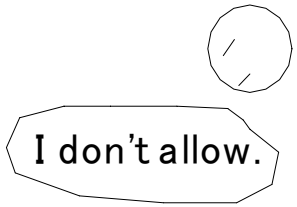
（ 753 ） Pollution and waste

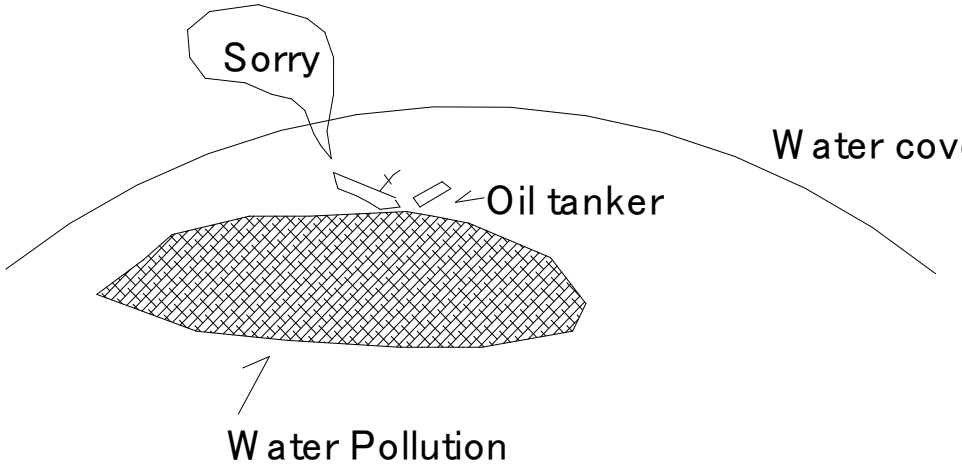
1.Pollution is a consequence of industry and urbanisation.



（ 754 ） water Pollution

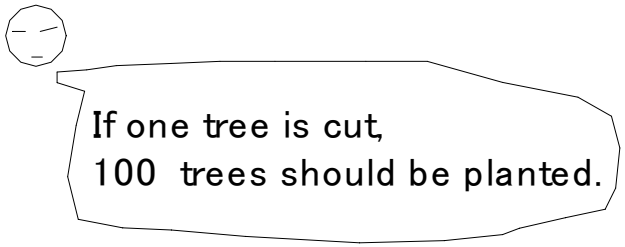
1.Non-stop polluting ground water.
2.Fish stocks and food are put at risk.
3.Many marine organisms and plankton are damaged by pollutants.

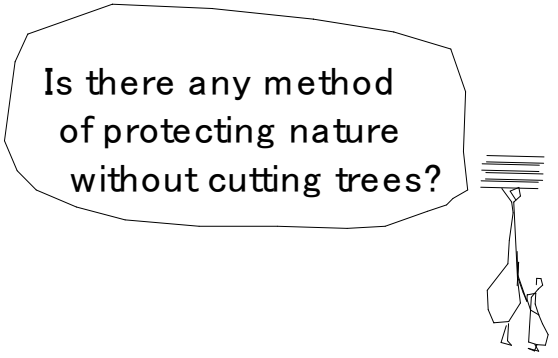




（ 755 ） Energy consumption

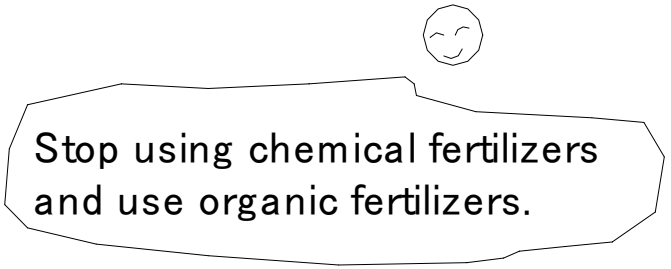
1.Developing world is going to need
these fuels(oil,coal and natural gas)
2.Third world families depend on fuel wood.

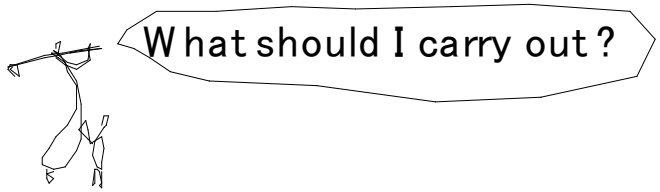




（ 756 ） Pesticides and fertilizers

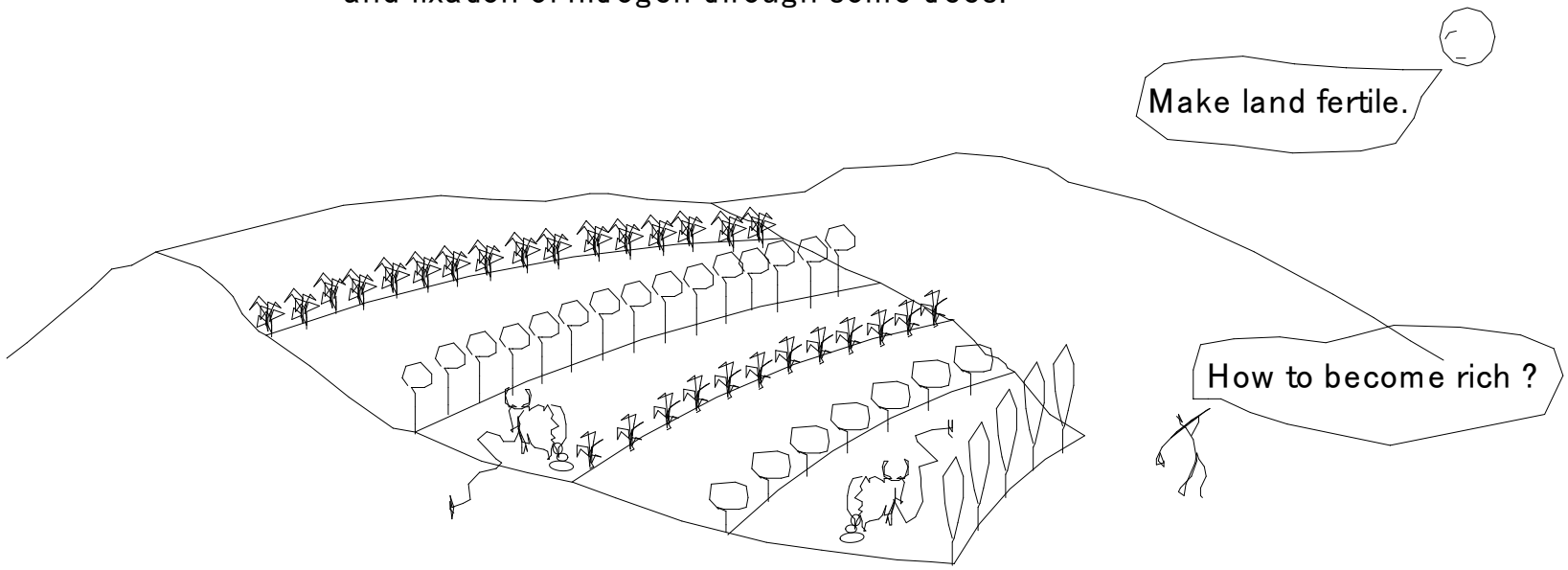
1. Without the use of fertilisers and pesticides,
   agricultural production would collapse.
2. But there are dangers from chemical fertilisers.





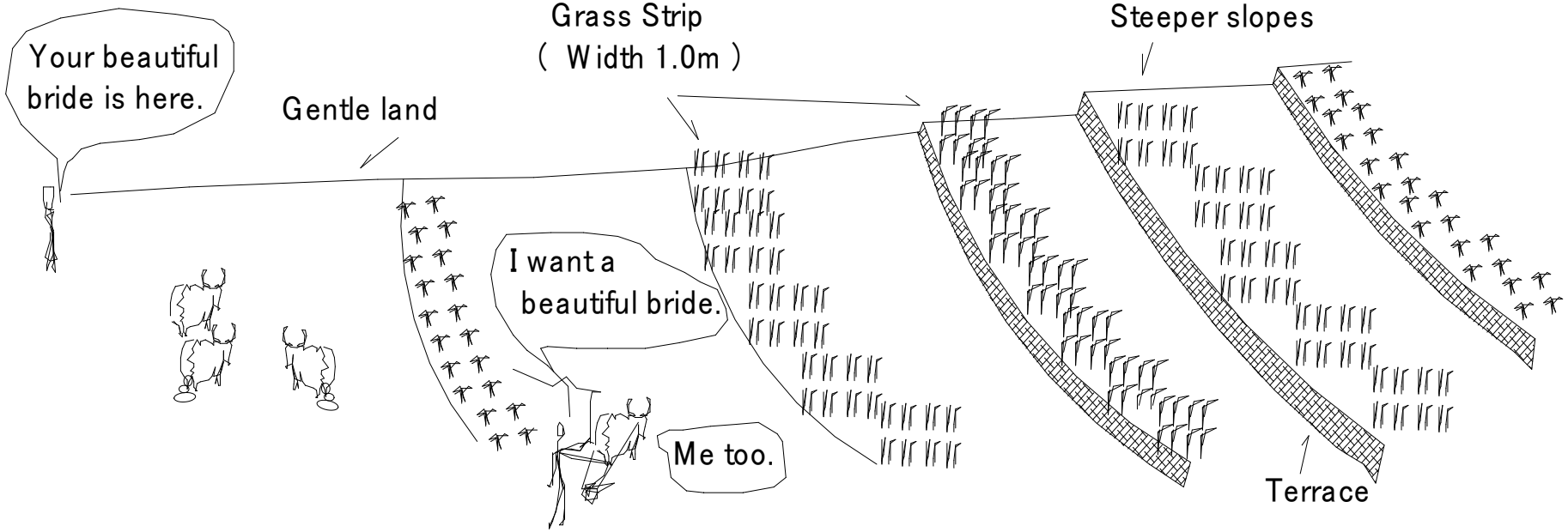
（ 757 ）Alley Cropping

1.Alley cropping is shown here on a steep slope.
2.Rows of trees and hedges alternate with strips of grassland or cultivated land.
3.Controlled grazing with cattle is possible between the rows.
4.Crops can be grown for sometime until the soil is left fallow to improve fertility,supported by organic material from tree leaves and fixation of nitrogen through some trees.



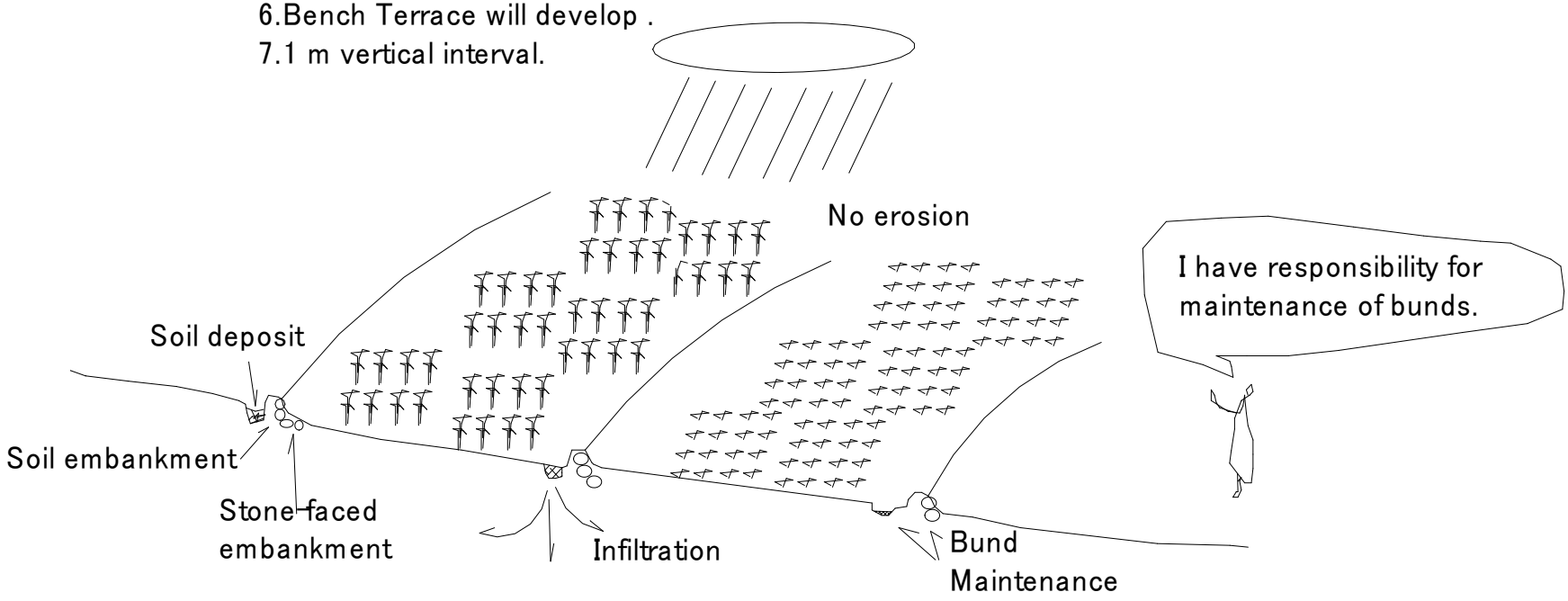
（ 758 ） Grass Strip

1.Grass strips are used on the gentle cultivated land to the left.
2.On the steeper slopes to the right,terrace development is needed.
3.The farmer automatically ploughs parallel to the strips.(a measure which reduces erosion further)
4.The grass strip has already developed into a small terrace.



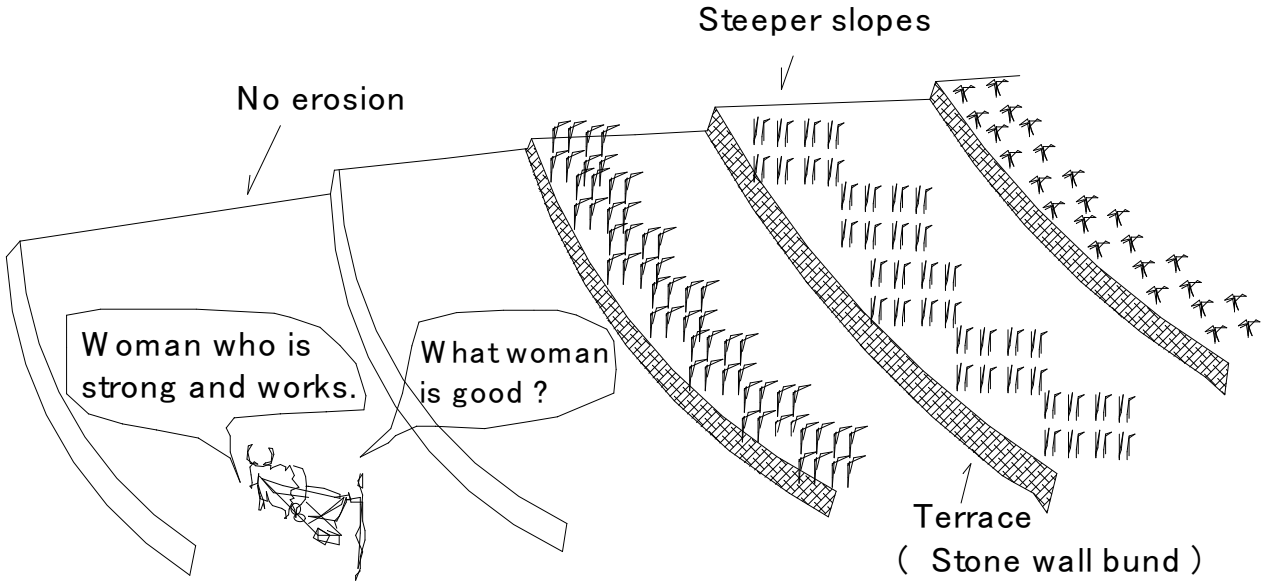
（ 759 ）Level Bund

1.The level bund in front of the slope follows a horizontal line.
2.Level bunds are walls to retain all runoff between two bunds.
3.Overflow should never occur.
4.Soil eroded between two bunds is deposited in the basin behind the lower bund.
5.Whenever the basin is full of sediment,the bund must be raised.
6.Bench Terrace will develop .
7.1 m vertical interval.



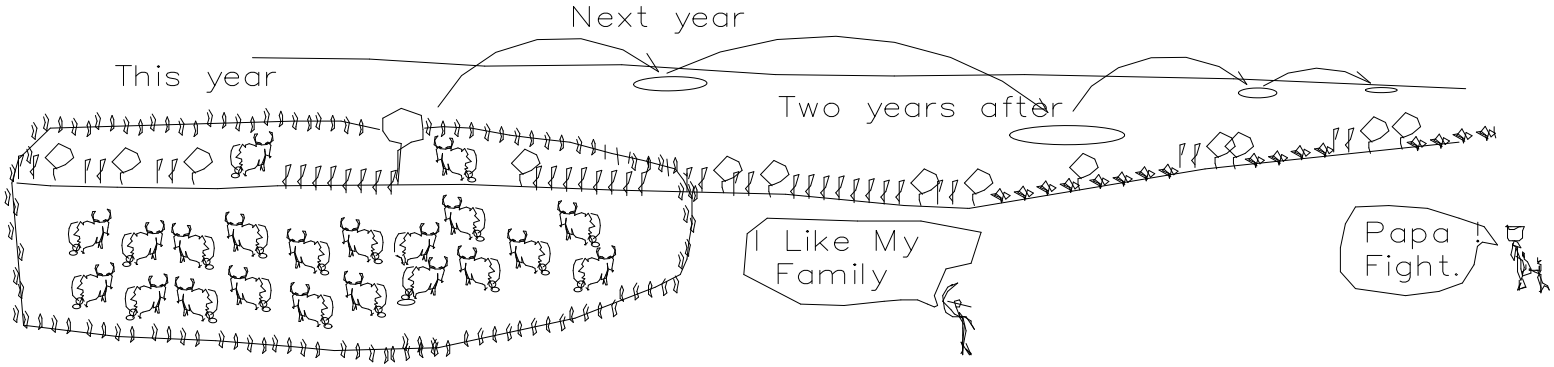
（ 760 ）Bench Terrace

1.Levelling the cultivated land will greatly reduce soil erosion.
2.The cultivated land will be almost level when terrace is developed.



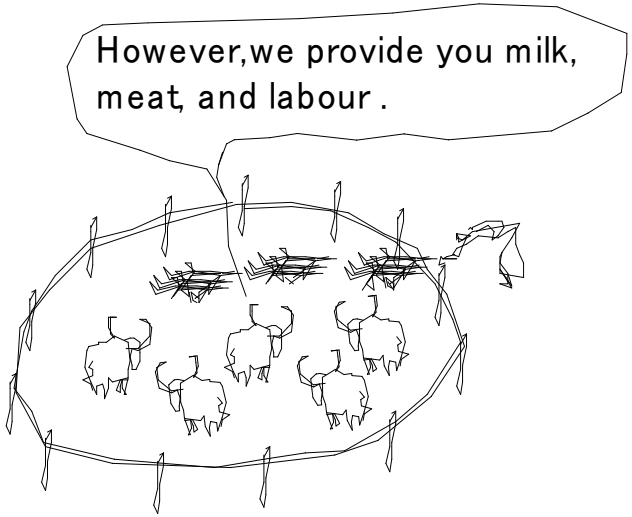
(761)Controlled Grazing

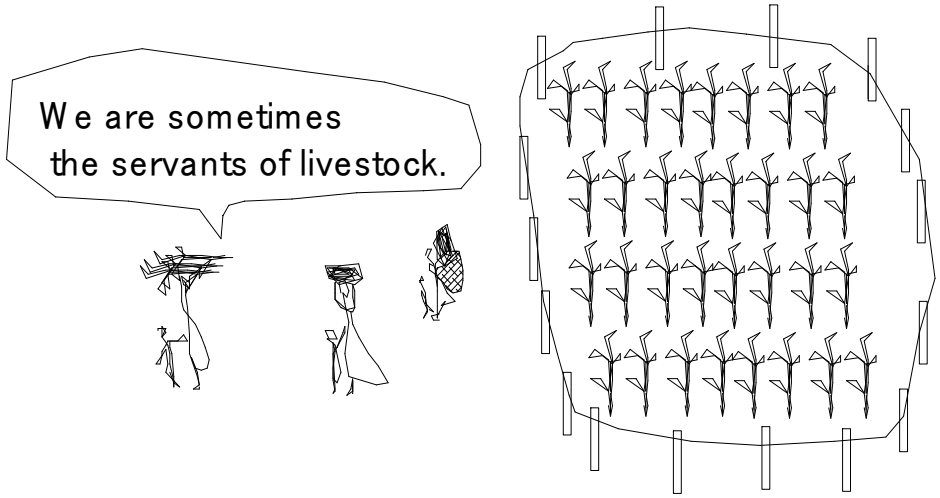
1. Grassland utilisation with livestock without degradation of vegetation and soil occurs.
2. Controlled grazing can be continuous or in rotation.
3. Controlled grazing helps to prevent degradation of grassland, conserve soil,water and vegetation and provide for better animal feed.
4. Herders prevent livestock from entering the portion of grassland.
5. The animals are allowed to move freely in the grassland.
6. When all grass is eaten up,the herd shifts to other grassland.
7. Supervision and training of herdsmen are needed to keep the rules of rotational grazing.
8. Live—fences are the responsibility of landlords who have to protect the cultivated land from grazing.



(762) Cut and Carry

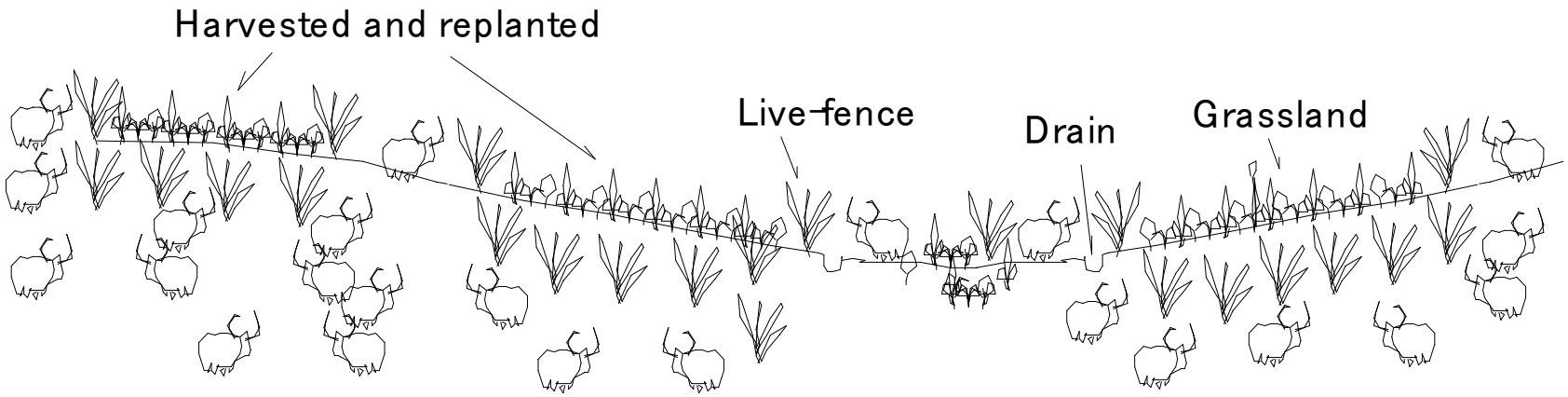
1.Cut and carry is a system of utilising forage for stall feeding.
2.Livestock is excluded from grazing.
3.Cut and carry is a conservation -based management technique to preserve soil and vegetation.
4.It also provides fodder for livestock,and firewood and small fuelwood.
5.Cut and carry is applied only after the grass has recovered.
6.It is advisable to cut grass once during rainy season.
7.Cut and carry allows an excellent recovery of vegetation and maximum soil protection.
8.Water is retained during storms and runoff is reduced.
9.Natural vegetation grows.
10.However,animal dropping is reduced with negative effects on soil fertility due to absence.
11.Cut and carry must be organised by the peasant association for communal land.
12.The peasant association provides for management of cut and carry.
13.Frequency of harvesting depends on the weather conditions.
14.Live-fences have to be developed by the land holders.





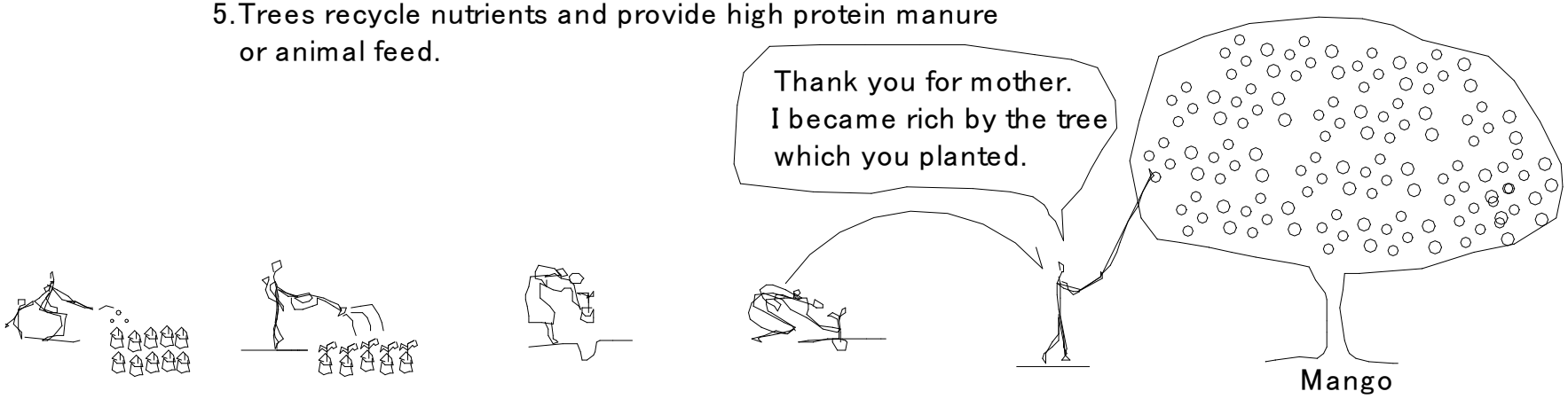
(763) Grassland Improvement

1. Grassland improvement includes all activities aimed at improving the productivity of grassland whereby runoff and soil erosion are reduced.
2. Grassland improvement increases the productivity of the area for fodder.
3. It reduces runoff and soil erosion through a better cover of the ground.
4. Removal of shrubs that prevent good growth of vegetation.



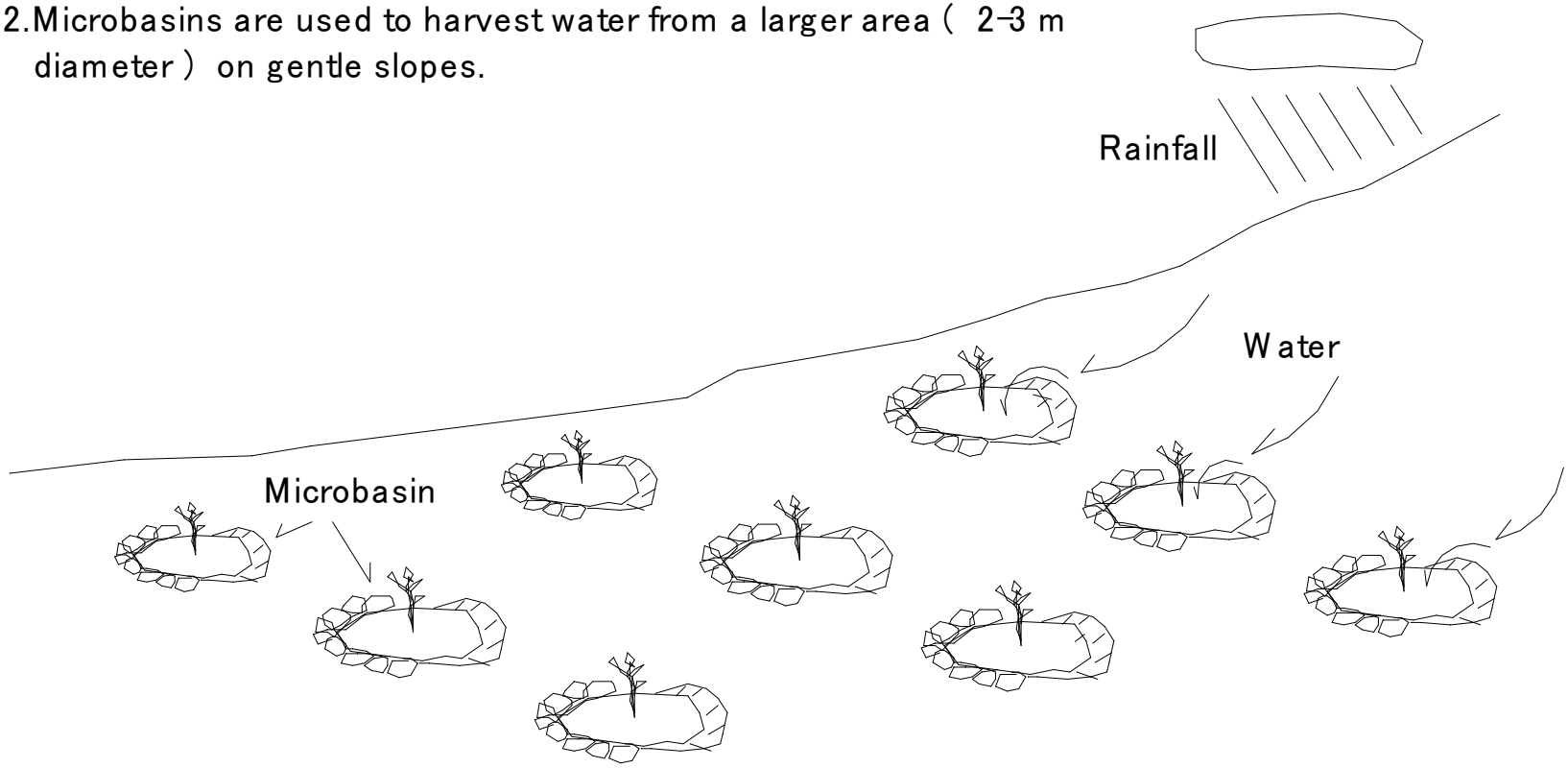
（ 764 ） Soil Conservation（ Tree Planting ）（ 1 ）

1. Tree planting for conservation is to improve the vegetative cover of the ground.
2. Tree planting reduces runoff and soil erosion and produces wood.
3. Tree roots stabilize the soil and tree protects the ground from raindrop impact.
4. Trees improve infiltration of moisture in the soil provide mulch and organic matter .
5. Trees recycle nutrients and provide high protein manure or animal feed.



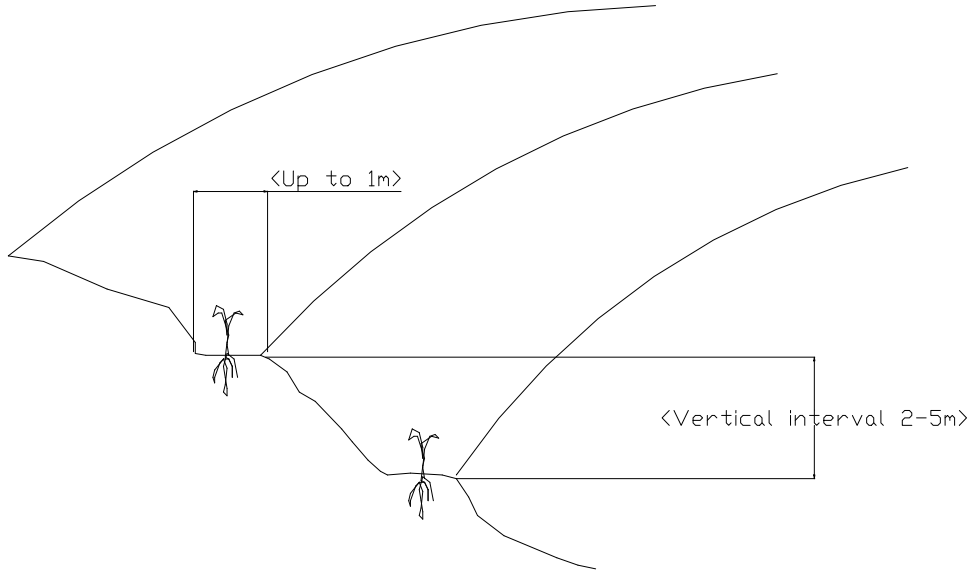
（ 765 ） Soil Conservation（ Microbasin ）（ 2 ）

1.Microbasins are used for tree planting in dry areas.
2.Microbasins are used to harvest water from a larger area（ 2-3 m diameter ） on gentle slopes.

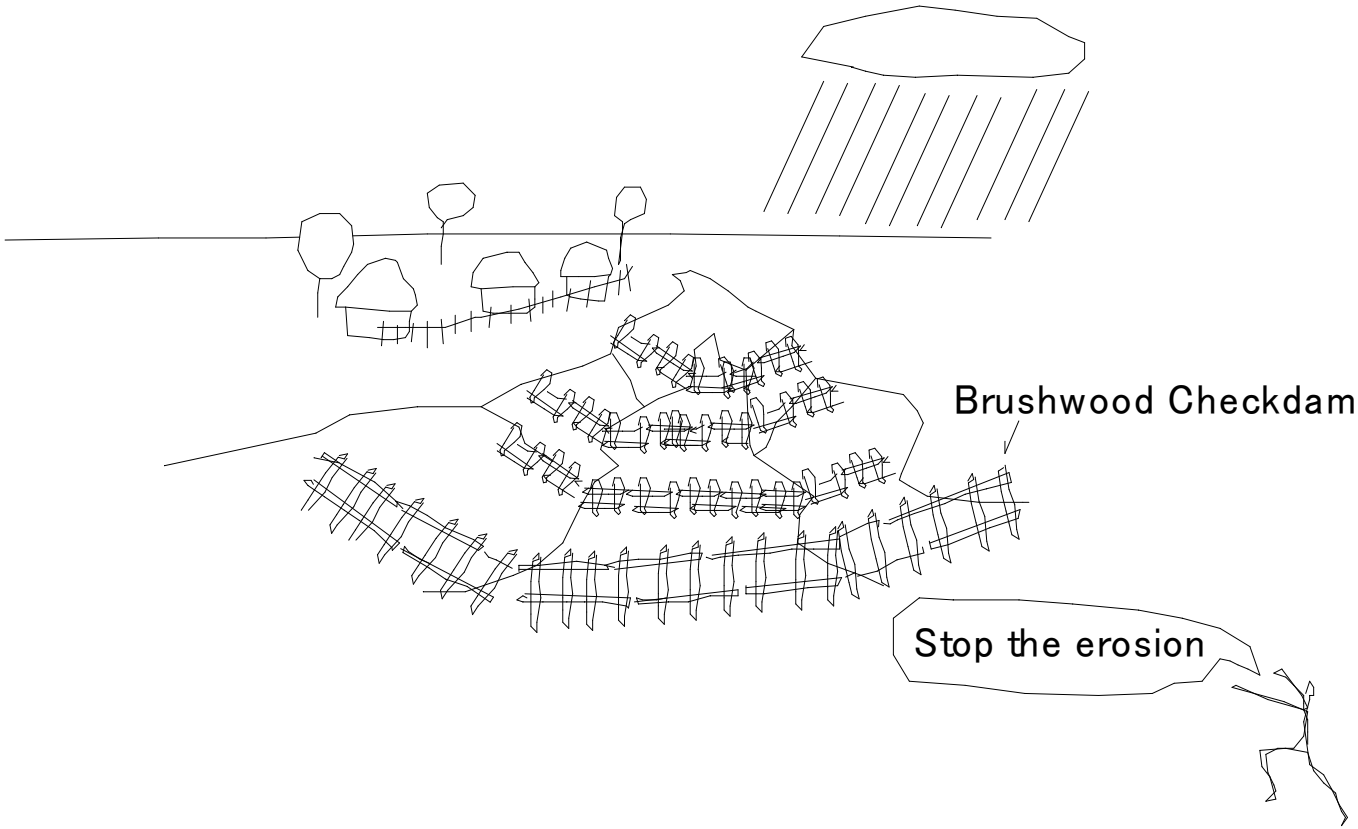


(766) Soil Conservation (Hillside Terrace) (3)

1.Hillside terraces are mainly used to prevent damage by floods on steep slopes and below.
2.Hillside terraces help to retain runoff and sediments on steep sloping land.

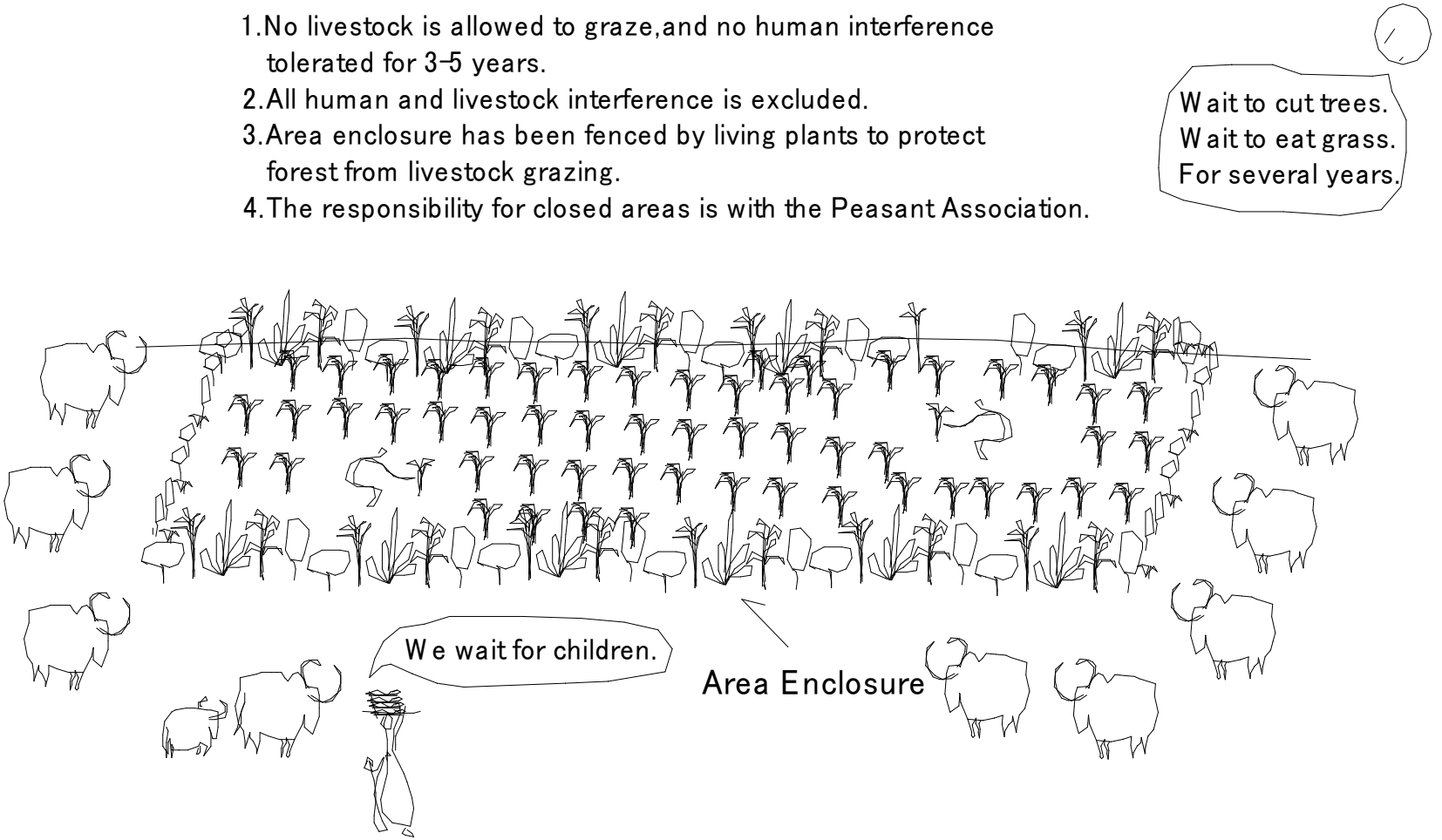


（ 767 ）Brushwood Checkdam



(768) Soil Conservation (Area Closure) (4)

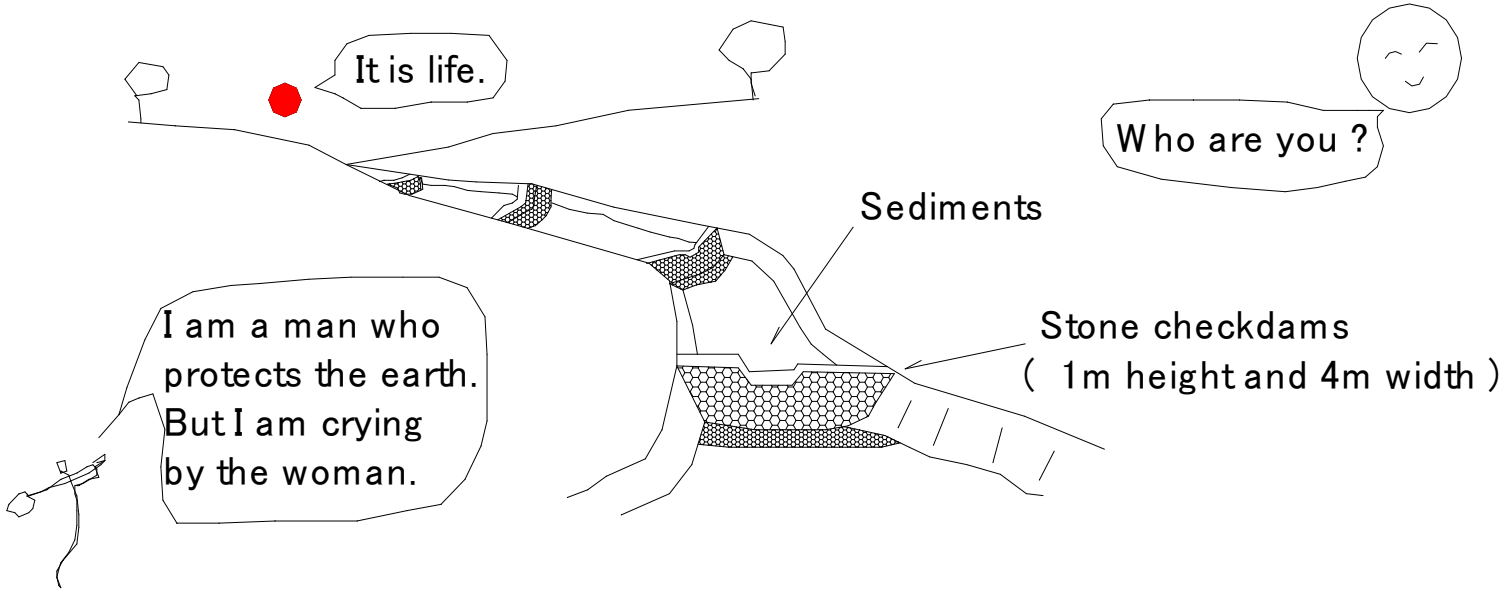
1. No livestock is allowed to graze,and no human interference tolerated for 3-5 years.
2. All human and livestock interference is excluded.
3. Area enclosure has been fenced by living plants to protect forest from livestock grazing.
4. The responsibility for closed areas is with the Peasant Association.



（ 769 ） Soil Conservation（ Revegetation ）（ 5 ）

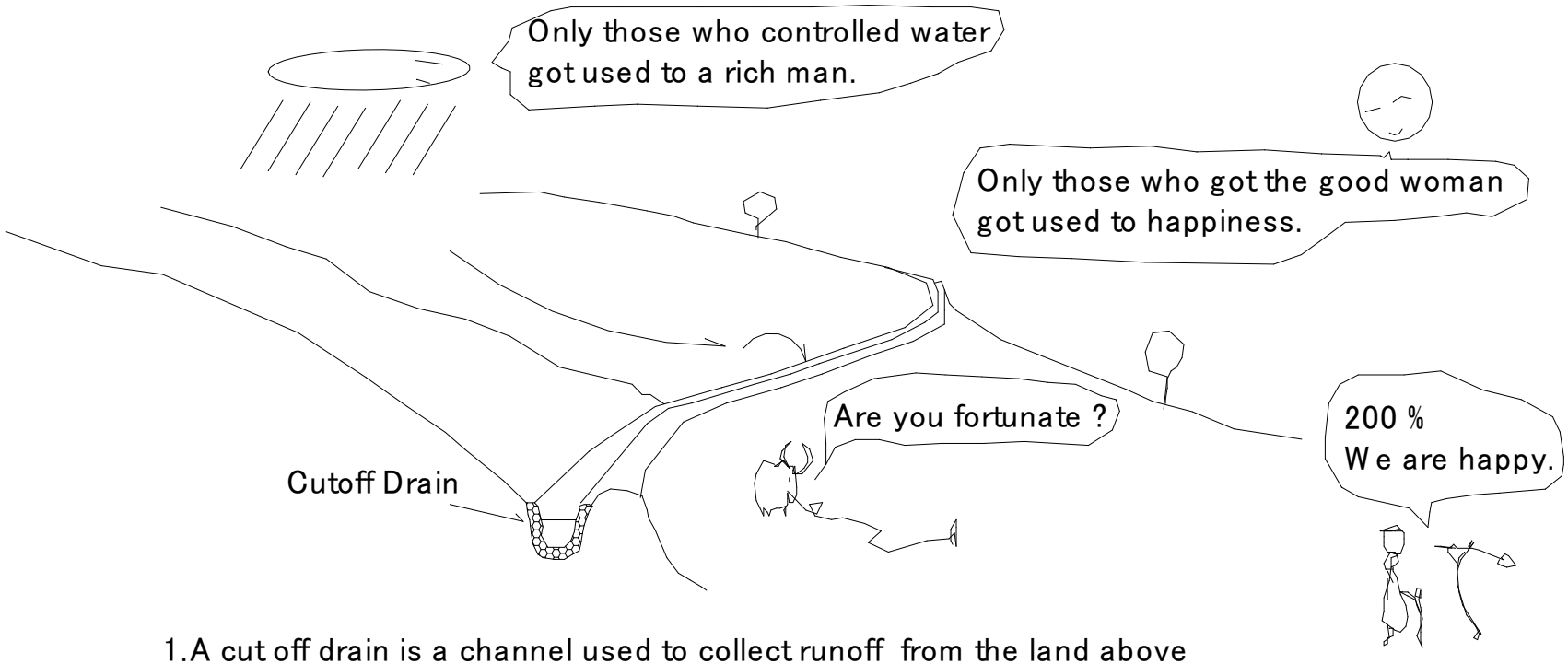
1.Revegetation is the most effective way for soil conservation.
2.Grass is able to reduce soil erosion .
3.Cattle are excluded from grazing all year.

(770) Soil Conservation (Checkdam) (6)



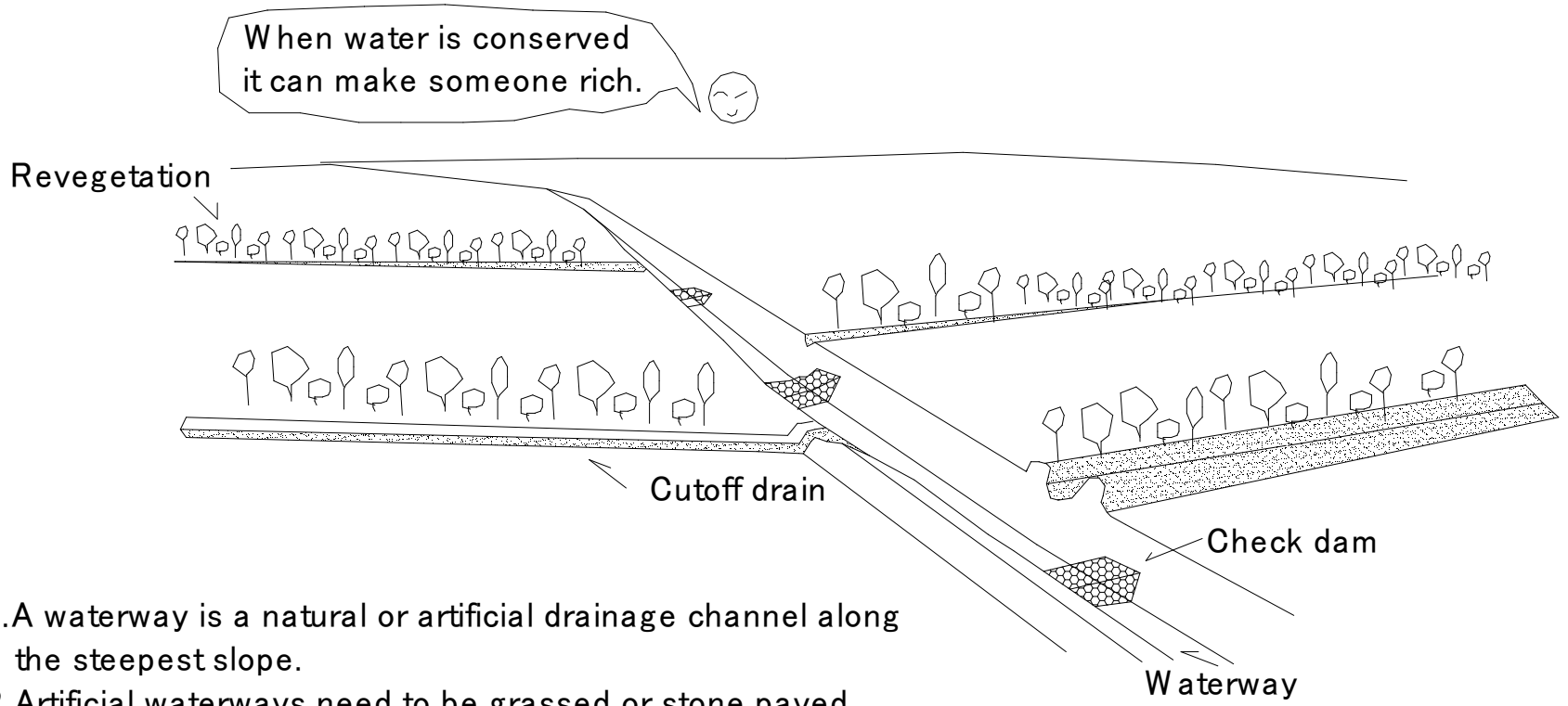
1. A checkdam is an obstruction wall across the bottom of a gully or a small river.
2. Checkdams prevent the widening and deeping of a gully.
3. Sediments are deposited behind the checkdam.
4. Stone checkdams of about 1m height and 4m width.

（ 771 ） Soil Conservation（ Cutoff Drain ）（ 7 ）



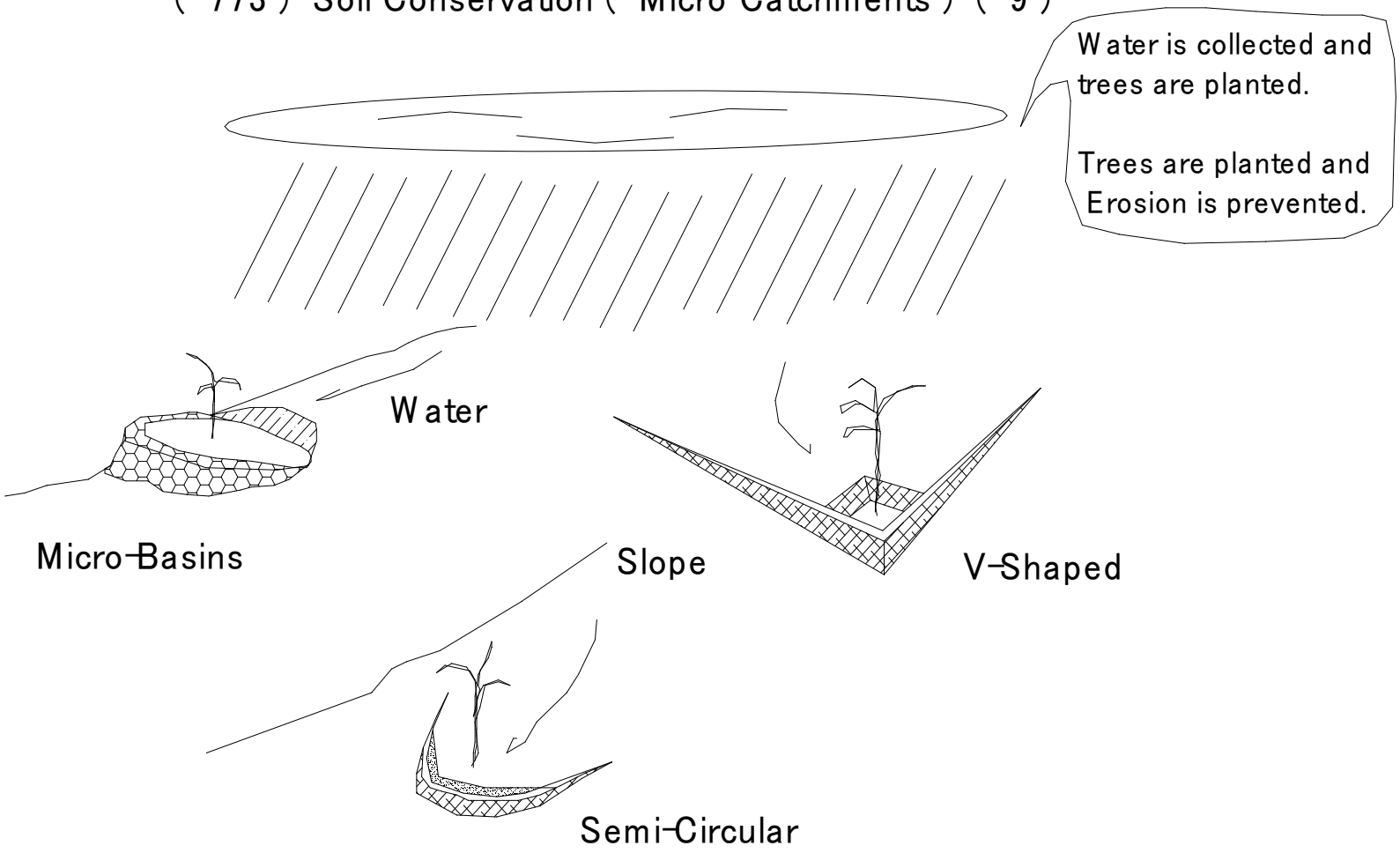
1. A cut off drain is a channel used to collect runoff from the land above and divert it safely to a waterway or river.
2. Cutoff drains protect cultivated land from upslope forest land or grassland.
3. Cutoff drains protect downslope land from runoff and erosion.
4. Controlled grazing is used with tied cattle.

（ 772 ） Soil Conservation（ Waterway ）（ 8 ）

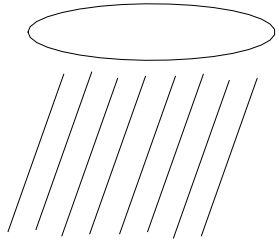


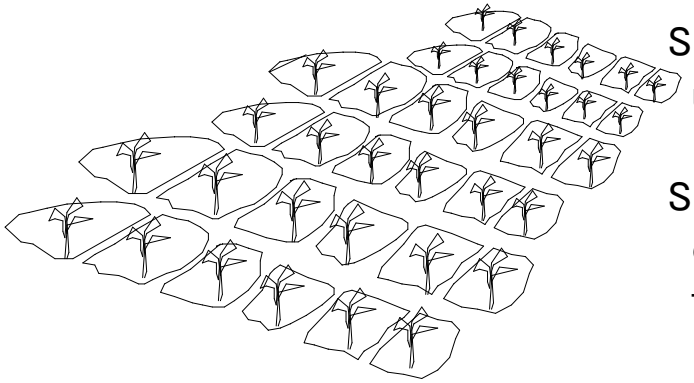
1.A waterway is a natural or artificial drainage channel along the steepest slope.
2.Artificial waterways need to be grassed or stone paved.
3.Waterways enable runoff water which is not stored behind bunds.

(773) Soil Conservation (Micro-Catchments) (9)



(774) Soil Conservation (Micro-Catchments) (10)

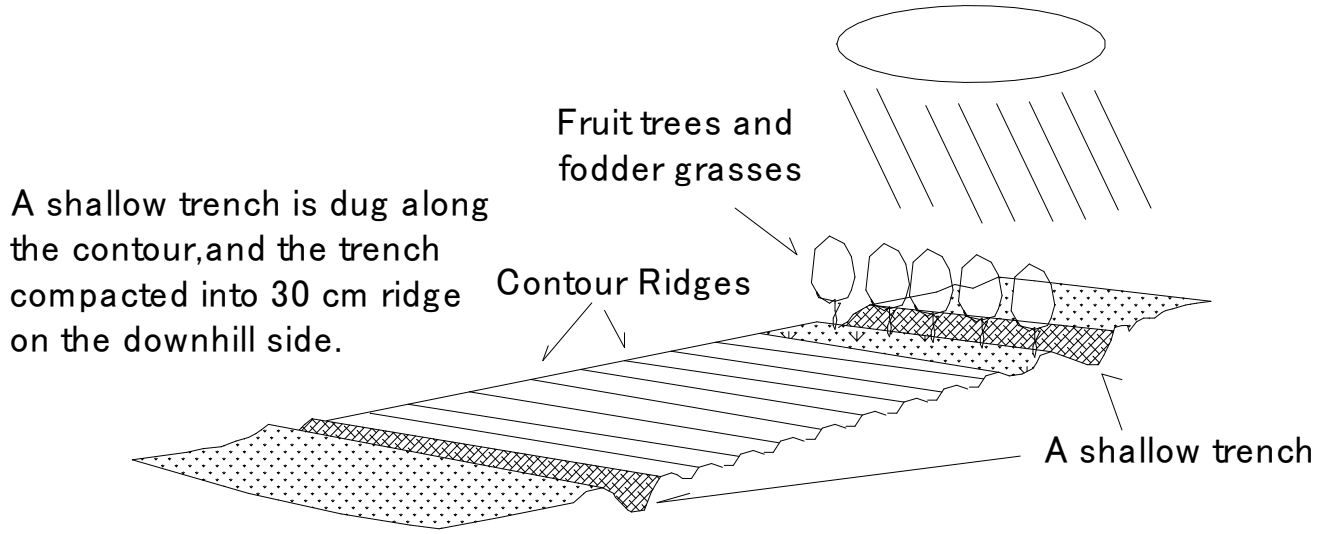




Small triangular microcatchments used to re-afforest a hillside.

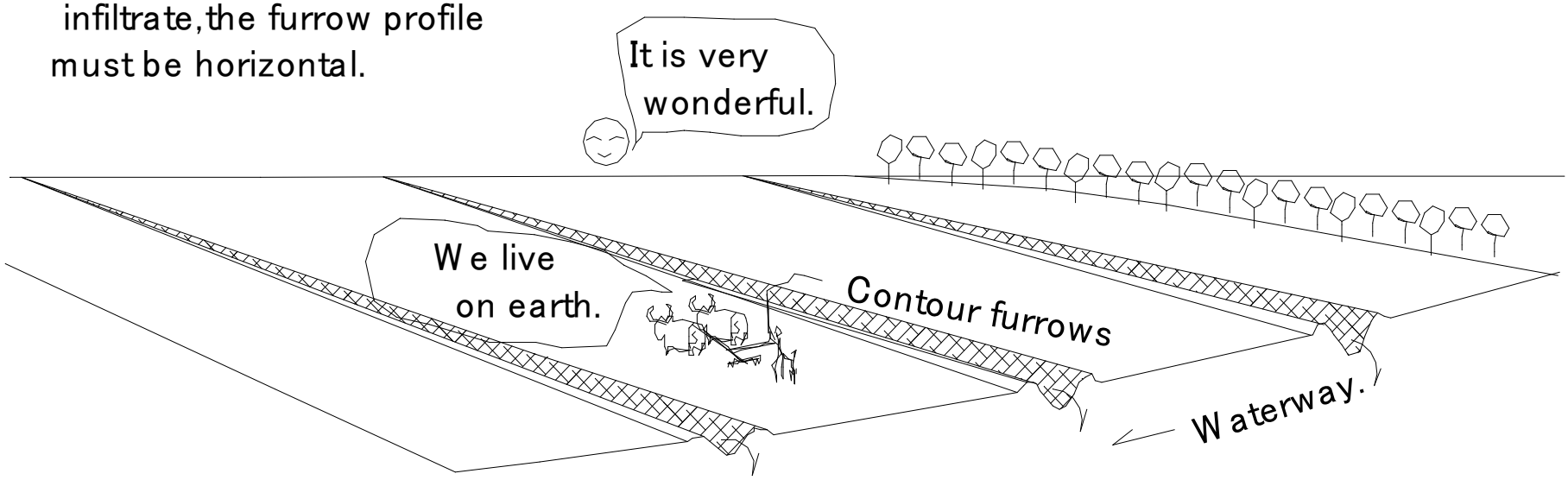
Small earthwork structures are usually cheaper and easier to build and maintain than terraces.

(775) Earthwork Structures (Contour Ridges) (1)



（ 776 ） Earthwork Structures（ Contour furrows ）（ 2 ）

To allow water infiltrate,the furrow profile must be horizontal.



Surface run-off can also be led off laterally into a waterway.

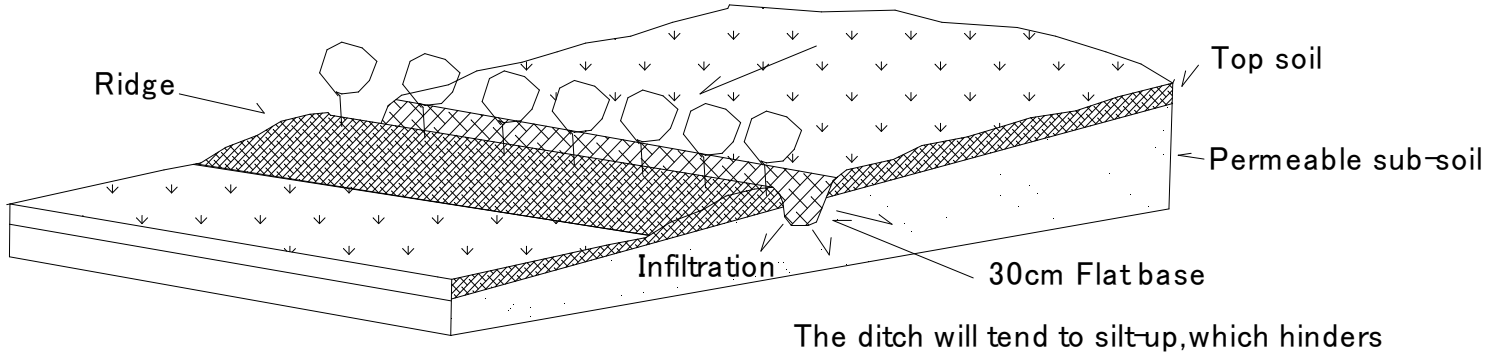
(777) Earthwork Structures (Infiltration Ditch) (3)

The rain which fell
is returned to the ground.

The borrowed money is paid.
The woman who took does not return.

The surface run-off water collects
in the horizontal ditch and slowly
infiltrates into the ground.

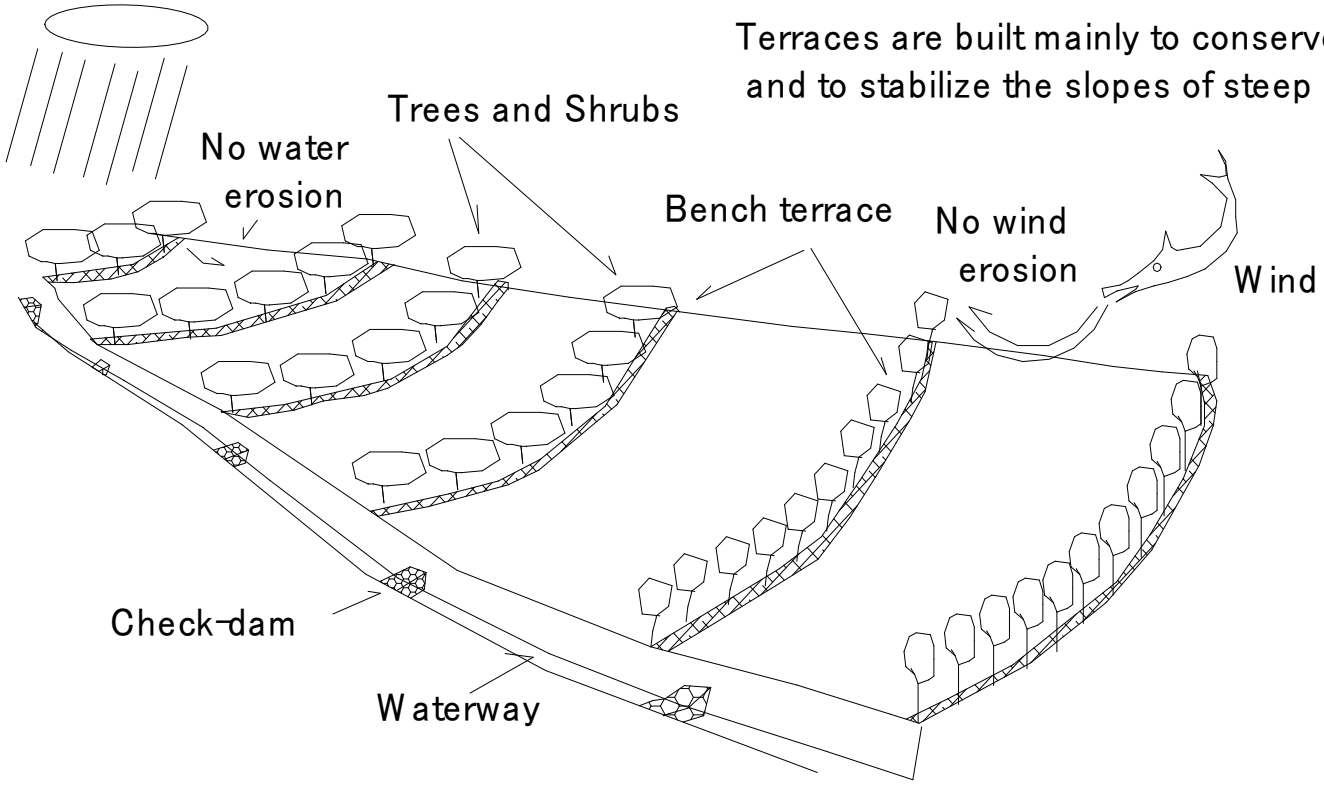
This technique only works on permeable soils
that have the capacity to absorb.
The storm run-off that will accumulate.



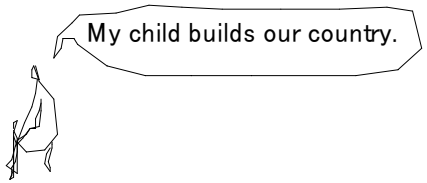
The ditch will tend to silt-up,which hinders
infiltration ,and must be cleaned out regularly.

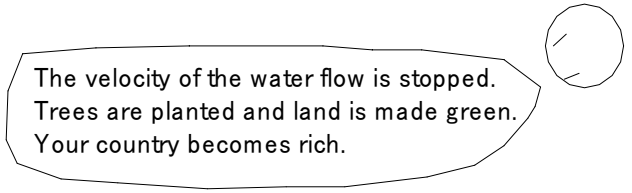
Protect the ridge with
the trees sand grasses.

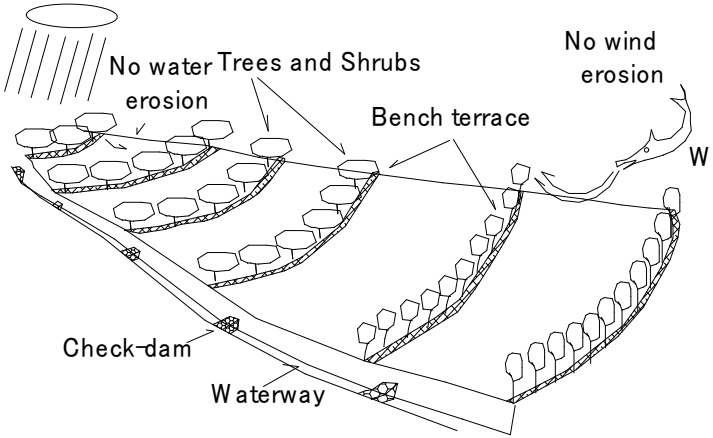
(778) Trees and Shrubs on Terraces(Bench terrace and waterway) (1)



(779) Trees and Shrubs on Terraces(Bench terrace and waterway) (2)

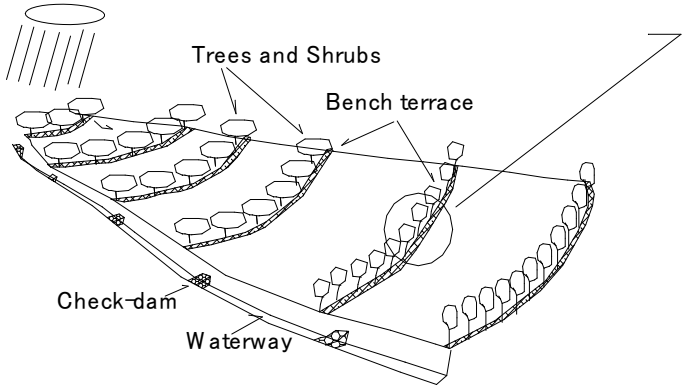


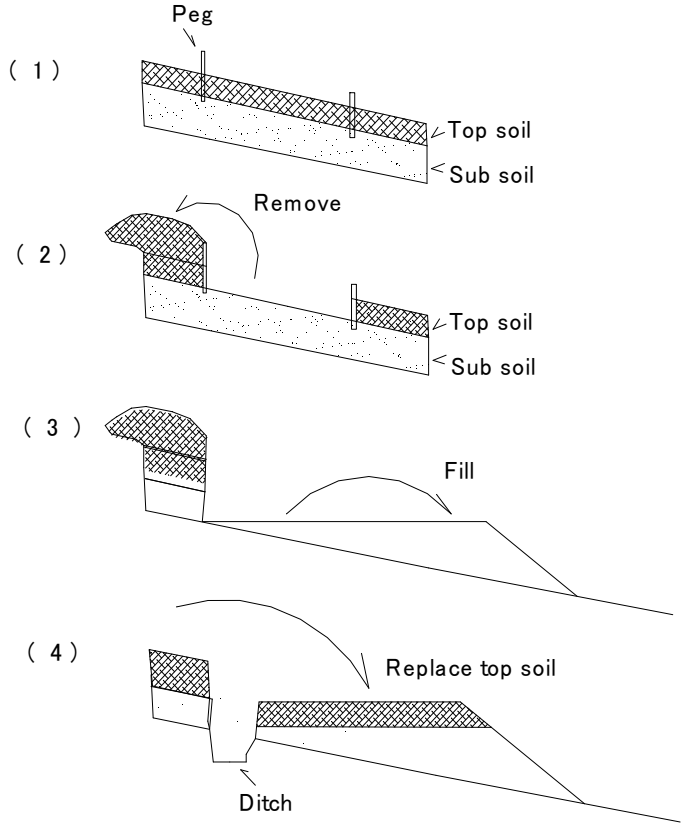




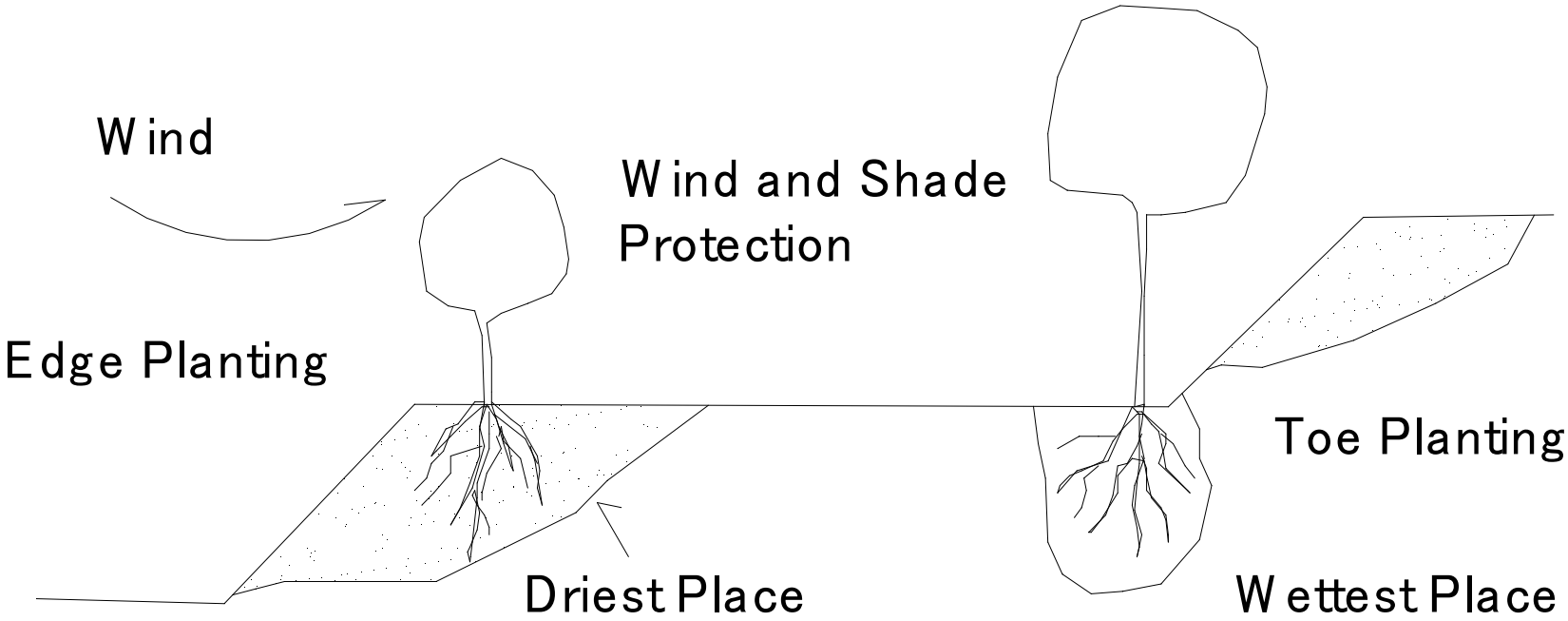
1.Terraces are built mainly to conserve the soil and to stabilize the slopes of steep land.
2.Trees and shrubs may be used to stabilize a terrace and provide leaf mulch,shade and shelter from wind.
3.Terraces may also improve site conditions.
4.Broadbase terraces designed to remove or retain water on sloping land.
5.Bench terraces are built to reduce the slope of land.

（ 780 ）Excavated Bench Terraces

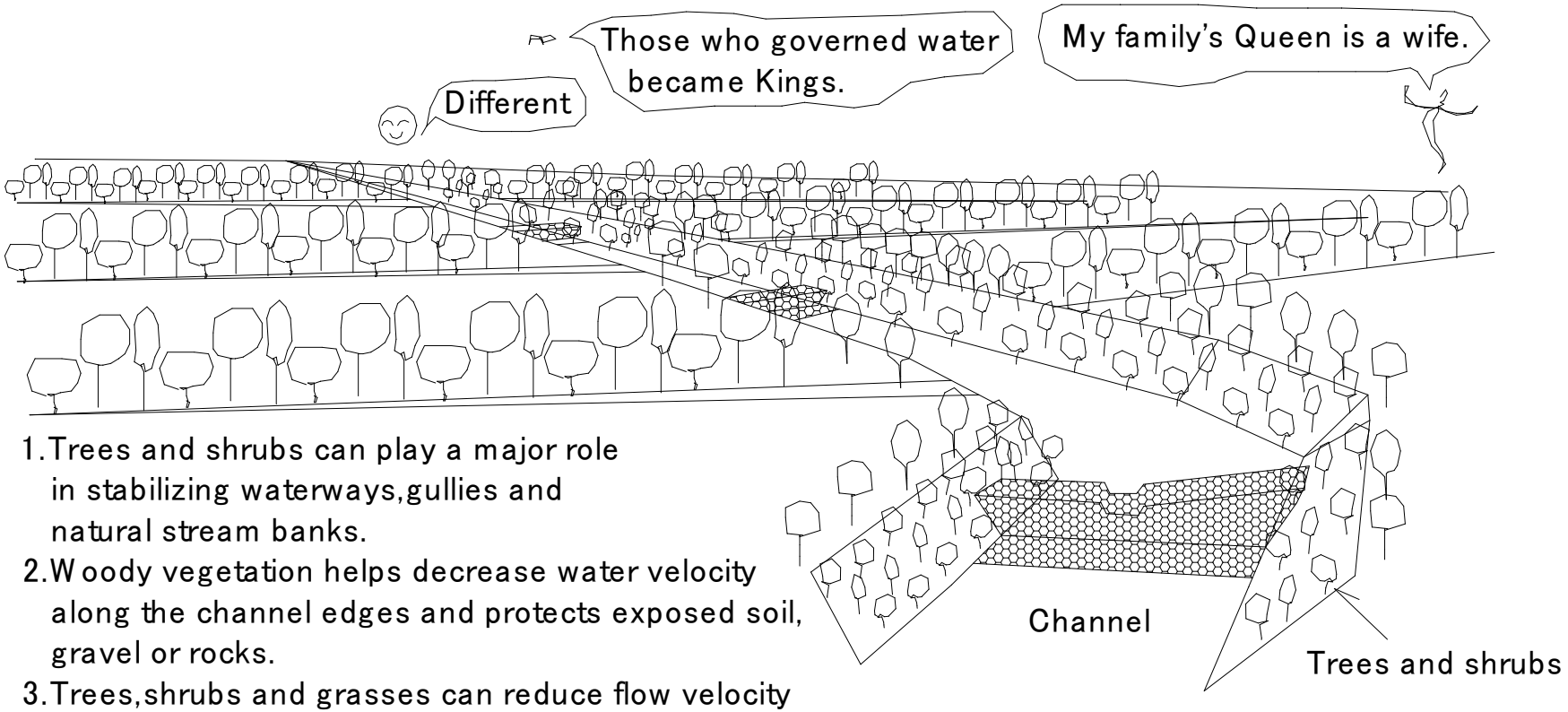




（ 781 ） Siting Trees on Terraces

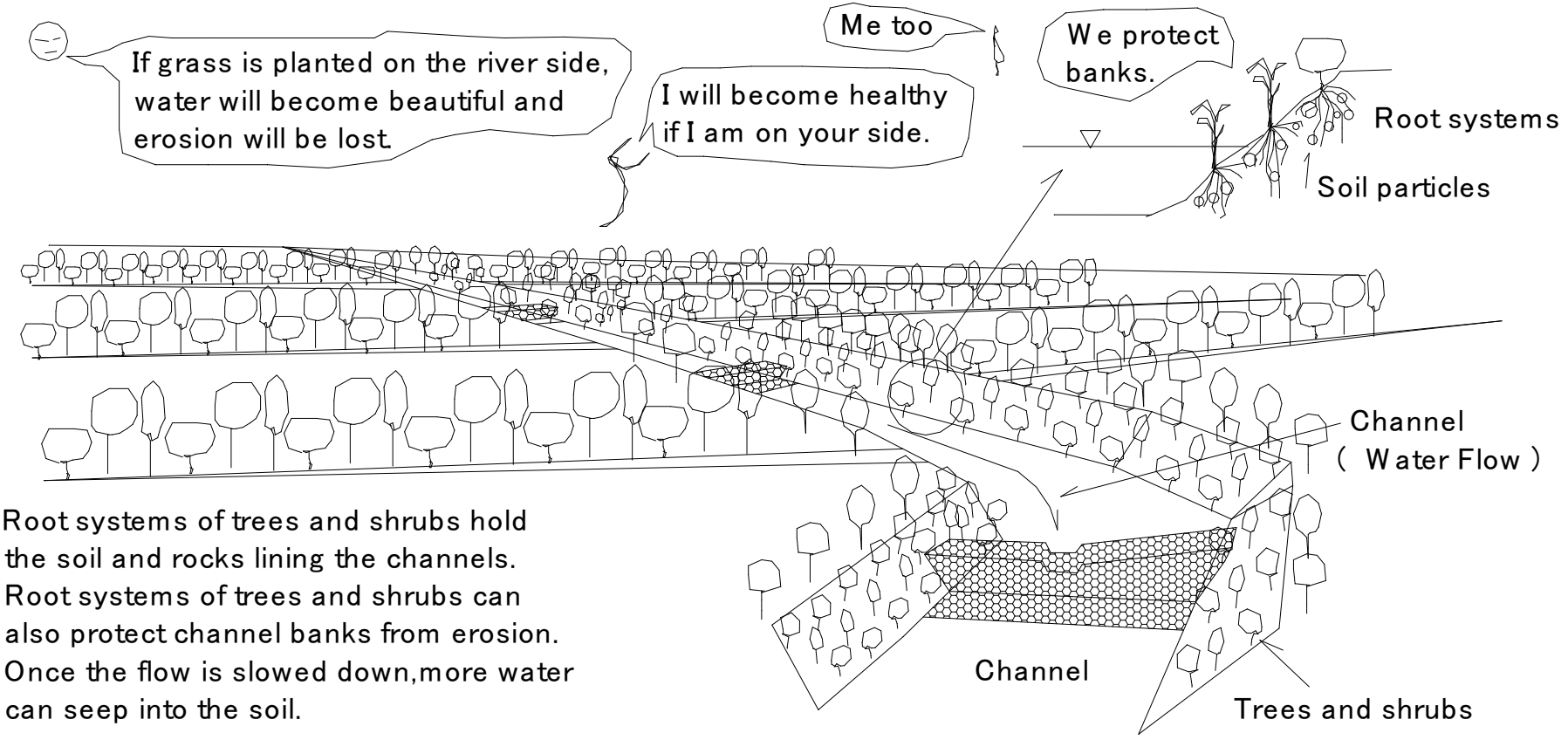


(782) Protection and Stabilization of Waterways and Gullies(1)



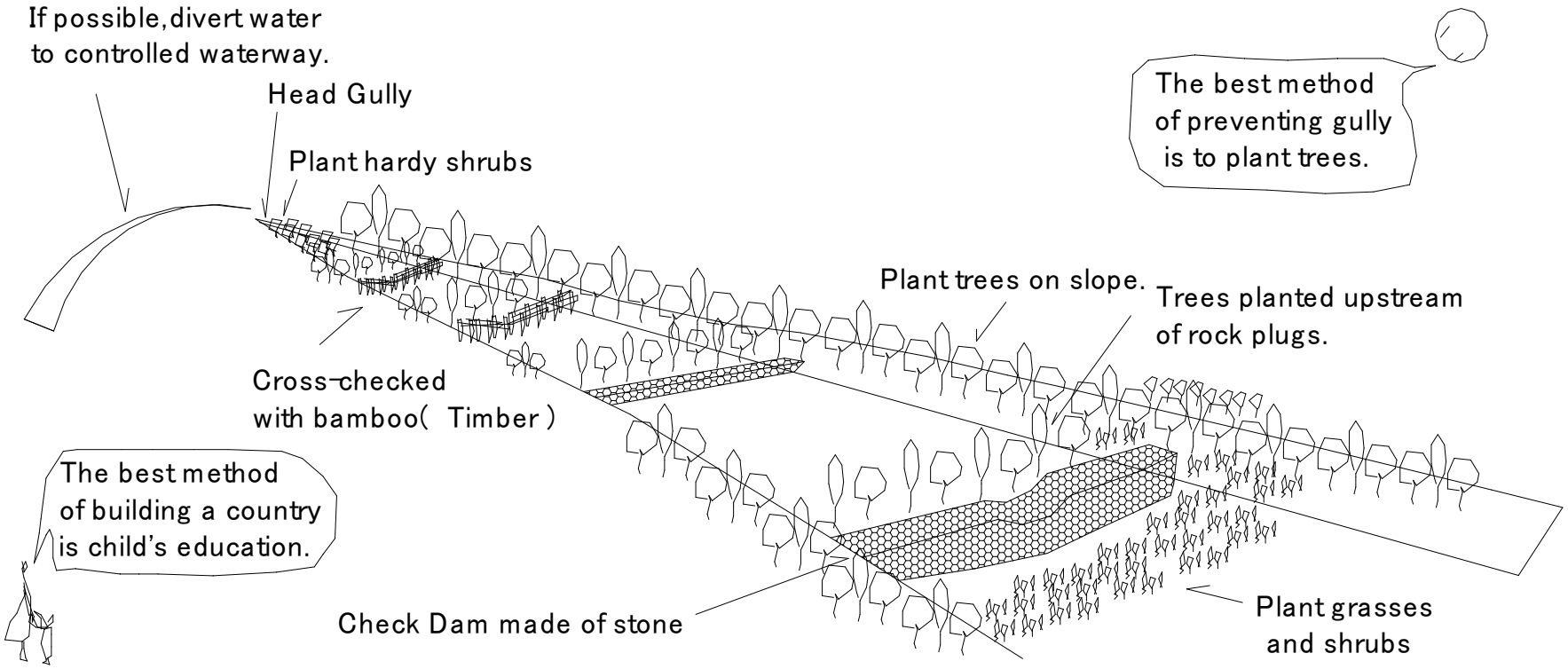
1. Trees and shrubs can play a major role in stabilizing waterways, gullies and natural stream banks.
2. Woody vegetation helps decrease water velocity along the channel edges and protects exposed soil, gravel or rocks.
3. Trees, shrubs and grasses can reduce flow velocity across the entire channel.

(783) Protection and Stabilization of Waterways and Gullies(2)

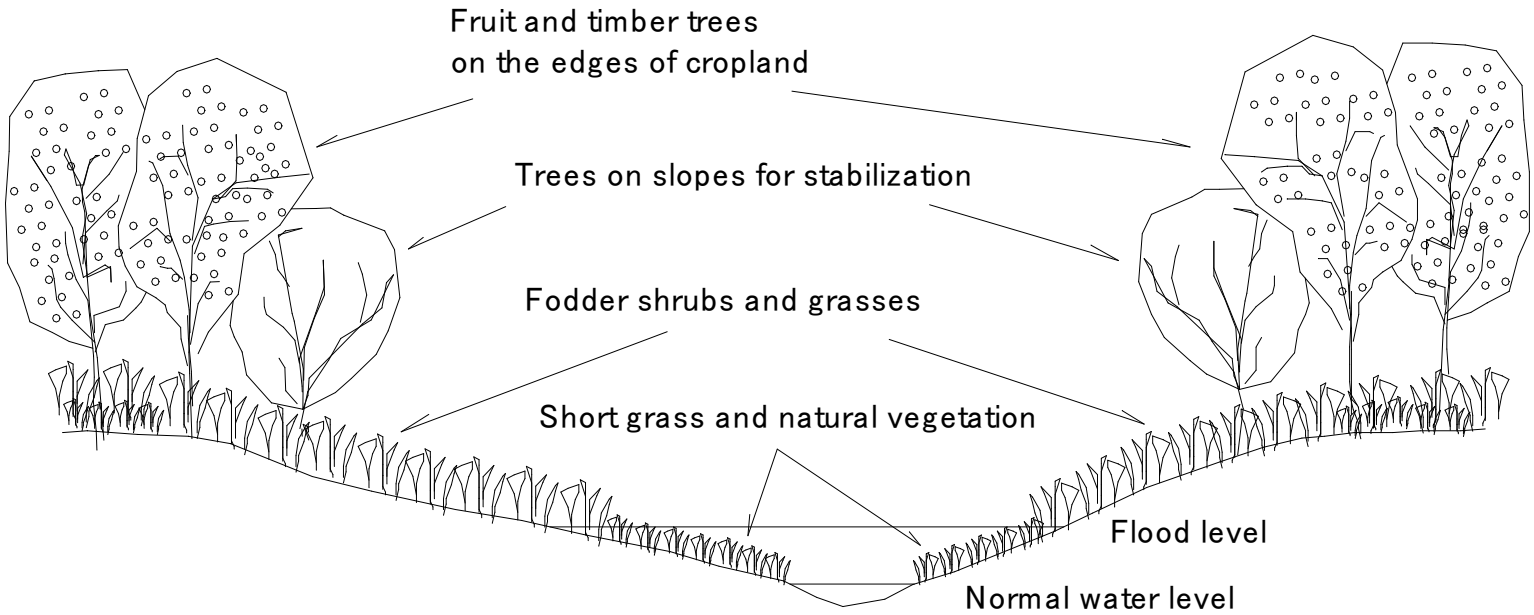


1. Root systems of trees and shrubs hold the soil and rocks lining the channels.
2. Root systems of trees and shrubs can also protect channel banks from erosion.
3. Once the flow is slowed down,more water can seep into the soil.

(784) Gully Control

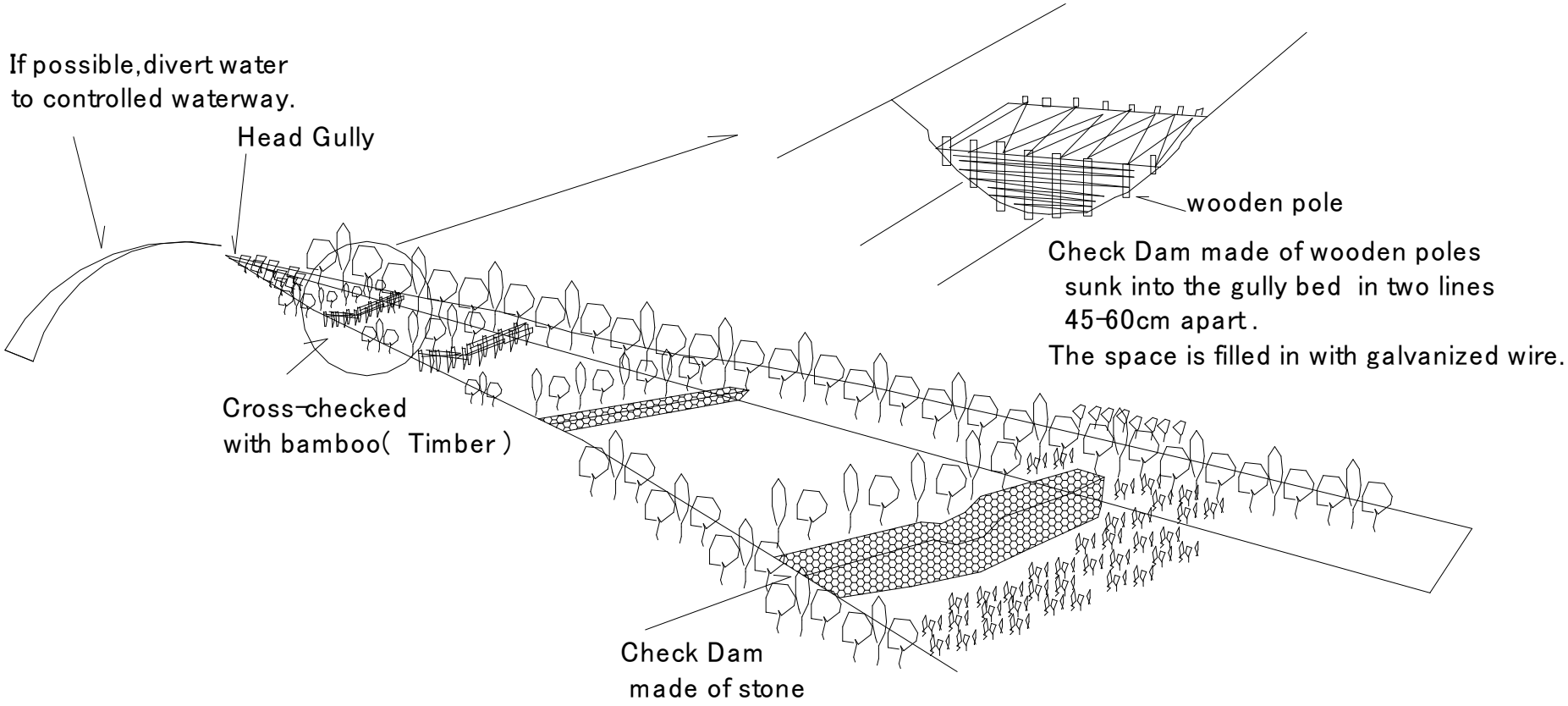


（ 785 ）Stream Bank Protection

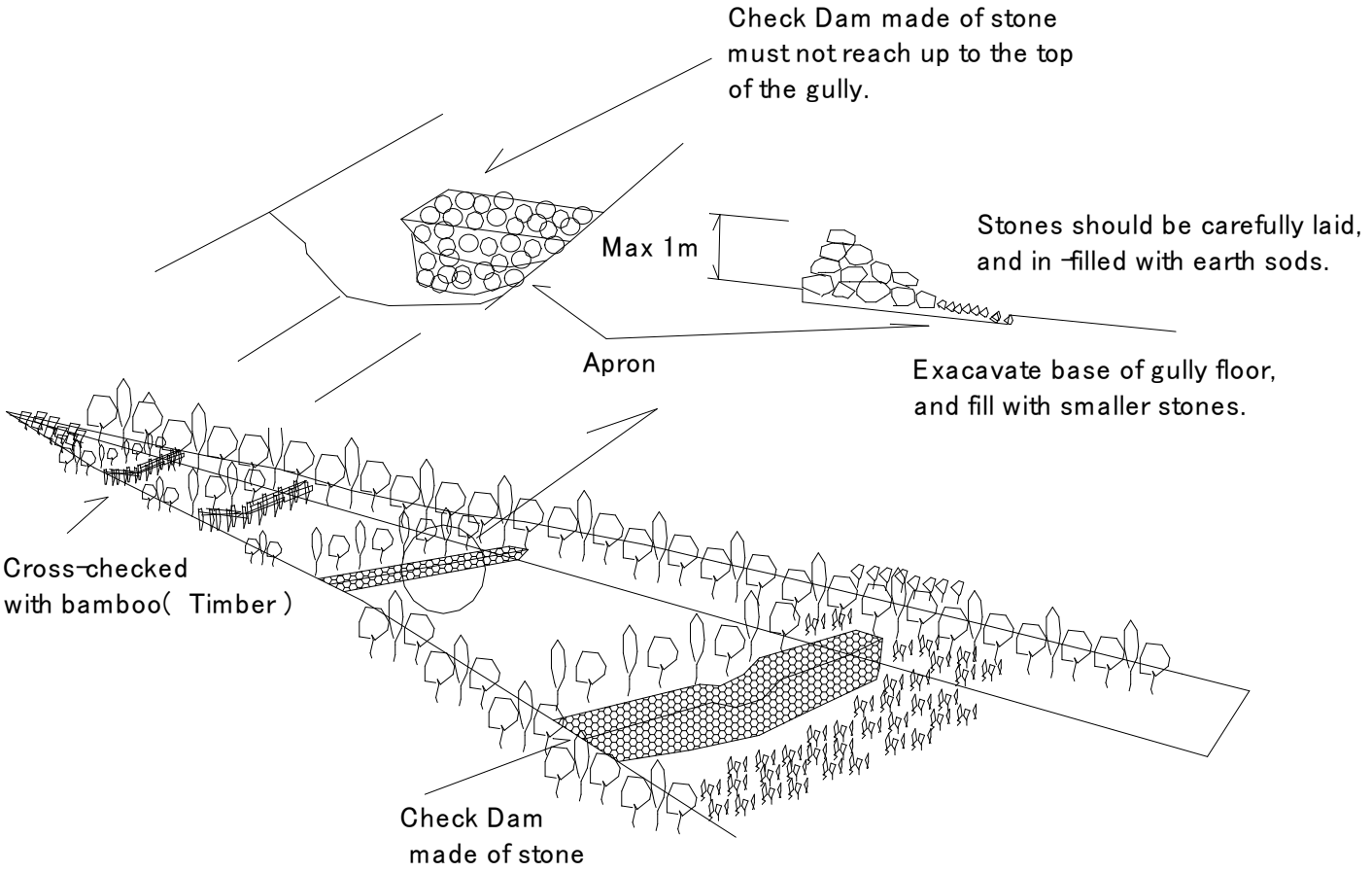


1.Channel is controlled by vegetation and trees.

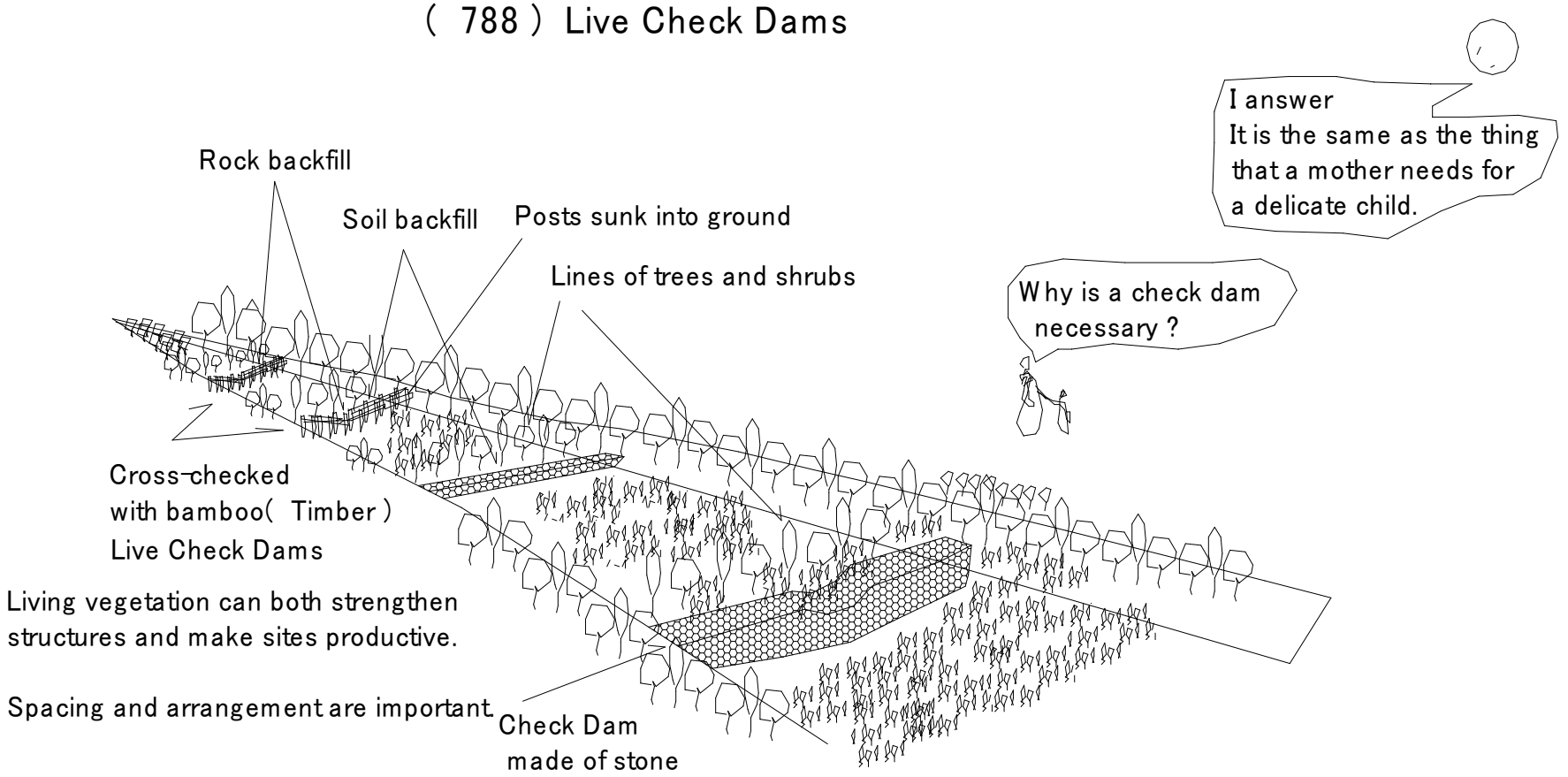
(786) Check Dams(1)



(787) Check Dams(2)

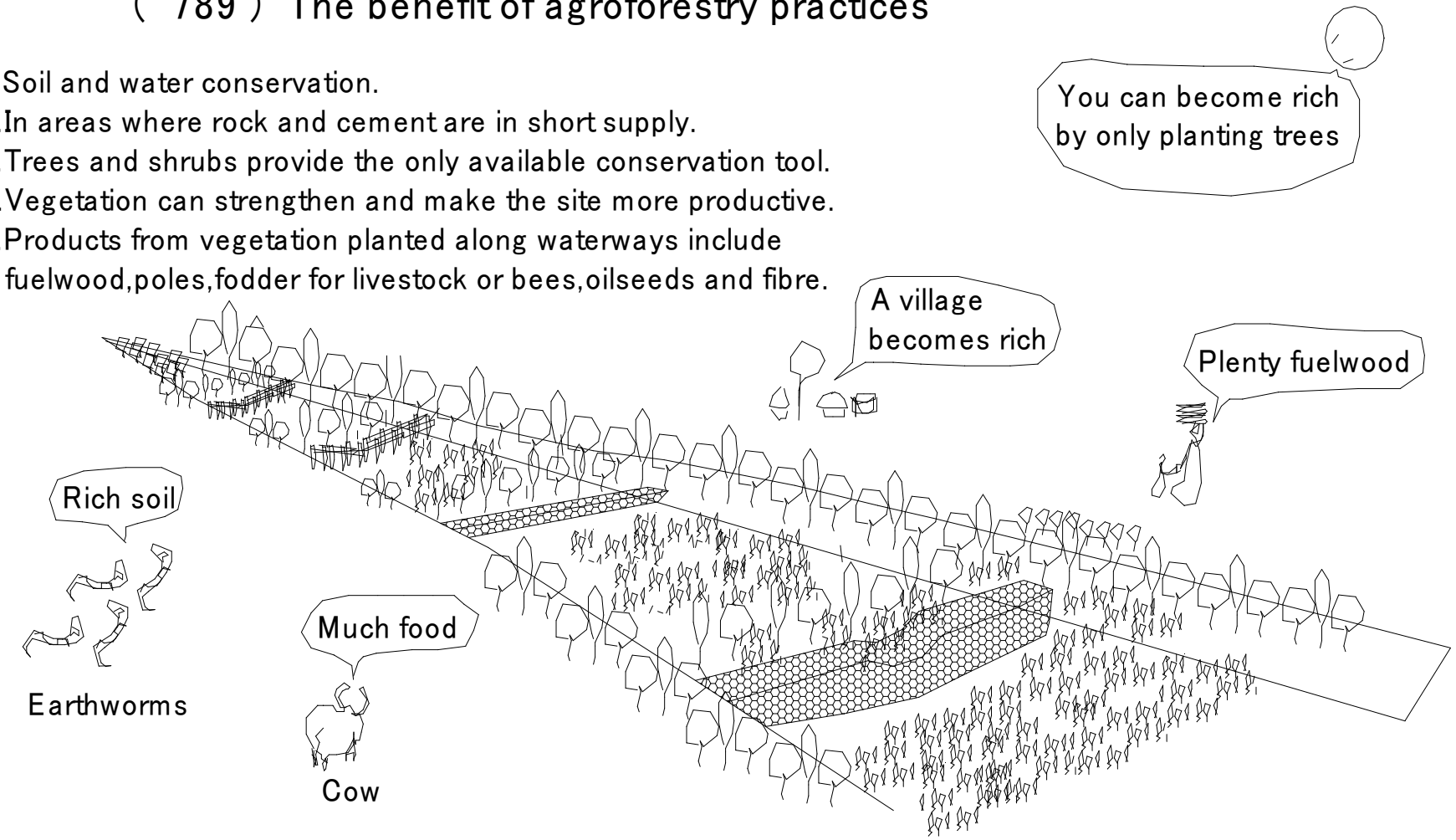


（ 788 ）Live Check Dams



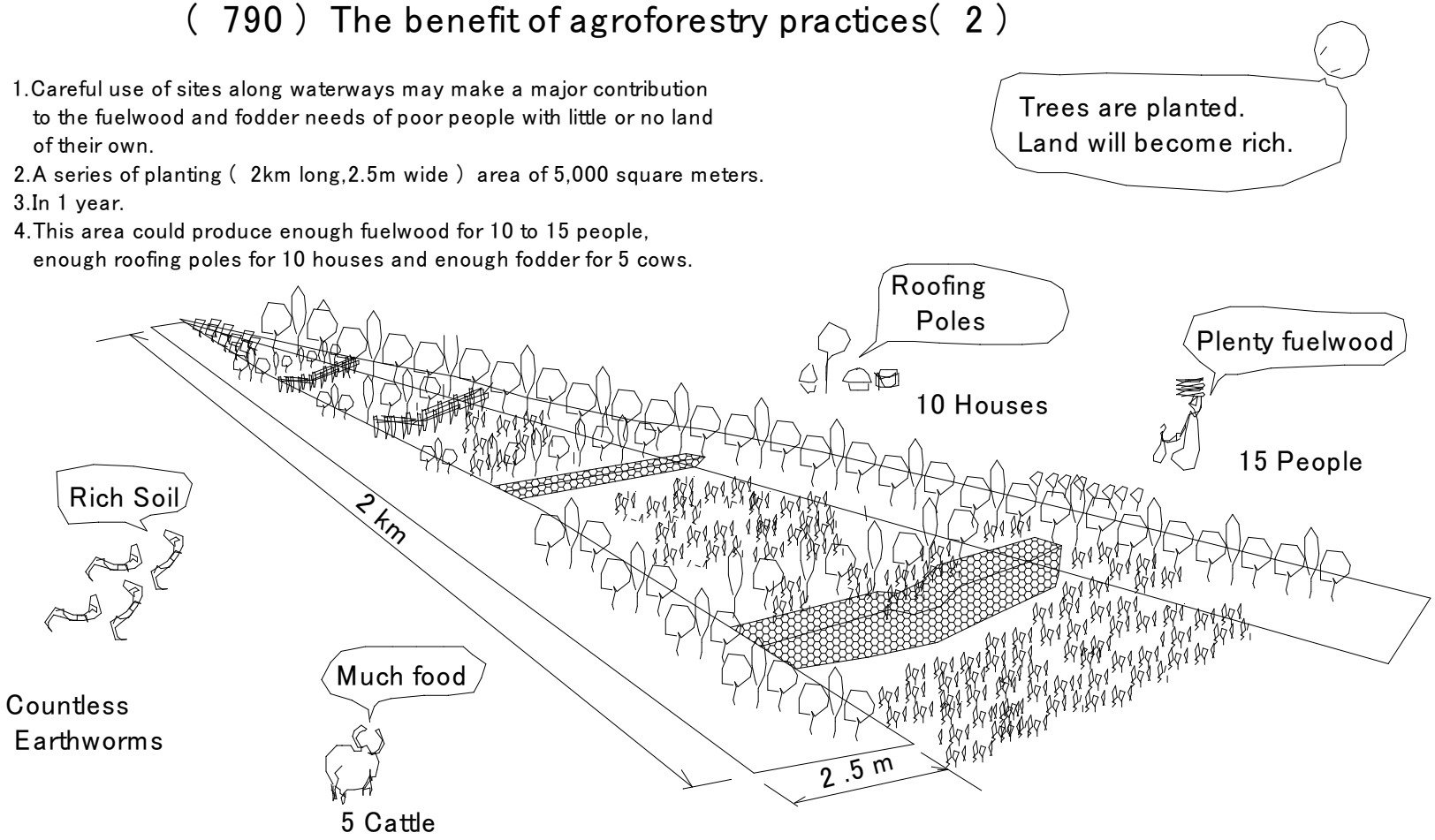
（ 789 ）The benefit of agroforestry practices

1.Soil and water conservation.
2.In areas where rock and cement are in short supply.
3.Trees and shrubs provide the only available conservation tool.
4.Vegetation can strengthen and make the site more productive.
5.Products from vegetation planted along waterways include fuelwood,poles,fodder for livestock or bees,oilseeds and fibre.



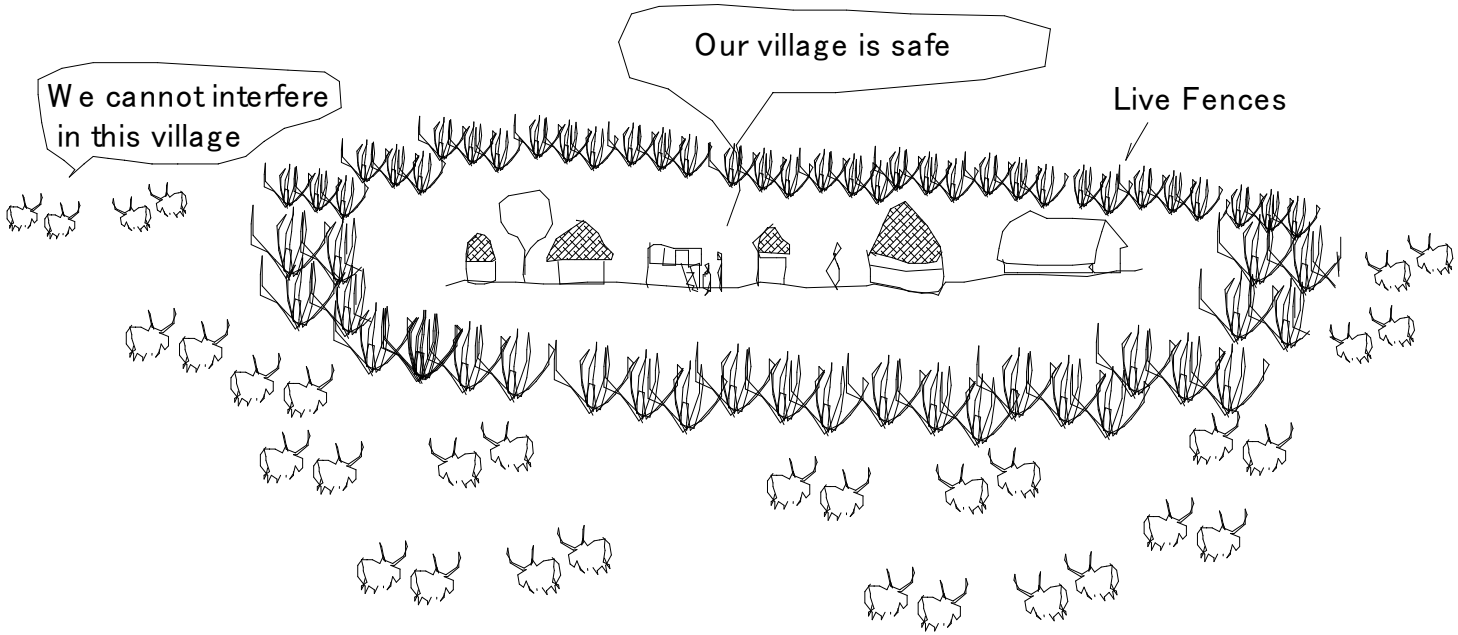
（ 790 ） The benefit of agroforestry practices（ 2 ）

1. Careful use of sites along waterways may make a major contribution to the fuelwood and fodder needs of poor people with little or no land of their own.
2. A series of planting （ 2km long,2.5m wide ） area of 5,000 square meters.
3. In 1 year.
4. This area could produce enough fuelwood for 10 to 15 people, enough roofing poles for 10 houses and enough fodder for 5 cows.



（ 791 ） Live Fences

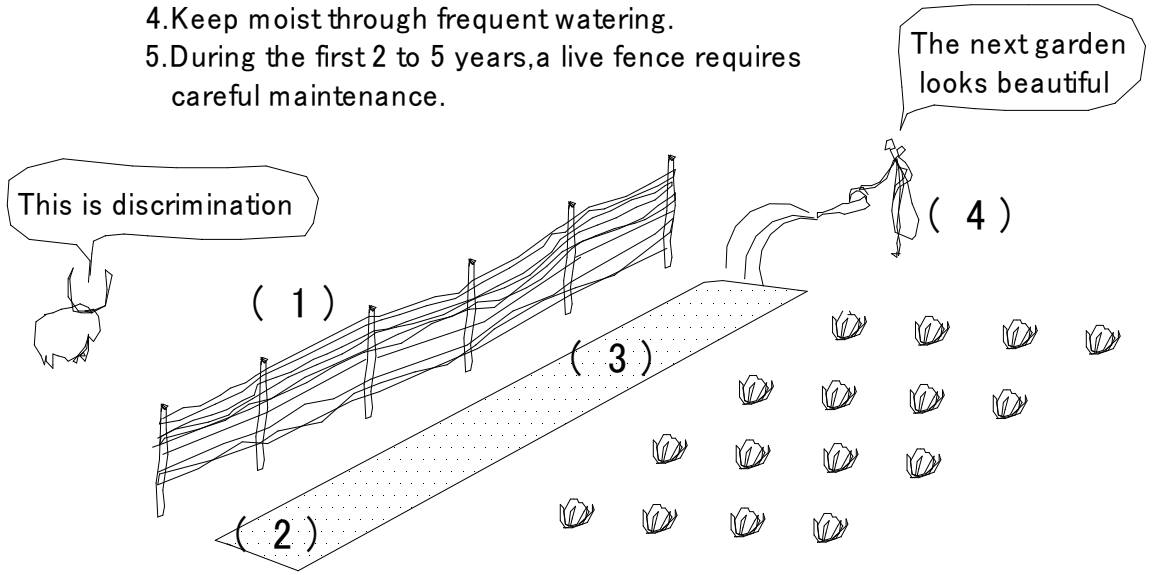
1.Live fences(walls of vegetation) protect croplands and pasture from moving animal.
2.Some live fences are constructed to protect communities from aggressive neighbours and foreign invaders.
3.People plant live fences to keep out domestic or wild animals.



(792) Direct Seeding Fences

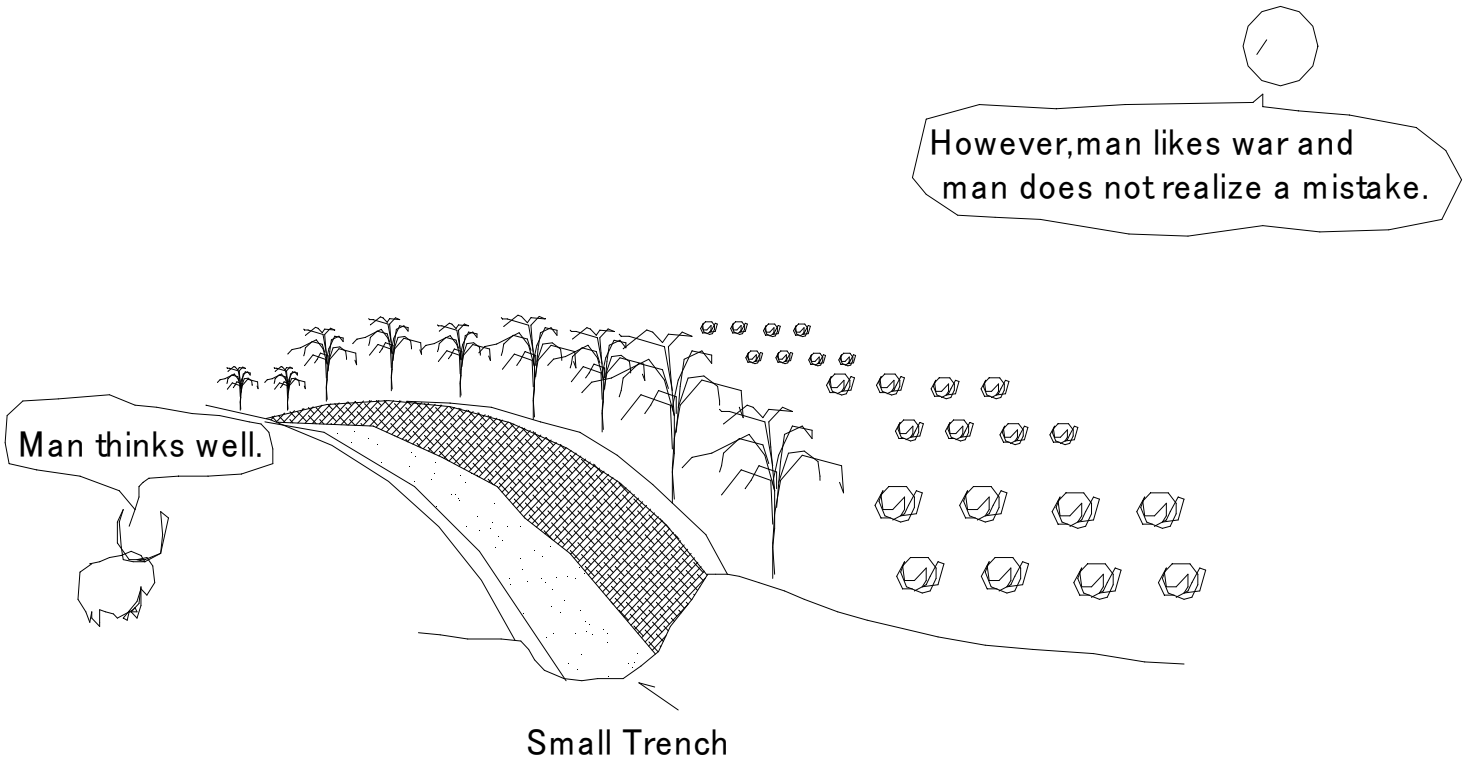
In small gardens,Where water is available ,direct seeding can rapidly establish live fences.

1.First build a temporary fence.
2.Dig a small shallow trench about 50cm from the temporary fence.
3.Place seeds in the trench(Treated seeds if necessary)
and lightly cover with soil.
4.Keep moist through frequent watering.
5.During the first 2 to 5 years,a live fence requires careful maintenance.



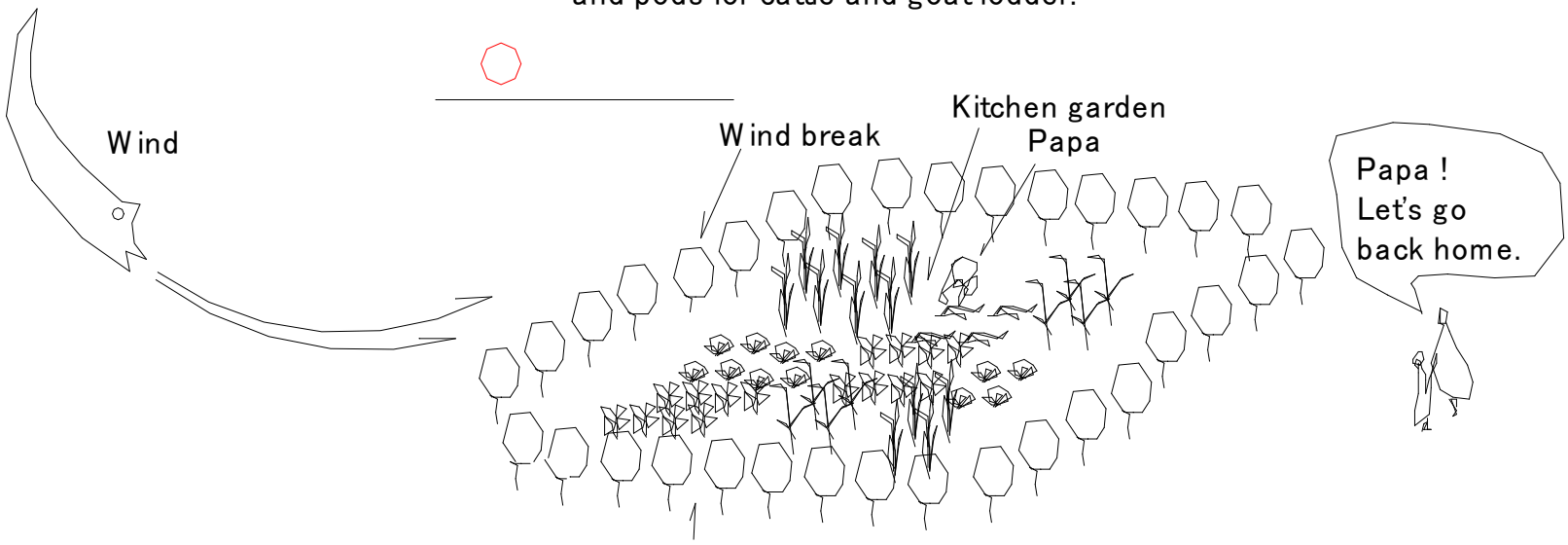
（ 793 ） Small Trench

1.A small trench can also help to protect both the live fence and the enclosed area.
2.A small trench prevents cattle from browsing young trees.



（ 794 ） A live fence with fruit trees

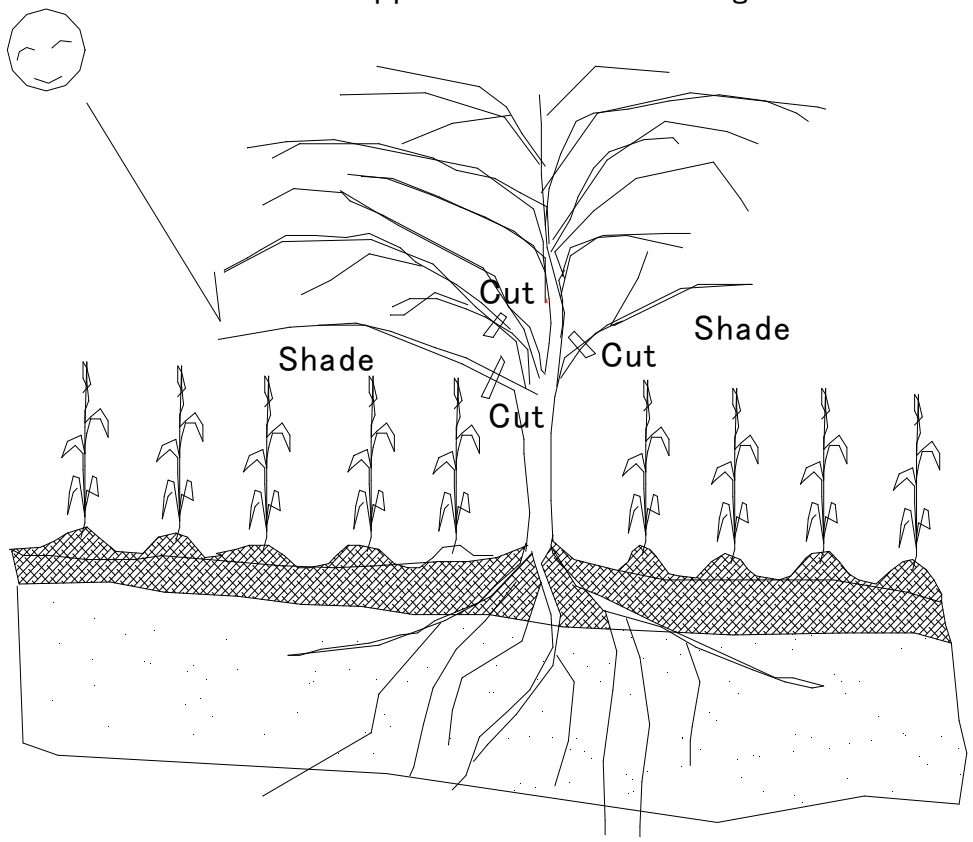
1.A live fence with fruit trees provides
a useful windbreak for a kitchen garden.
2.Live fences protect gardens ,tree nurseries
and tree planting sites.
3.Live fences provide fuelwood for domestic use
and pods for cattle and goat fodder.



A live fence with fruit trees

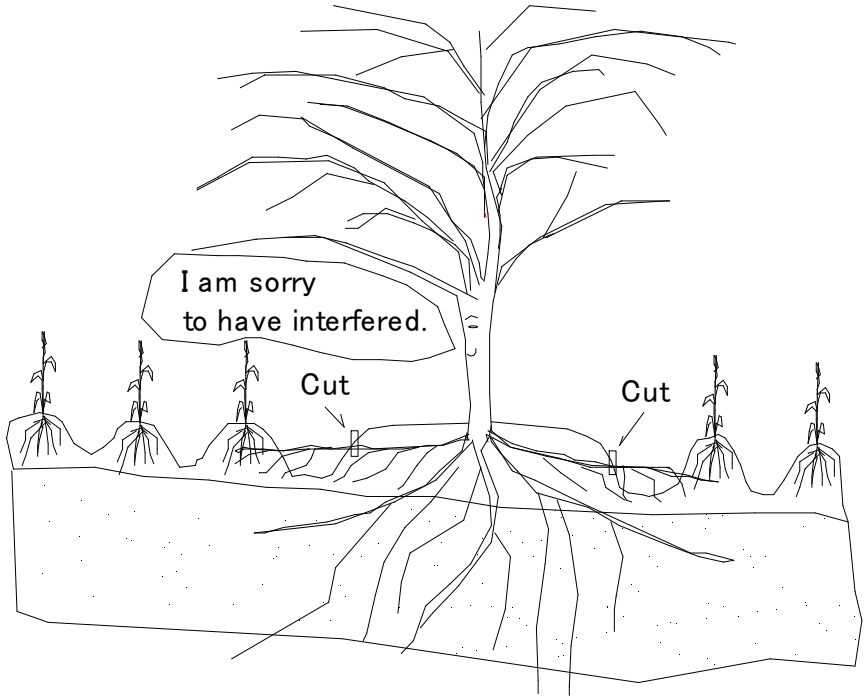
（ 795 ） Branch Pruning

1.As the trees mature,branches may be pruned or lopped to reduce shadding.



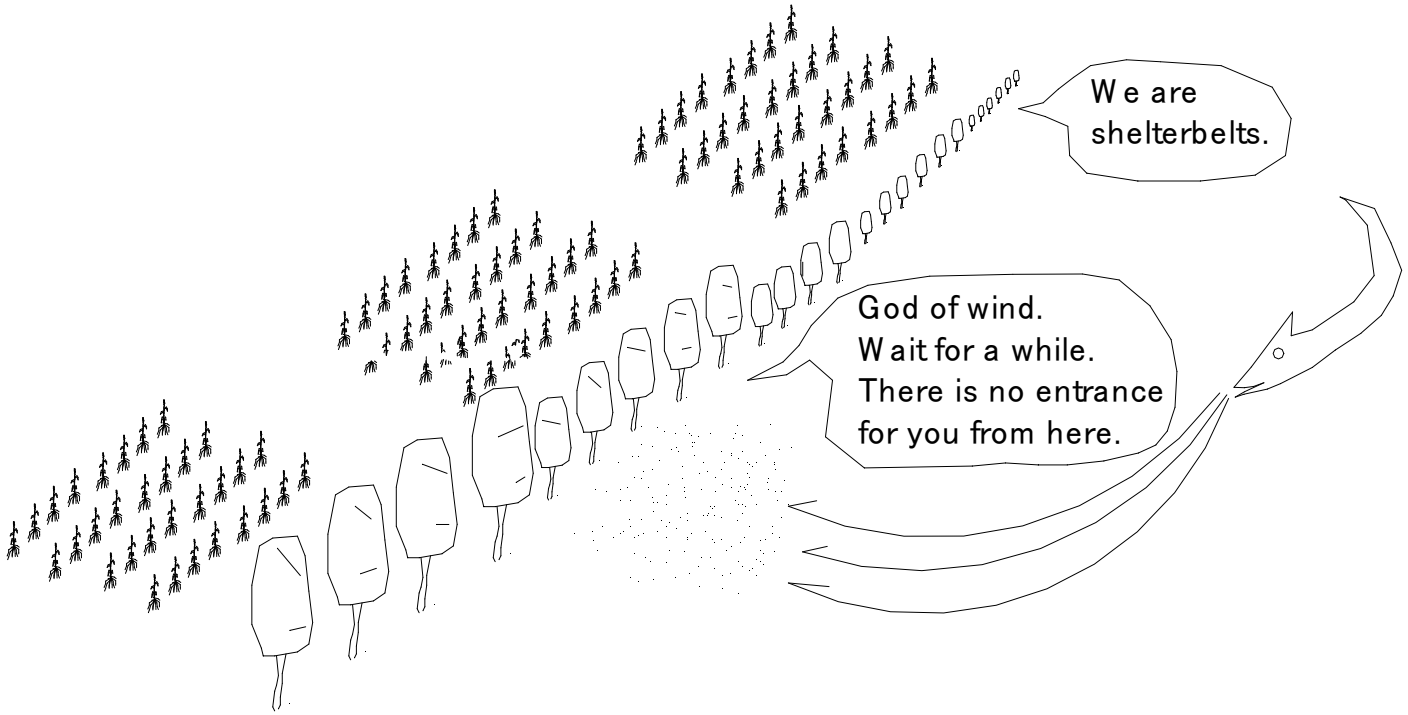
（ 796 ） Root Pruning

1.Lateral roots that would compete with crops can be pruned from young trees once they have established themselves.
2.Dig a trench 50-100cm from the tree line.
Cut the exposed lateral roots with clean angled cuts.



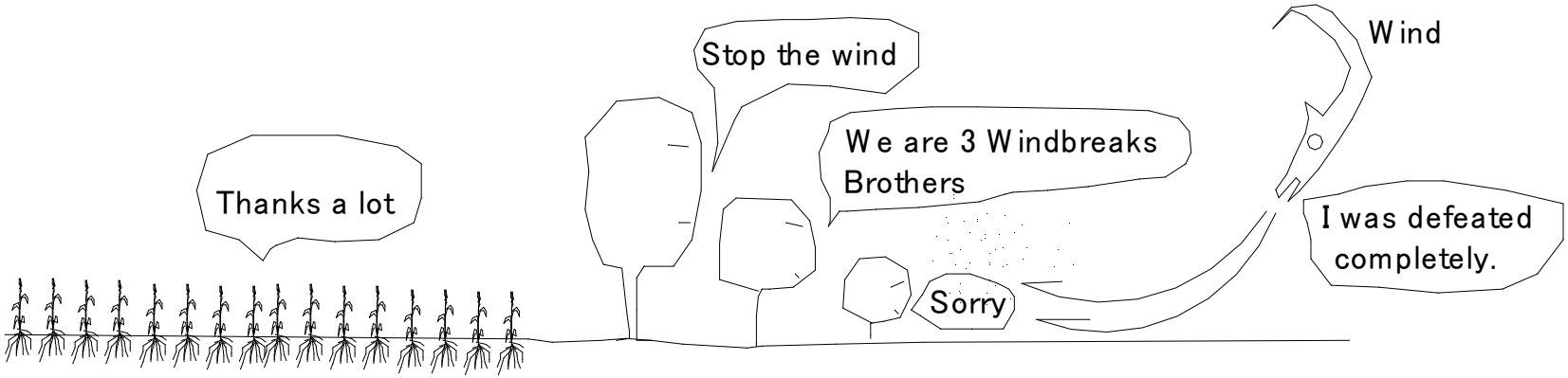
(797) Windbreaks(1)

1.Trees or shrubs planted to protect fields,homes,canal or other areas from wind and blowing soil or sand.



(798) Windbreaks(2)

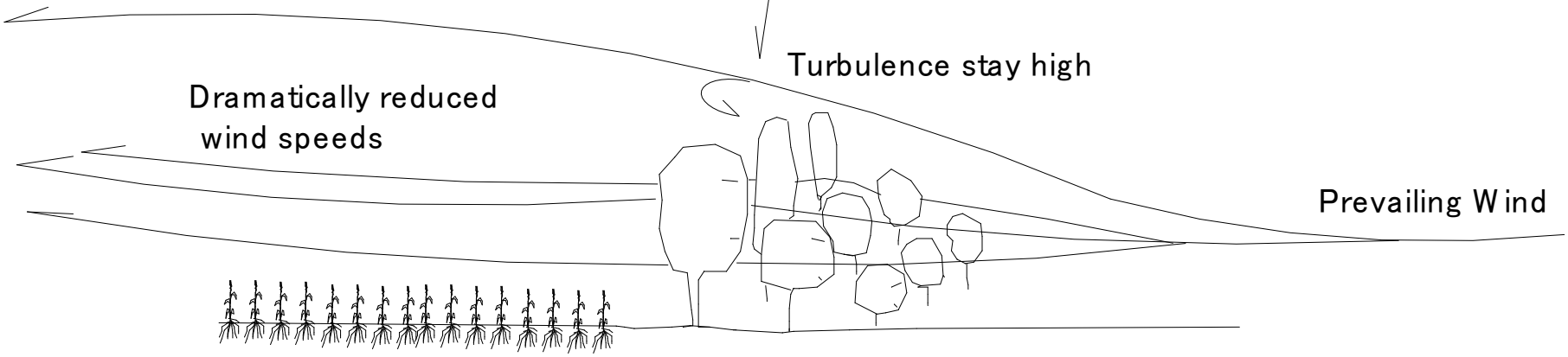
1.Reduce soil erosion.
2.Improve the microclimate for growing crops.
3.Shelter for people and livestock.
4.Wind is a major cause of soil erosion and moisture loss in dry areas.
5.Windbreaks can increase and sustain crop productivity.
6.Windbreaks reduce the speed of the wind.
7.Windbreaks decrease water evaporation from soil.
8.Plants reduce evaporation from water surfaces,irrigation ponds,canals or streams.
10.Windbreaks can provide poles,fuelwood,fruit,fodder,fiber and mulch.



(799) Windbreaks (3)

Windbreaks Design

1. Windbreaks must be semi-permeable by the wind -to slow it.
2. The windbreak must not be too dense.
   If the wind is blocked completely,it will cause turbulence over crops.
3. Dense windbreaks create strong air currents that damage crops and promote soil erosion.



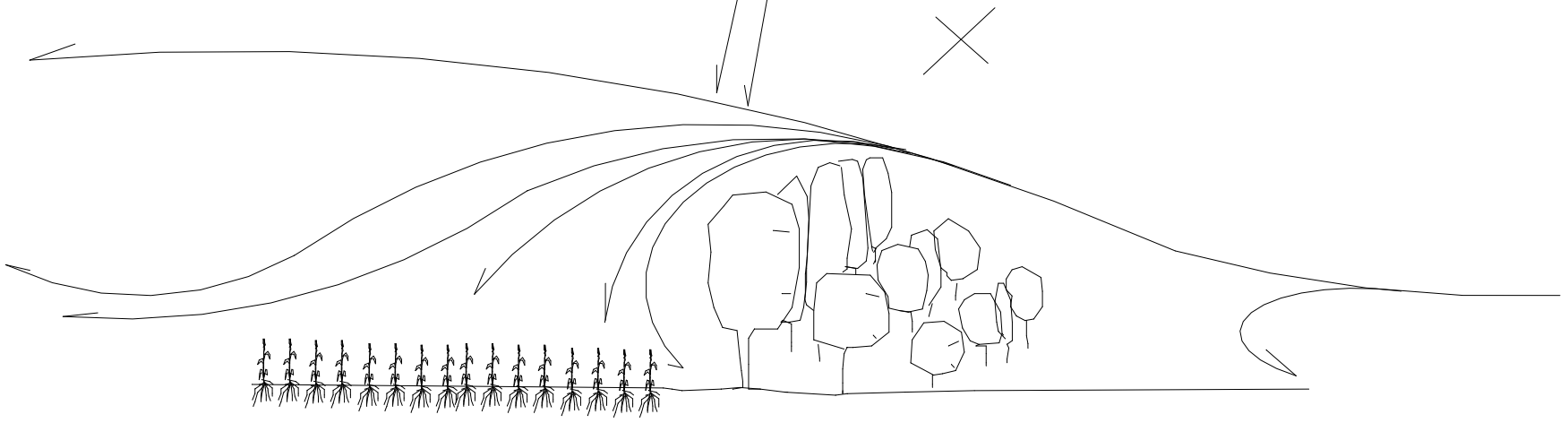
(800) Windbreaks (4)

Windbreaks Design

1.Windbreaks must be semi-permeable by the wind -to slow it.

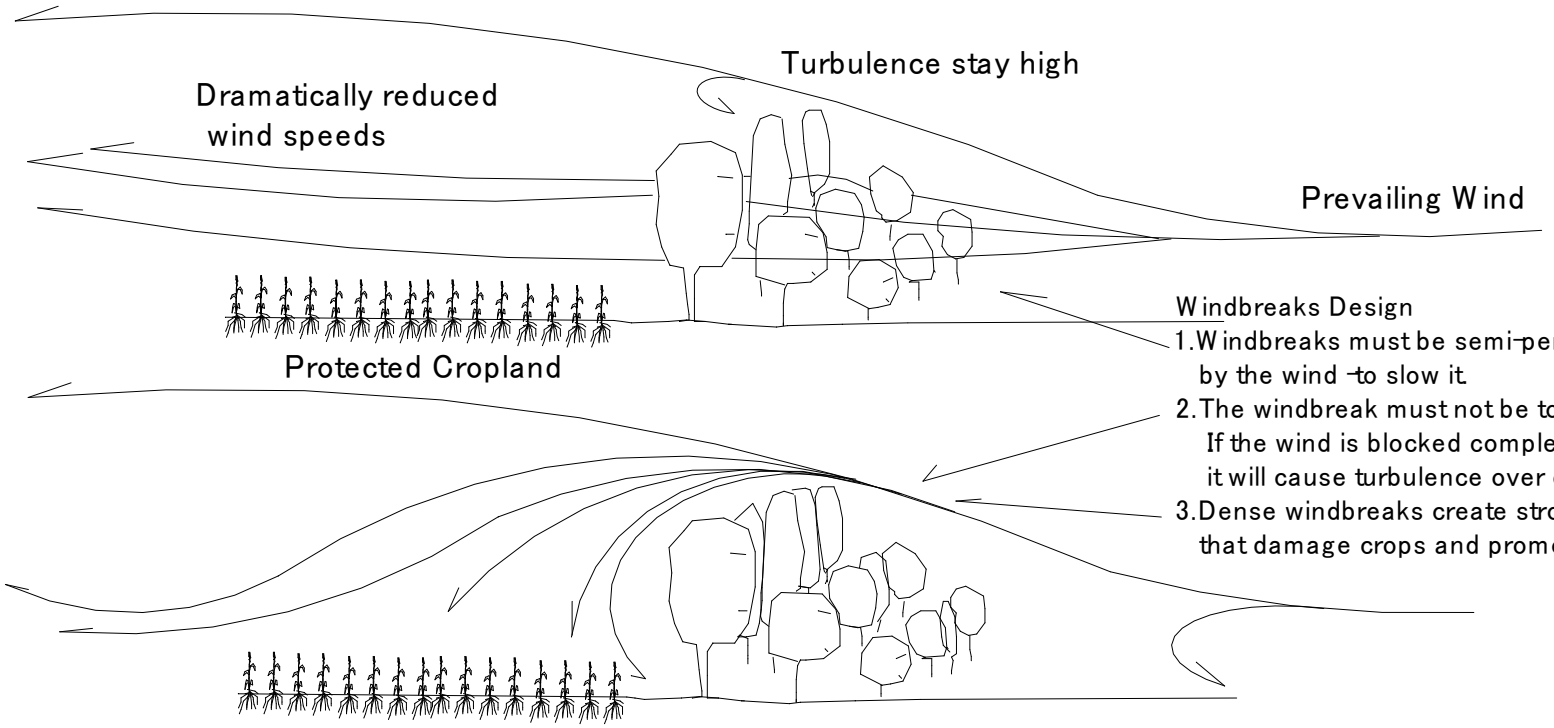
2.The windbreak must not be too dense.
If the wind is blocked completely,it will cause turbulence over crops.

3.Dense windbreaks create strong air currents that damage crops and promote soil erosion.



Dense Windbreaks

(801) Windbreaks (5)



(802) Windbreaks (6)

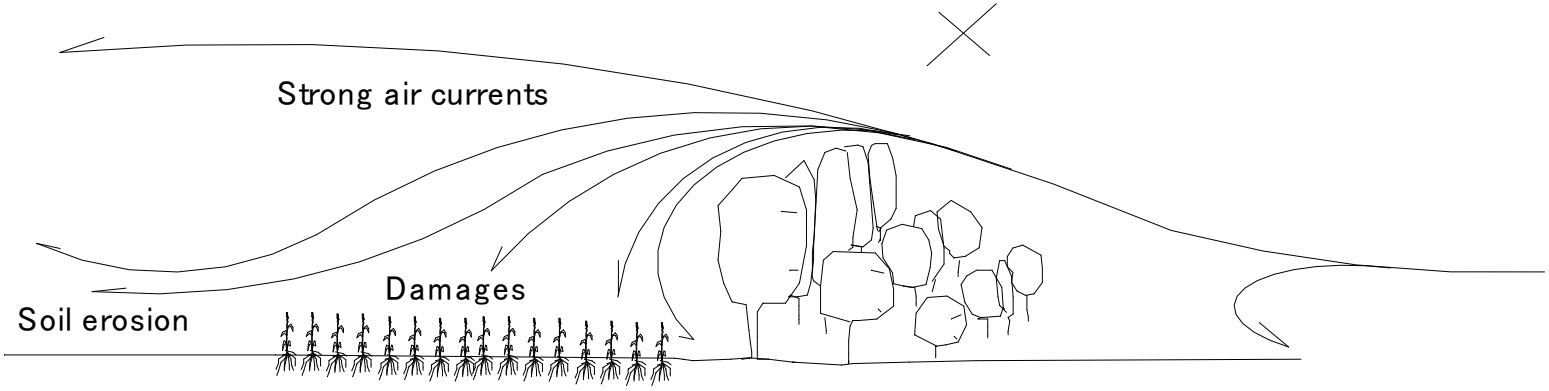
Windbreaks Design

1.Dense windbreaks increase wind speed and contribute to soil erosion and crop damage on the leeward side.

2.The windbreak must not be too dense.
If the wind is blocked completely,it will cause turbulence over crops.

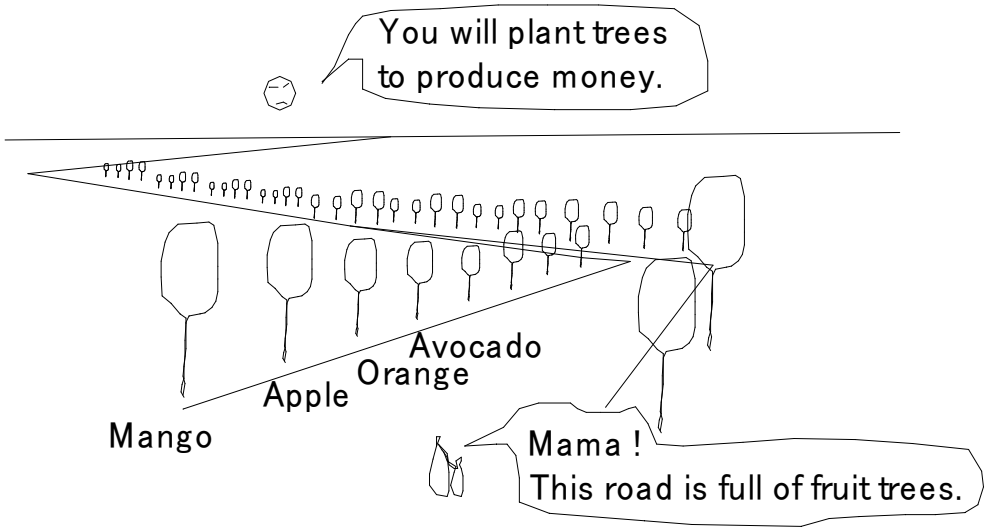
3.Dense windbreaks create strong air currents that damage crops and promote soil erosion.

4.farmers use windbreaks to protect crops,water sources,soils and settlements on farmlands.



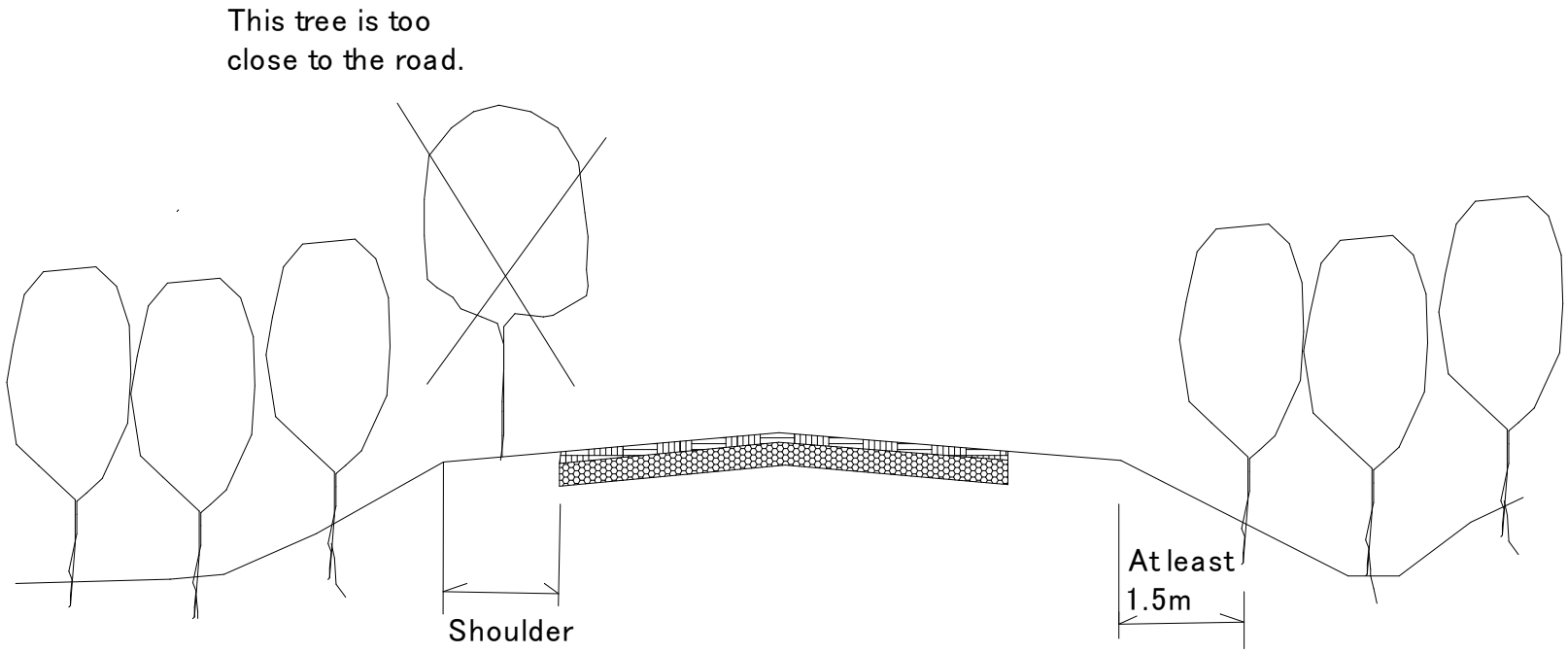
（ 803 ）Trees and Shrubs along roads and paths

1.Trees provide shade and reduce dust on land.
2.Trees provide wood,fruit,gum,oilseeds,honey and animal fodder and other useful products.
3.Poor and landless people may derive an important income by harvesting tree products from roadsides.



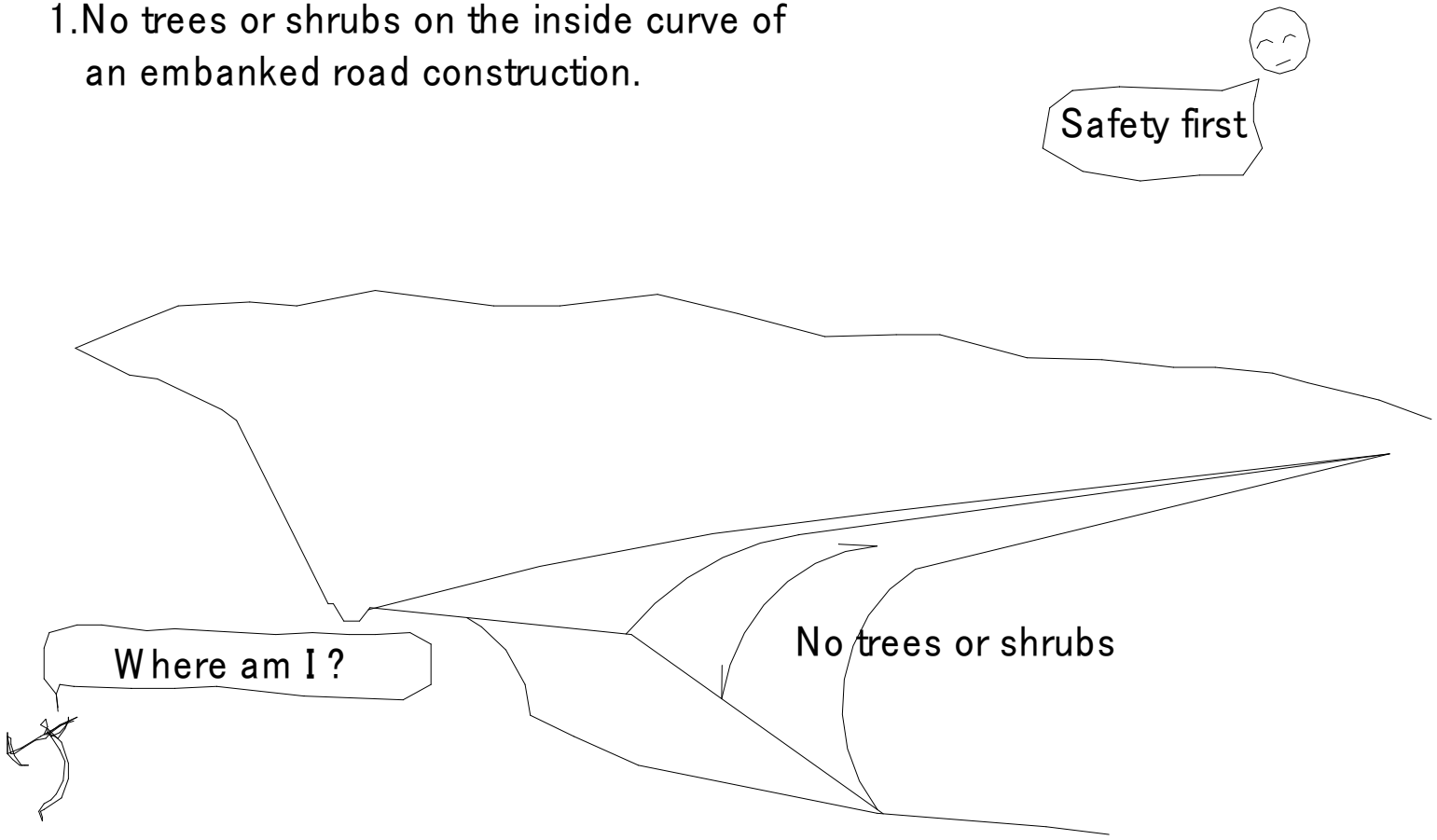
（ 804 ） Roadside tree placement

1. The placement of trees along roads and footpaths must leave room for the safe passage of traffic, including people, animals and vehicles.



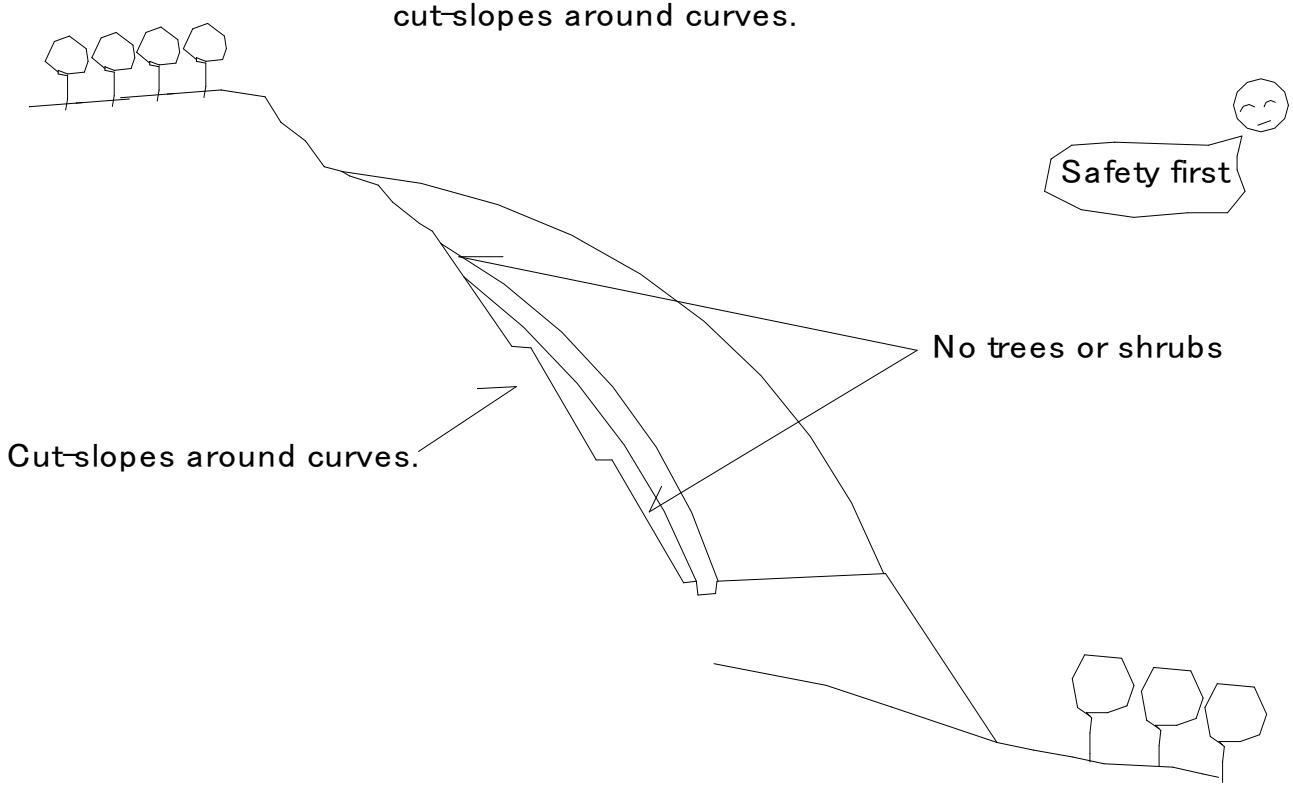
（ 805 ） Roadway visibility

1.No trees or shrubs on the inside curve of an embanked road construction.

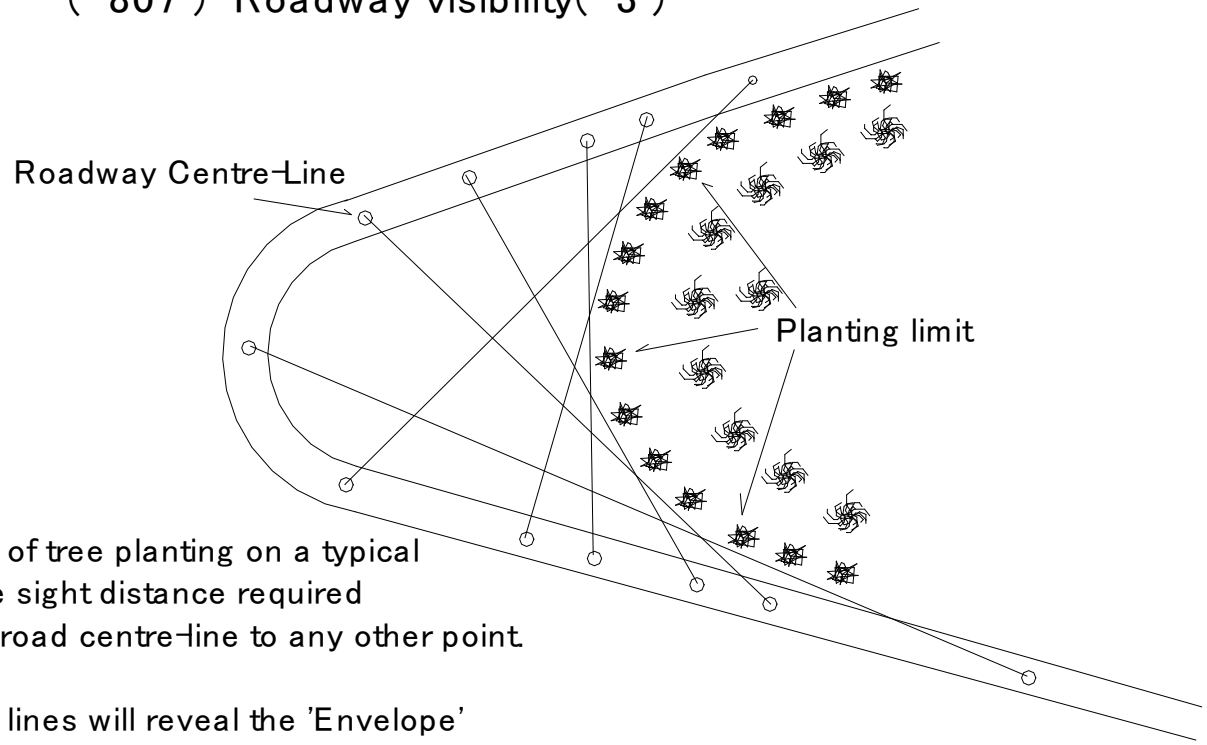


（ 806 ） Roadway visibility（ 2 ）

1.No trees or shrubs on the inside curve of cut-slopes around curves.



(807) Roadway visibility(3)

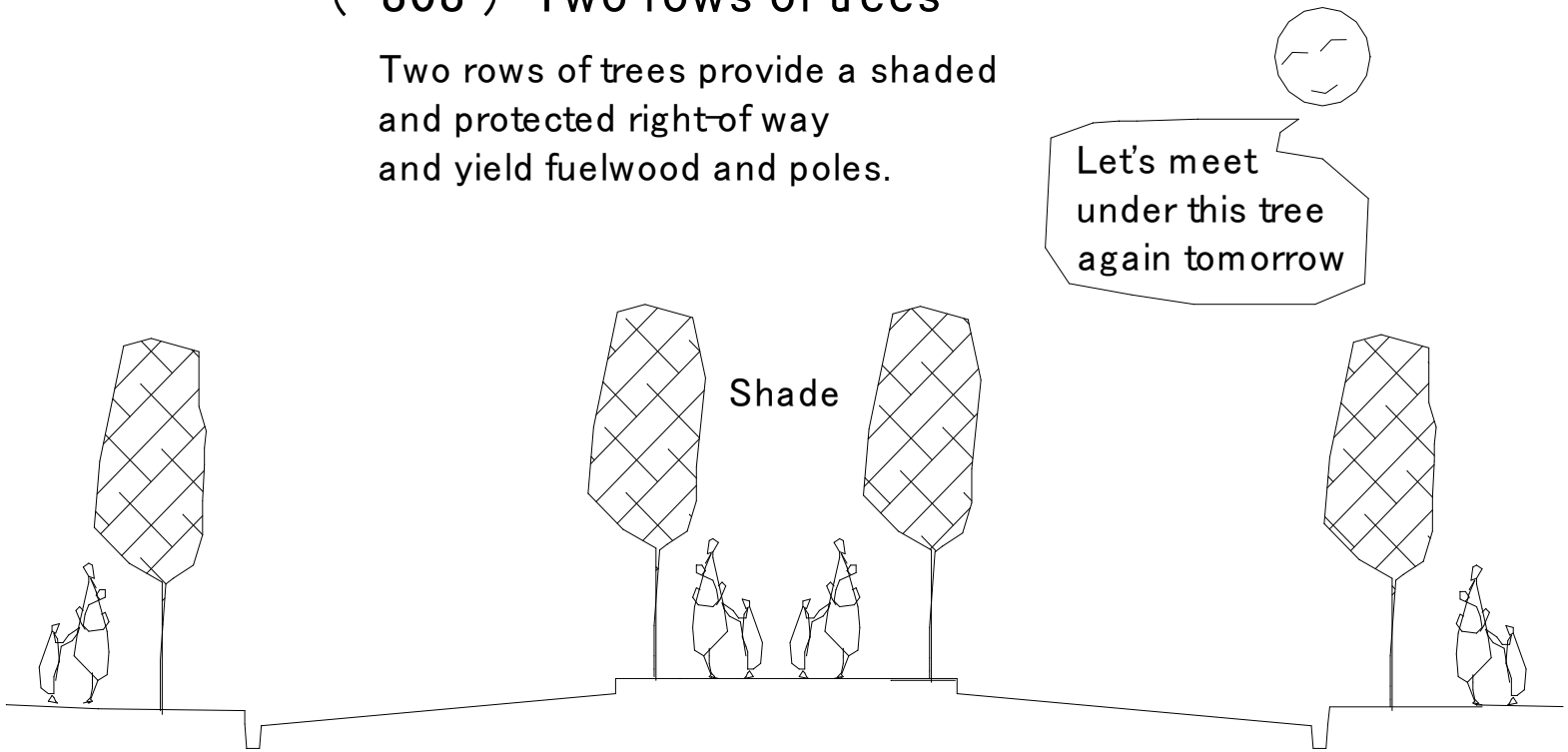


To establish the limits of tree planting on a typical curve-layout ,measure sight distance required from any point on the road centre-line to any other point.

The build-up of all the lines will reveal the 'Envelope' curve that forms the limit within which trees and shrubs can be safely planted.

（ 808 ） Two rows of trees

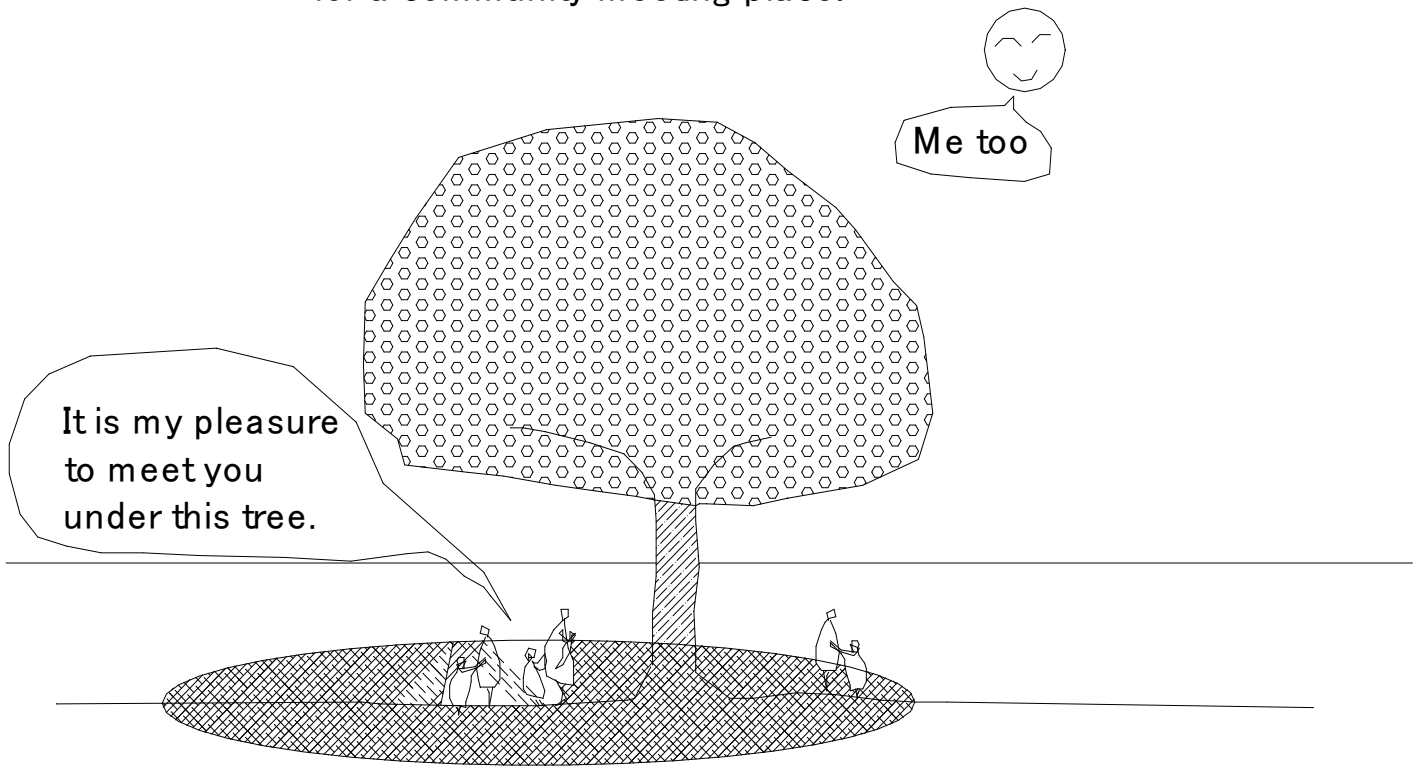
Two rows of trees provide a shaded
and protected right-of way
and yield fuelwood and poles.



Shade is important for draught animals carrying or pulling loads or
for people walking,riding or cycling along a road,especially
under hot and dry climatic conditions.

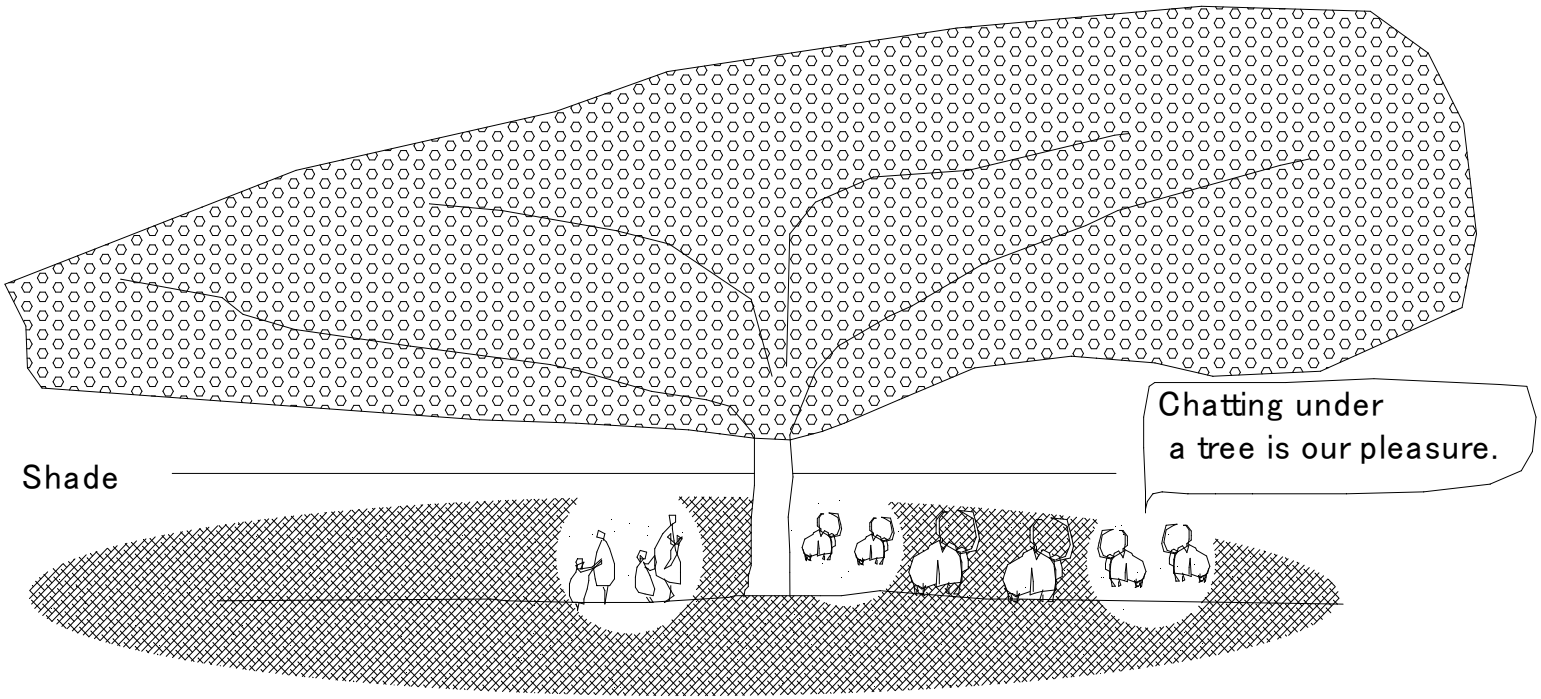
（ 809 ） Trees and shrubs around houses and in public places

Big trees and shrub provide shade
for a community meeting place.

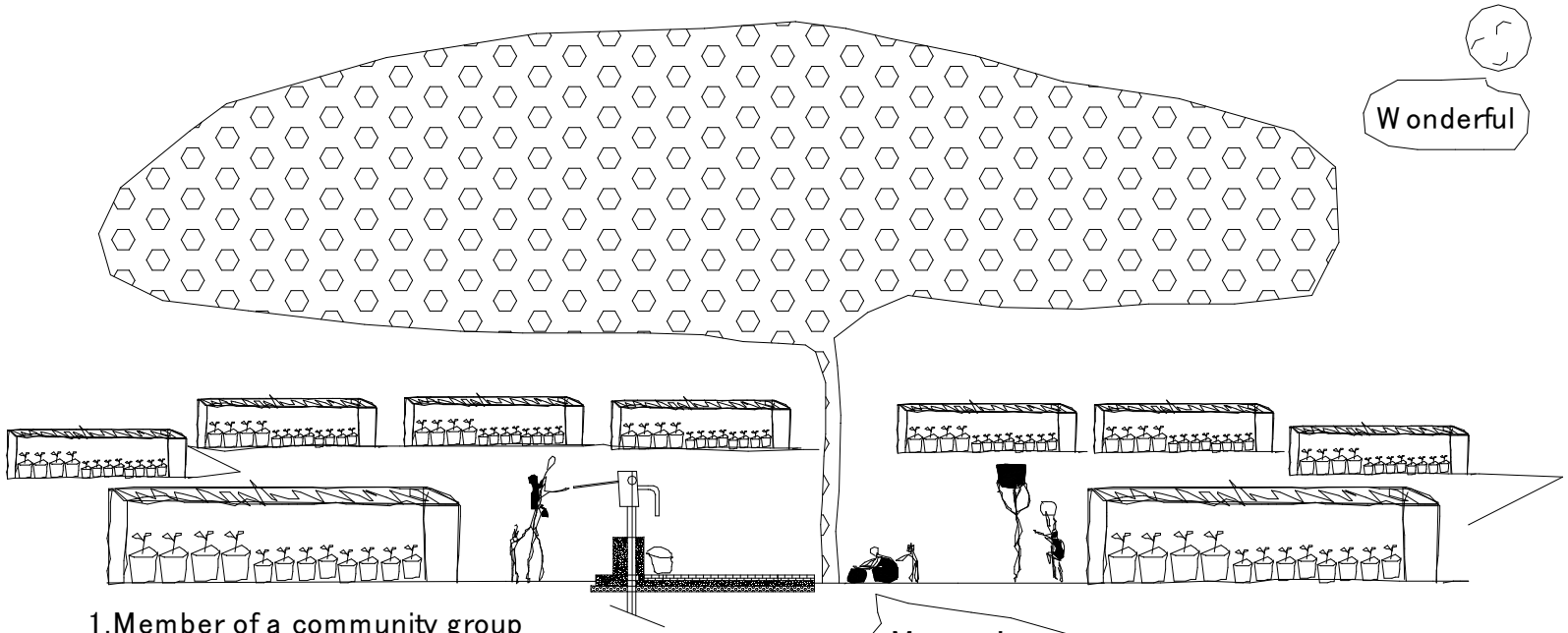


（ 810 ）Agroforestry in pastures and rangeland

1.The trees and shrubs produce fodder for livestock,
timber,fuel wood,fruit,and to improve the soil.
2.Trees provide shade in the dry season.



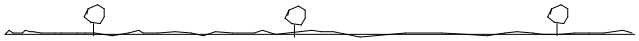
(811) Nursery

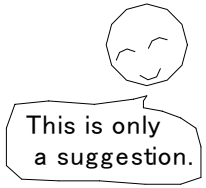


1.Member of a community group
tends tree seedlings in a horticultural nursery.
2.Women plant and maintain trees for fuelfood
or other products in a home garden.
3.Women's group in some areas have combined
vegetable gardens with tree nurseries at a community site.

（ 812 ） Improving Fallows with Trees

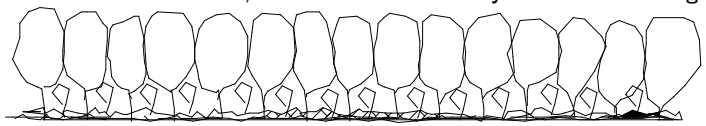
（ 1 ） The farmland is left for fallow.





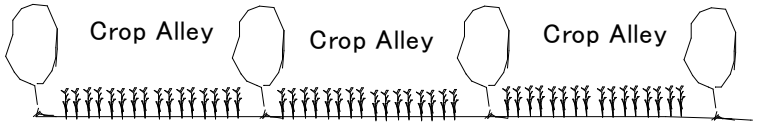
（ 2 ） Trees and legume cover crops are planted to produce
dense cover.

（ 3 ） Trees are growing,and natural vegetation also establishes itself.
Selective cutting for poles and fuel wood can take place.
The soil recovers,and the land is ready to be farmed again.

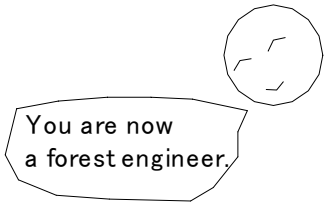


Several years after

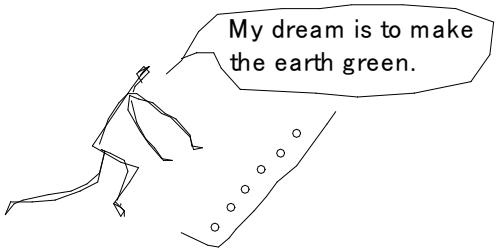
（ 4 ） Some Trees are harvested.
The land is cleaned and replanted
using alley-cropping system.

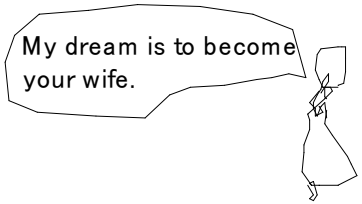


(813) Improving Fallows with Trees (2)

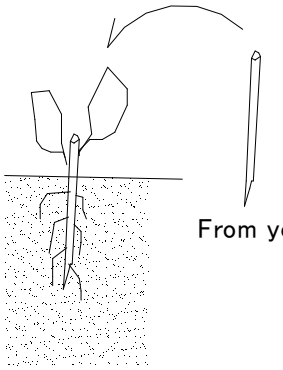


(1) Direct seeding.

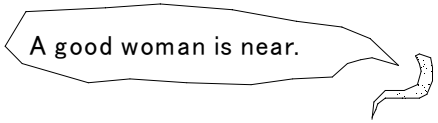




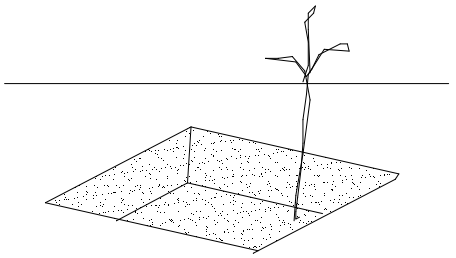
(2) Cuttings and stumps



From young trees

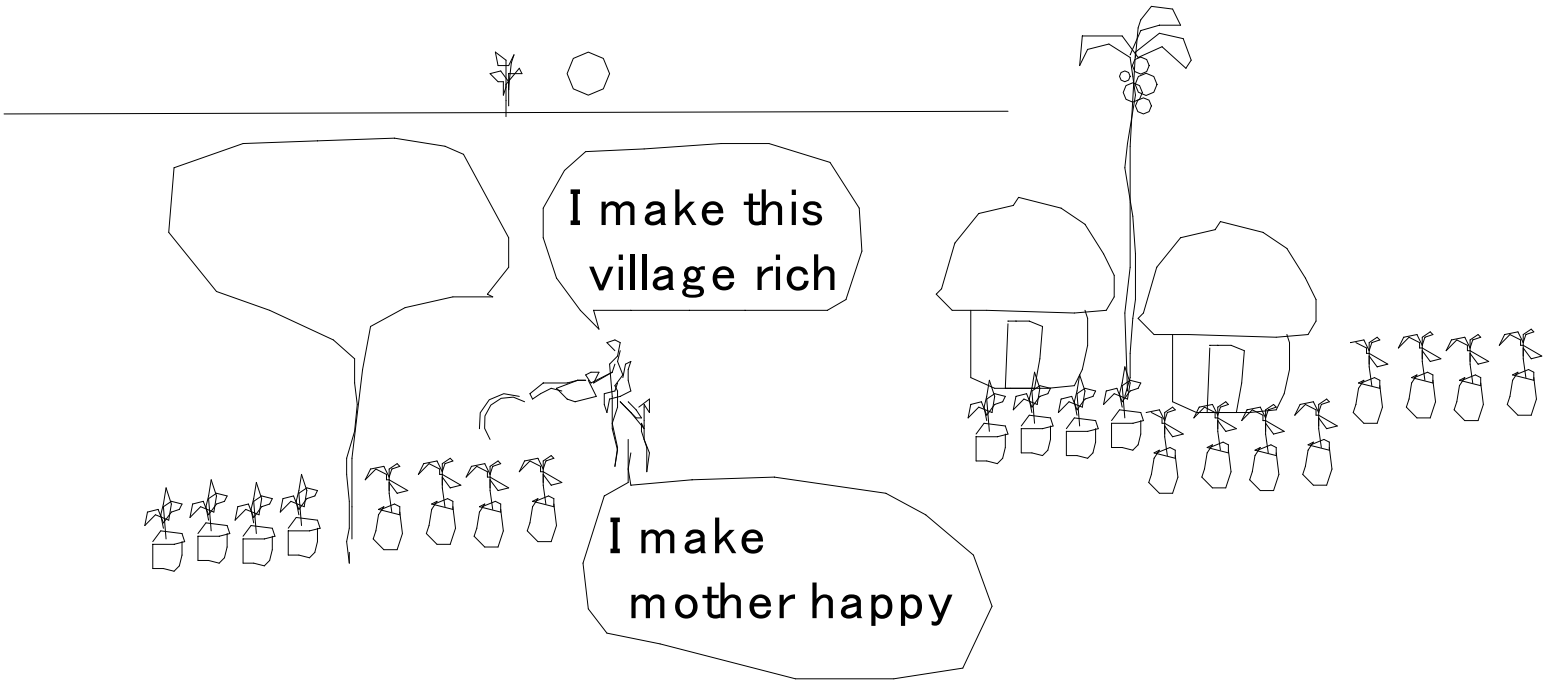


(3) Deep holes



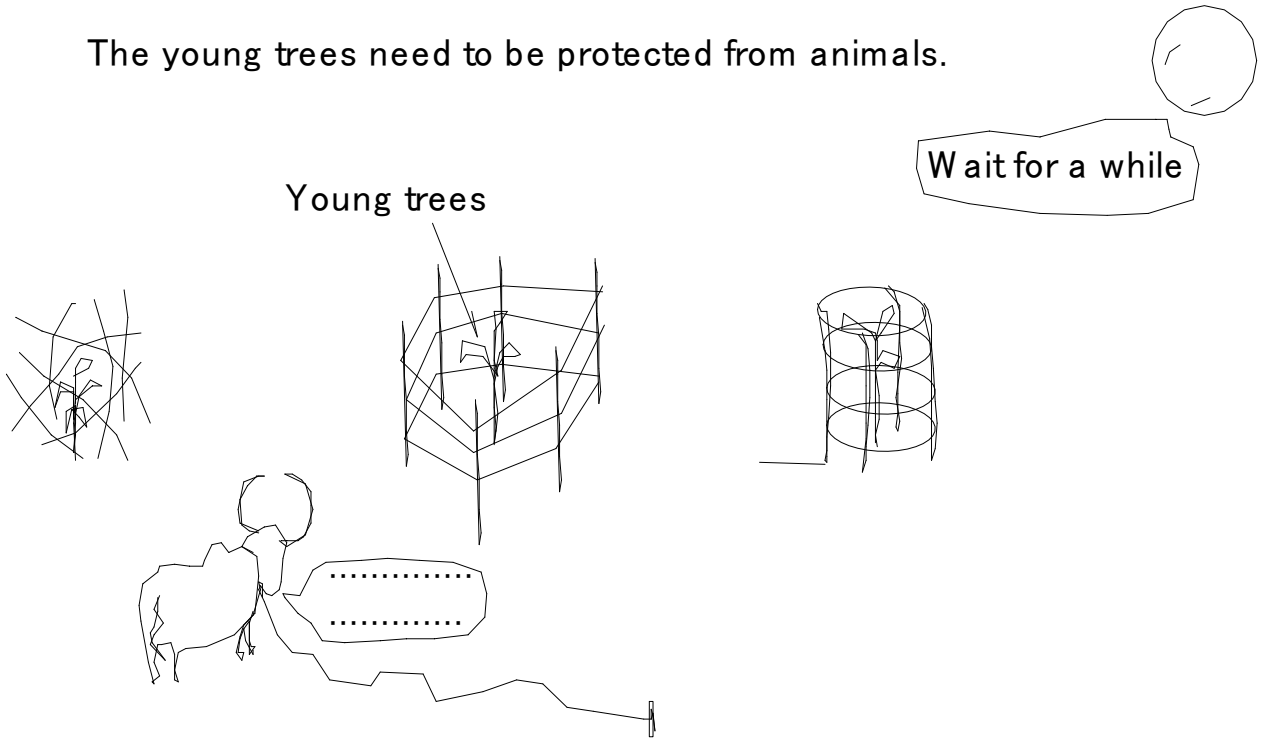
In drier areas planting holes of up to
1m deep can be useful on well drained soils.

（ 814 ） Watering a home tree nursery

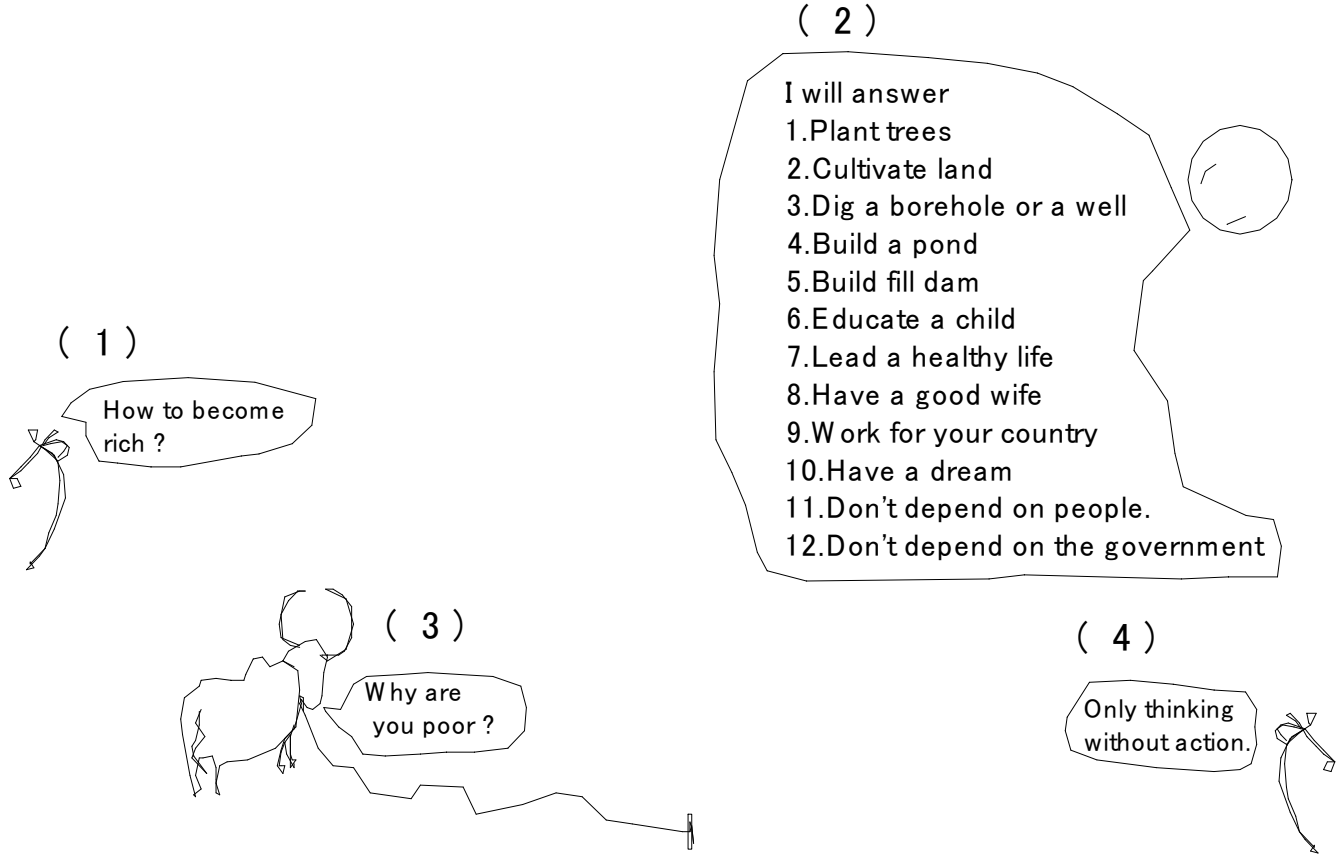


(815) Trees in the field need to be protected from animals.

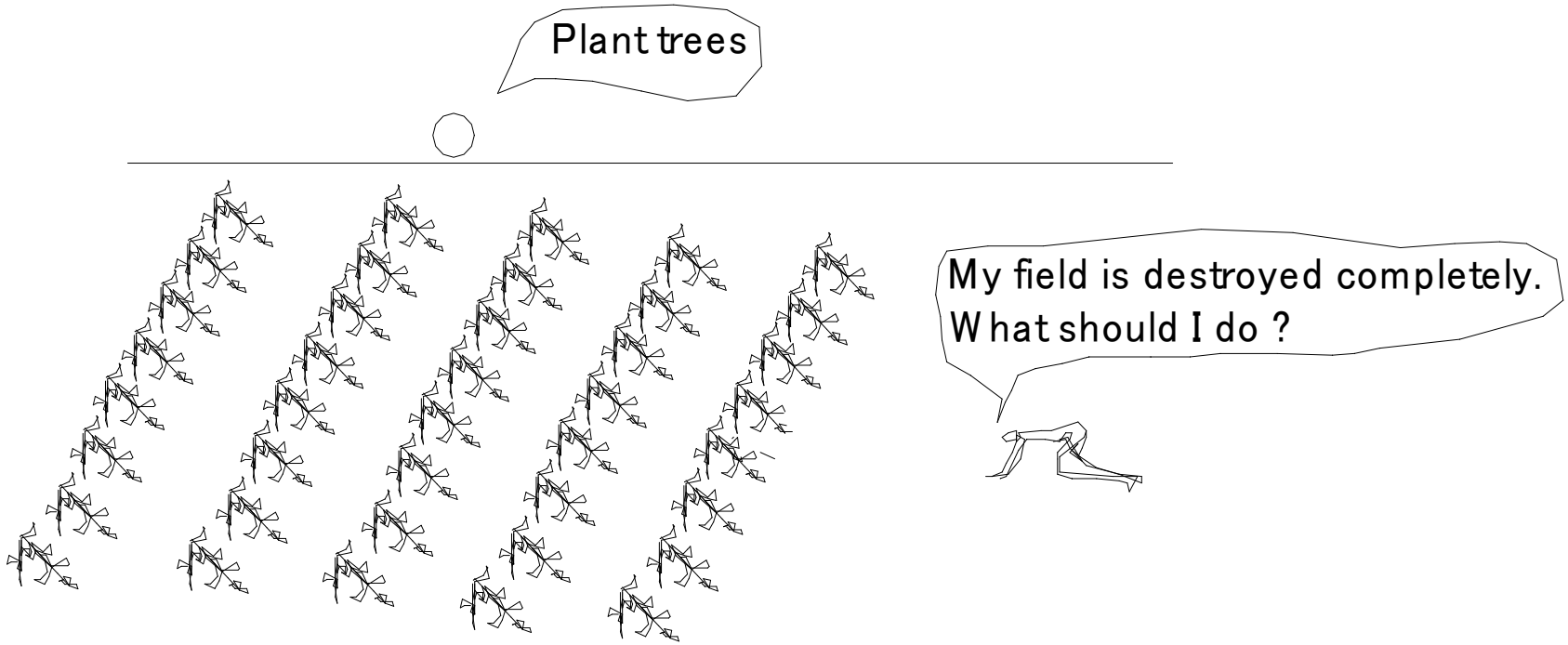
The young trees need to be protected from animals.



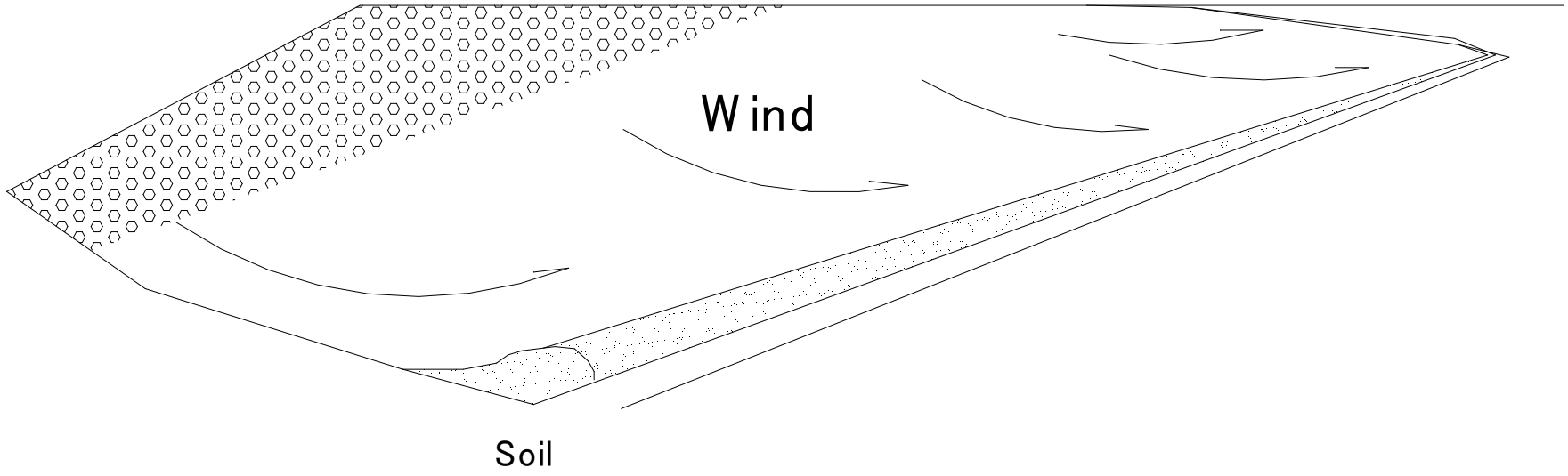
（ 816 ） How to become rich in africa



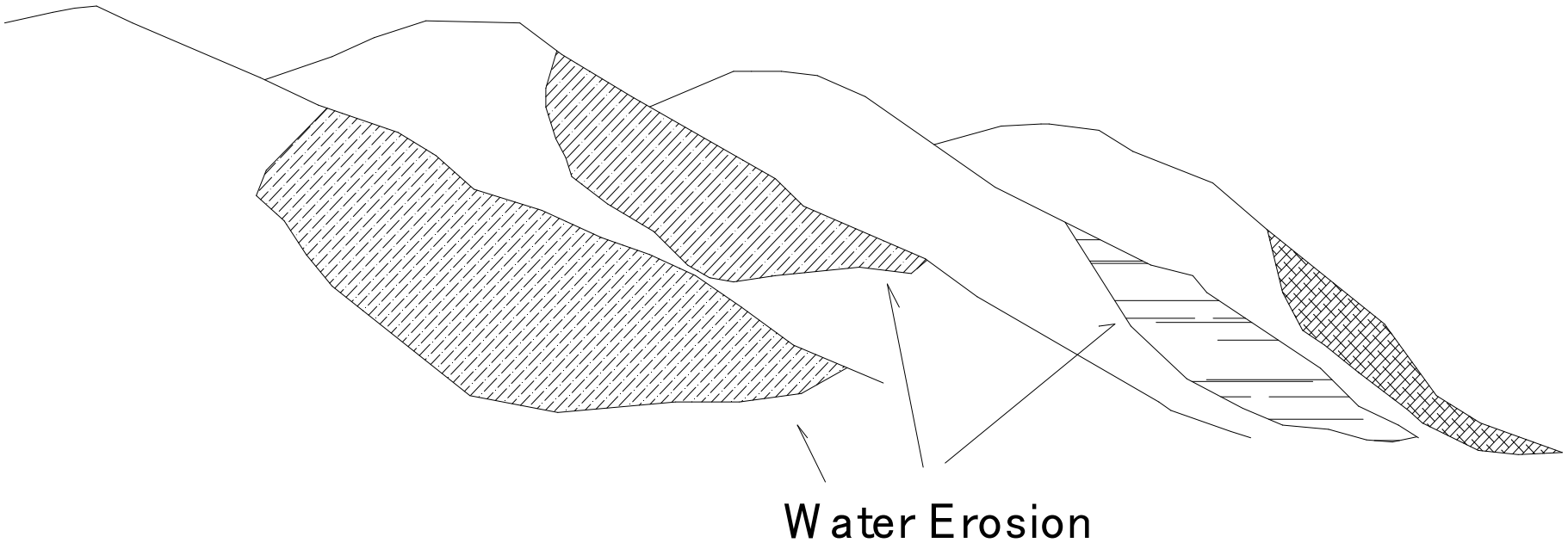
（ 817 ） Destructive effect of erosion on agricultural land



（ 818） Deposition of soil caused by wind erosion

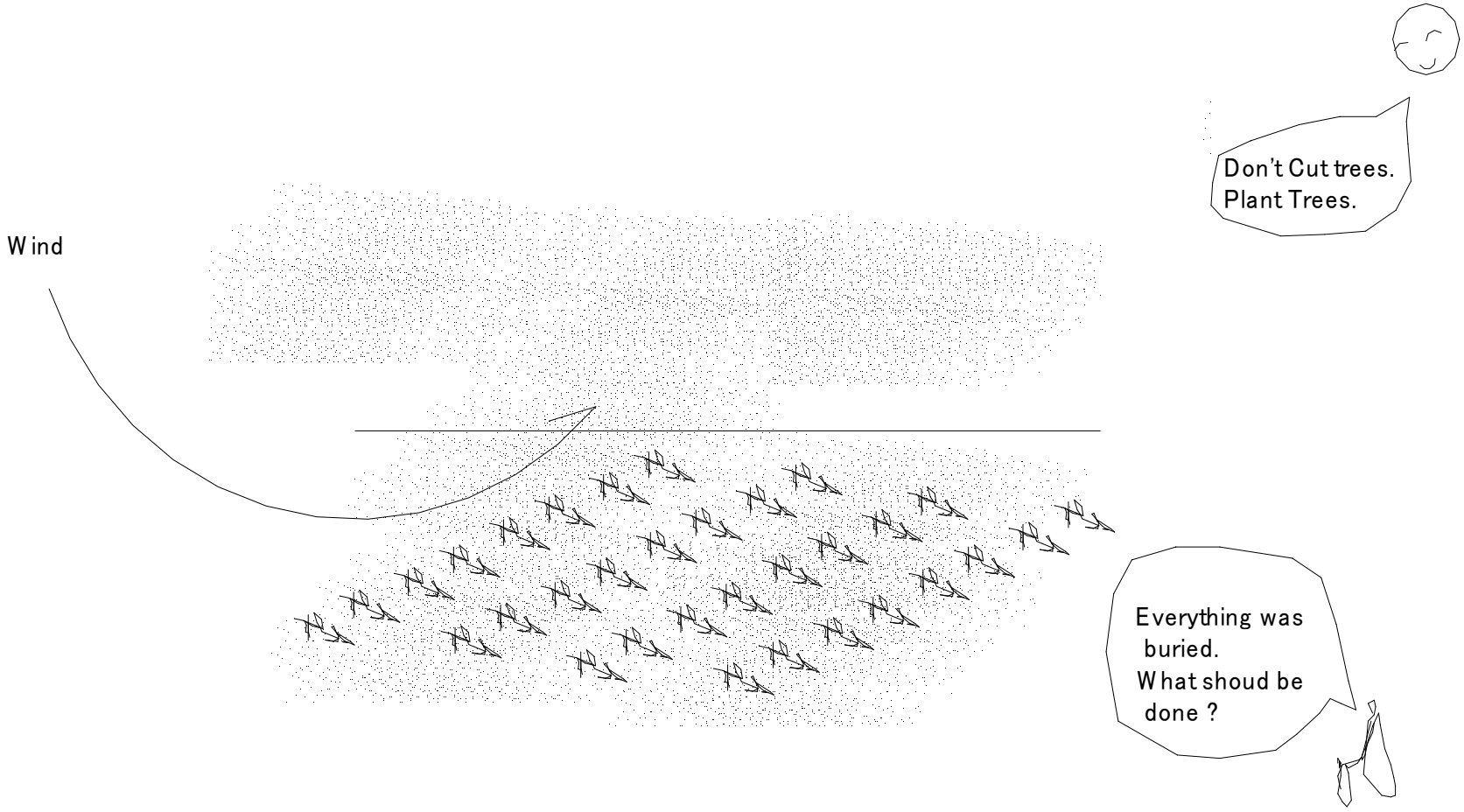


（819） Water Erosion

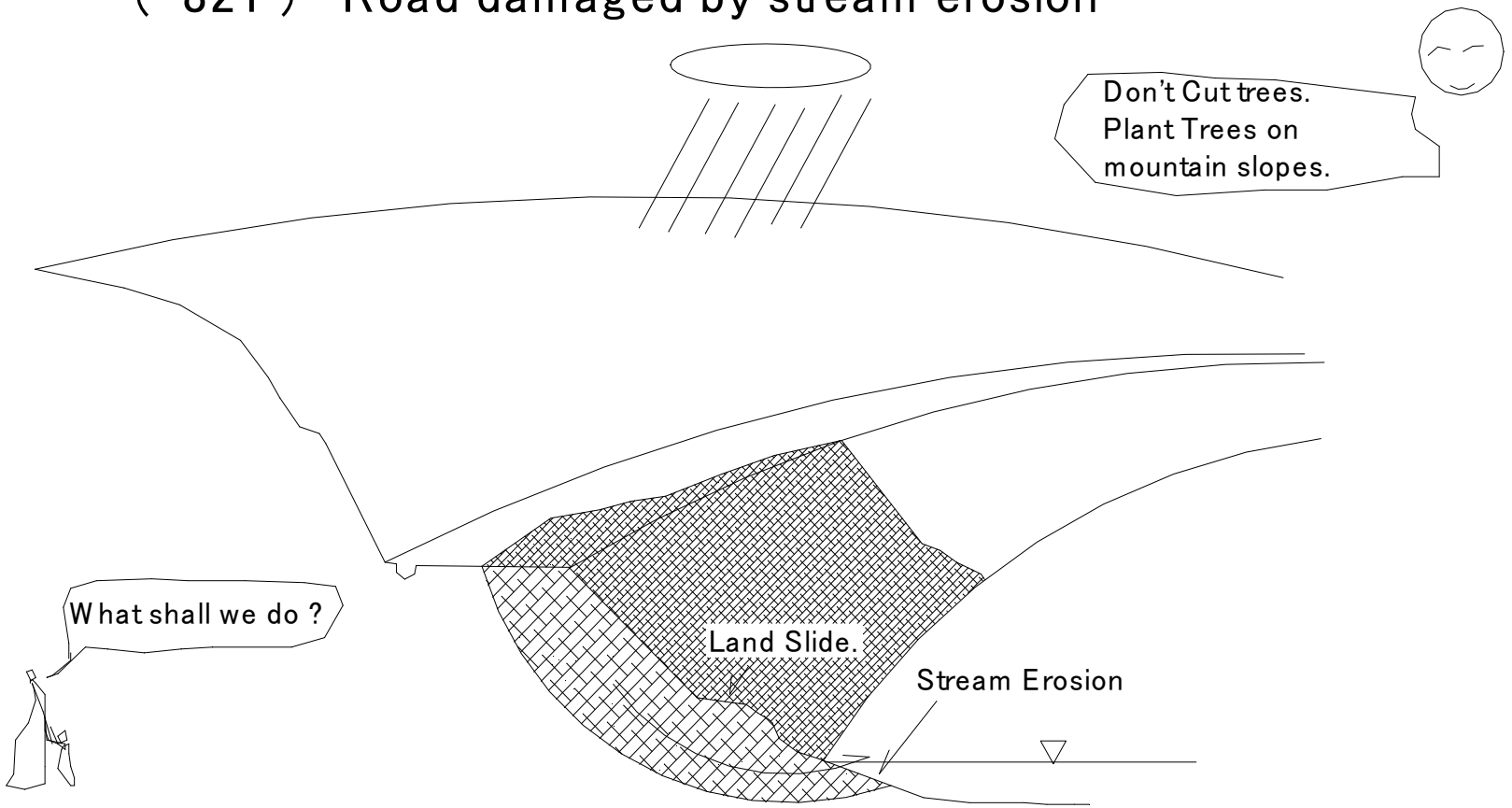


820 Dust storm caused by the wind erosion (1)

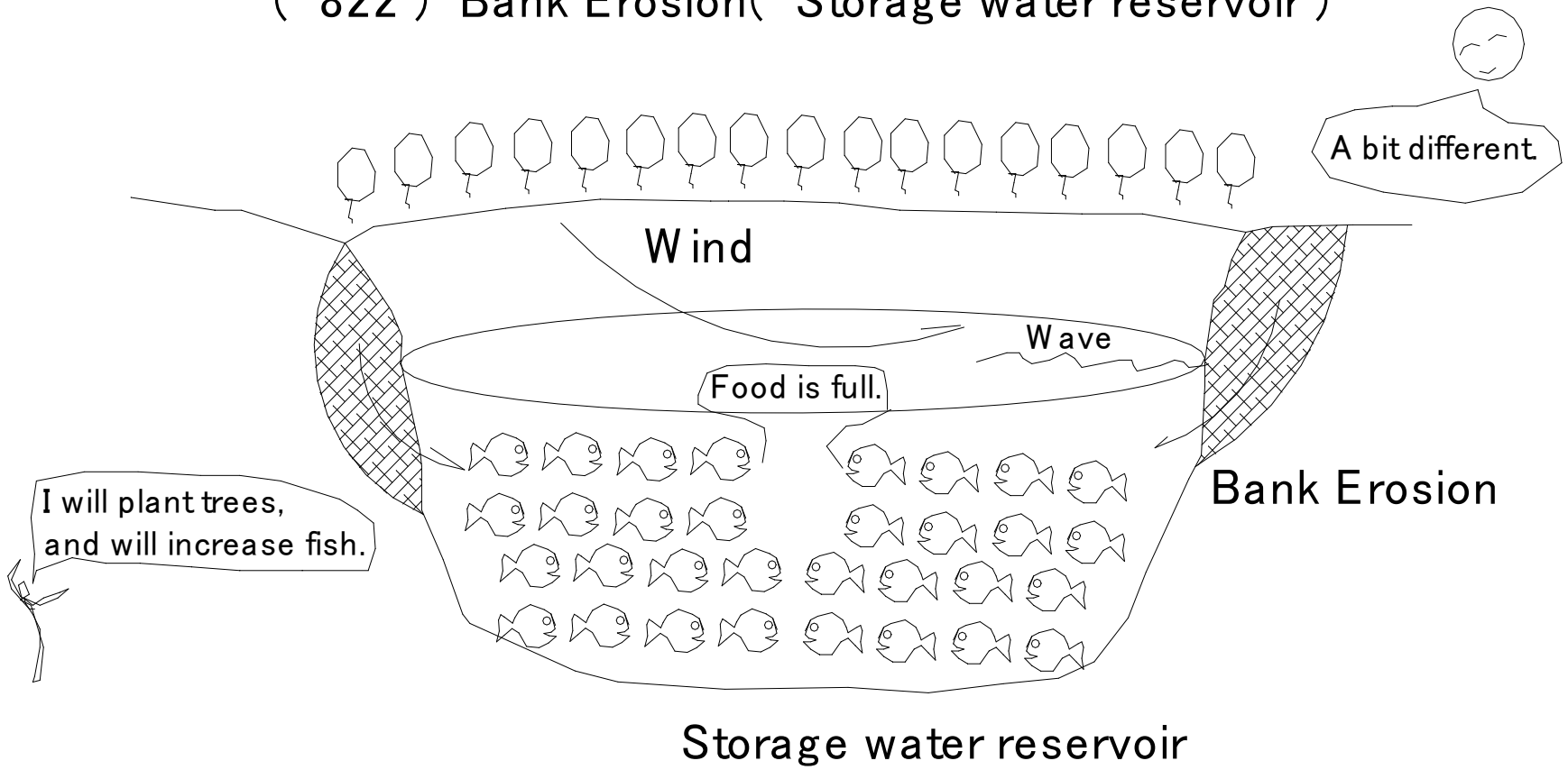
（ 820 ） Dust storm caused by the wind erosion



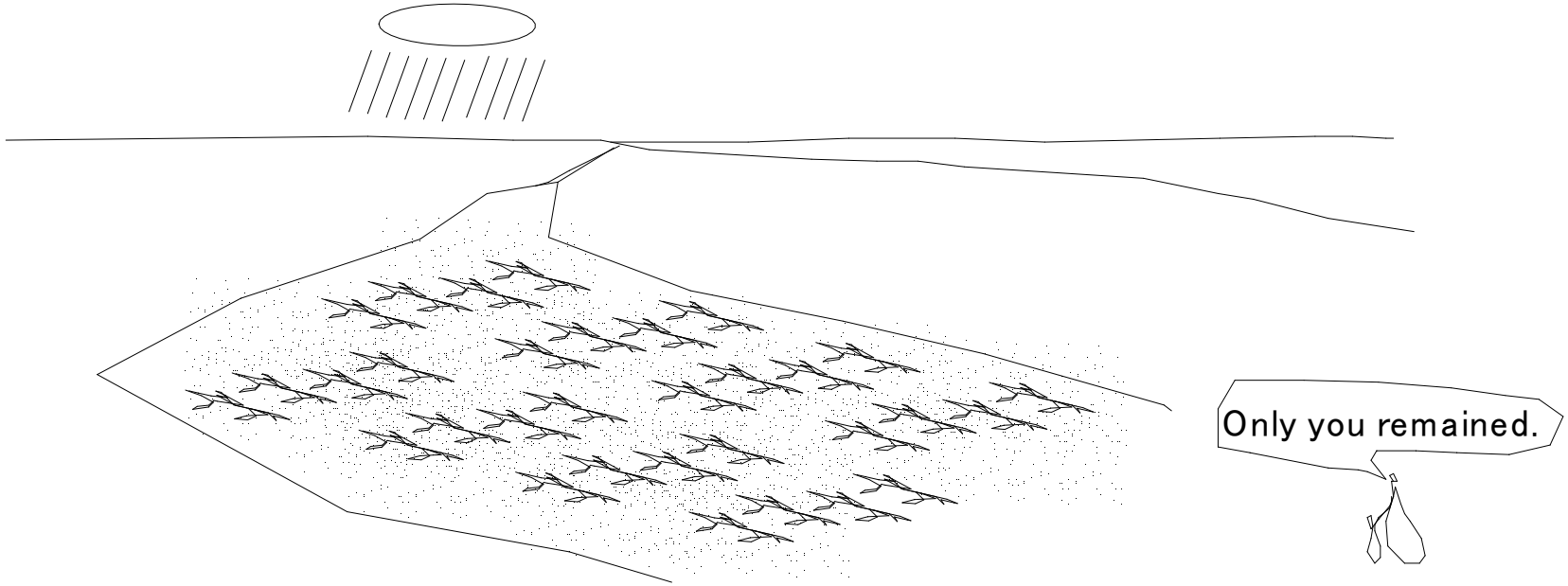
（ 821 ） Road damaged by stream erosion



（ 822 ） Bank Erosion（ Storage water reservoir ）

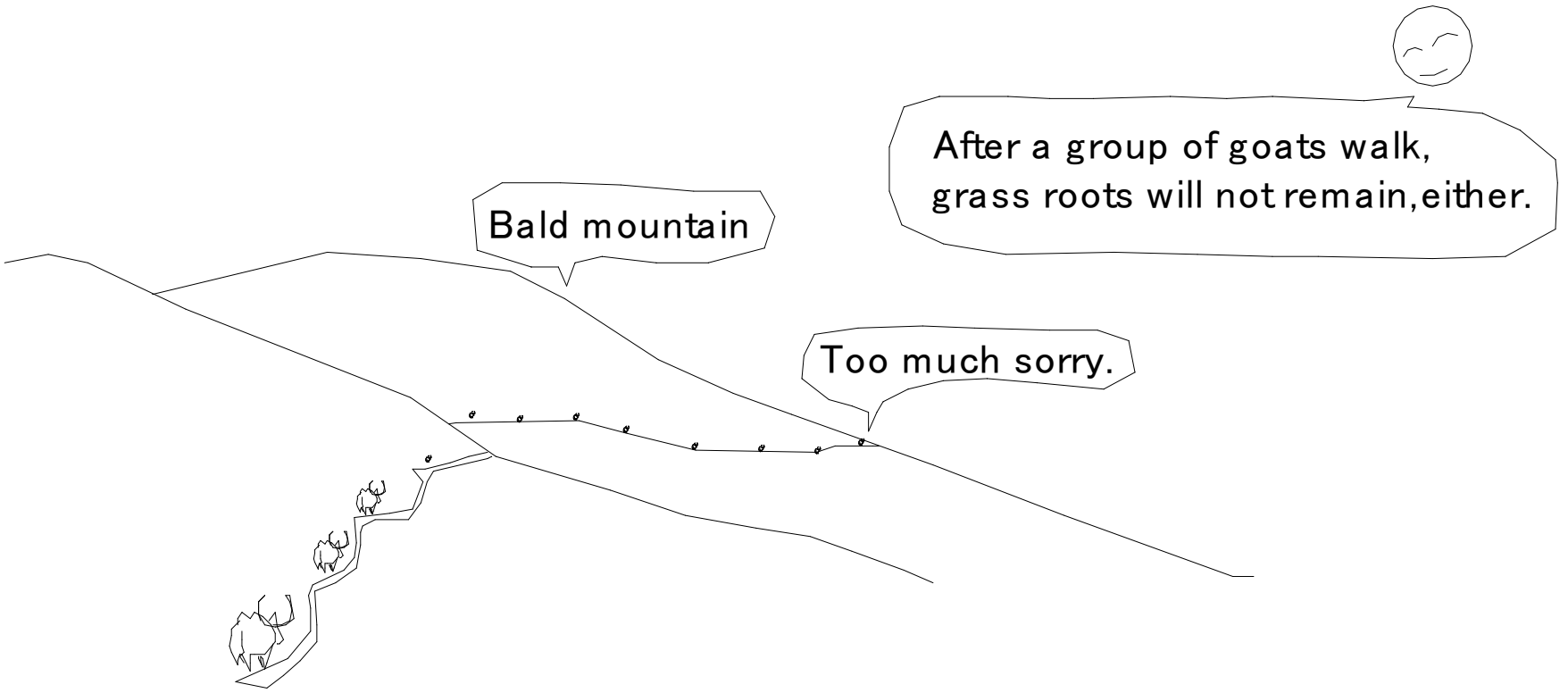


（ 823 ）Farmland depleted by water erosion

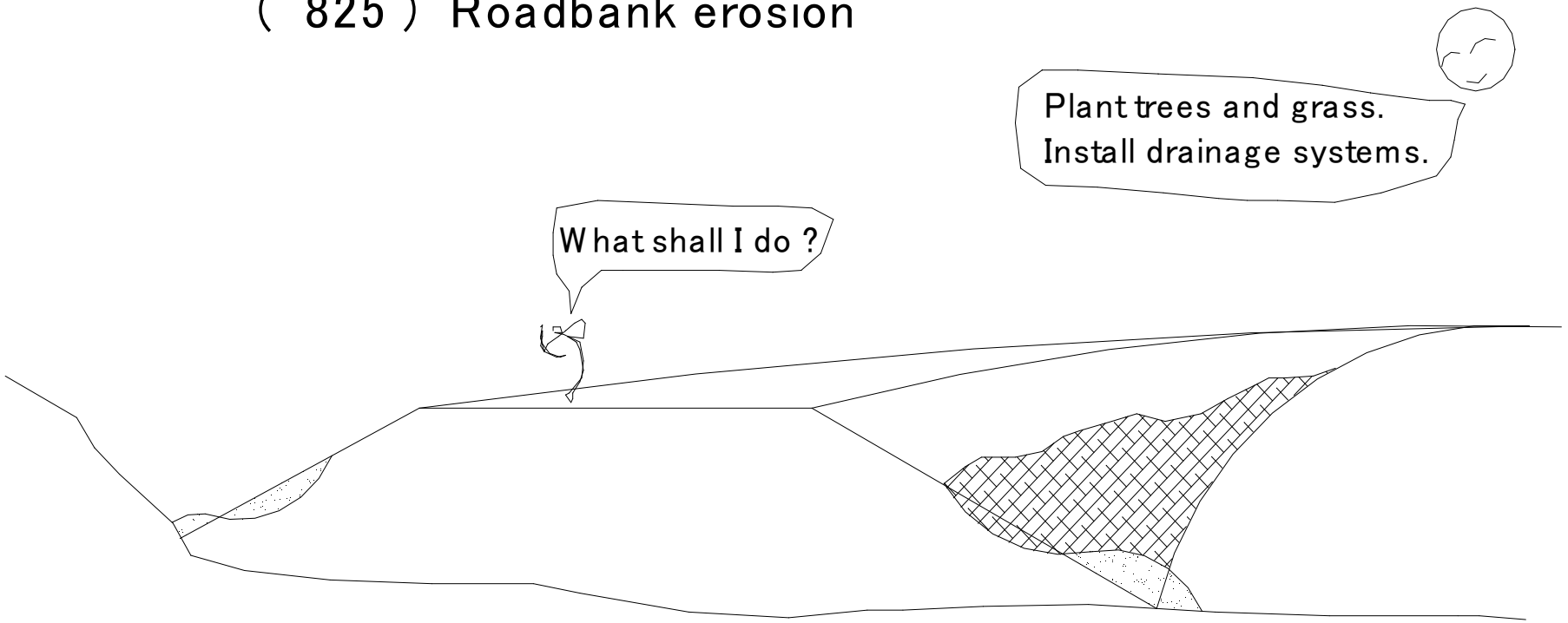


Farmland depleted by water erosion

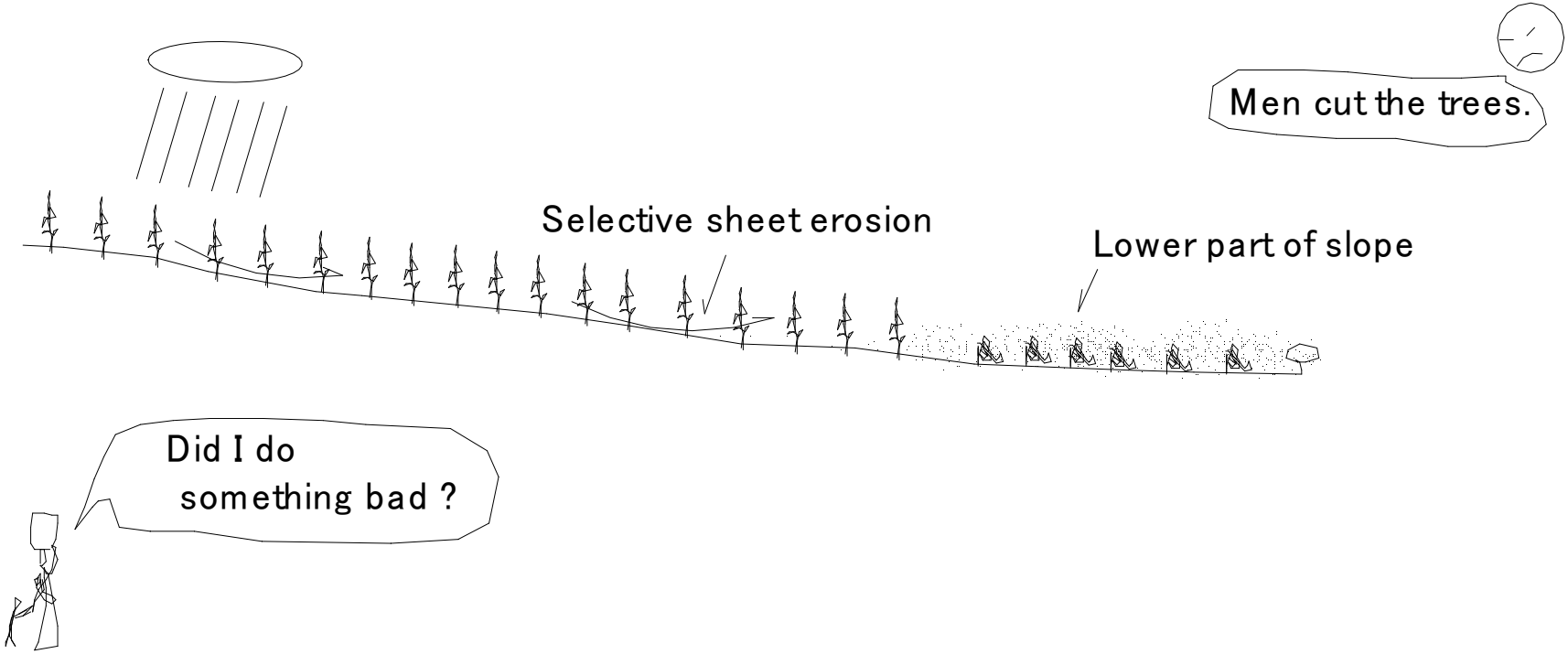
（ 824 ） Pastures gullied due to compaction caused by livestock



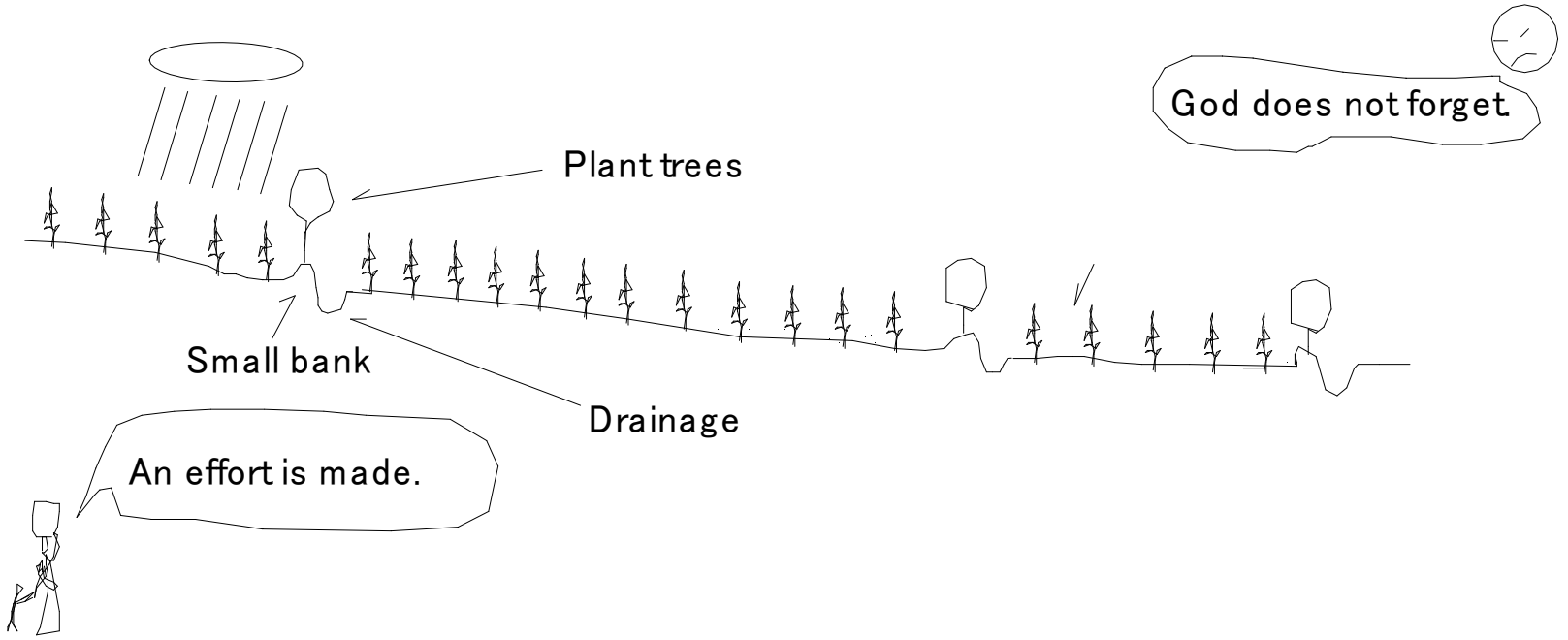
（ 825 ） Roadbank erosion



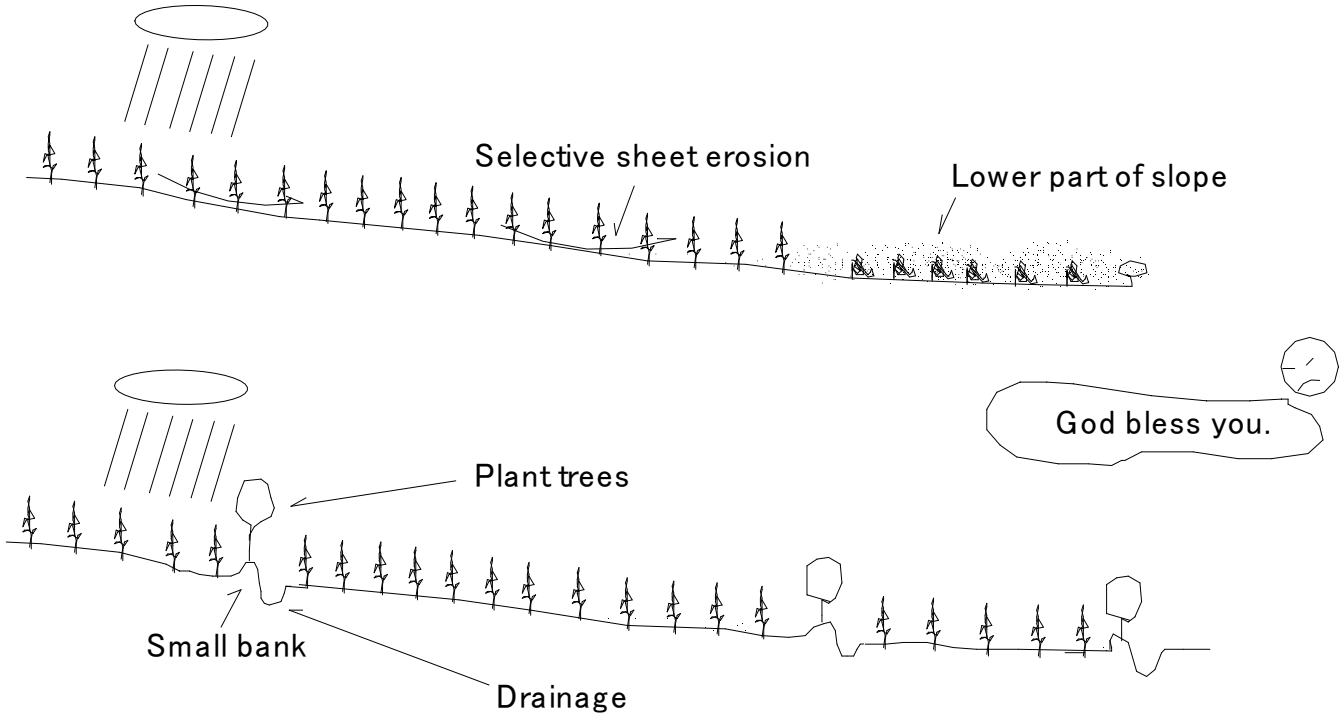
(826) Lower part of slope affected by selective sheet erosion (1)



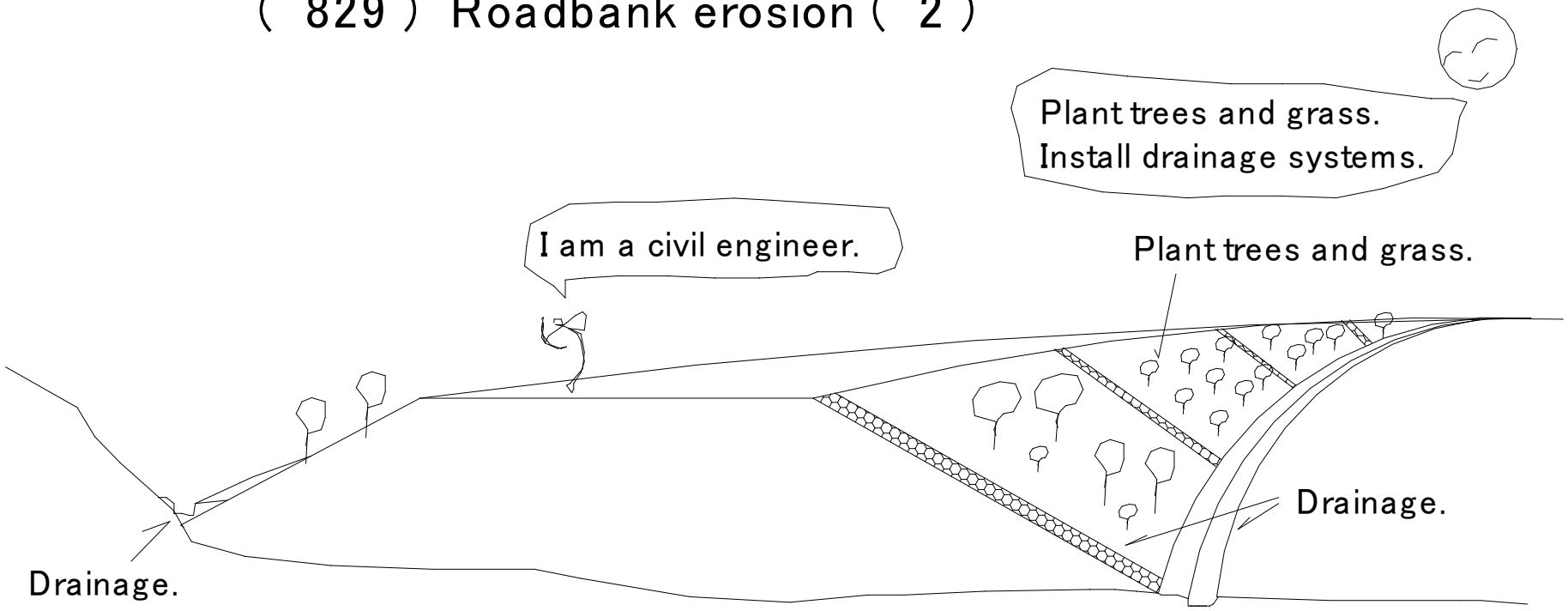
(827) Lower part of slope affected by selective sheet erosion (2)



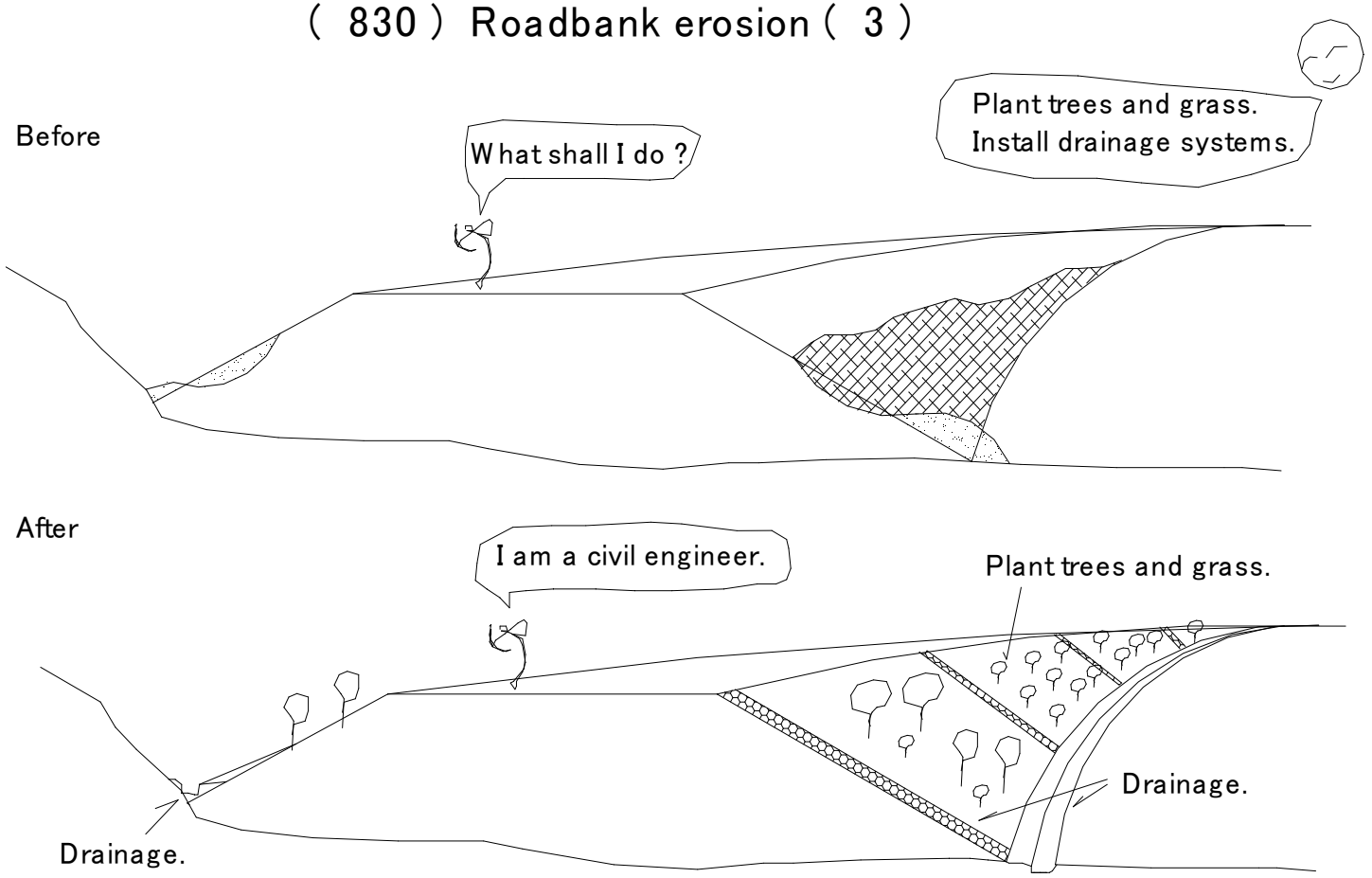
（ 828 ） Lower part of slope affected by selective sheet erosion（ 3 ）



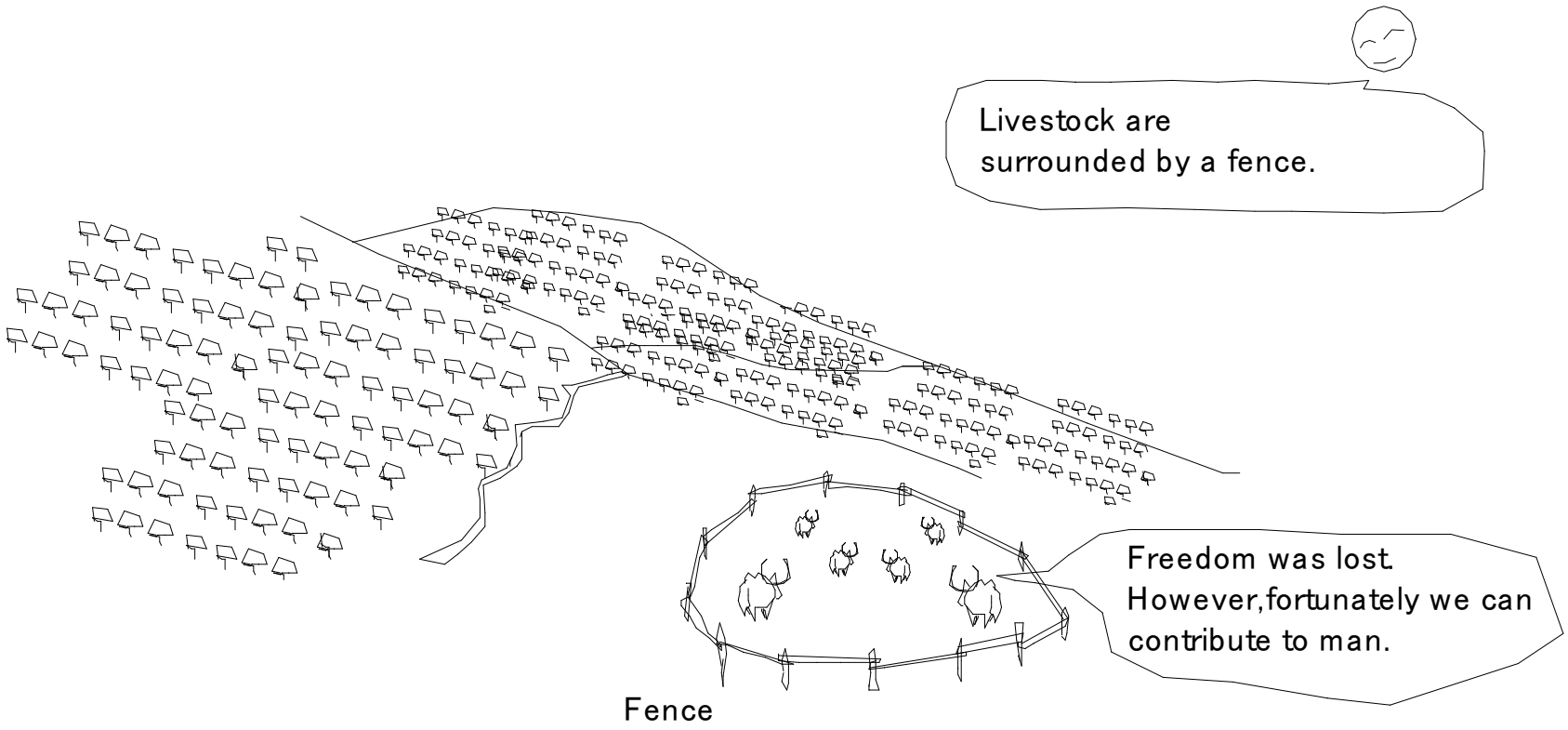
(829) Roadbank erosion (2)



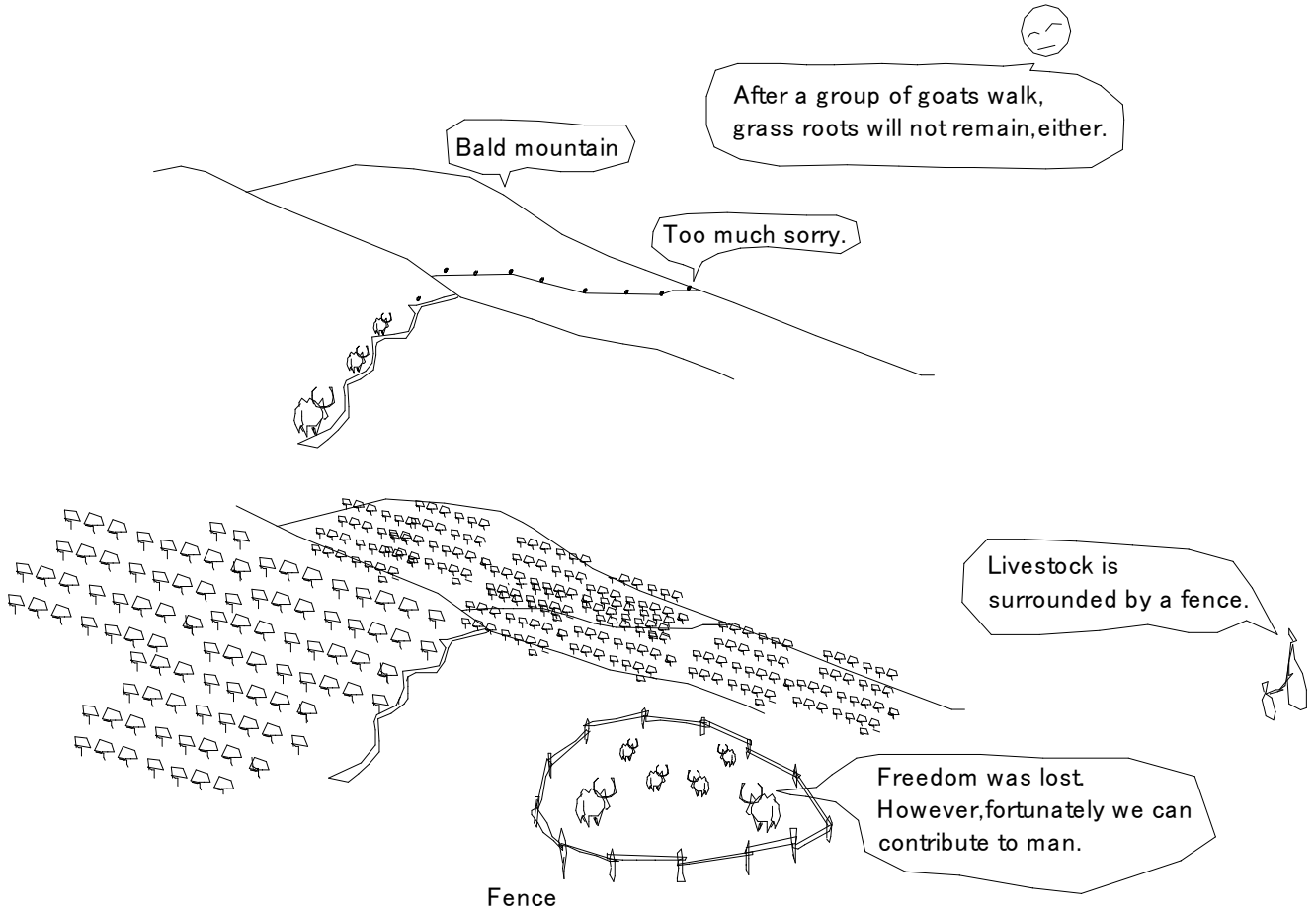
（ 830 ） Roadbank erosion（ 3 ）



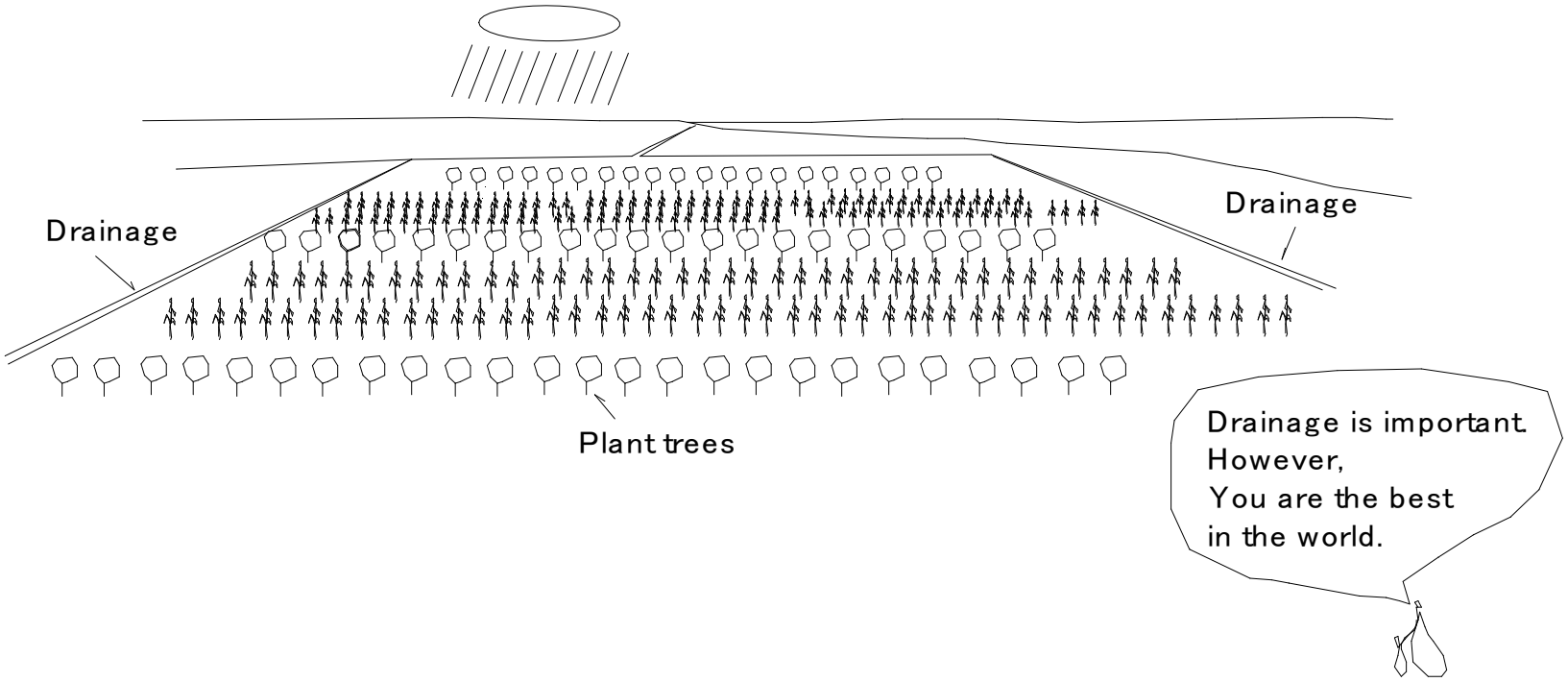
(831) Pastures gullied by goat or cow trail (2)



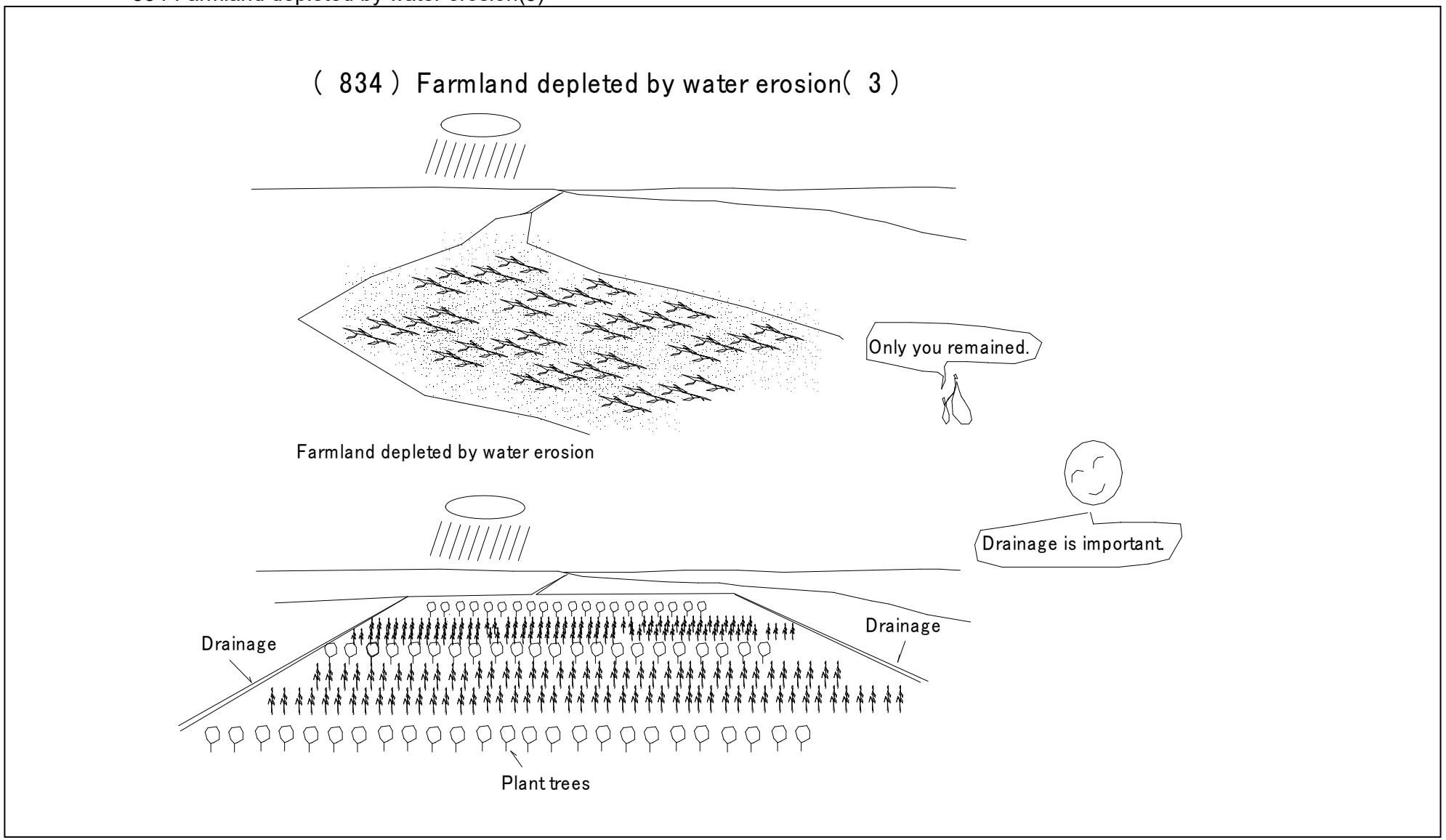
（ 832 ） Pastures gullied by goat or cow trail(　3　)



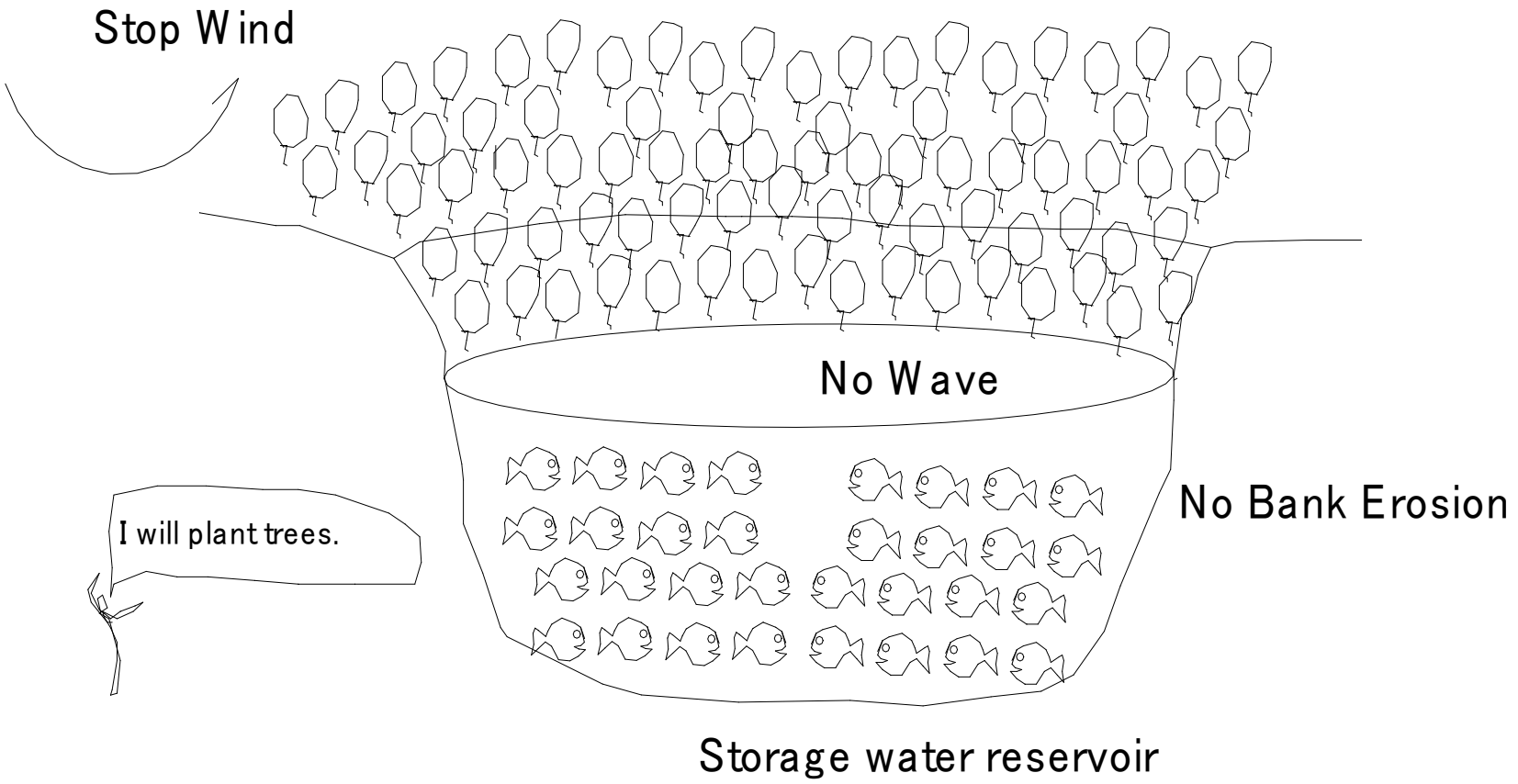
（ 833 ） Farmland depleted by water erosion（ 2 ）



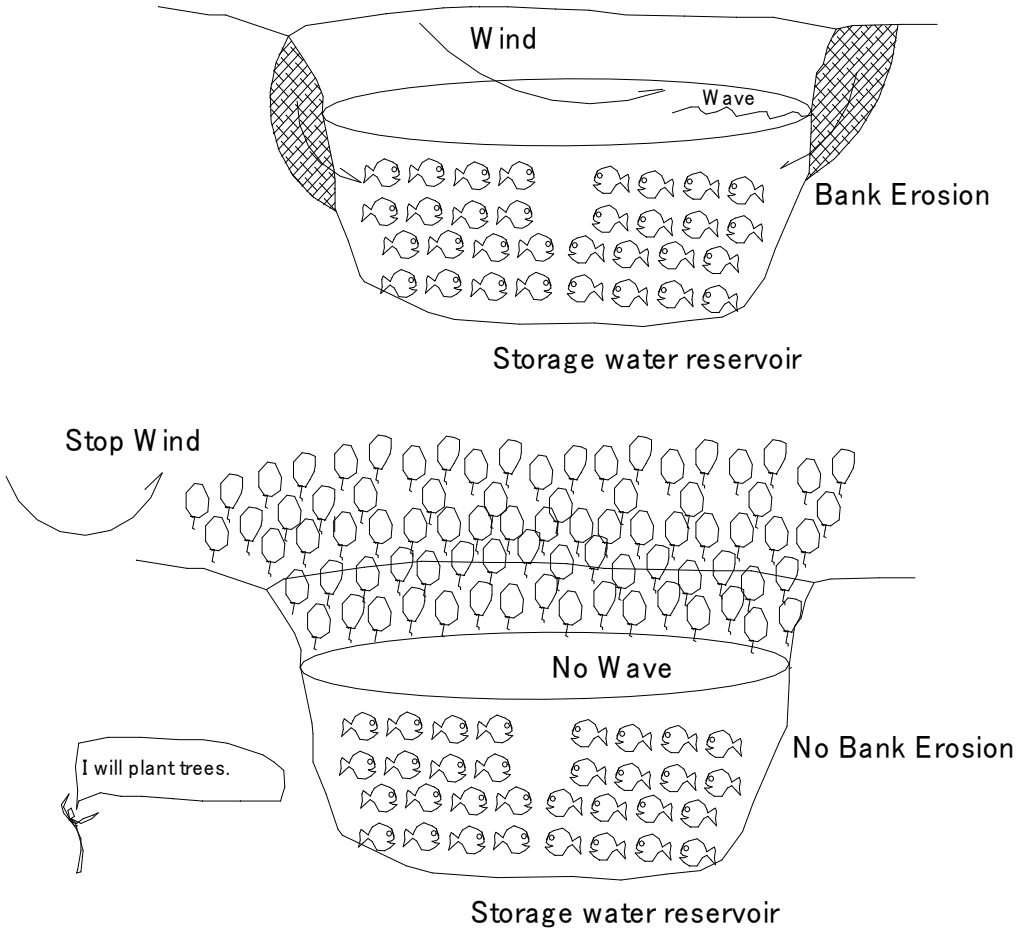
834 Farmland depleted by water erosion(3)



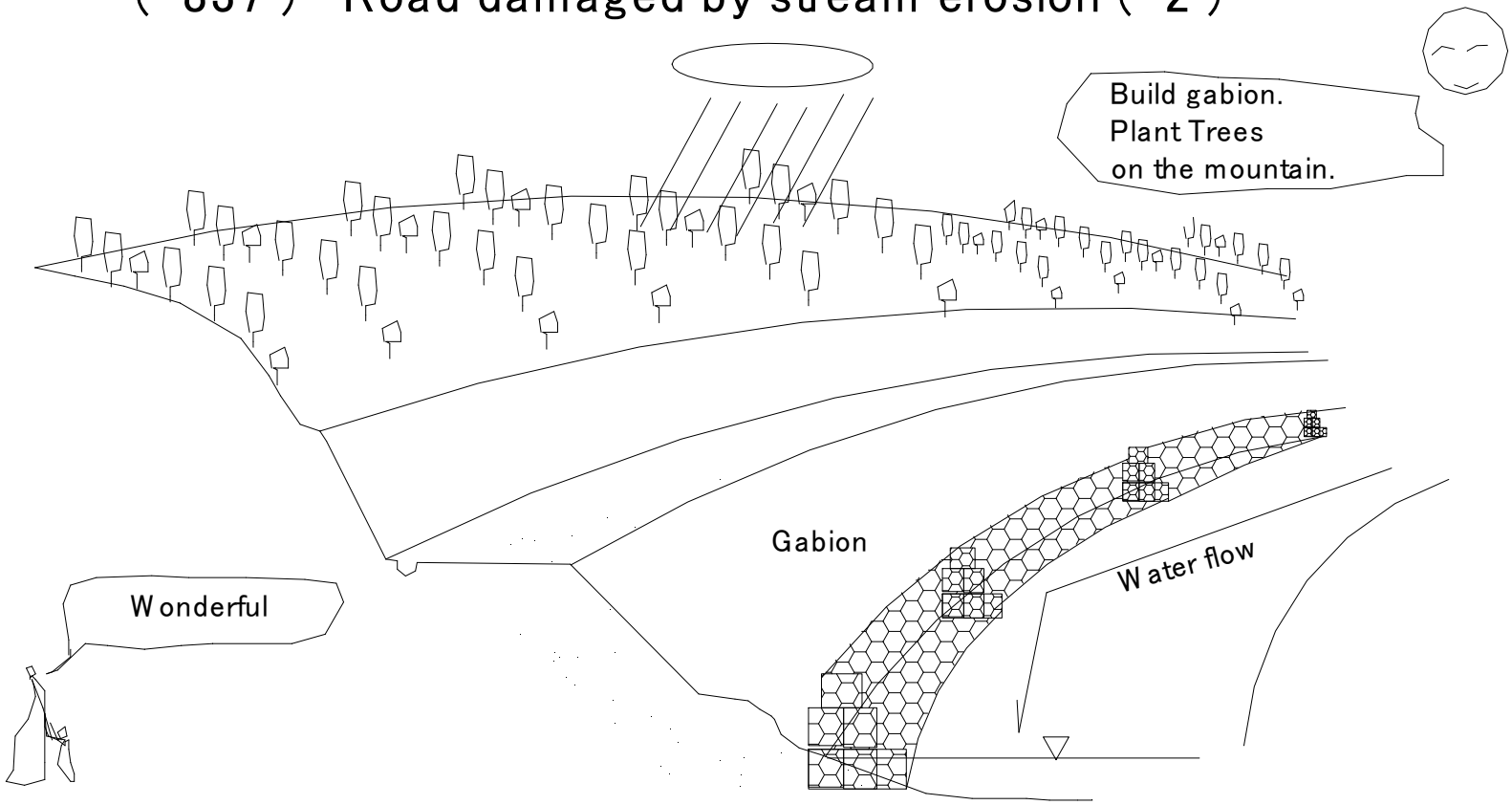
(835) Bank Erosion(Storage water reservoir) (2)



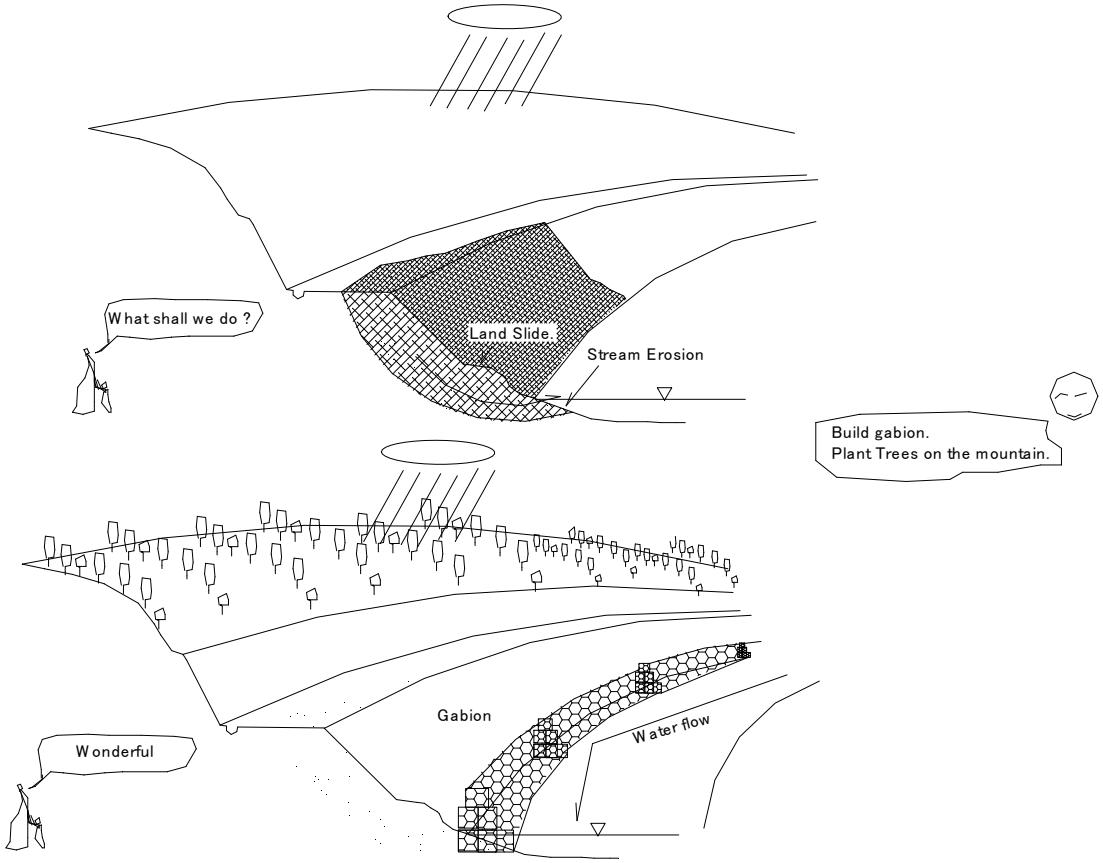
(836) Bank Erosion(Storage water reservoir) (3)



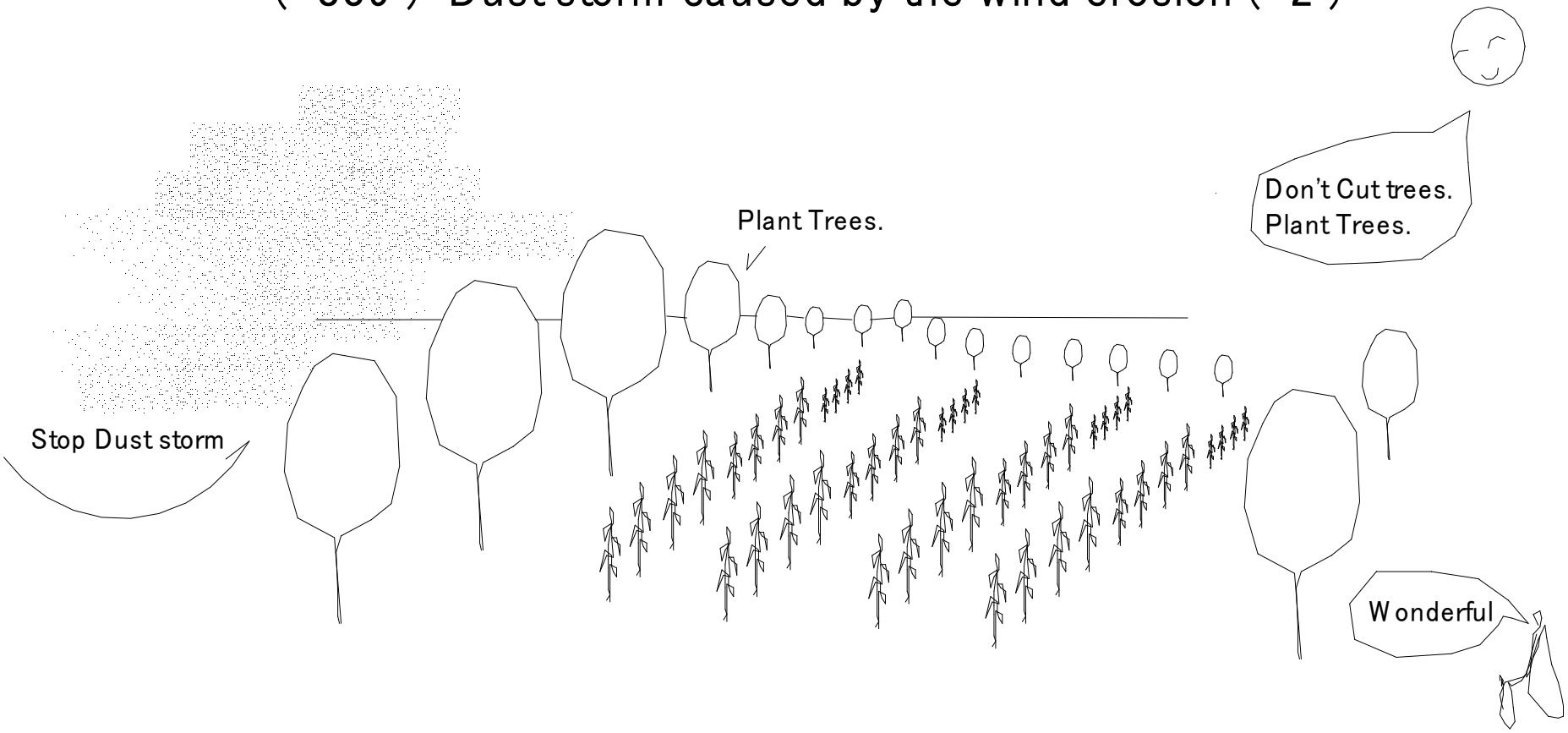
（ 837 ） Road damaged by stream erosion（ 2 ）



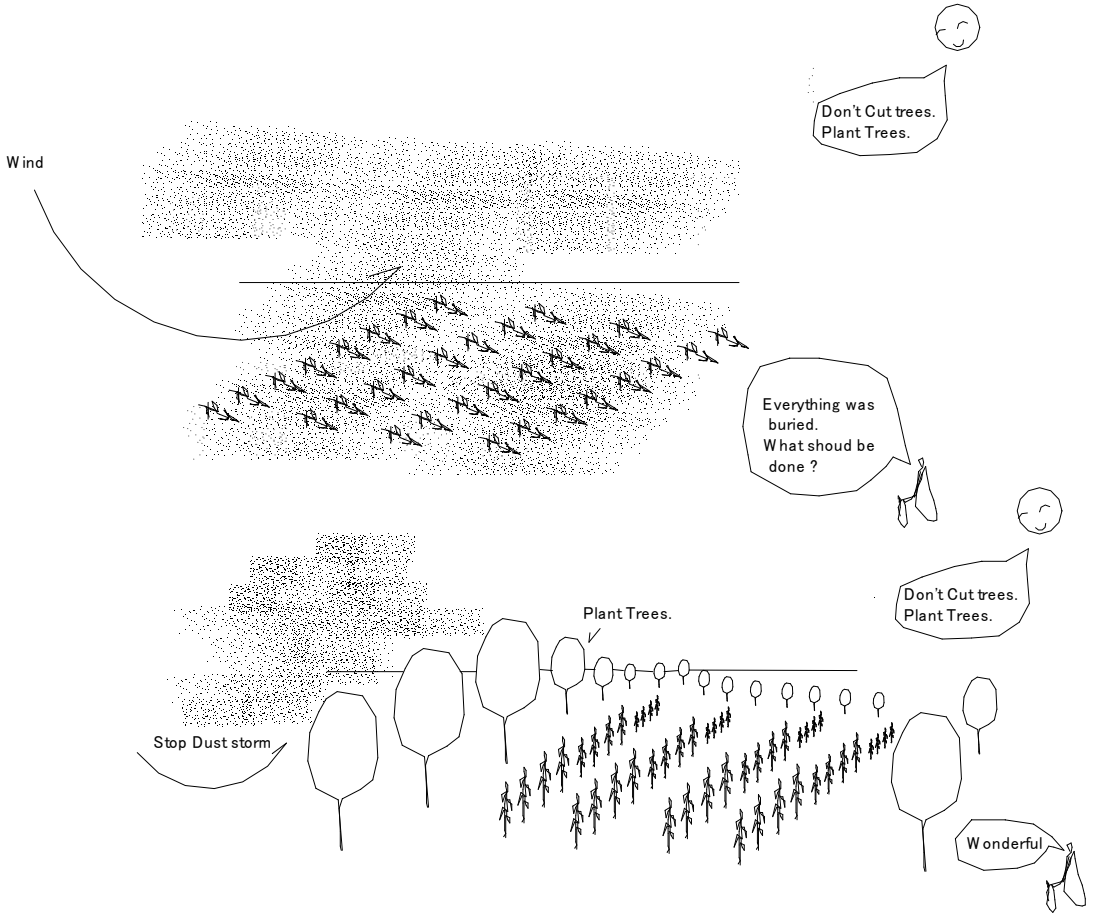
(838) Road damaged by stream erosion (3)



（ 839 ） Dust storm caused by the wind erosion（ 2 ）

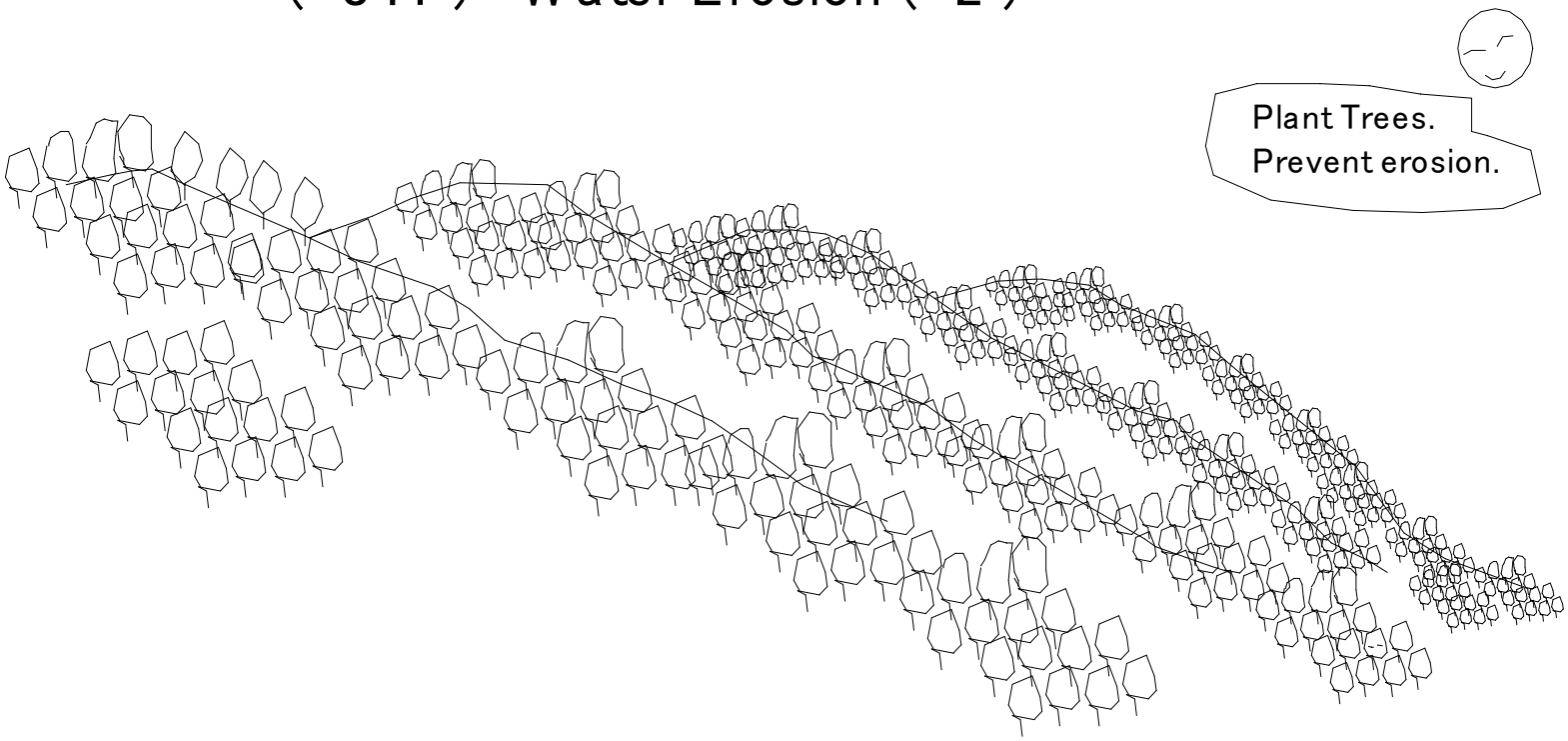


(840) Dust storm caused by the wind erosion (3)

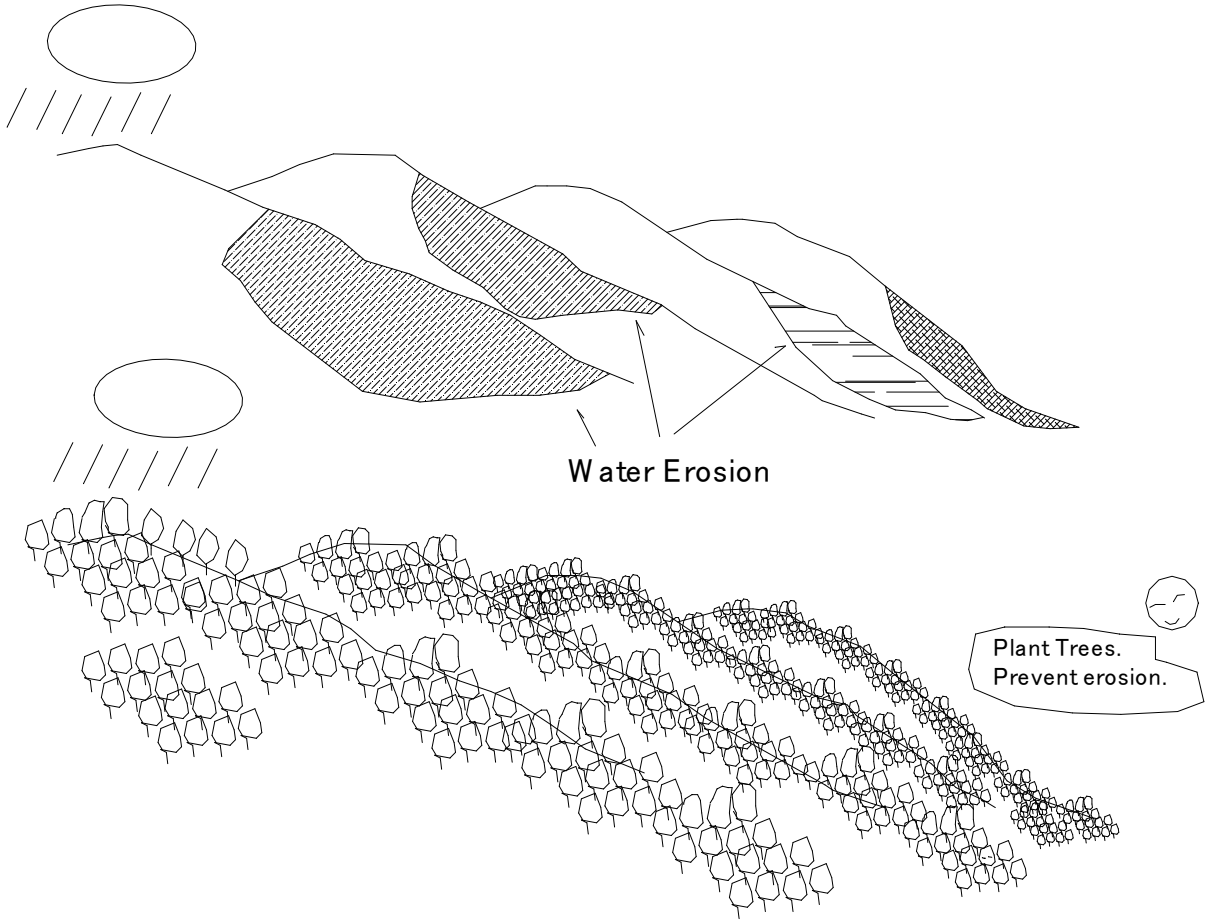


841 Water Erosion(2)

（ 841 ） Water Erosion（ 2 ）

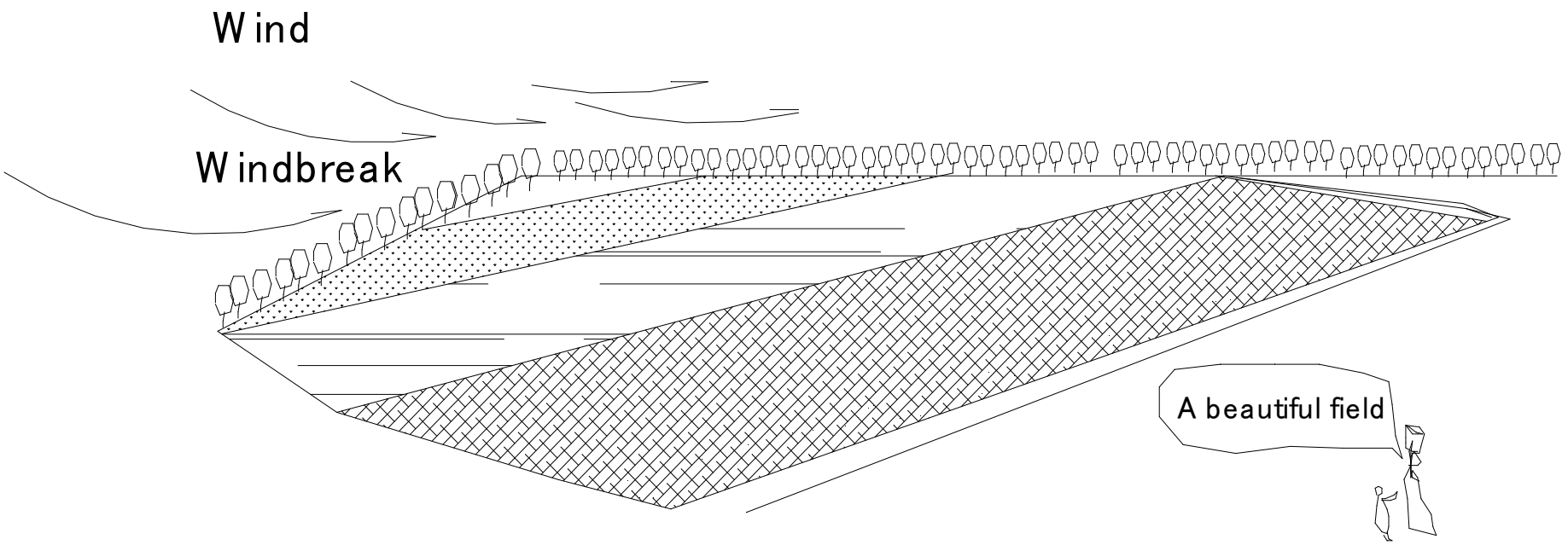


（ 842 ） Water Erosion（ 3 ）

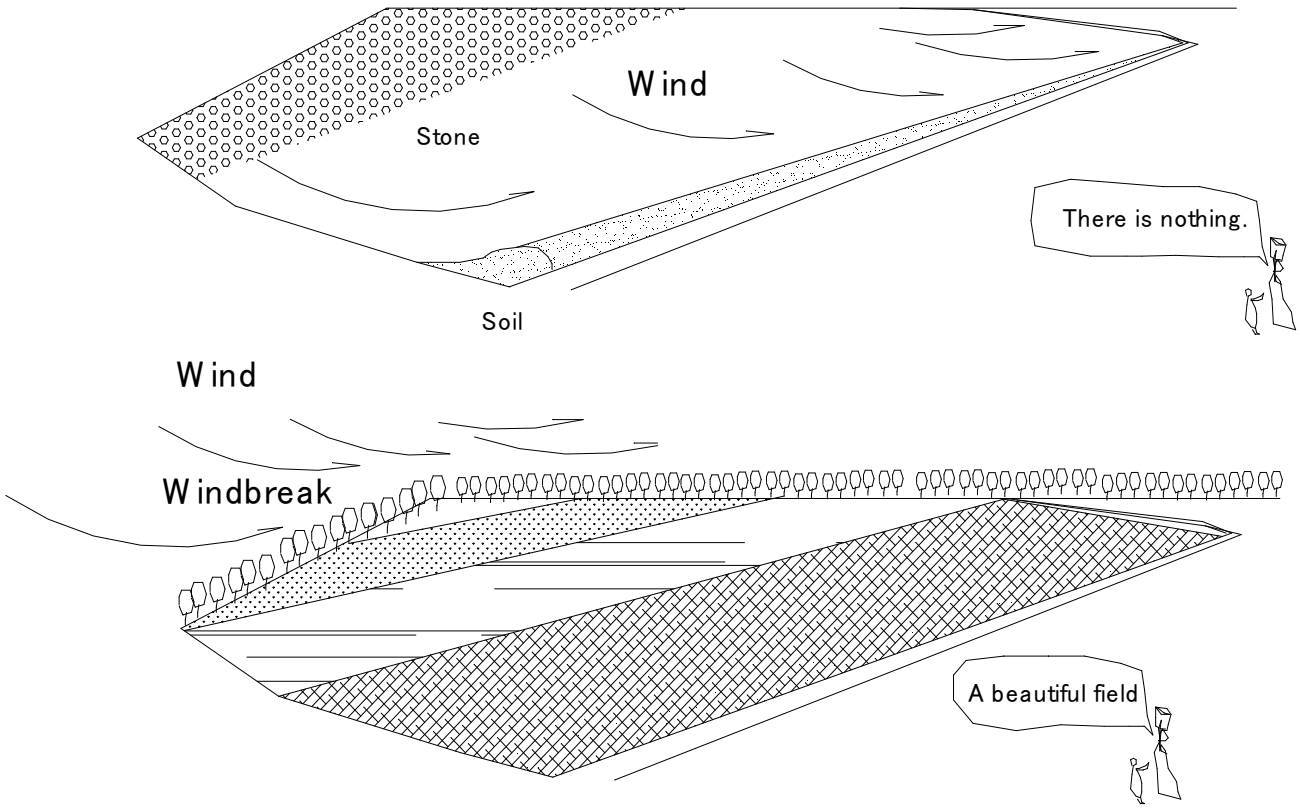


843 Deposition of soil wind erosion(2)

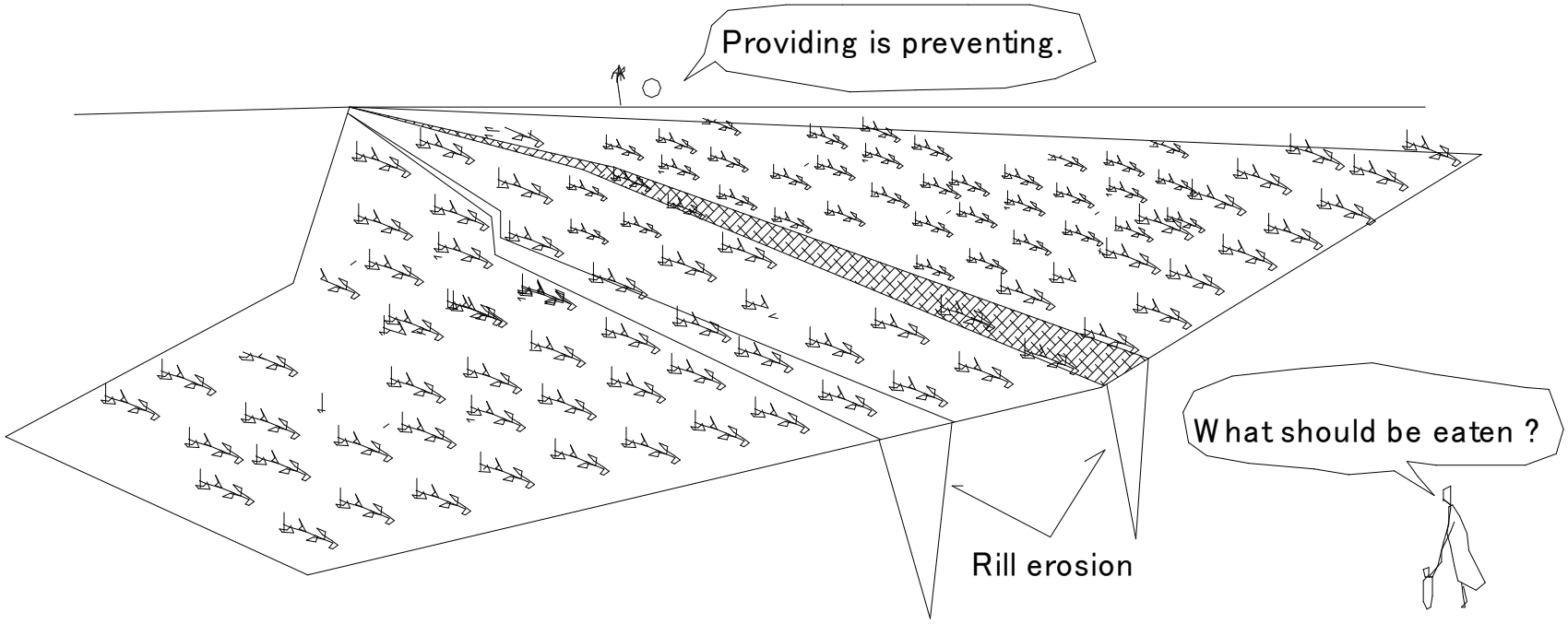
（ 843 ） Deposition of soil by wind erosion（ 2 ）



（ 844 ） Deposition of soil by wind erosion（ 3 ）

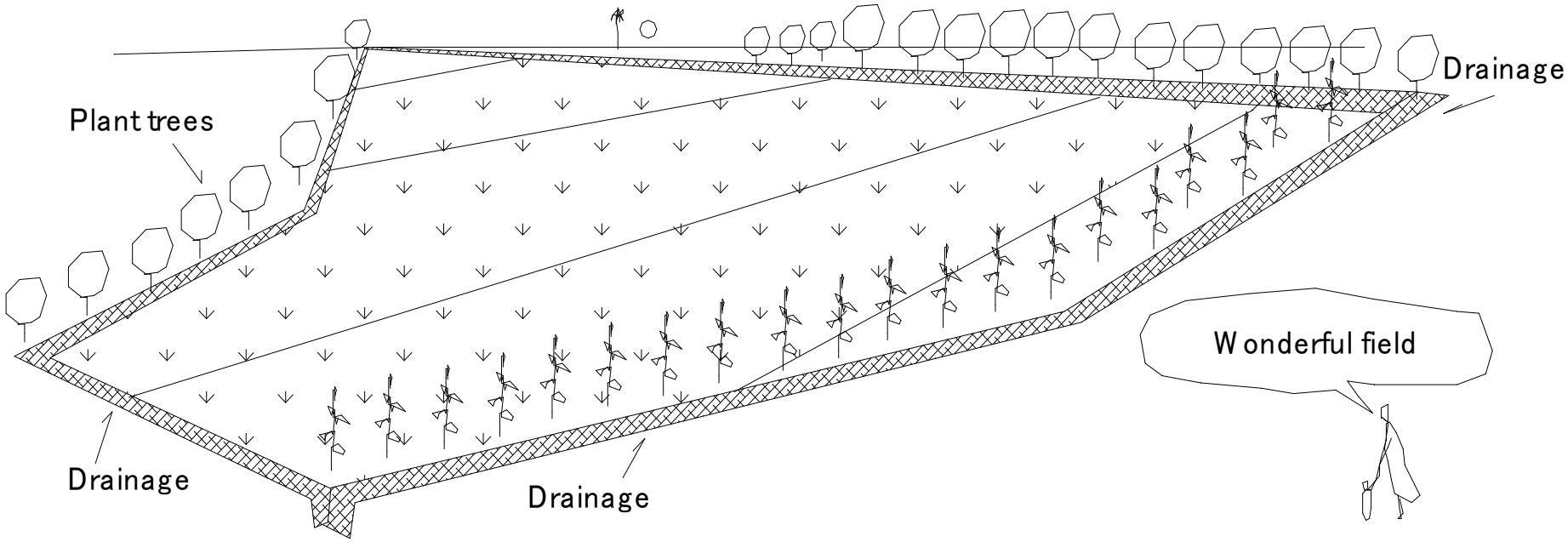


（ 845 ） Field affected by rill erosion（ 1 ）



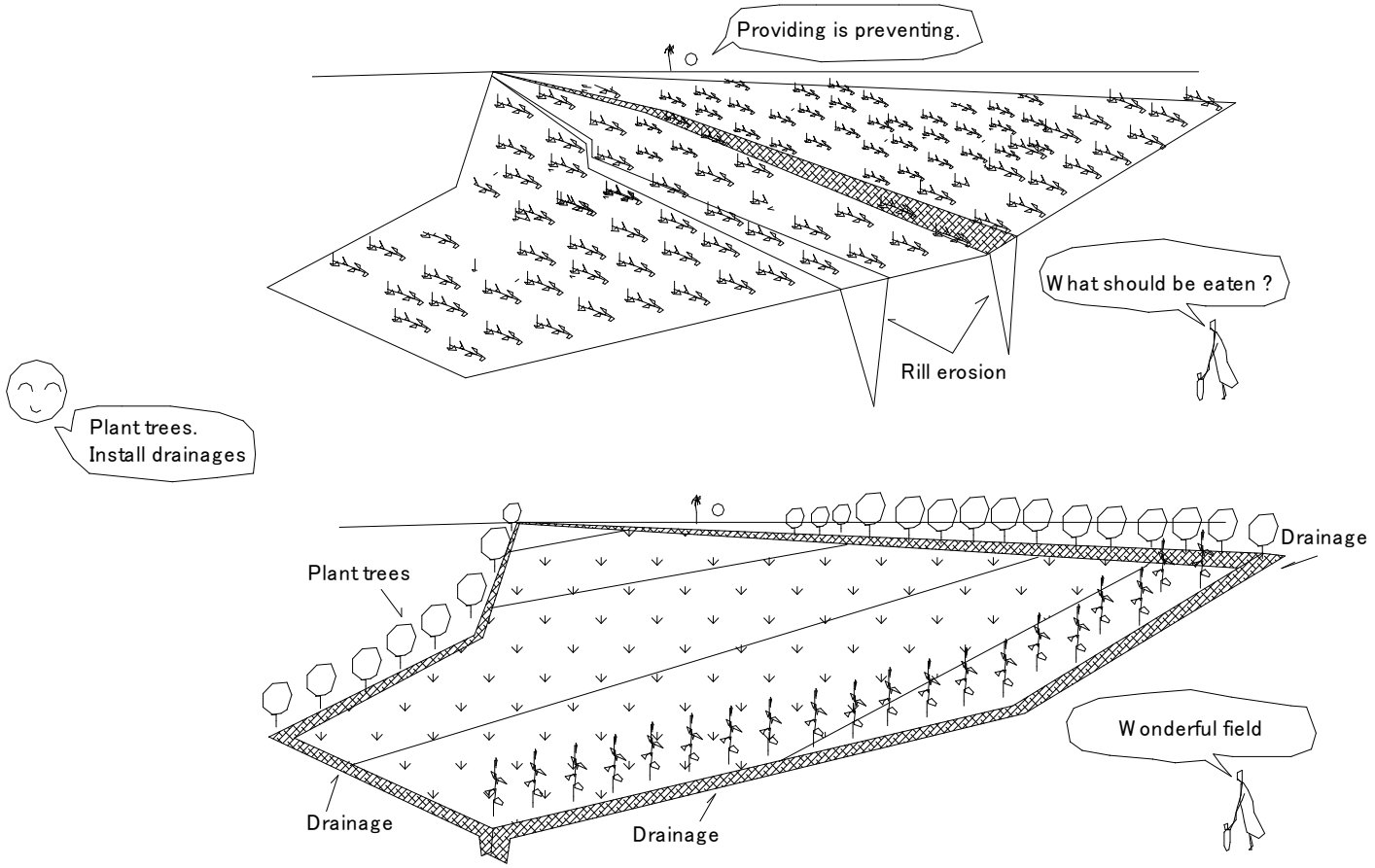
846 Field affected by Rill erosion(2)

(846) Field affected by rill erosion(2)

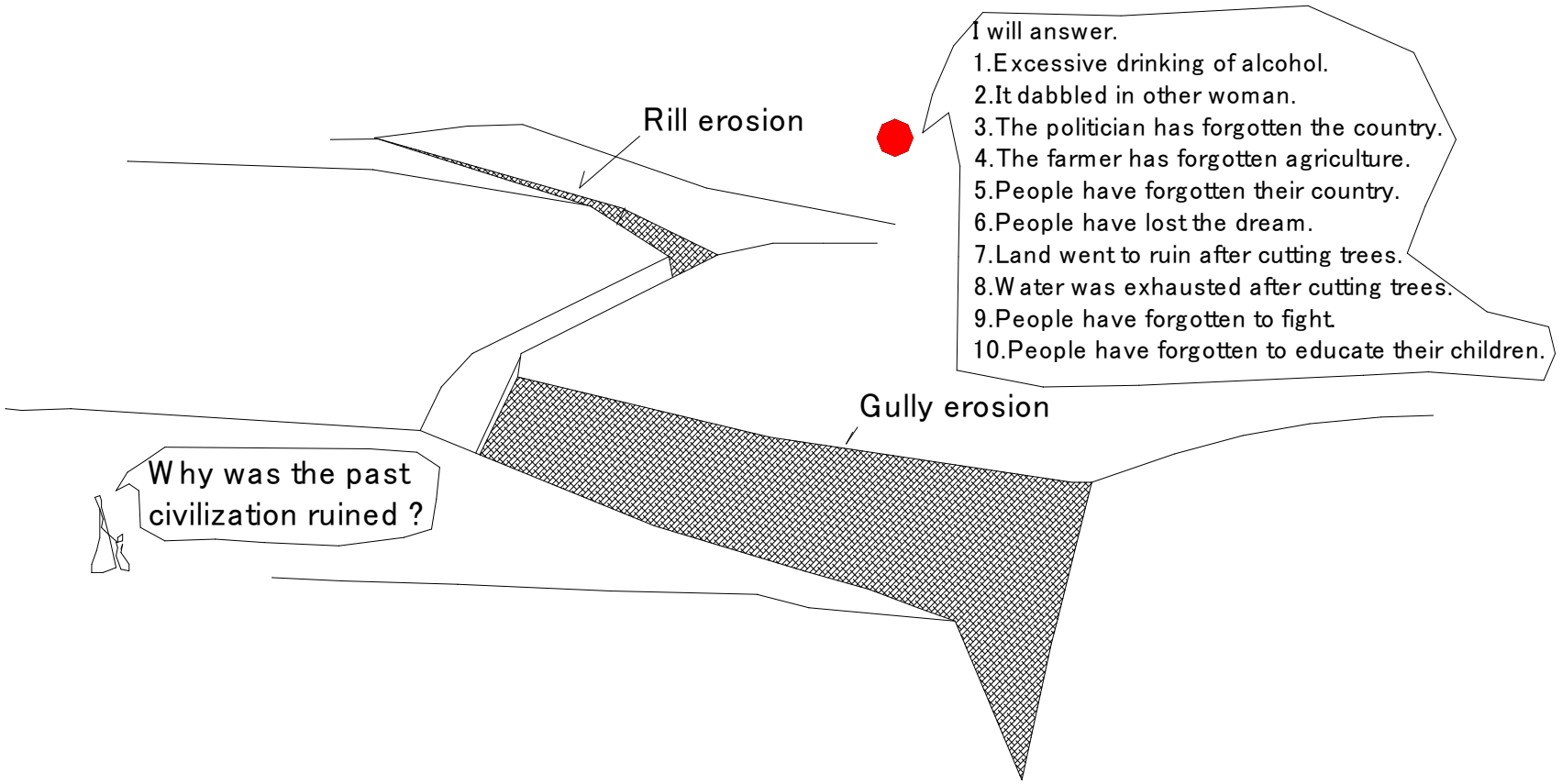


847 Field affected by Rill erosion(3)

（ 847 ） Field affected by rill erosion（ 3 ）

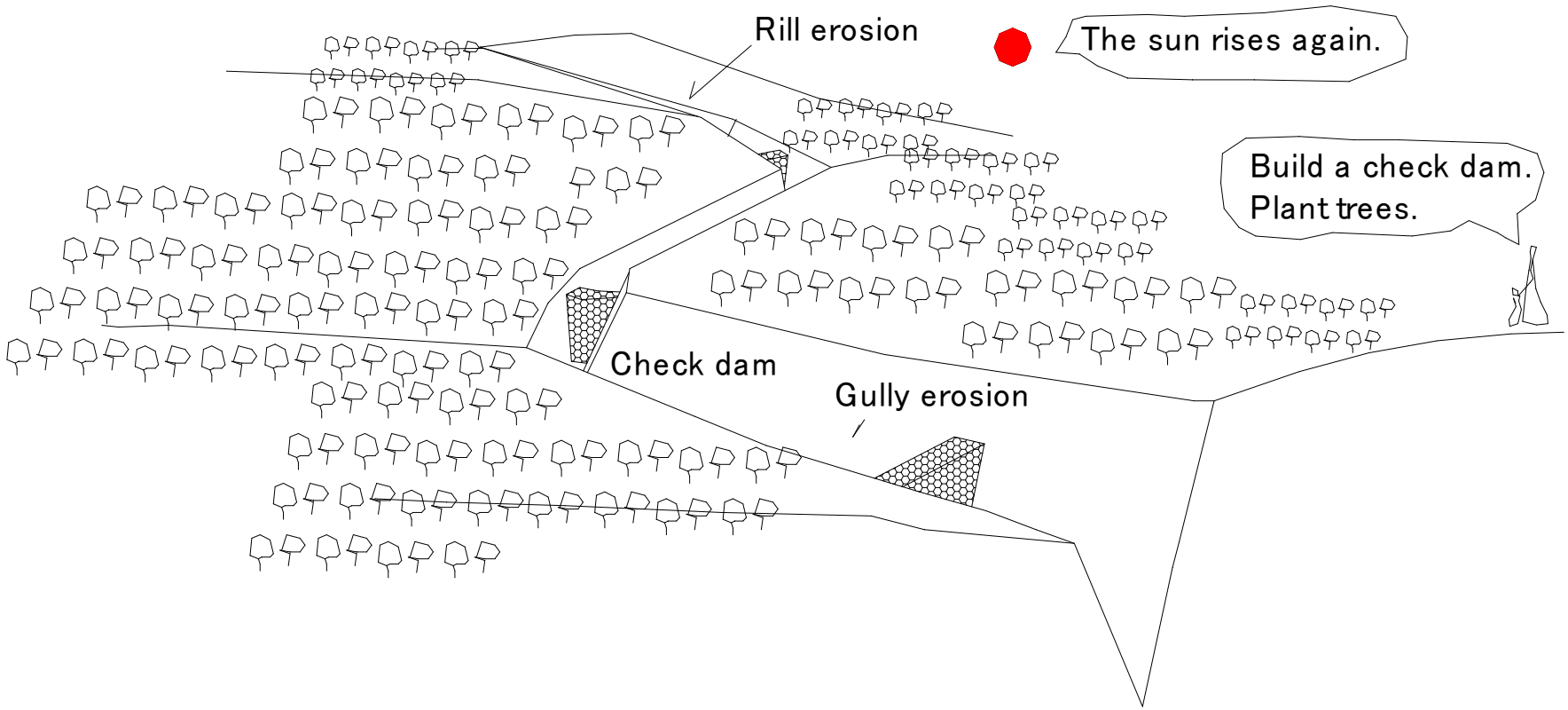


(848) Gully erosion(1)



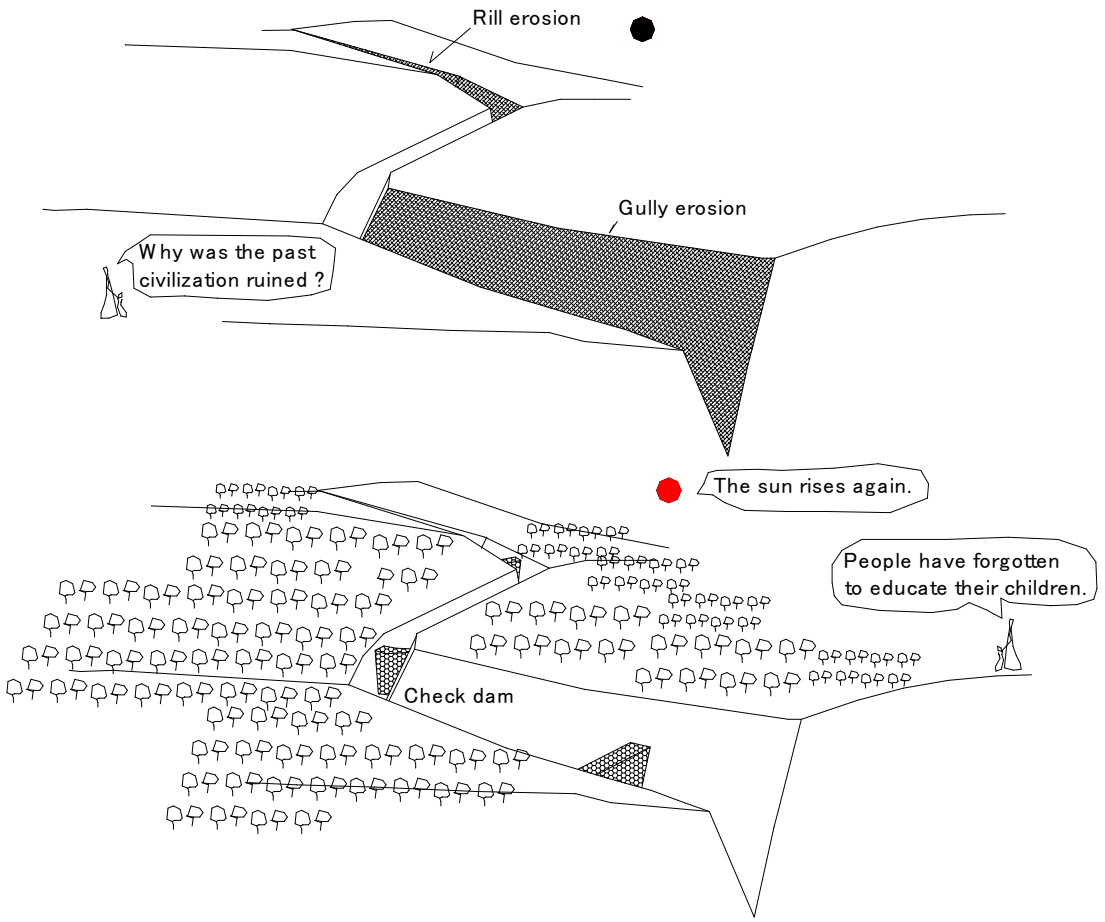
849 Gully erosion (2)

(849) Gully erosion(2)

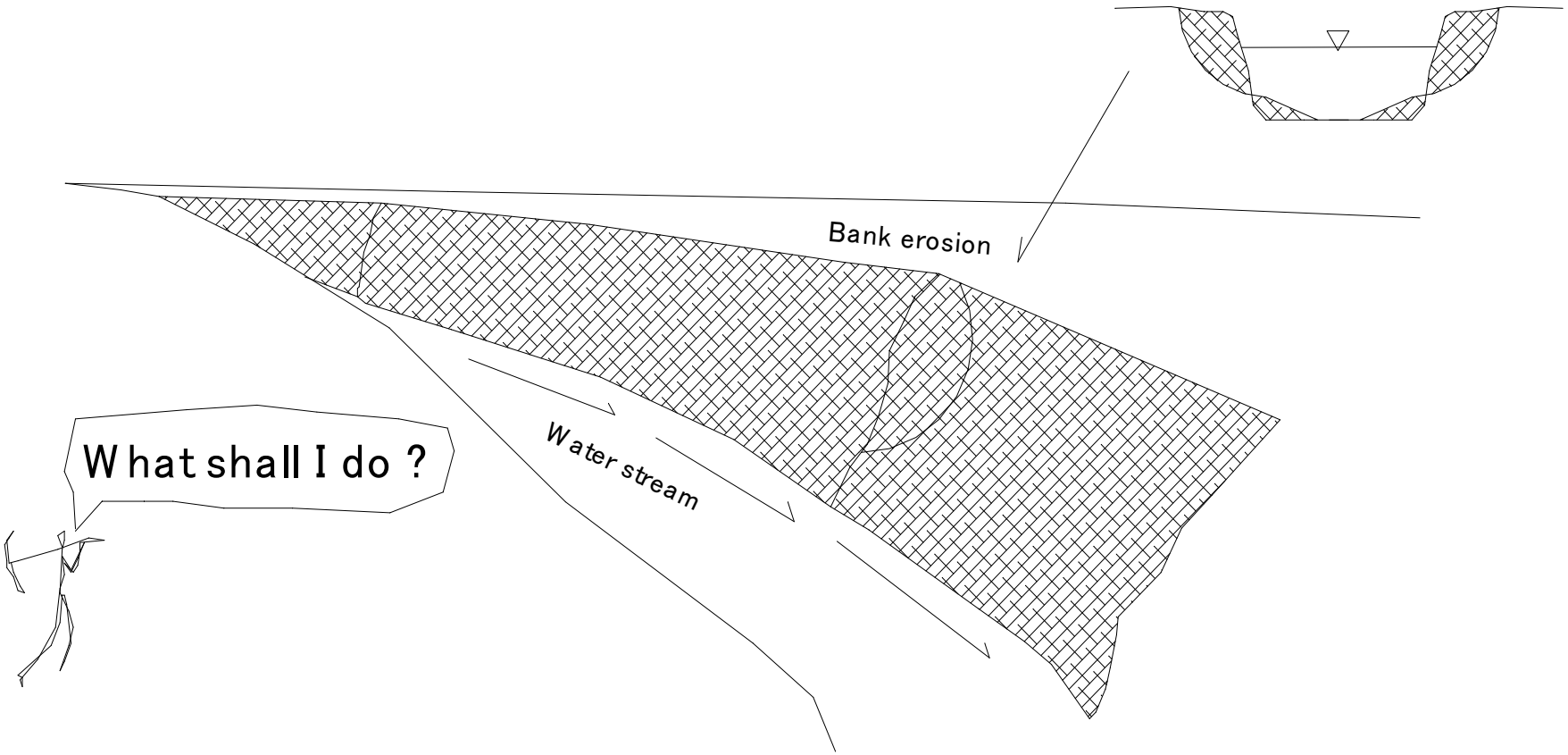


850 Gully erosion (3)

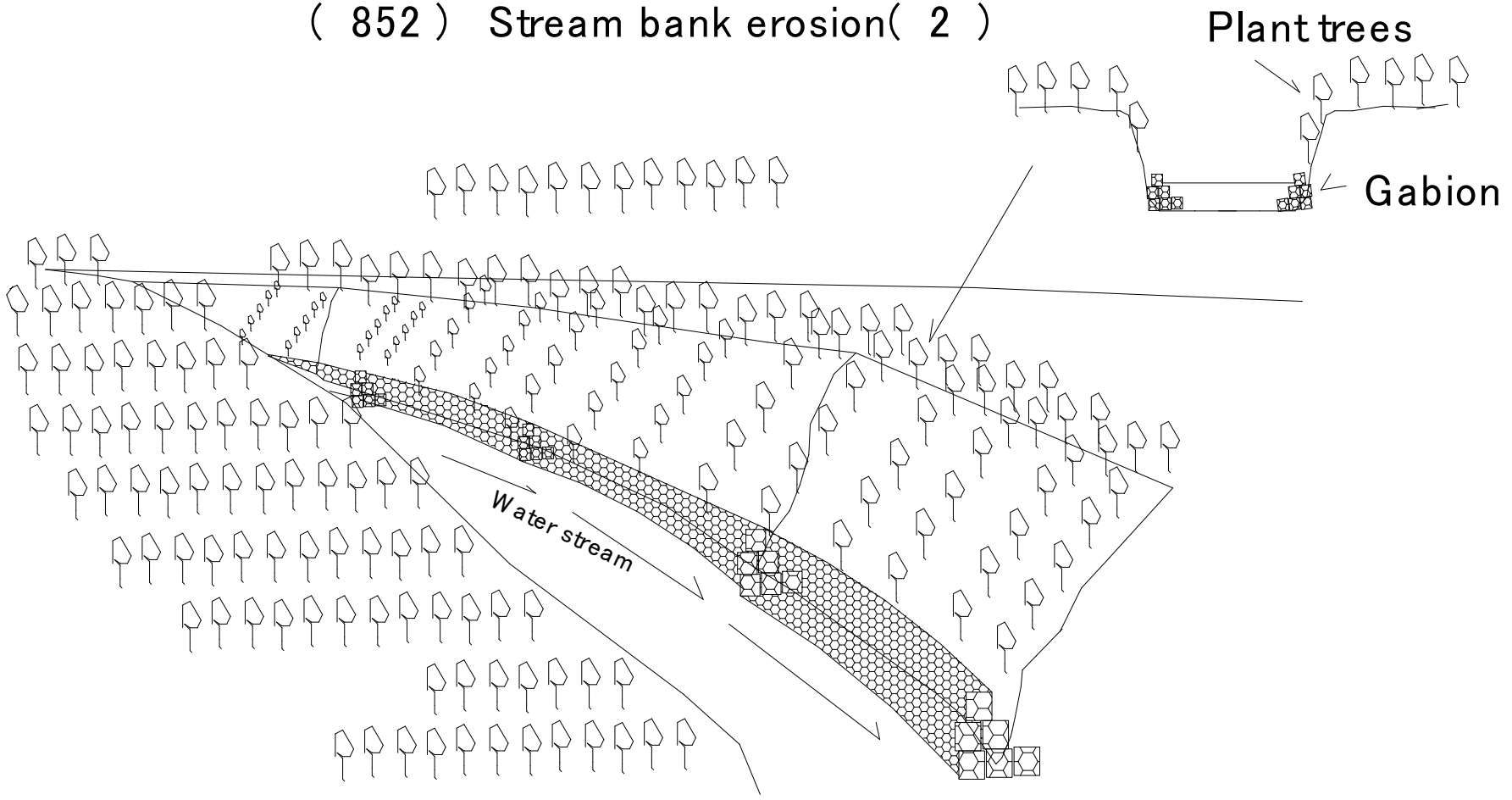
（ 850 ） Gully erosion（ 3 ）



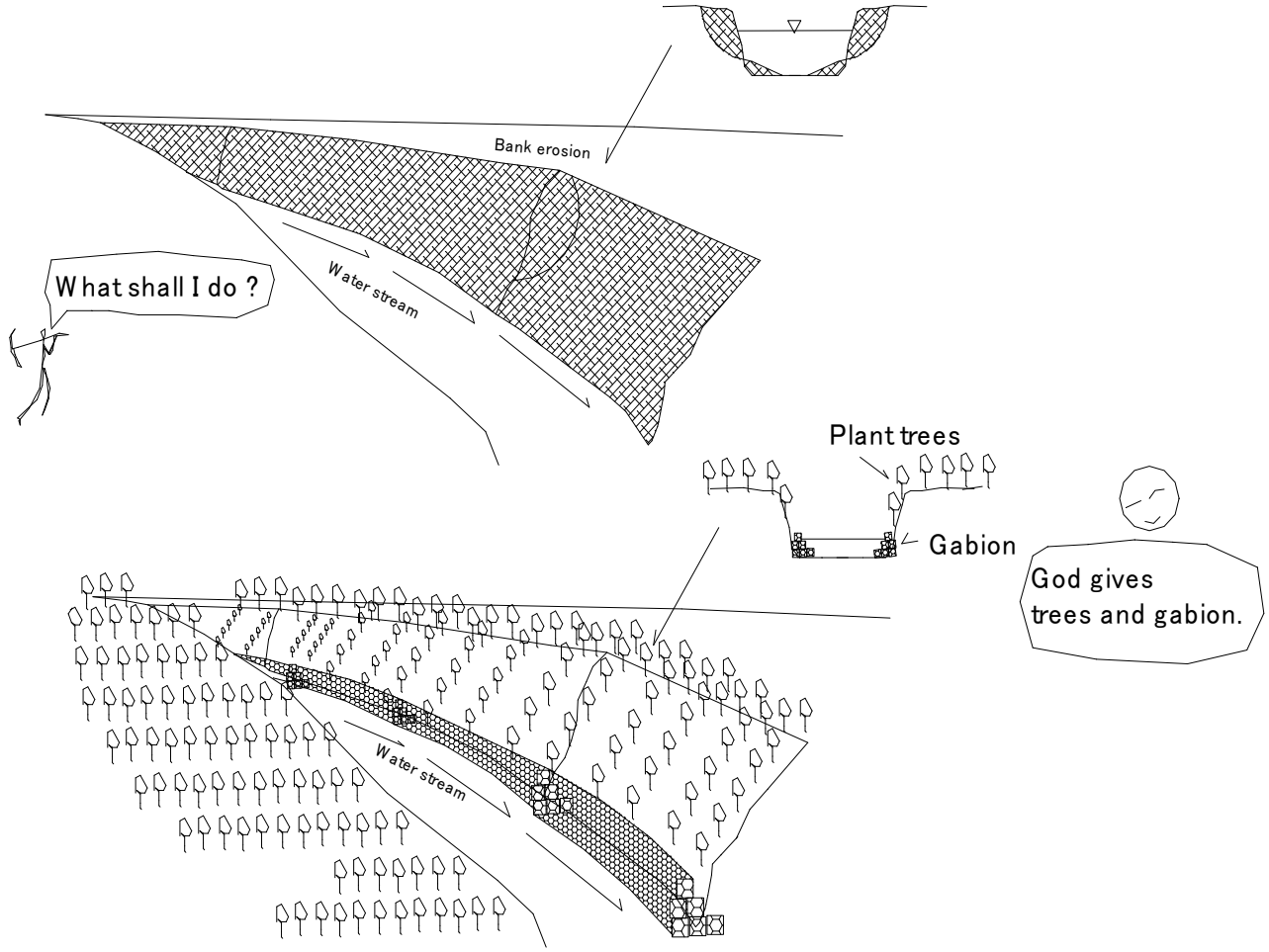
（ 851 ） Stream bank erosion（ 1 ）



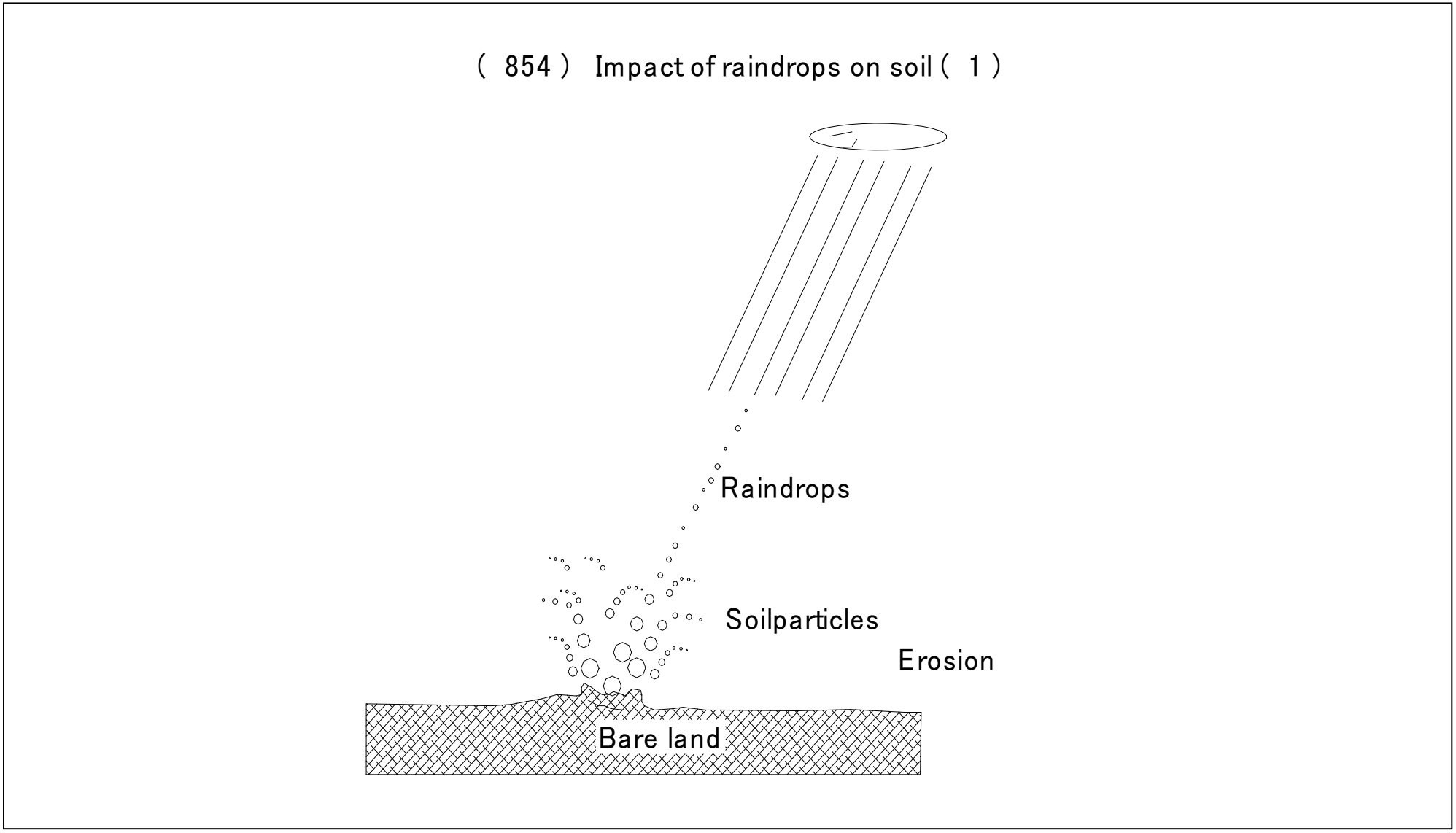
（ 852 ） Stream bank erosion（ 2 ）



(853) Stream bank erosion(3)

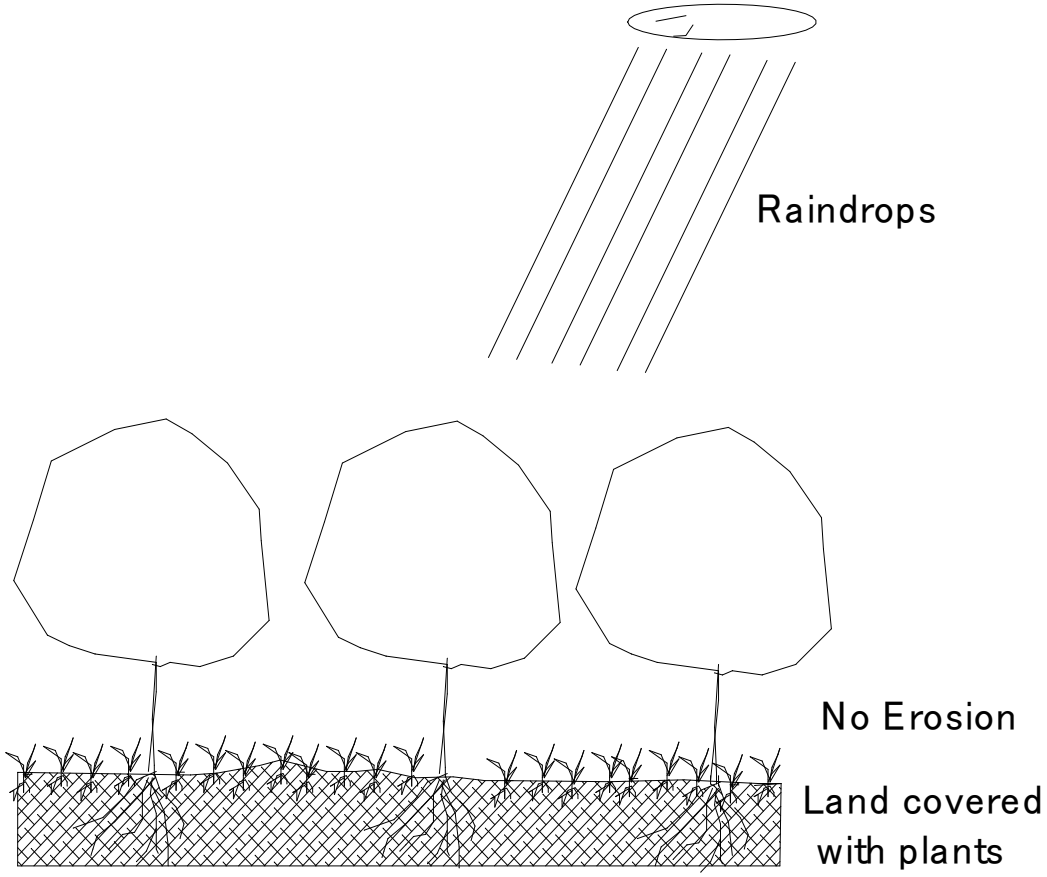


854 Impact of raindrops on soil (1)

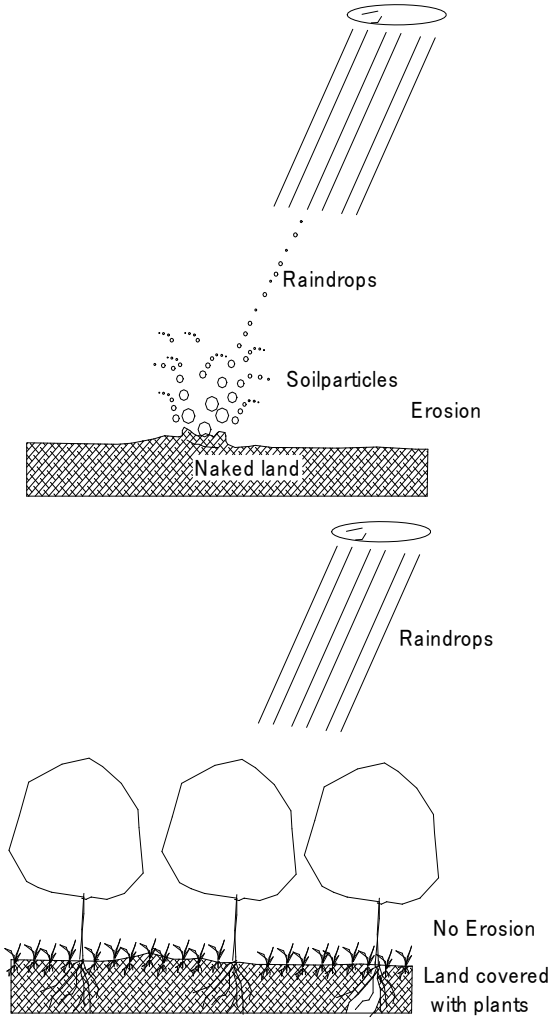


855 Impact of raindrops on soil (2)

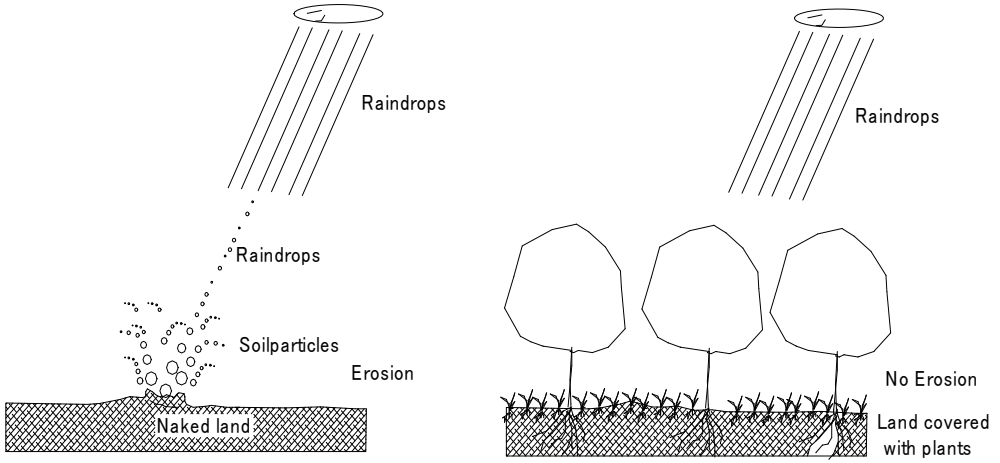
（ 855 ） Impact of raindrops on soil（ 2 ）



(856) Impact of raindrops on soil (3)

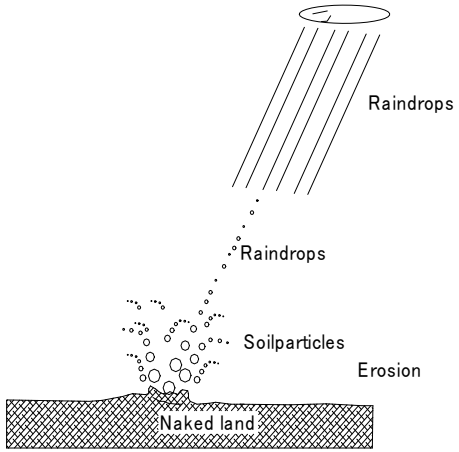


（857） Comparison between bare land and Land covered with plants（1）



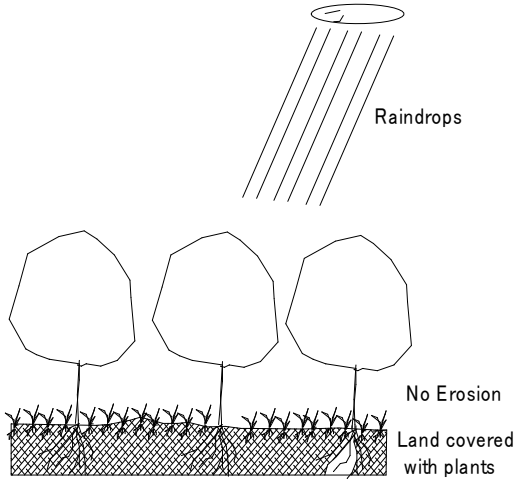
Water erosion	Much	Little
Wind erosion	Much	Little
Underground water level	Low	High
Fertile land	Poor	Rich
Infiltration	Little	Much
Earthworms	Little	Plenty
Land suitable for agriculture	None	Suitable
Evaporation	Much	Little
Desertification	Much	Little
Runoff	Much	Little

（ 858 ） Comparison between bare land and Land covered with plants（ 2 ）



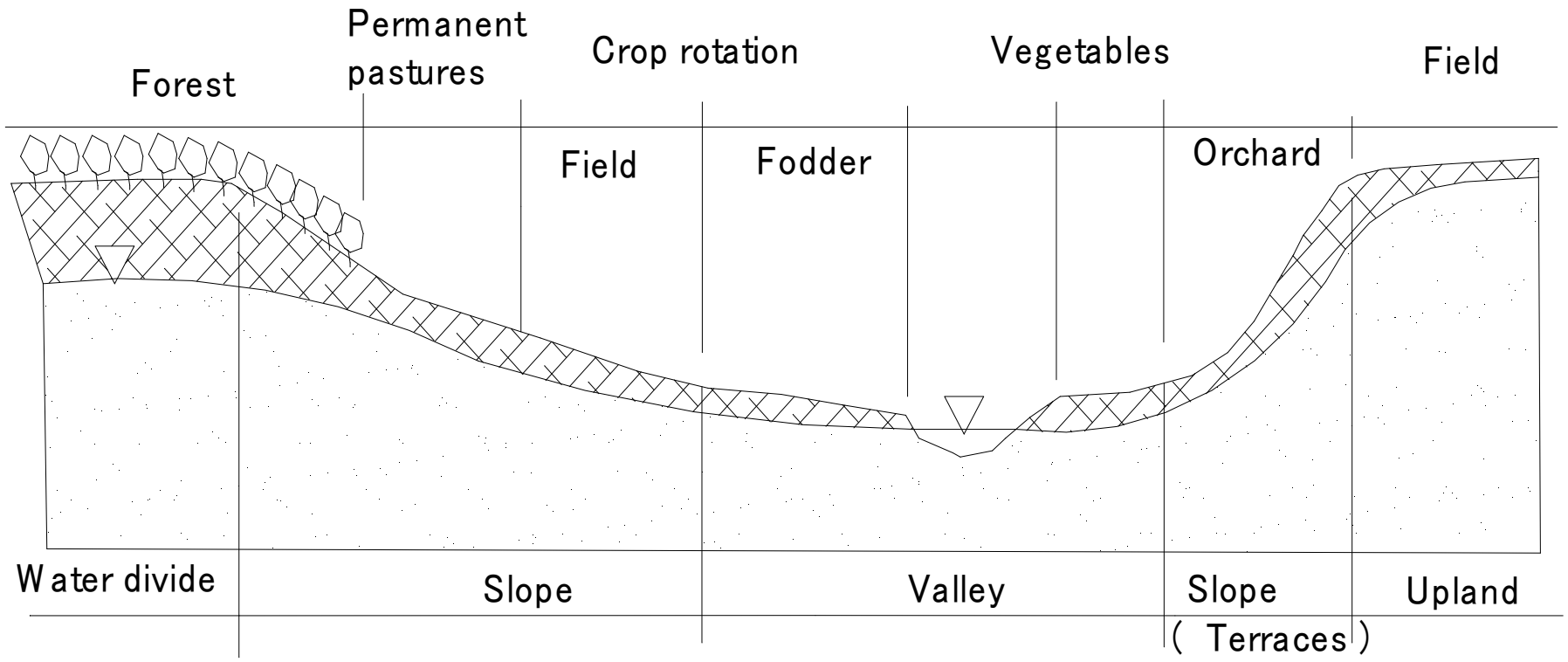
Water erosion	Much
Wind erosion	Much
Underground water level	Low
Fertile land	Less
Infiltration	Little
Earthworms	Little
Land suitable for agriculture	Non
Evaporation	Much
Desertification	Much
Runoff	Much

(859) Comparison between bare land and Land covered with plants(3)

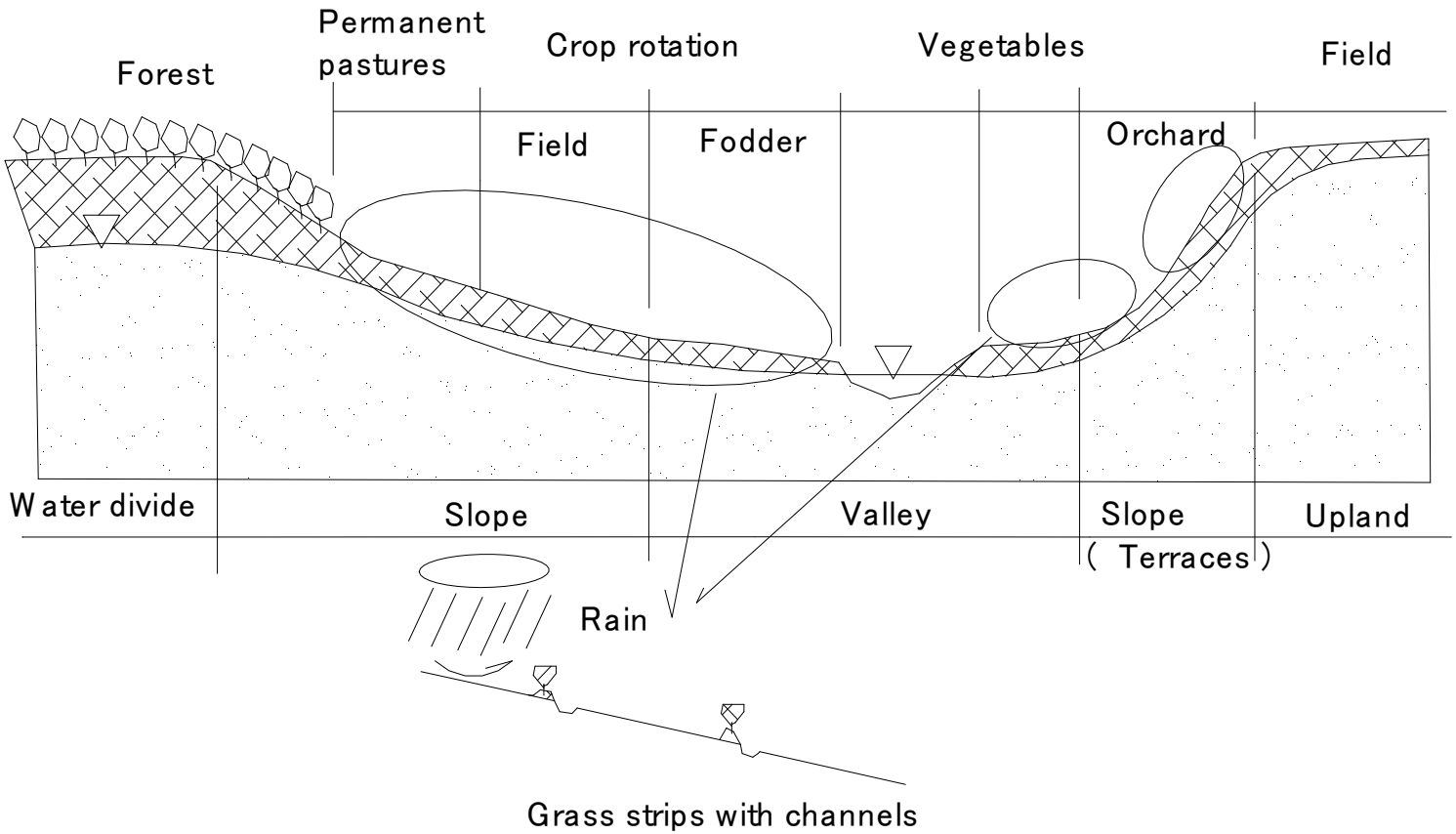


Water erosion	Little
Wind erosion	Little
Underground water level	High
Fertile land	Plenty
Infiltration	Much
Earthworms	Plenty
Land suitable for agriculture	Suitable
Evaporation	Little
Desertification	Little
Runoff	Little

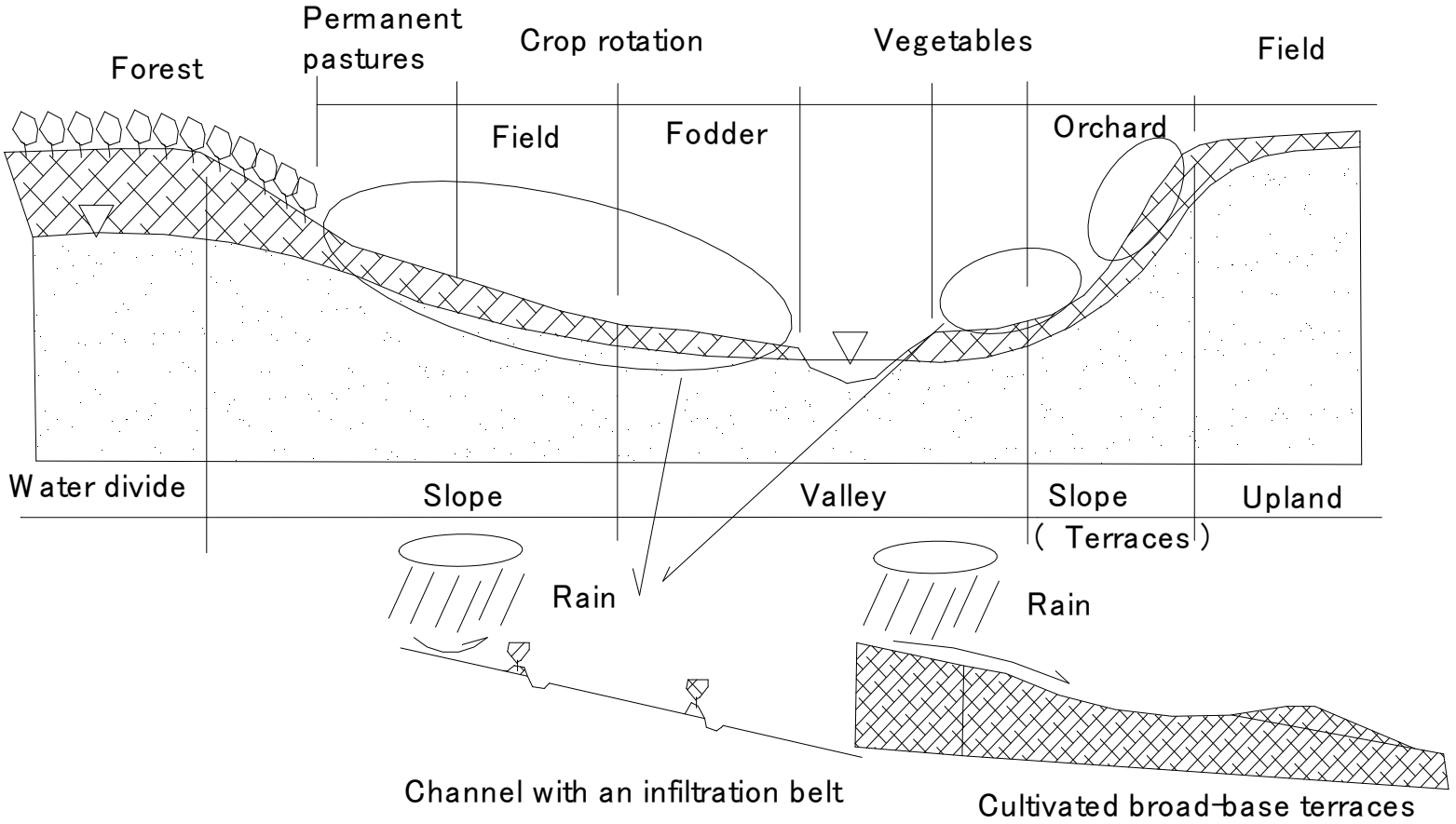
(860) Area and location of agricultural plots (1)



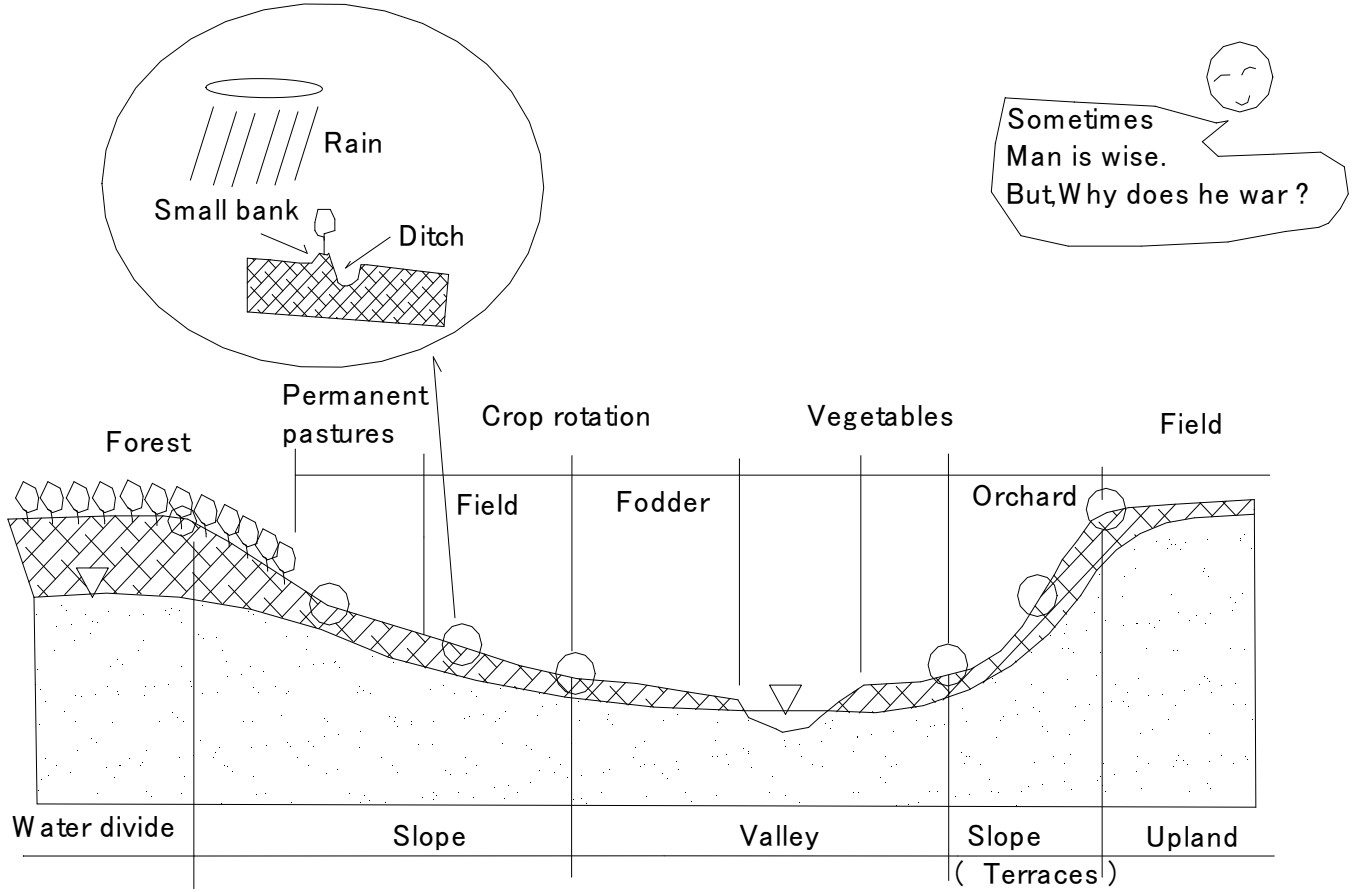
(861) Area and location of agricultural plots (2)



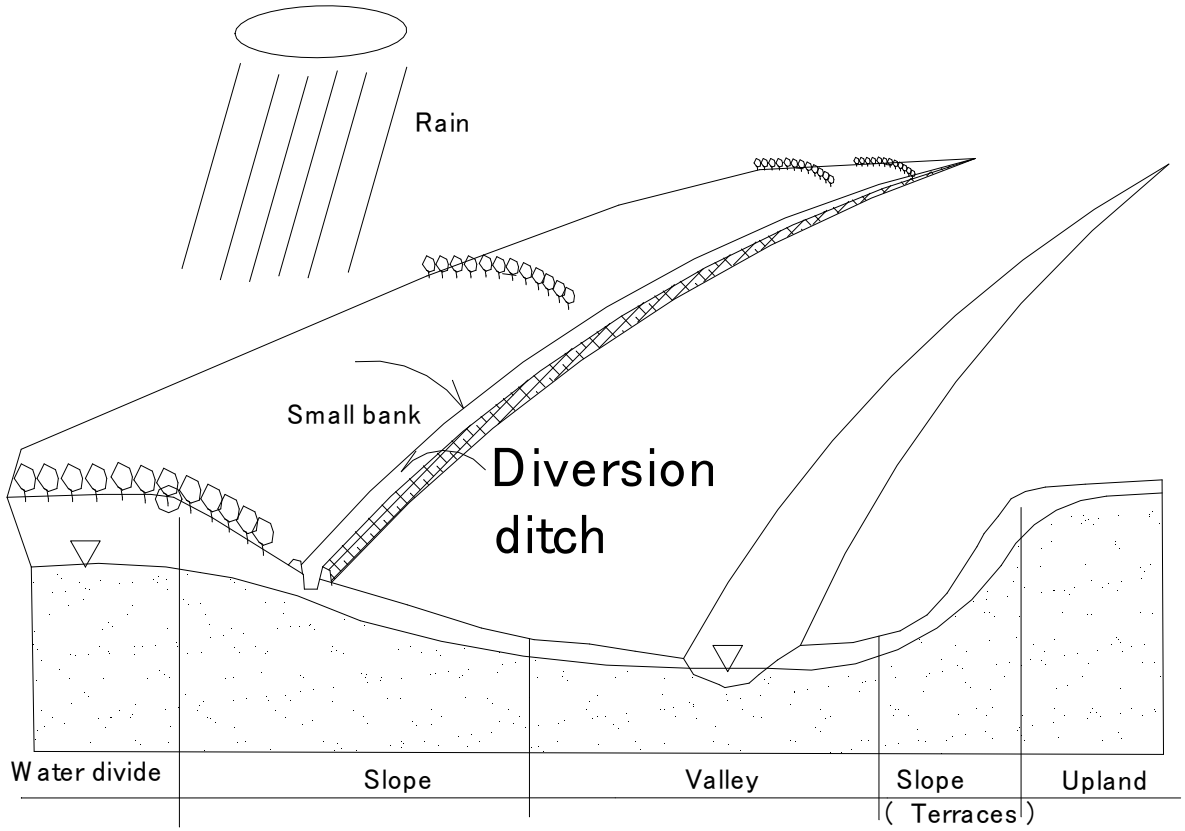
(862) Area and location of agricultural plots (3)



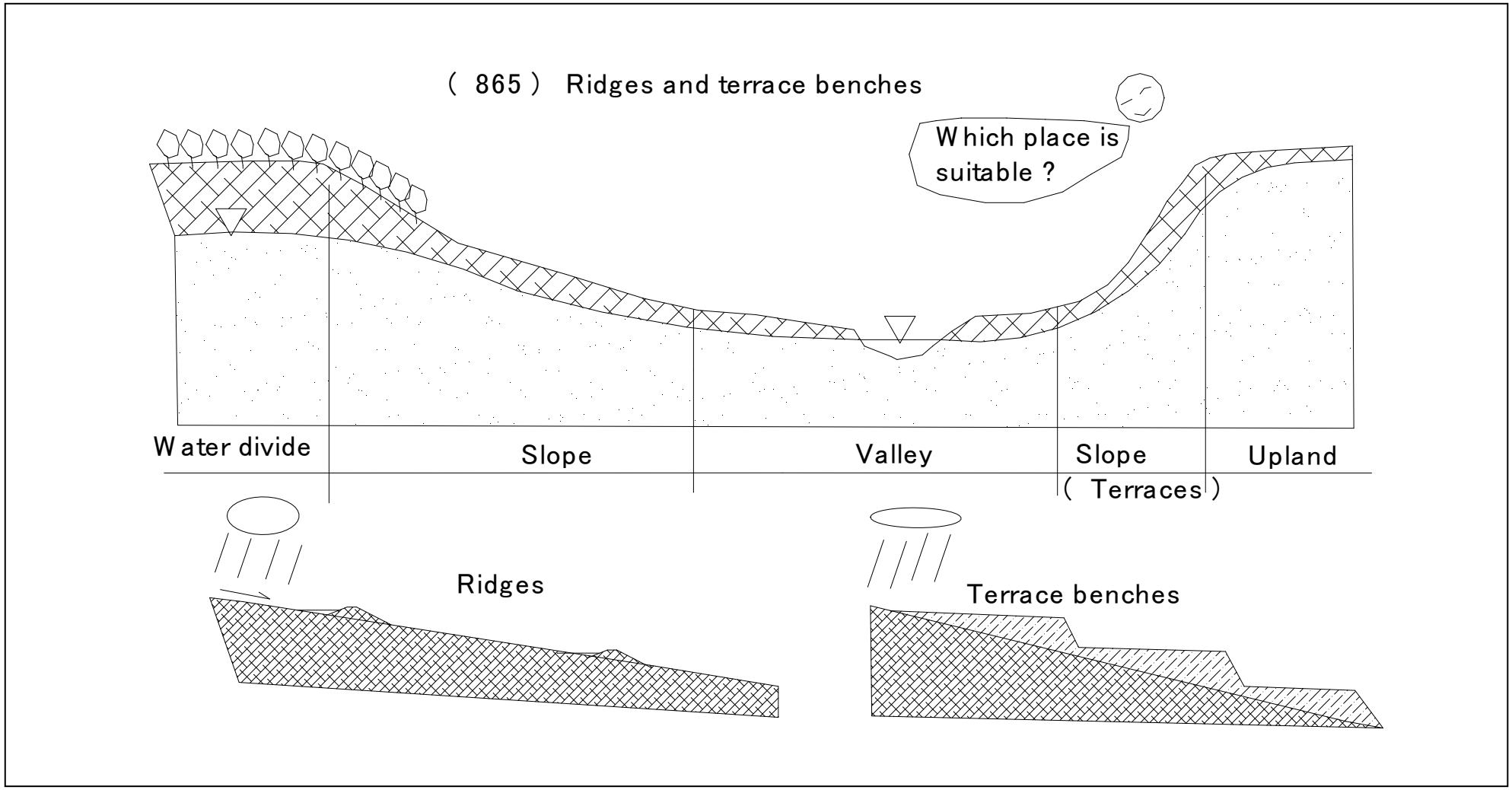
（ 863 ） Area protected by a ditch



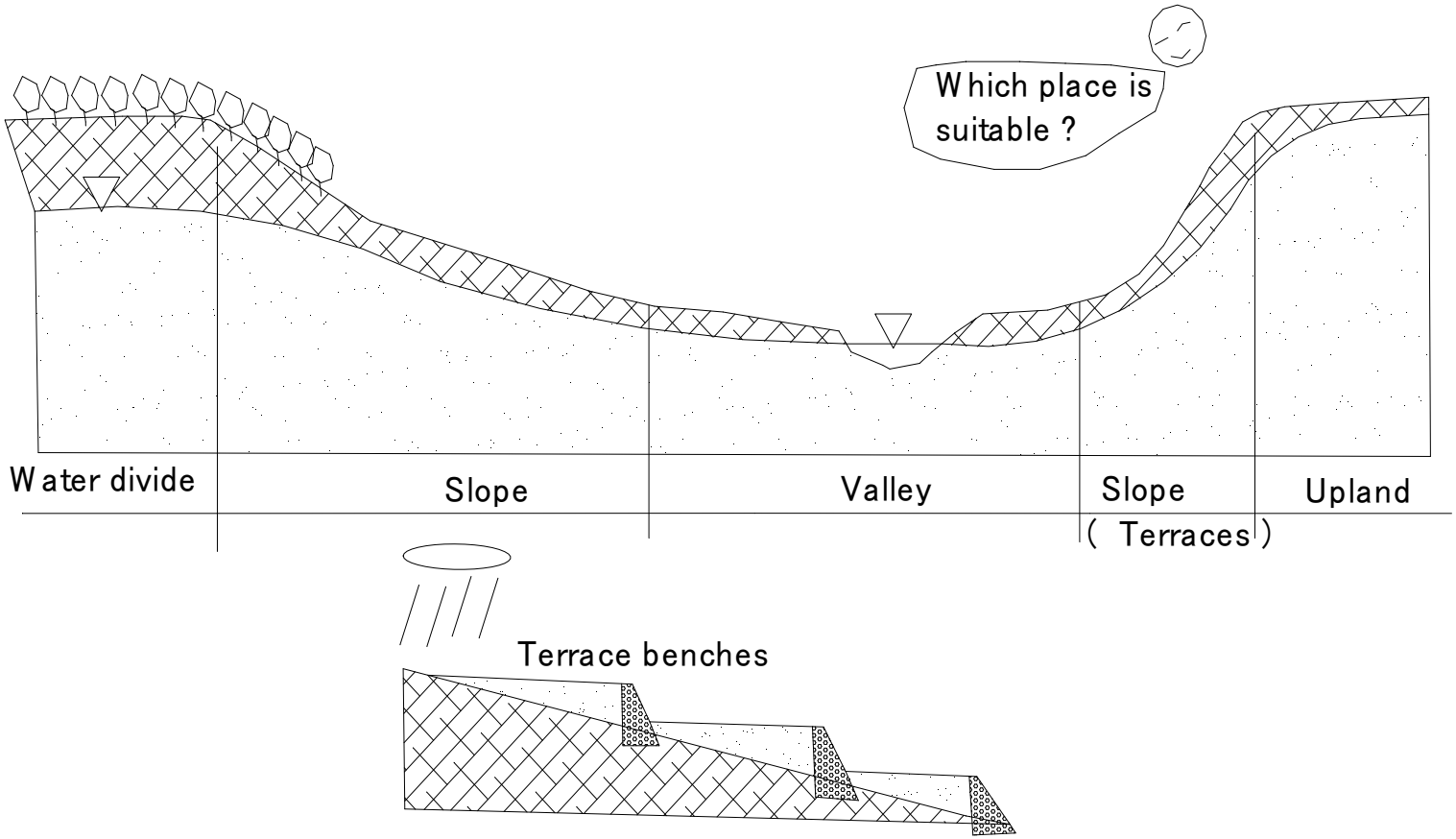
（ 864 ） Diversion ditch



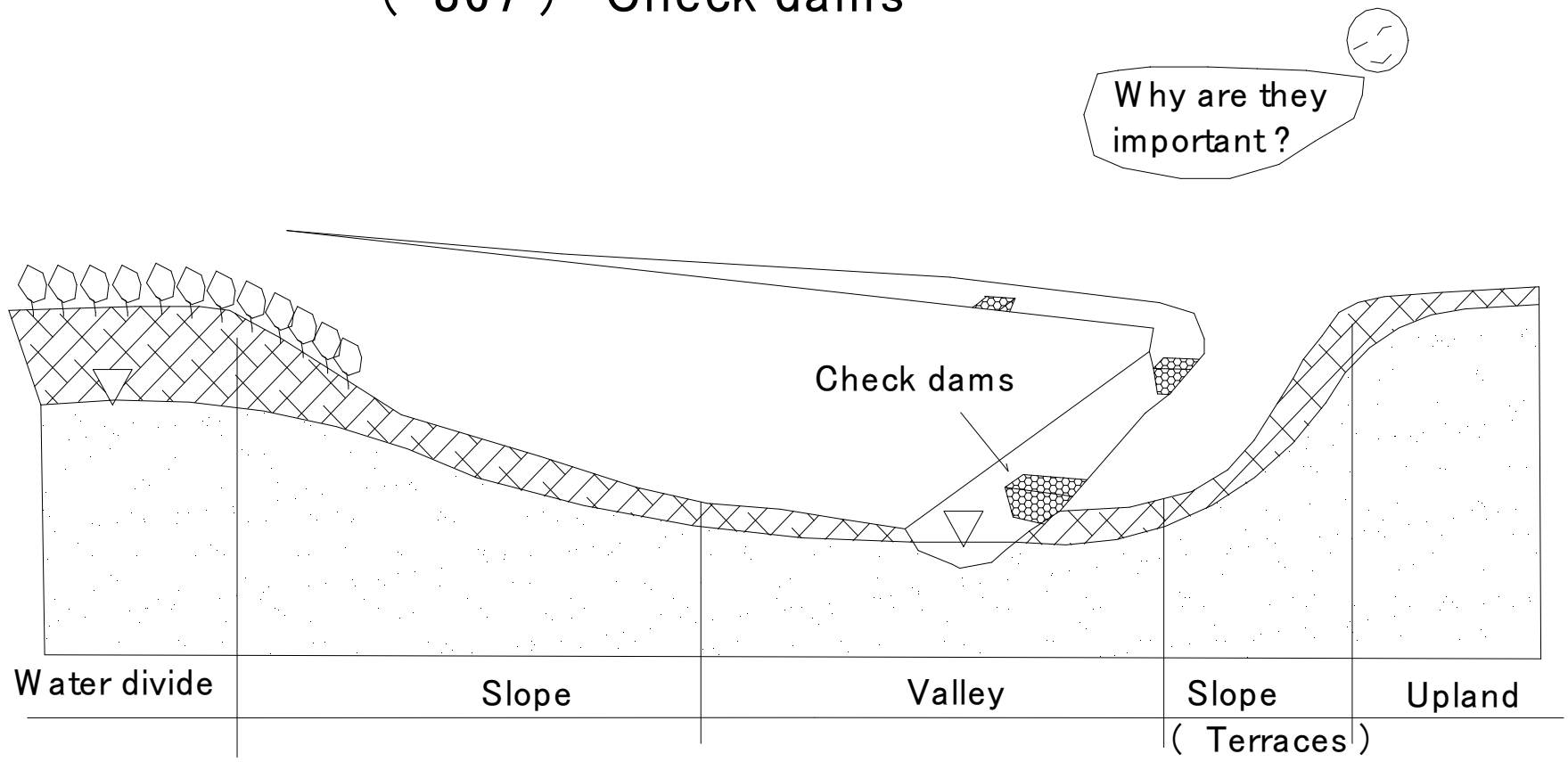
865 Ridges and terrace benches



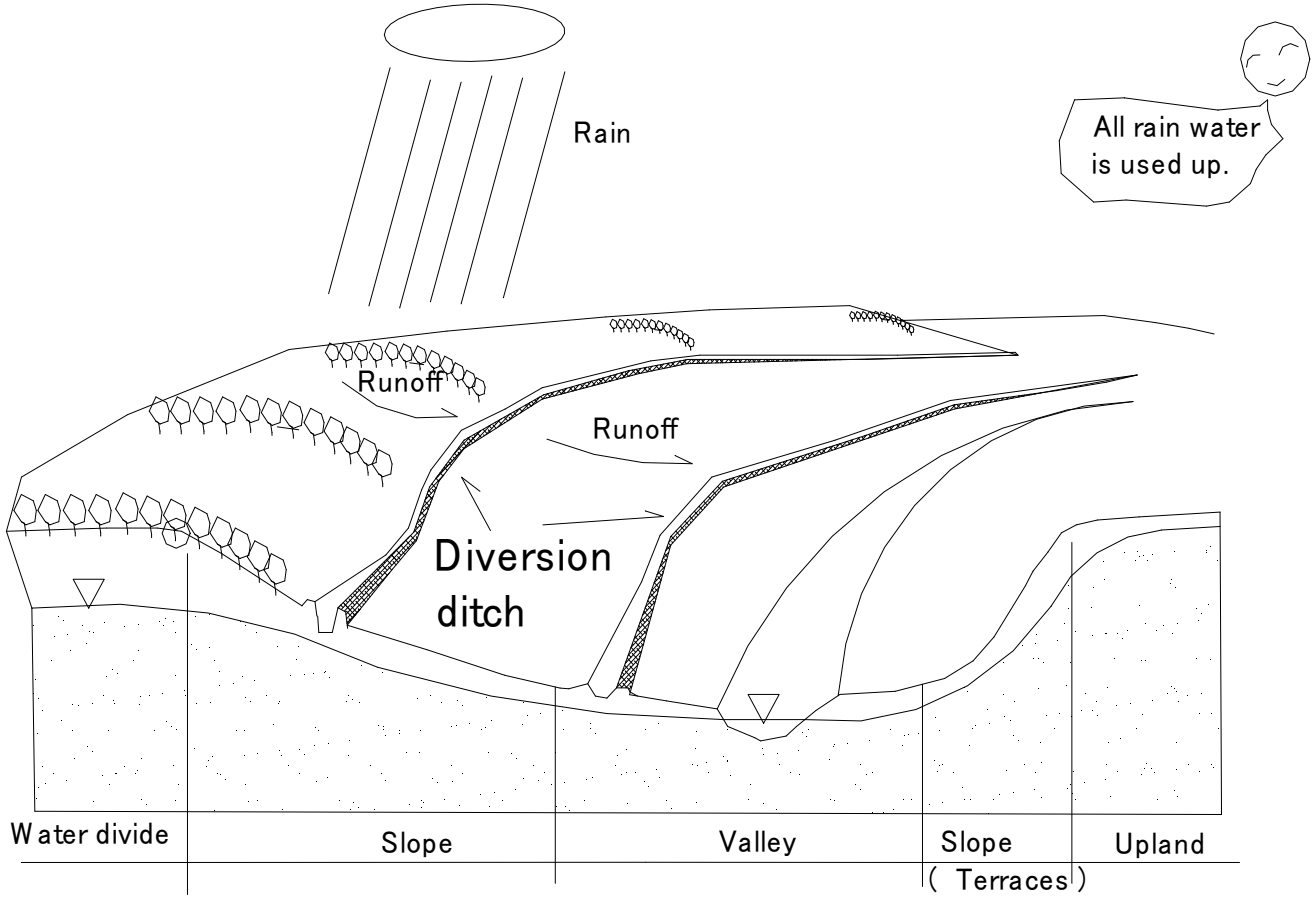
（ 866 ） Stone wall terraces



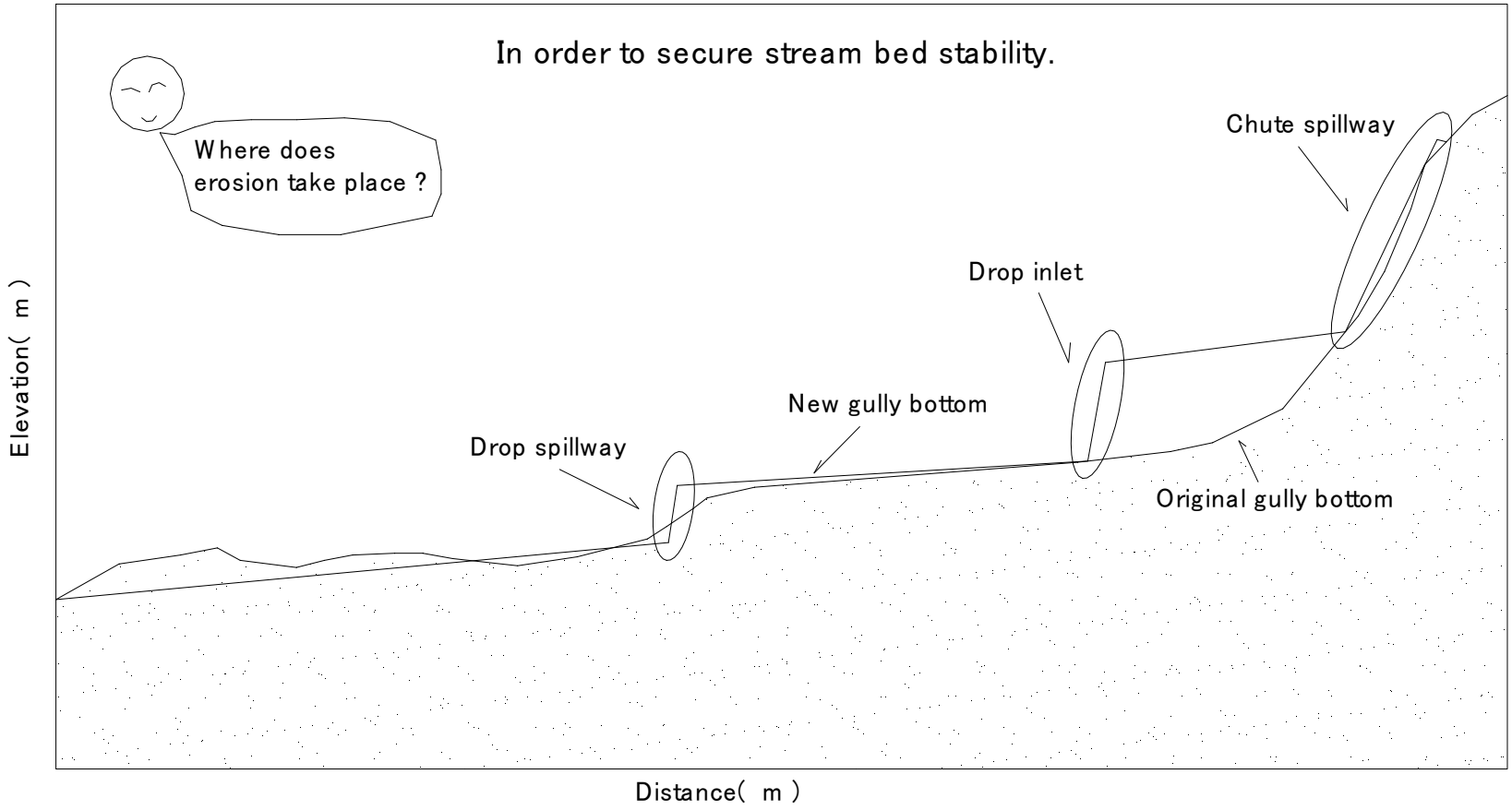
(867) Check dams



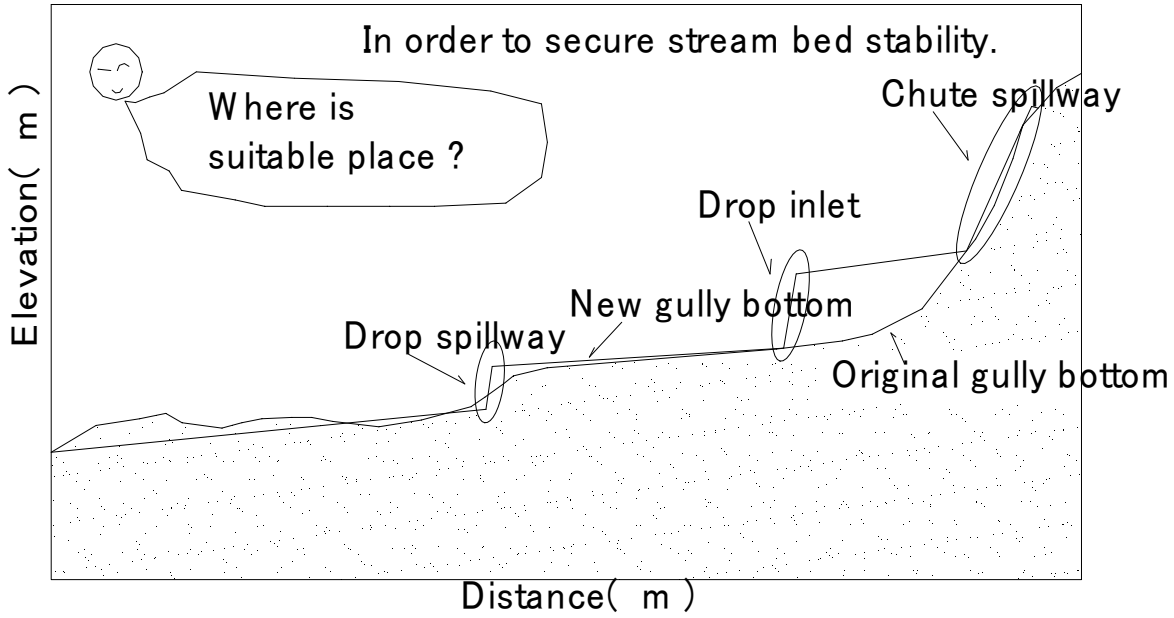
(868) Diversion ditch(2)



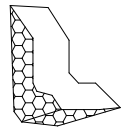
(869) Conservation Water-Control Structures(1)



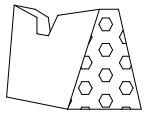
(870) Conservation Water-Control Structures(2)



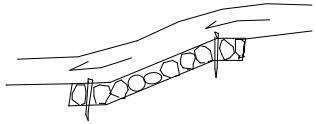
Check Dam



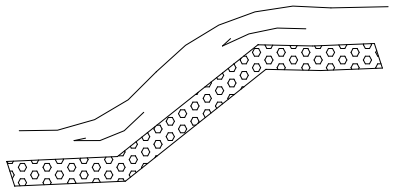
Cross structure
Compound wall



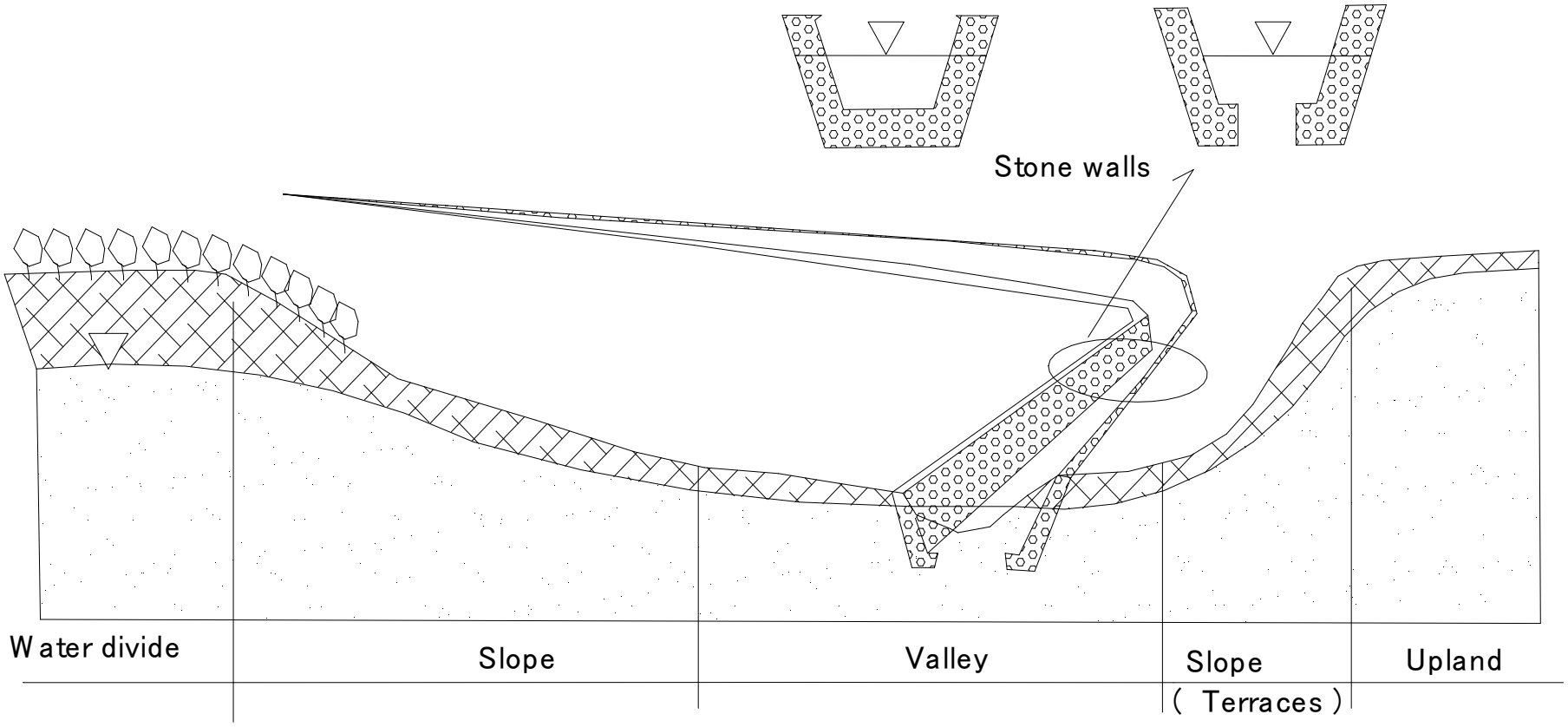
Boulder Chute



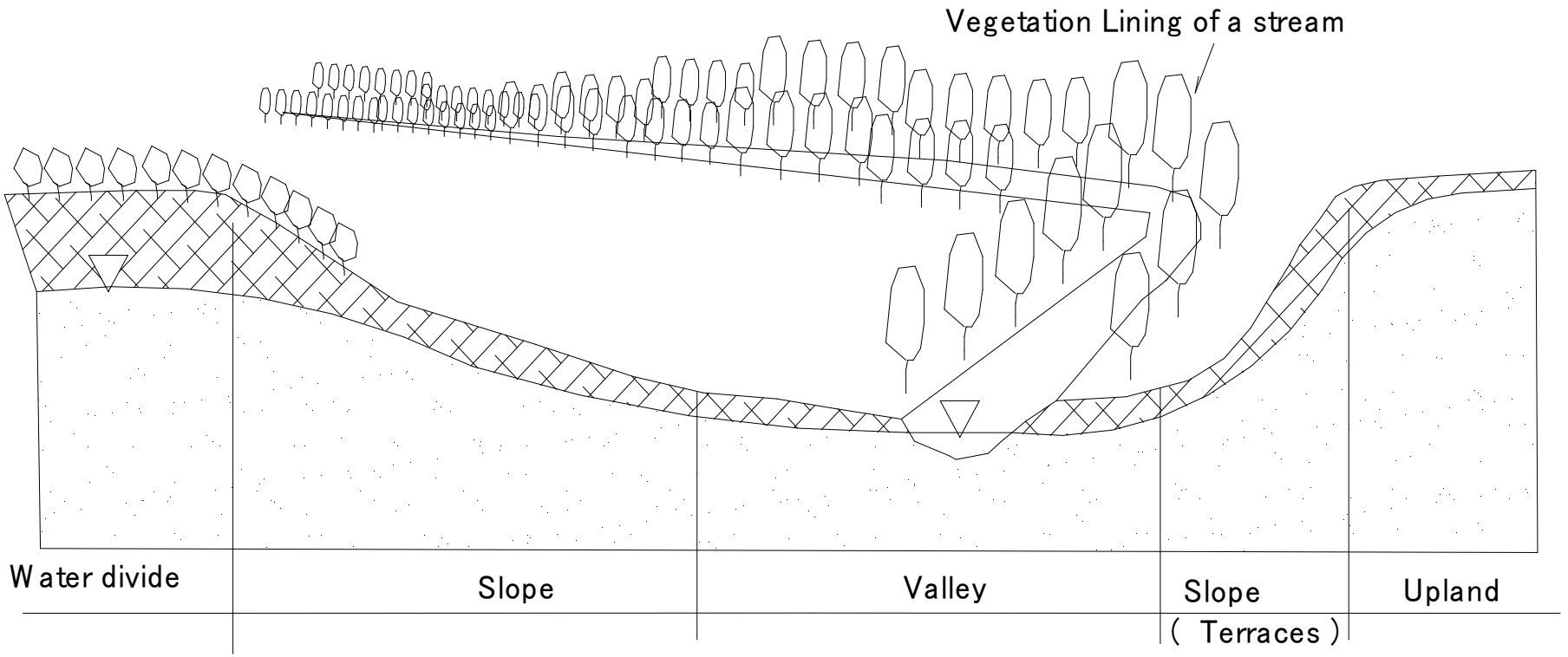
Concrete Chute



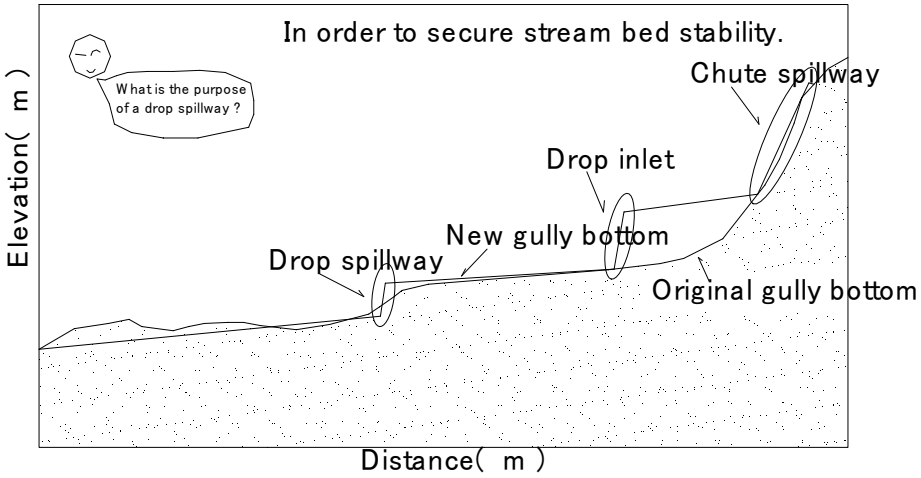
（ 871 ） Lining with stone walls on stream

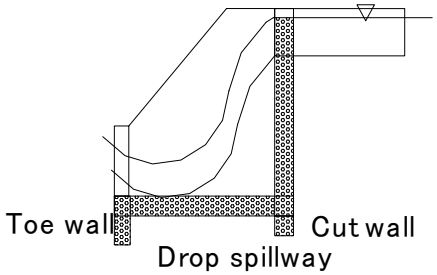


（ 872 ） Vegetation Lining of a stream

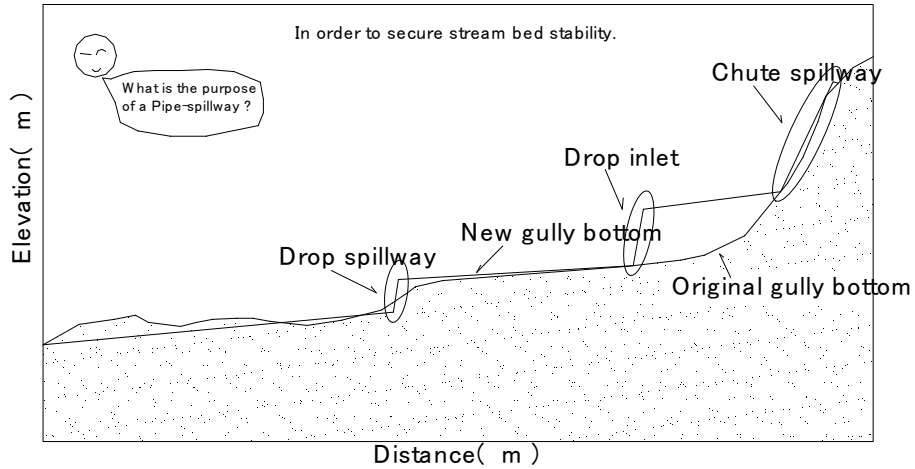


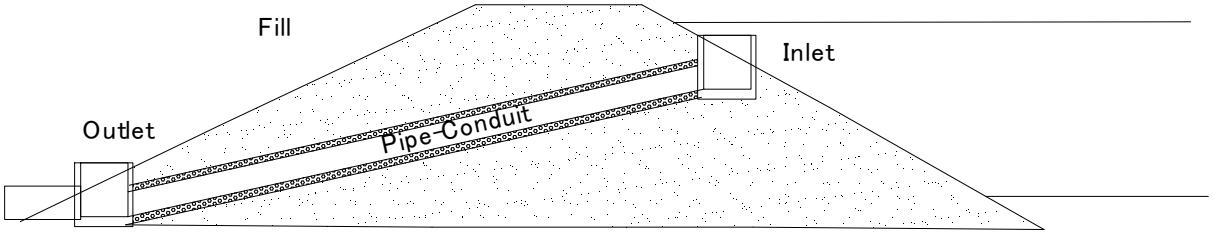
（ 873 ） Conservation Water-Control Structures（ 3 ）





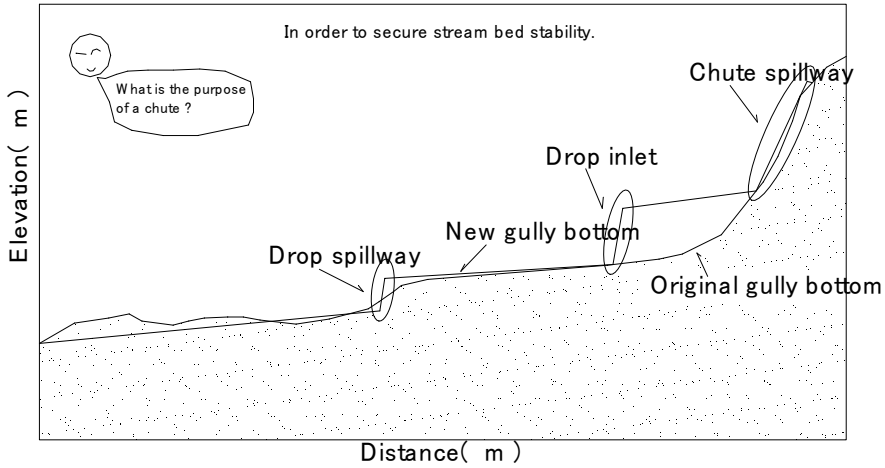
(874) Conservation Water-Control Structures(4)

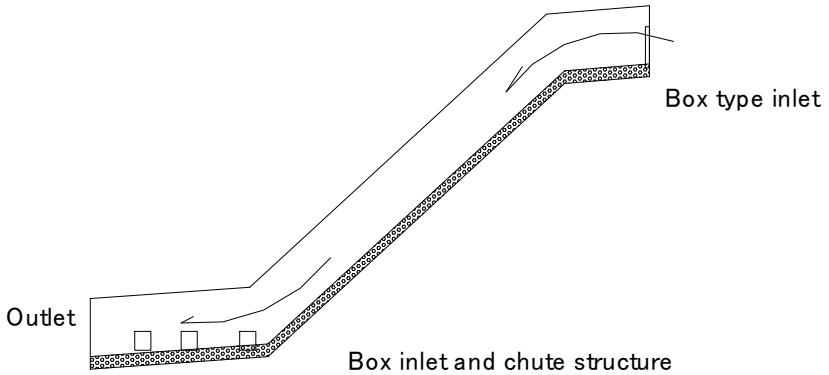




Drop inlet,Pipe-spillway

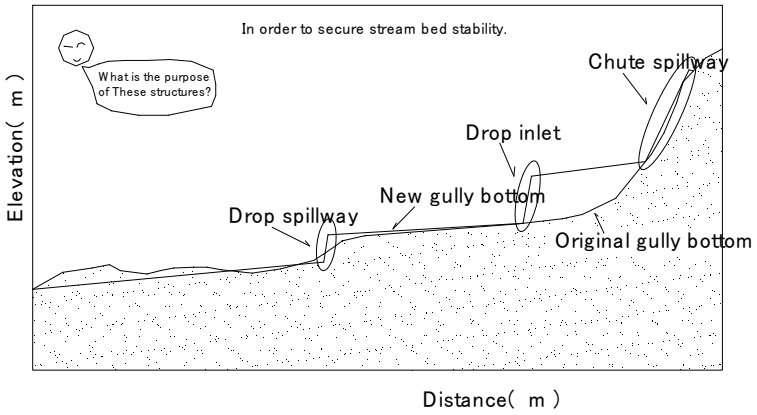
(875) Conservation Water-Control Structures(5)

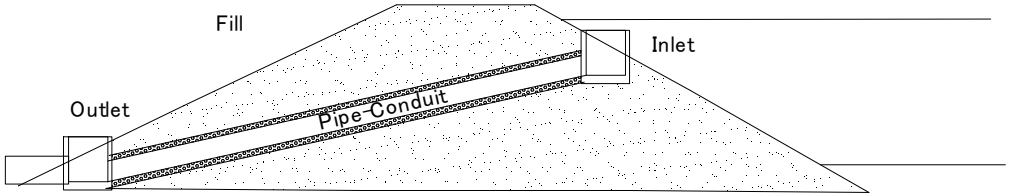




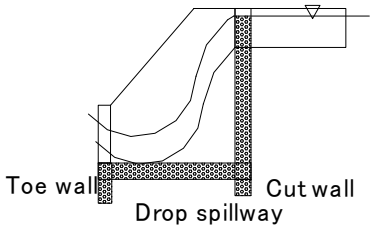
Box inlet and chute structure

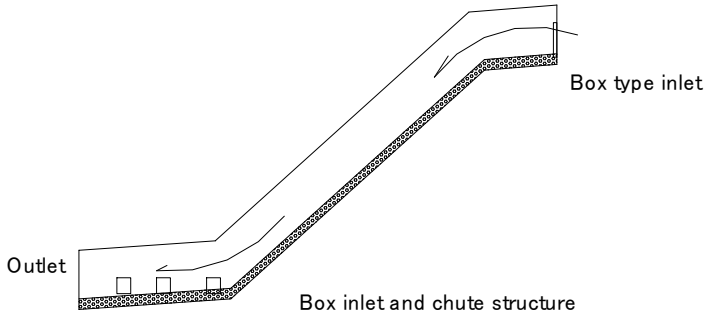
(876) Conservation Water-Control Structures(6)





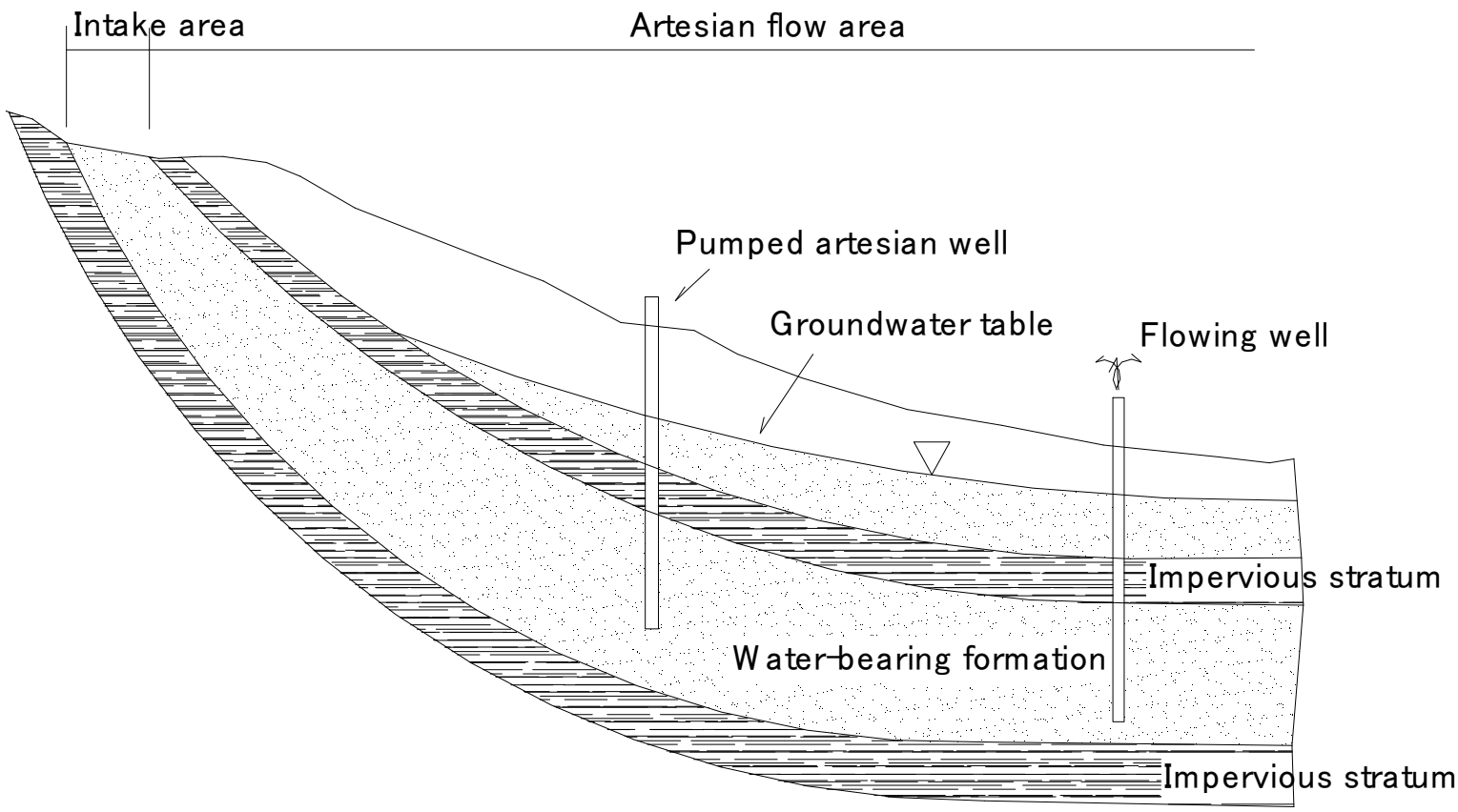
Pipe-Spillway





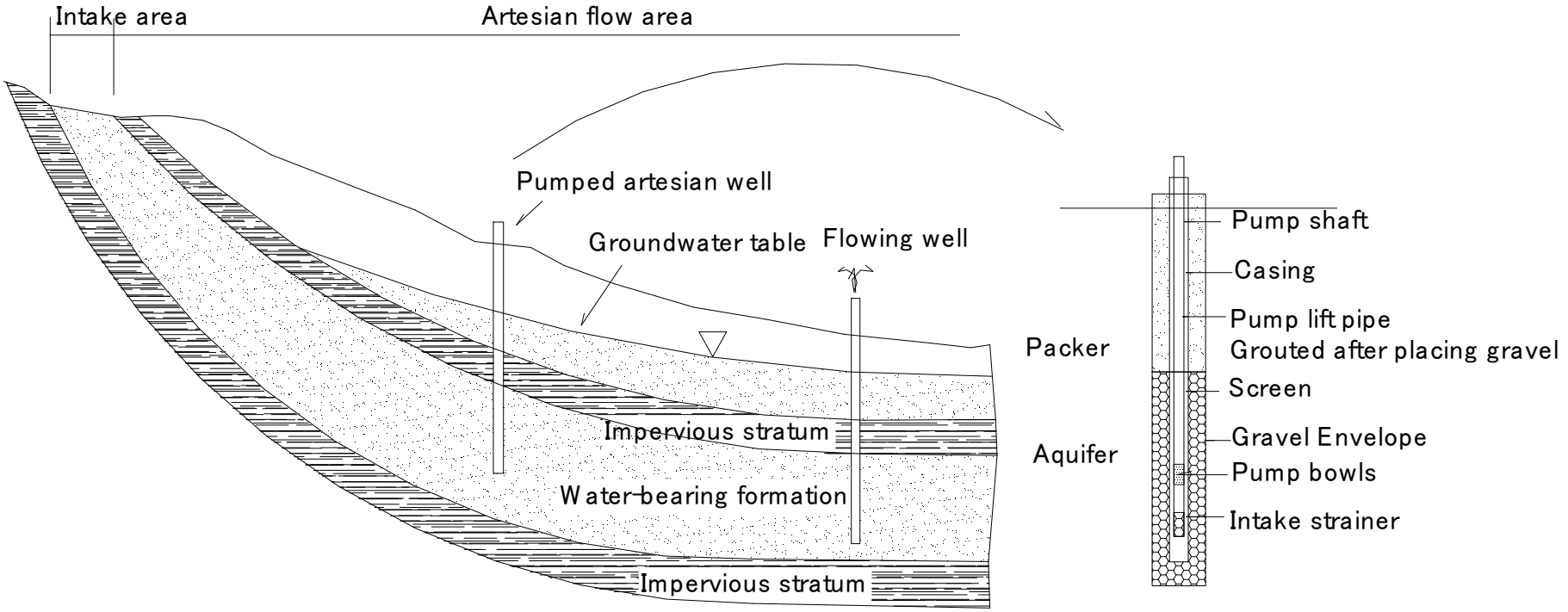
Box inlet and chute structure

(877) Groundwater

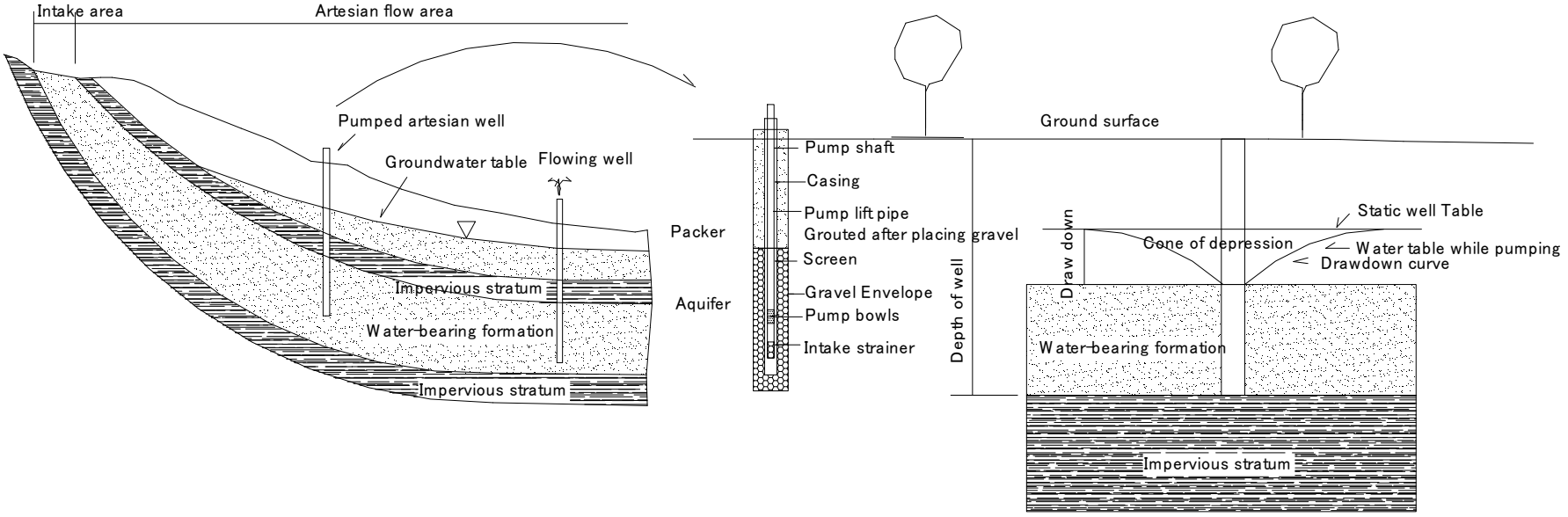


878 Cross section of a typical gravity well

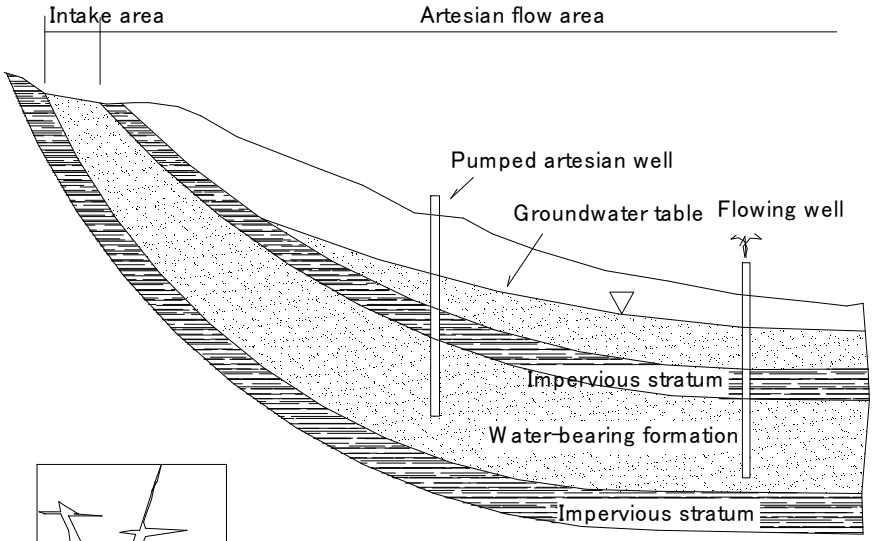
（ 878 ）Cross section of a typical gravity well

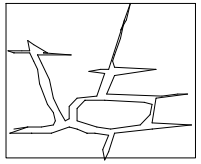


（ 879 ）Cross section of a typical gravity well

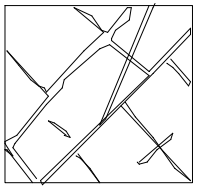


（ 880 ）Several types of rock interstices and the relationship of porosity

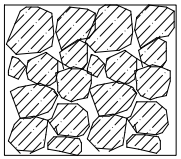




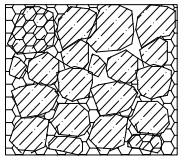
（ e ）Rock rendered porous by solution.



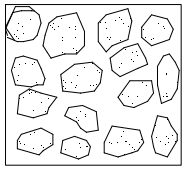
（ f ）Rock rendered porous by fracturing.



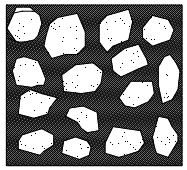
（ a ）Well sorted sedimentary deposit having high porosity.



（ b ）poorly sorted sedimentary deposit having low porosity.



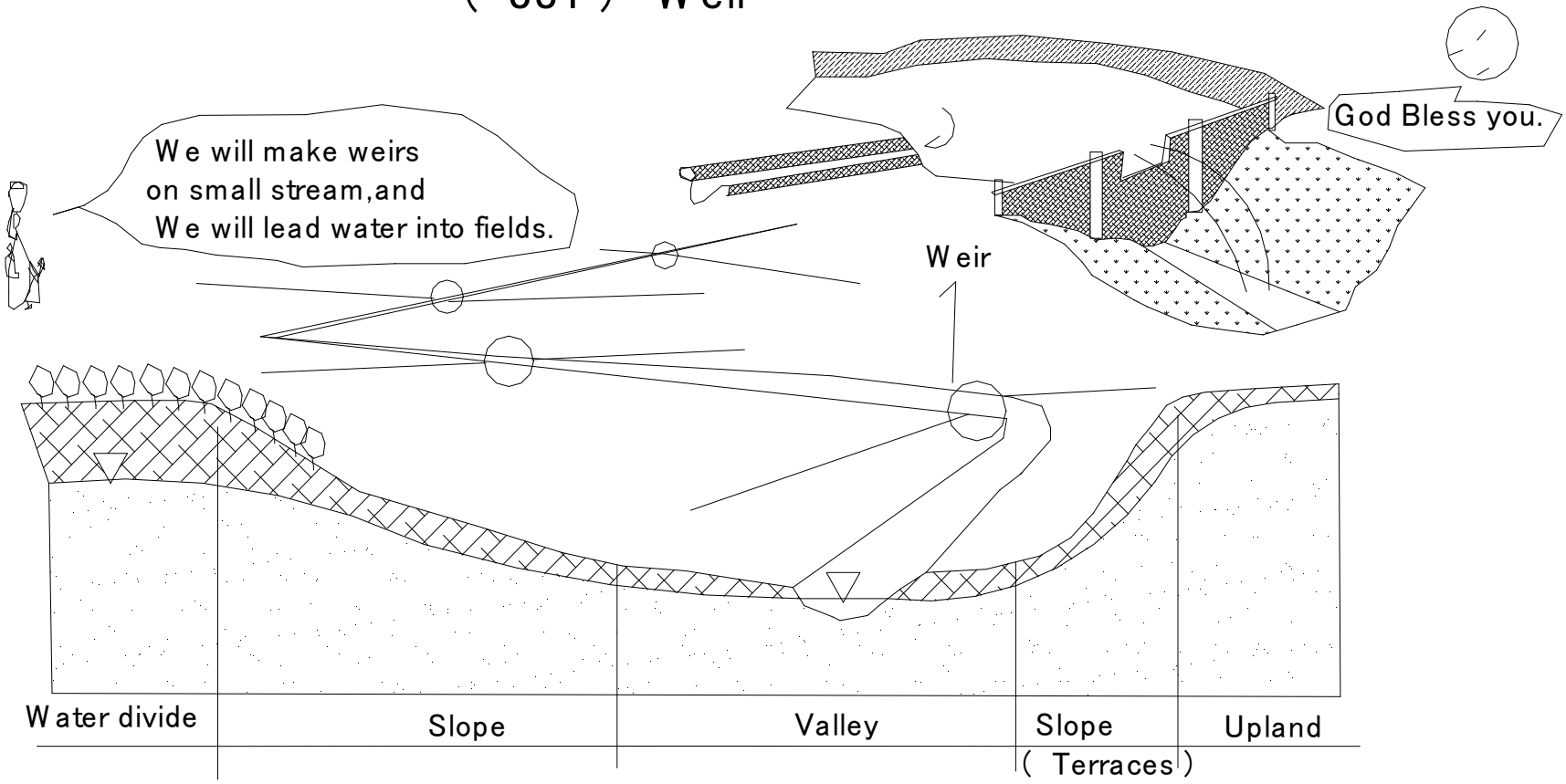
（ c ）well sorted sedimentary deposit with pebbles which are porous so that the deposit as a whole has a very high porosity.



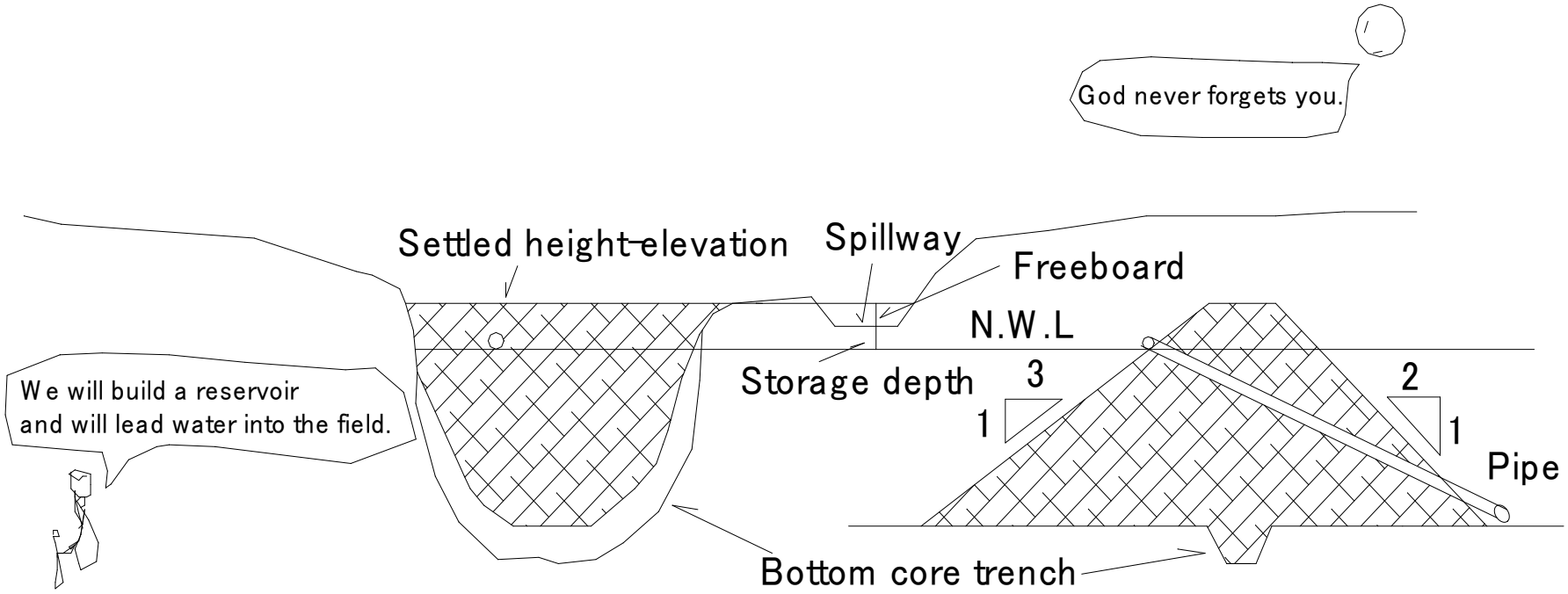
（ d ）Well sorted sedimentary deposit whose porosity has been diminished by the deposition of mineral matter in the interstices.

881 Weir

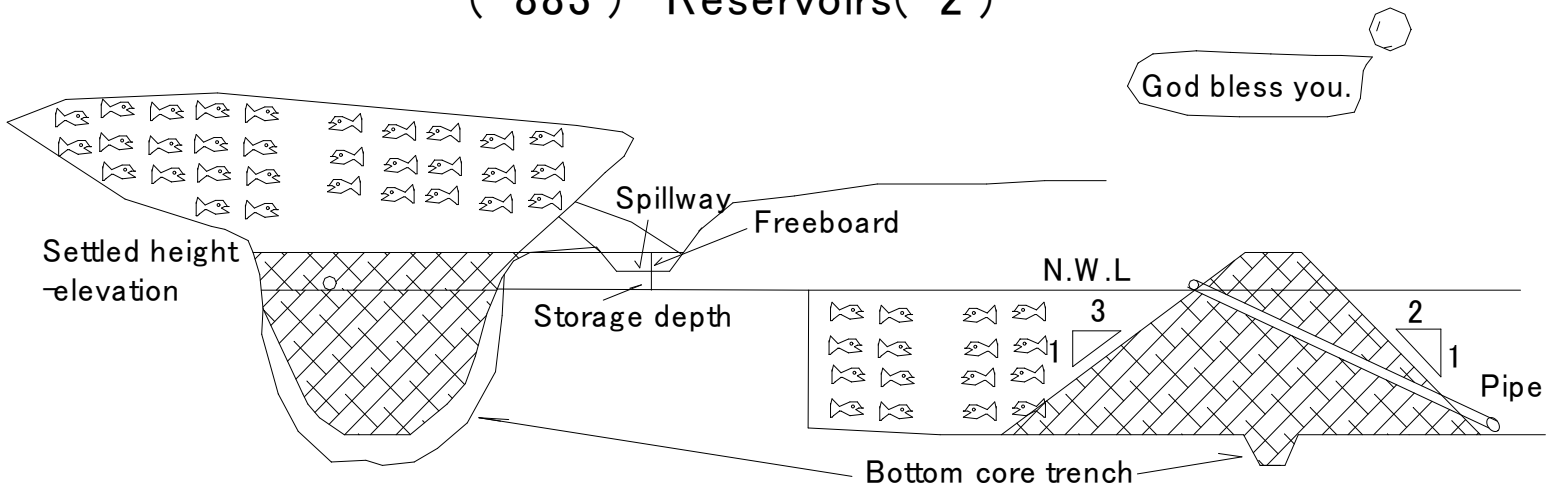
(881) Weir

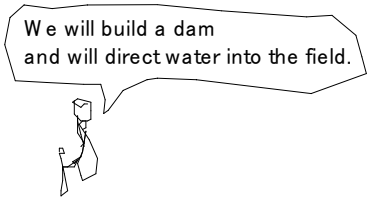


(882) Reservoirs



(883) Reservoirs(2)

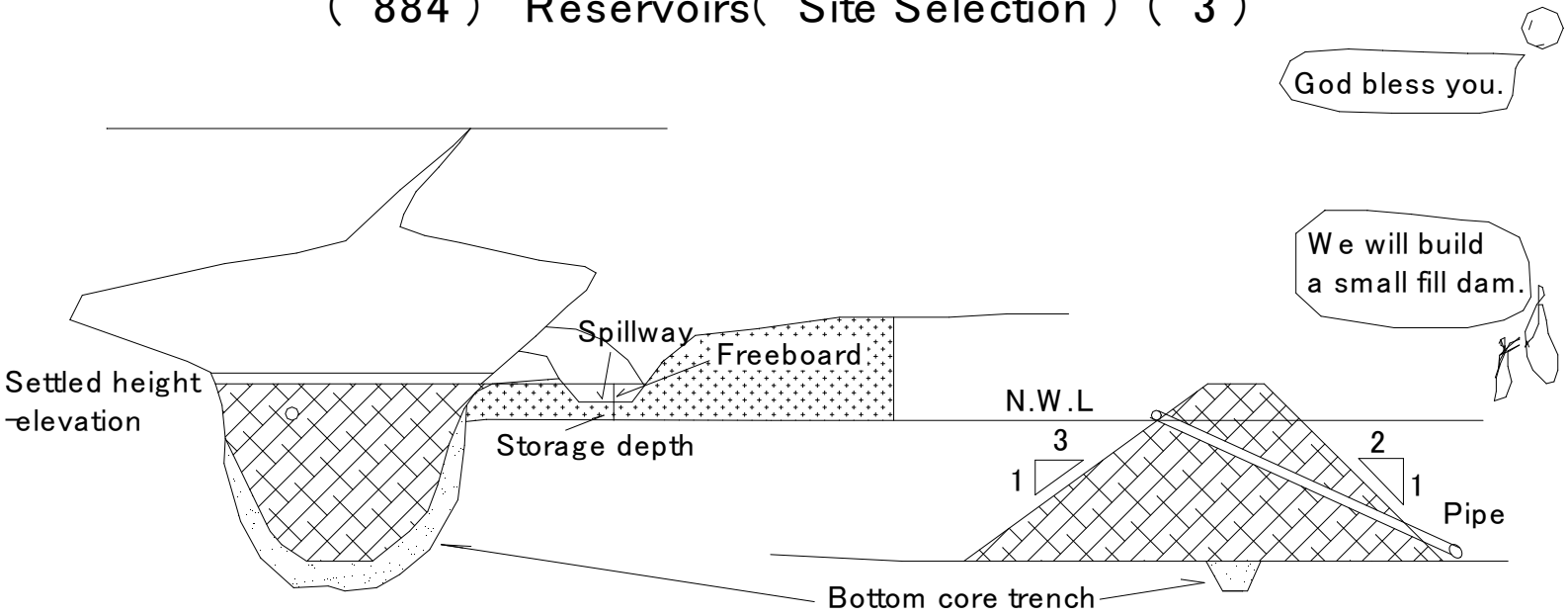




A farm reservoir is a multiple-use.

1. Store water for irrigation.
2. Livestock,spraying.
3. Fish production.
4. Fire protection.
5. A reservoir is the same as ponds, lakes,and tanks.
6. Water is suitable for domestic use with the proper filtering and purification equipment.
7. Water is mostly used for livestock.
8. Reservoirs are for constructing a dam in a natural ravine to form an on-stream reservoir.

(884) Reservoirs(Site Selection) (3)



Site Selection

1.Storage capacity is the most important.

Topography of the pond site.

1.Water depth:at least 2.5m~3.0m.

2.The dam center line perpendicular to the contour lines.

3.Fill material is obtained from the inundated area.

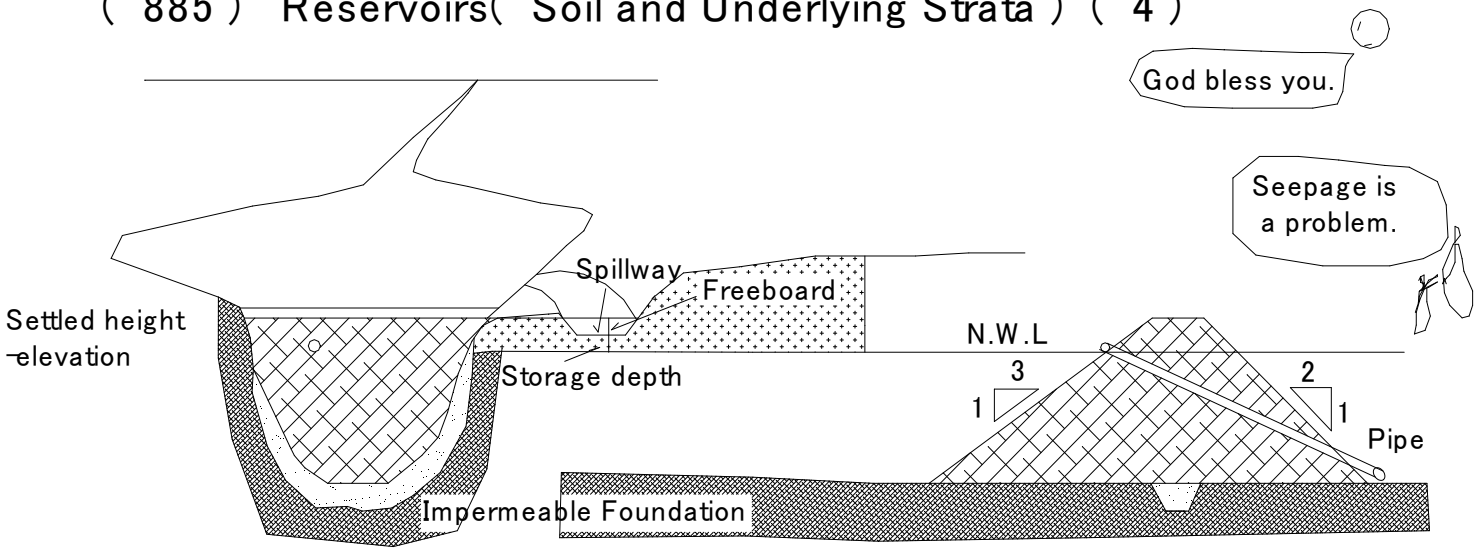
4.Channel slope above the dam (4~8%) .

5.Narrow channels will give a small surface and volume.

6.Flat ,wide channels produce a large surface area and volume.

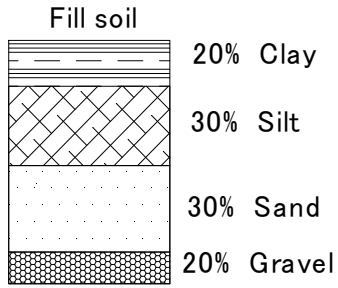
7.Reduce wave damage(Do not strike directly against the upstream face)

（ 885 ） Reservoirs（ Soil and Underlying Strata ）（ 4 ）

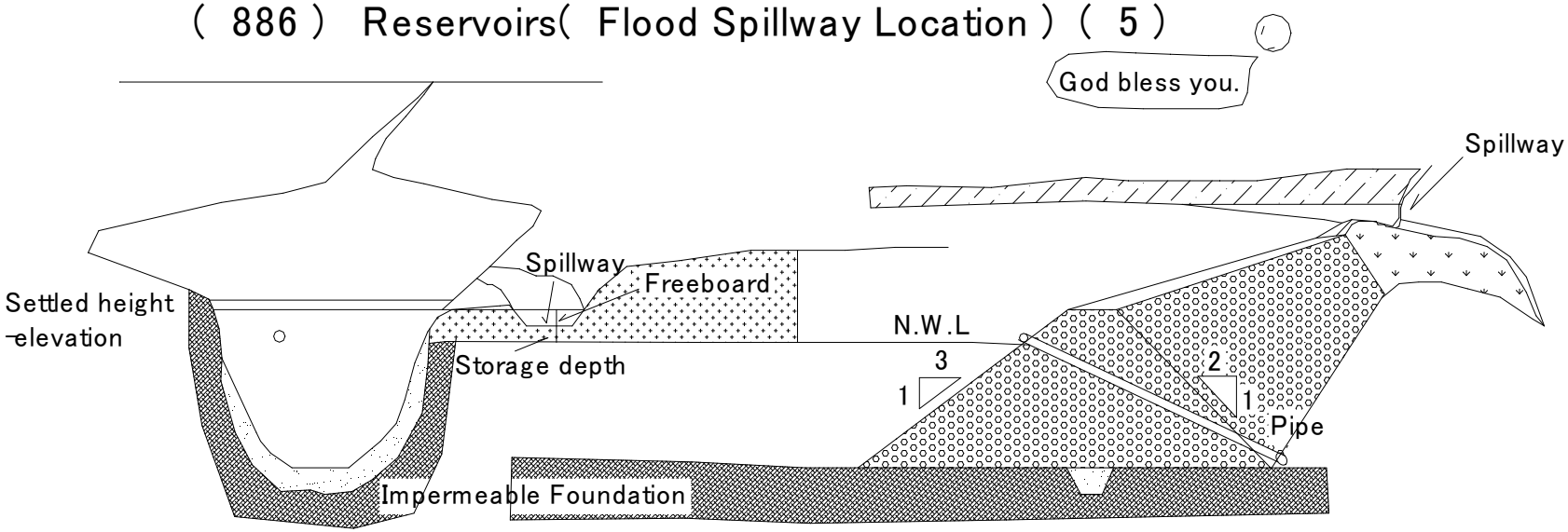


Soil and Underlying Strata

1. Foundation material under the dam and under the water surface should be impermeable.
2. Suitable fill should be available near the dam.
3. Fill soil no more than 20 % gravel,20% to 50% sand, less than 30% silt,and 15% to 25% clay.
4. Surface soil can be easily removed.
5. Deep peat,sand,gravel,or marl should be avoided as foundation material.
6. Horizontal strata of sand and gravel or fractured rock at shallow depth may result in high seepage losses.
7. Soil conditions prior to construction must be carefully evaluated .
8. Because control of seepage after construction is much more diificult.



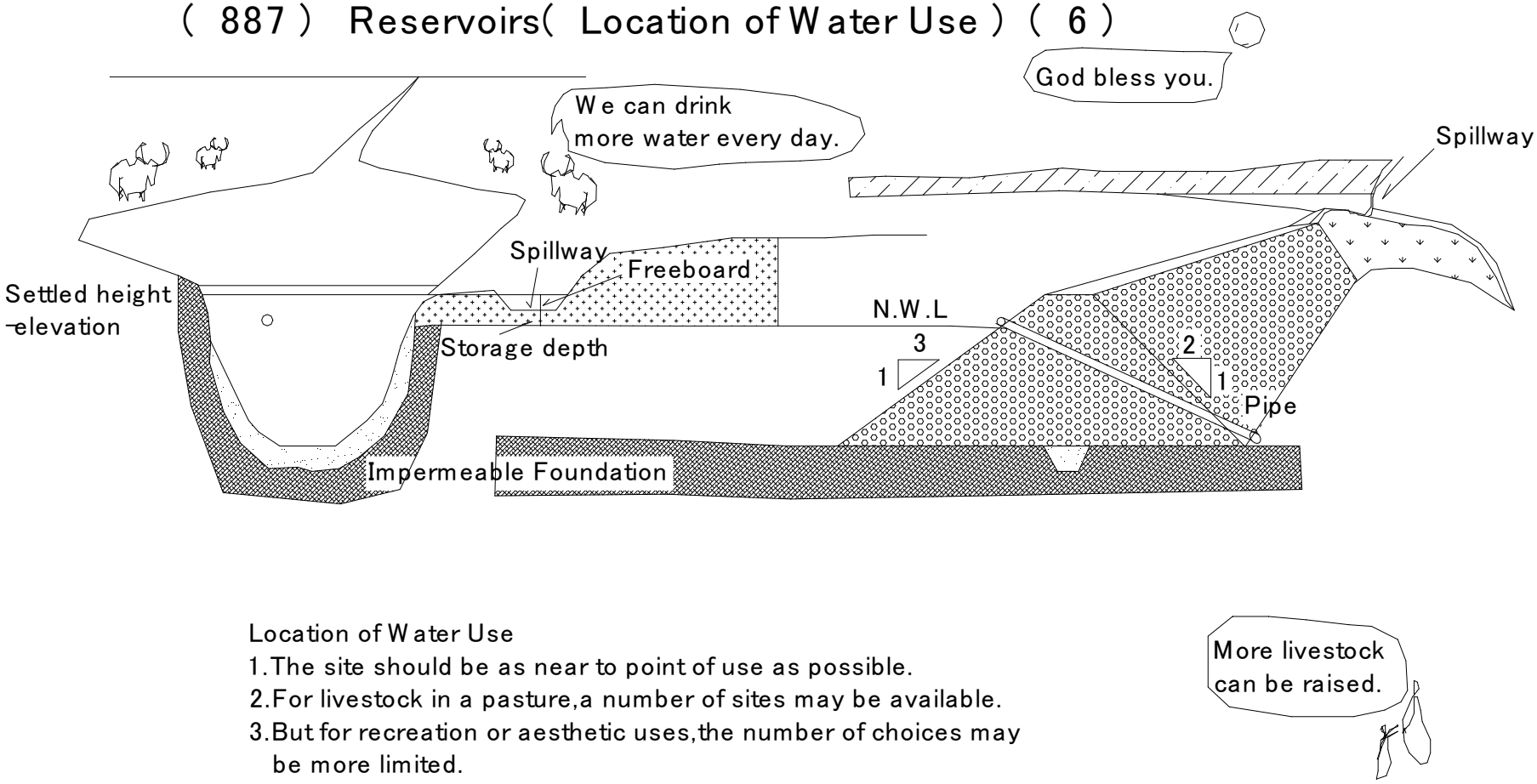
(886) Reservoirs(Flood Spillway Location) (5)



Flood Spillway Location

1. The most economical spillway is a grassed waterway around the end of the dam or across an adjacent ridge and into another natural channel.
2. Steep slopes along waterway should be avoided, where possible, to reduce the danger of erosion.
3. Concrete or permanent structures in the dam for carrying flood flows are normally not recommended because they are too costly.

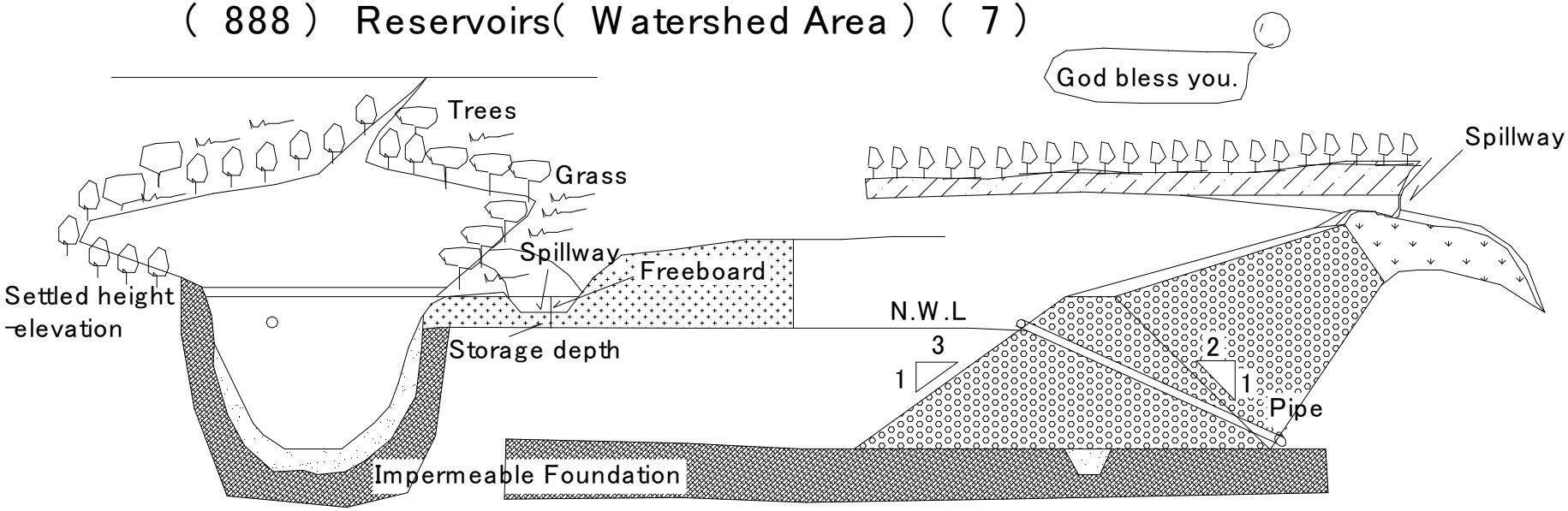
(887) Reservoirs(Location of Water Use) (6)



Location of Water Use

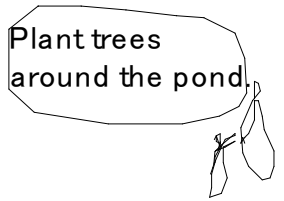
1. The site should be as near to point of use as possible.
2. For livestock in a pasture, a number of sites may be available.
3. But for recreation or aesthetic uses, the number of choices may be more limited.

(888) Reservoirs(Watershed Area) (7)

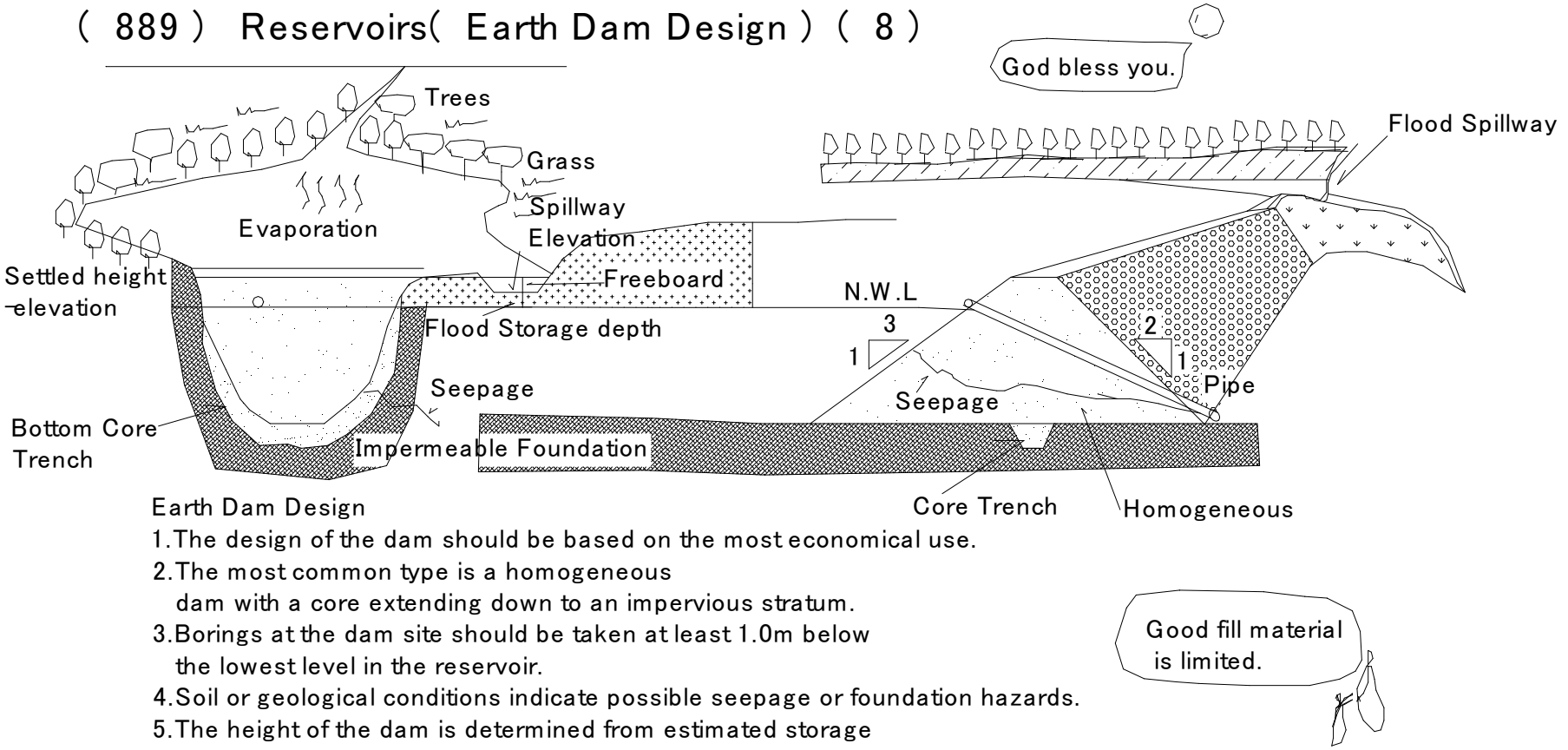


Watershed Area

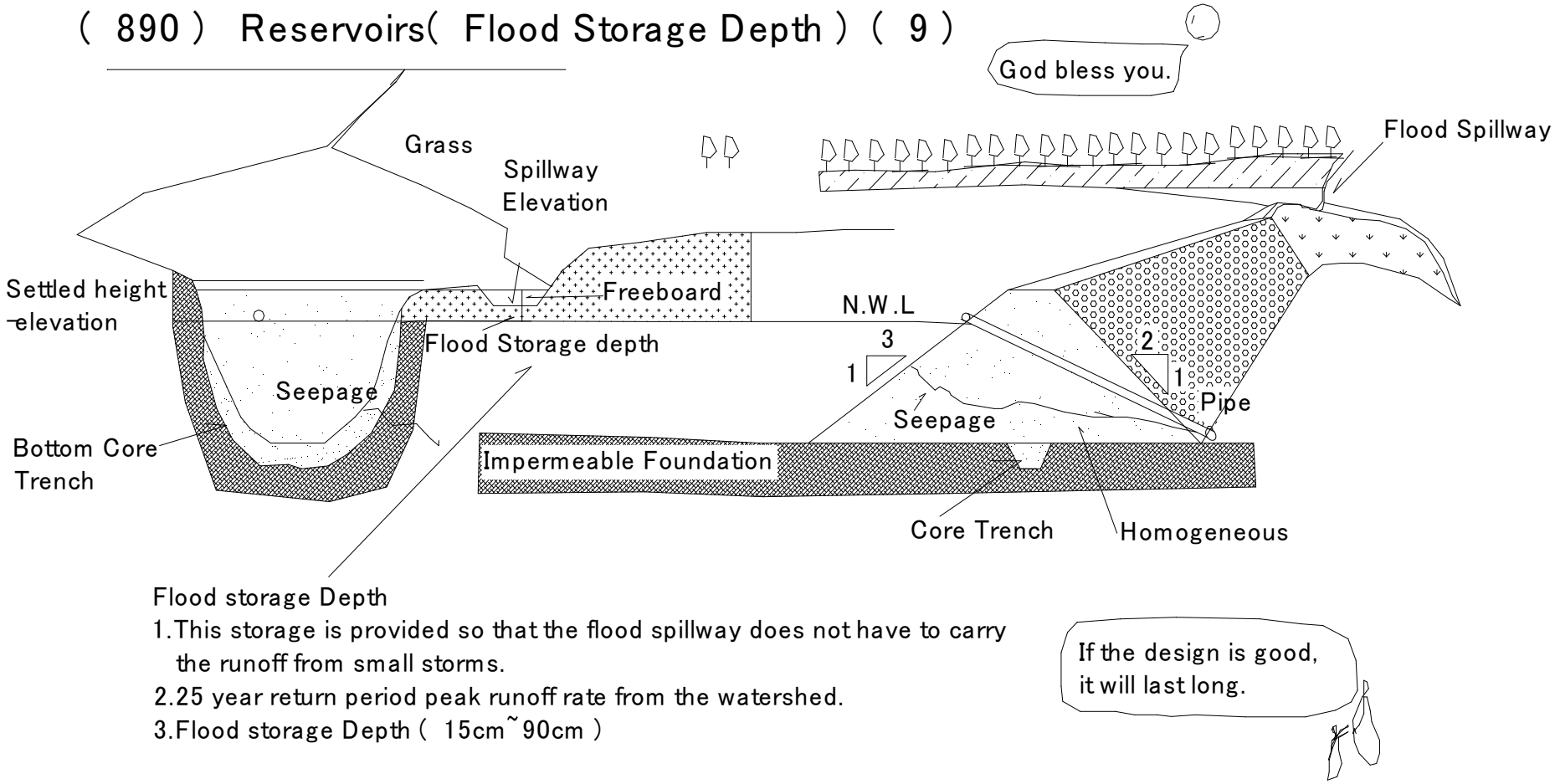
1. Small dams produce rapid sedimentation in the pond and create an erosion problem in the flood spillway at the dam.
2. Grass cover around the pond will greatly reduce sediment inflow.
3. Locations near farm buildings are desirable for fire protection.
4. The pollution hazard may be diverted away from the pond.
5. Water from barnyards and other sources of pollution should be diverted away from the pond.



(889) Reservoirs(Earth Dam Design) (8)



(890) Reservoirs(Flood Storage Depth) (9)



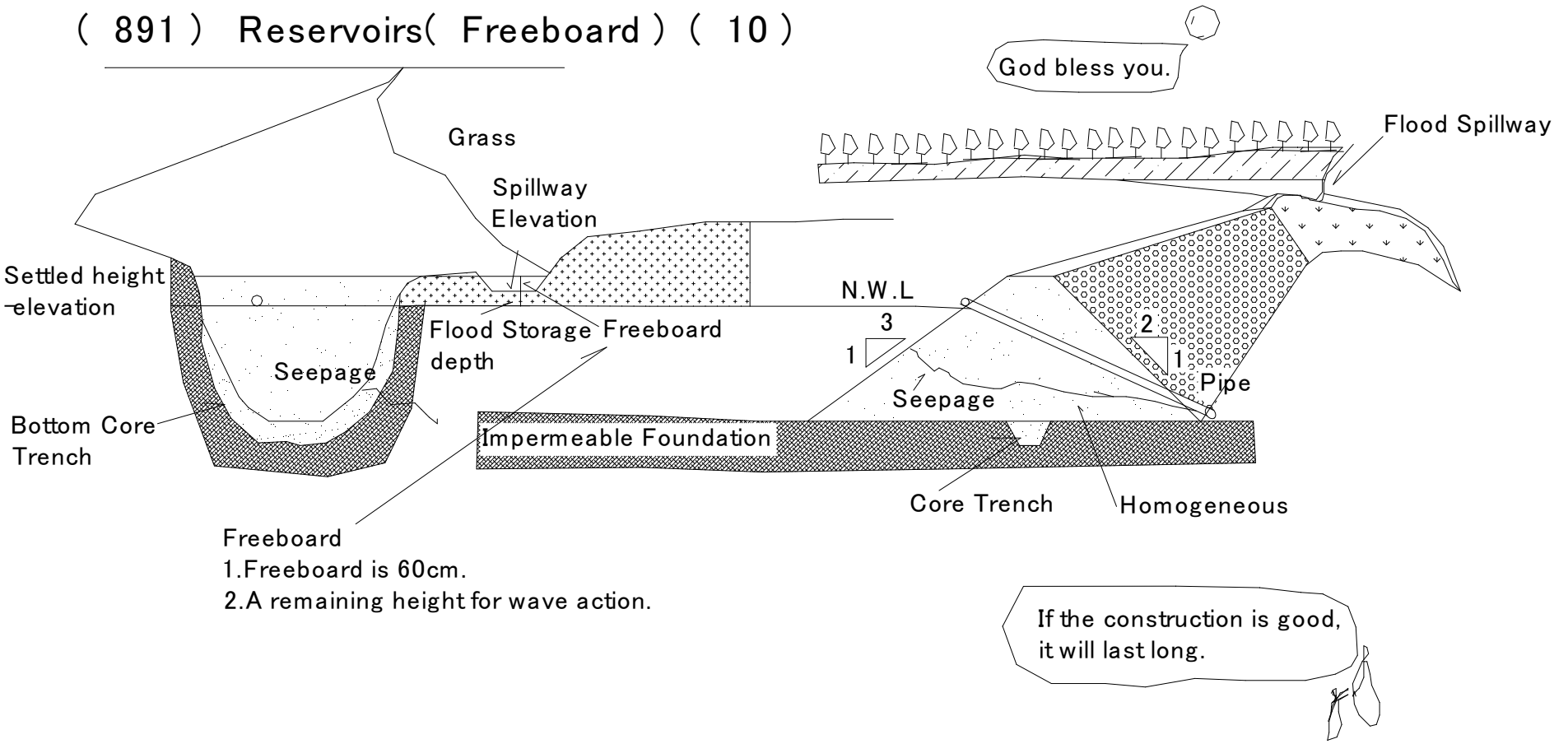
1.This storage is provided so that the flood spillway does not have to carry the runoff from small storms.

2.25 year return period peak runoff rate from the watershed.

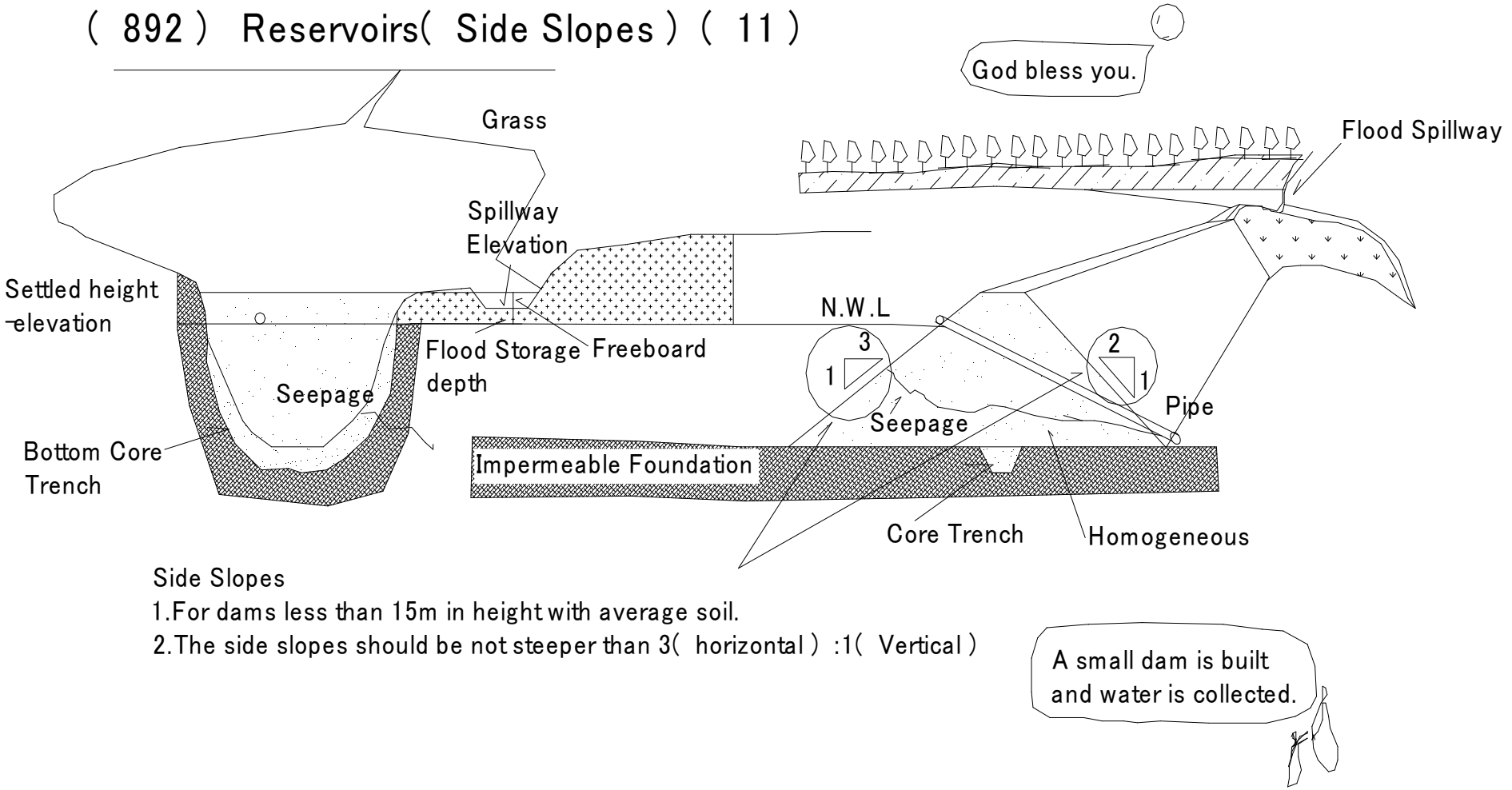
3.Flood storage Depth (15cm~90cm)

If the design is good,
it will last long.

(891) Reservoirs(Freeboard) (10)



(892) Reservoirs(Side Slopes) (11)

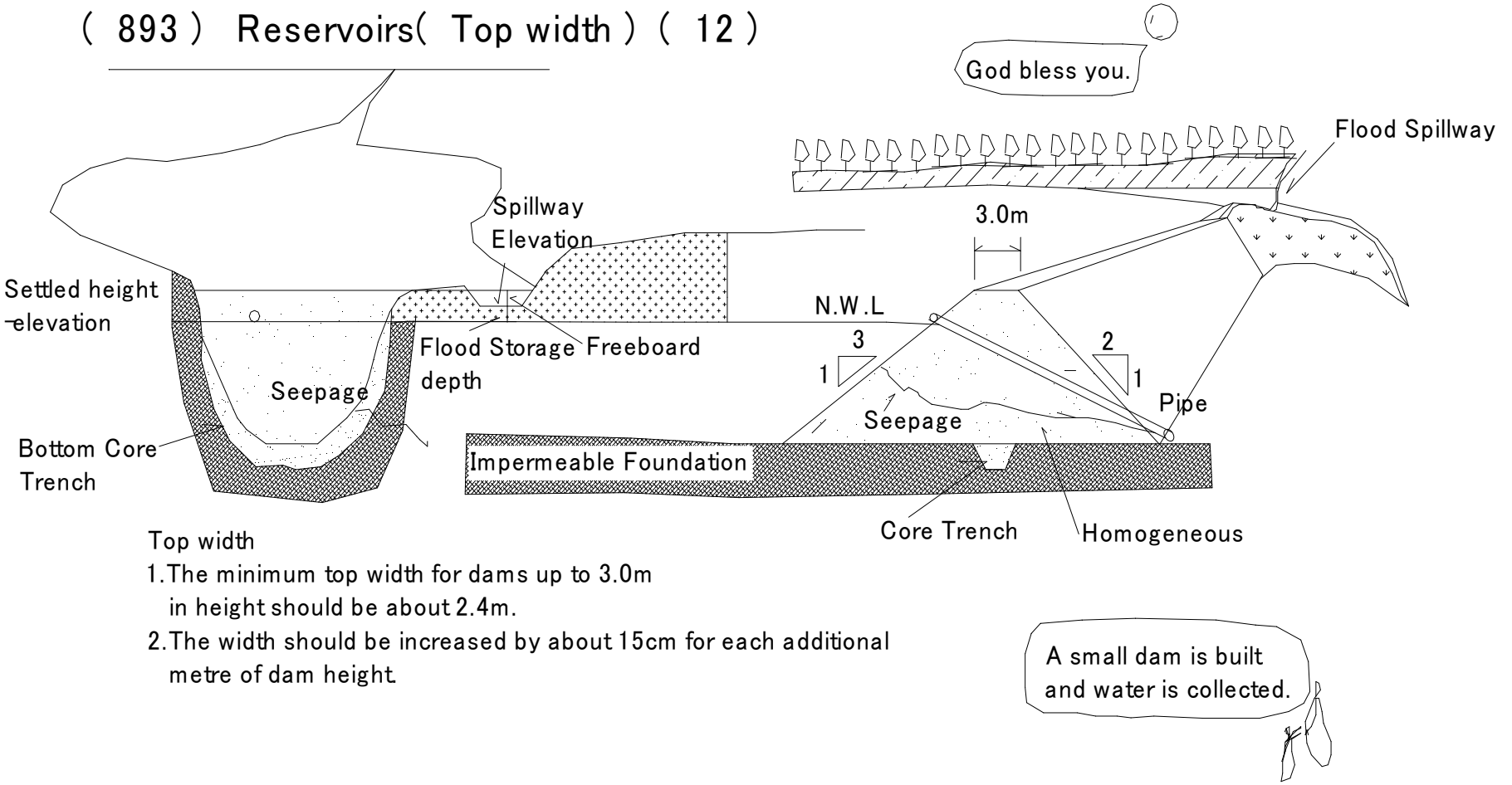


Side Slopes

1.For dams less than 15m in height with average soil.

2.The side slopes should be not steeper than 3(horizontal) :1(Vertical)

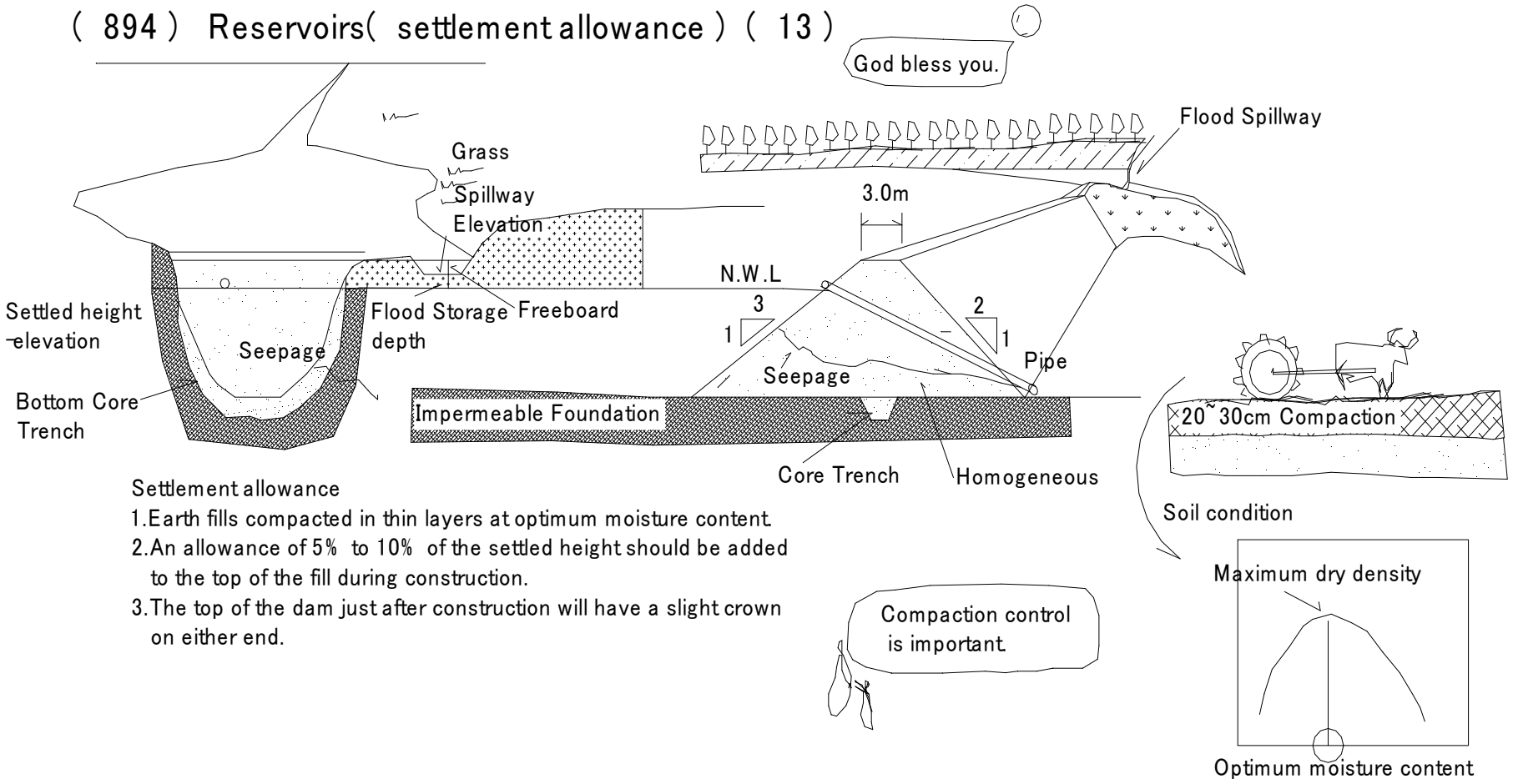
(893) Reservoirs(Top width) (12)



Top width

1. The minimum top width for dams up to 3.0m in height should be about 2.4m.
2. The width should be increased by about 15cm for each additional metre of dam height.

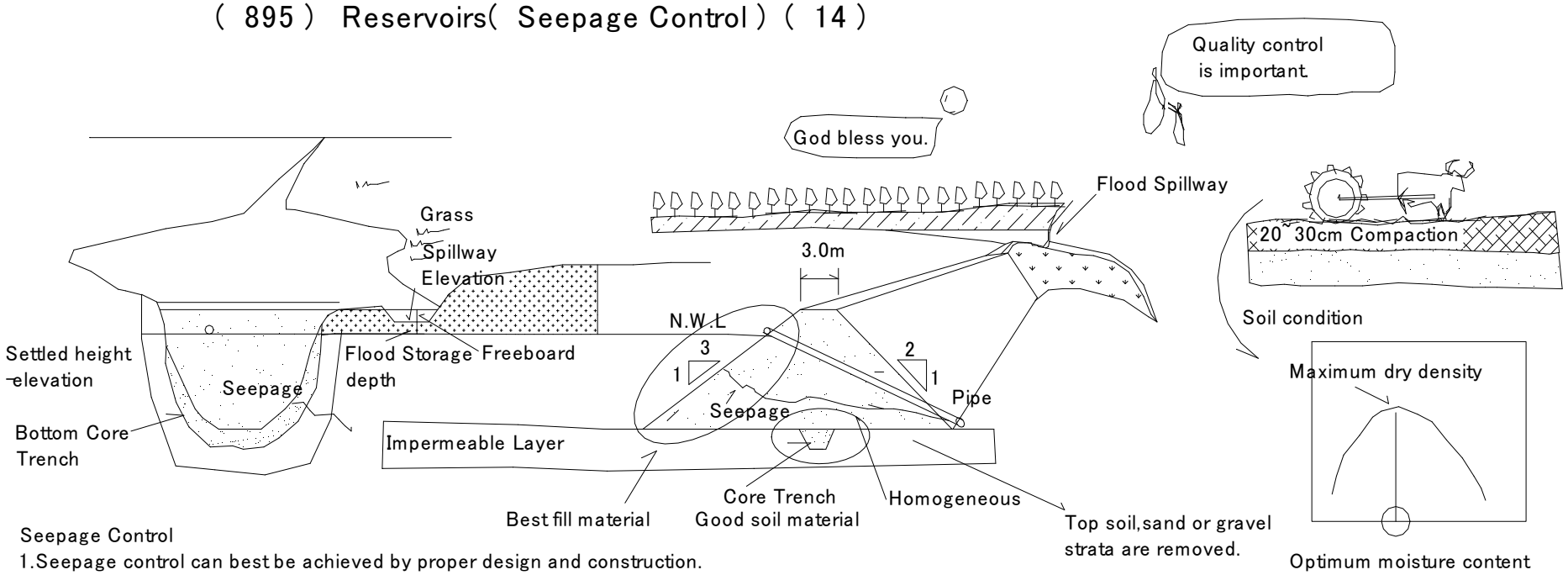
(894) Reservoirs(settlement allowance) (13)



Settlement allowance

1. Earth fills compacted in thin layers at optimum moisture content.
2. An allowance of 5% to 10% of the settled height should be added to the top of the fill during construction.
3. The top of the dam just after construction will have a slight crown on either end.

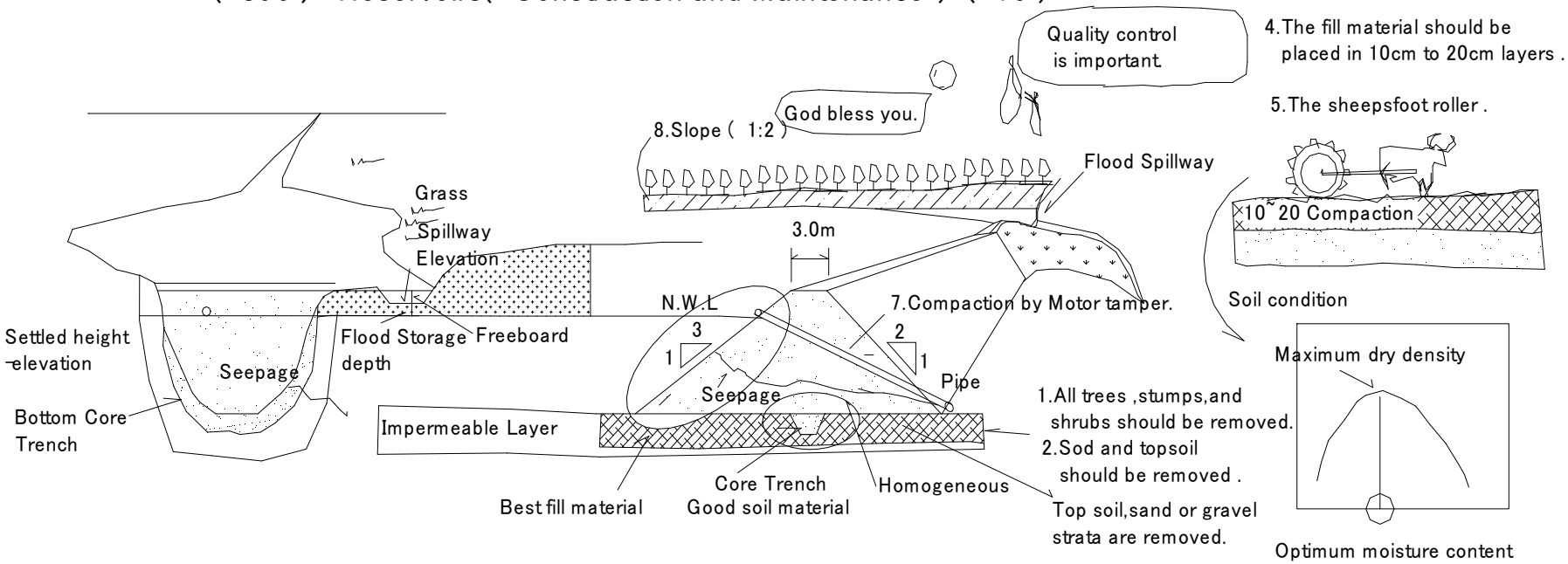
(895) Reservoirs(Seepage Control) (14)



Seepage Control

1.Seepage control can best be achieved by proper design and construction.
2.Seepage may occur through the dam or when pond area is underlain by rock,sand,and gravel strata or solution channels.
3.The core trench should extend down to an impermeable layer.
4.The core trench should have a minimum width of 2.4 m and side slopes 1:1 .
5.The topsoil or other permeable material under the dam should be removed.
6.Maximum density of the fill should be obtained by compaction at the optimum moisture content.
7.Free water cannot be squeezed.
8.Soil should be carefully compacted.
9.The core of good material should be as wide as possible.
10.The next-best fill material should be placed upstream in the face of the dam and the poorest in the downstream section.

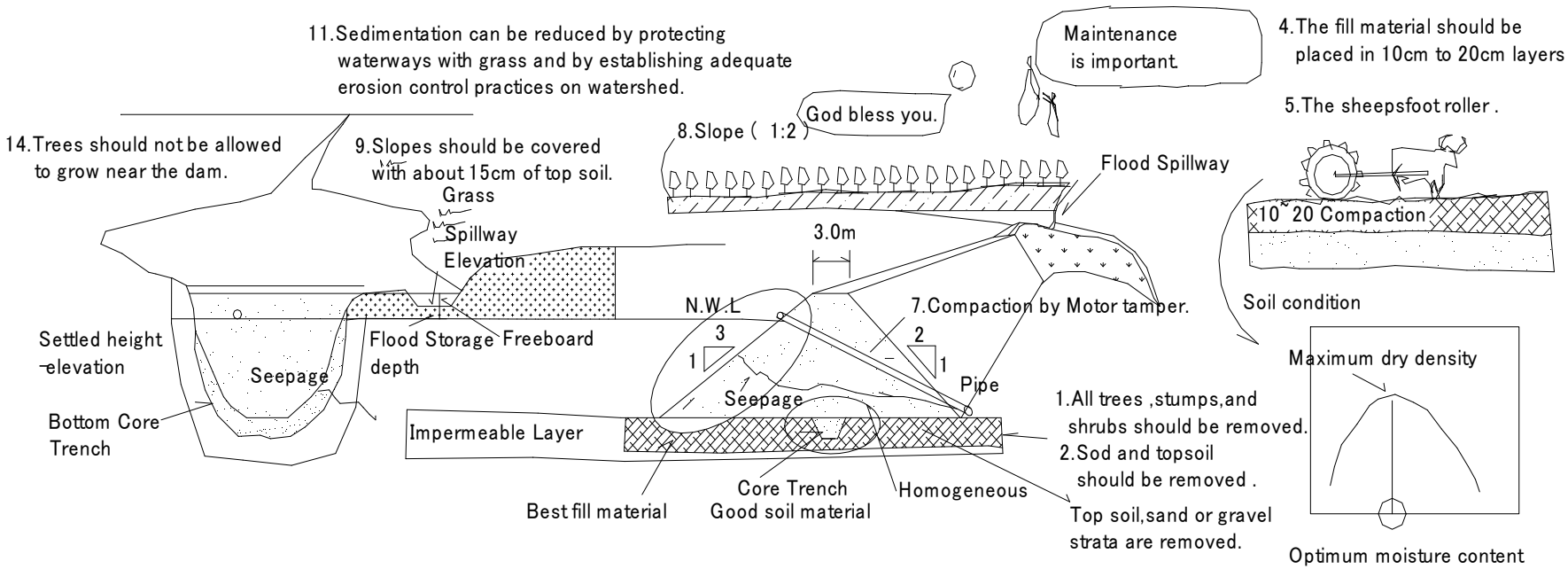
(896) Reservoirs(Construction and Maintenance) (15)



Construction and Maintenance

1.All trees ,stumps,and shrubs should be removed from dam site and from area to be inundated.
2.Sod and topsoil should be removed and stockpiled.
3.Before placement of fill in the dam,existing soil should be ploughed and be near optimum moisture content.
4.The fill material should be placed in 10cm to 20cm layers evenly,over the entire dam.
5.The sheepsfoot roller is best suited for compacting the fill.
6.Heavy hauling equipment should use varied travel paths so as to avoid over compaction.
7.Hand-operated pneumatic or motor tampers are best for compaction around pipes.
8.Along the shore line,except at the dam,the slope should be increased to 2:1 to a minimum depth of 1.20m.

(897) Reservoirs(Construction and Maintenance) (16)



Construction and Maintenance

9.Slopes and other areas above the water line where the subsoil has been exposed should be covered with about 15cm of top soil,fertilized,and seeded with a suitable grass.

10.The entire pond area should be fenced to prevent damage to the dam,spillways,and dams.

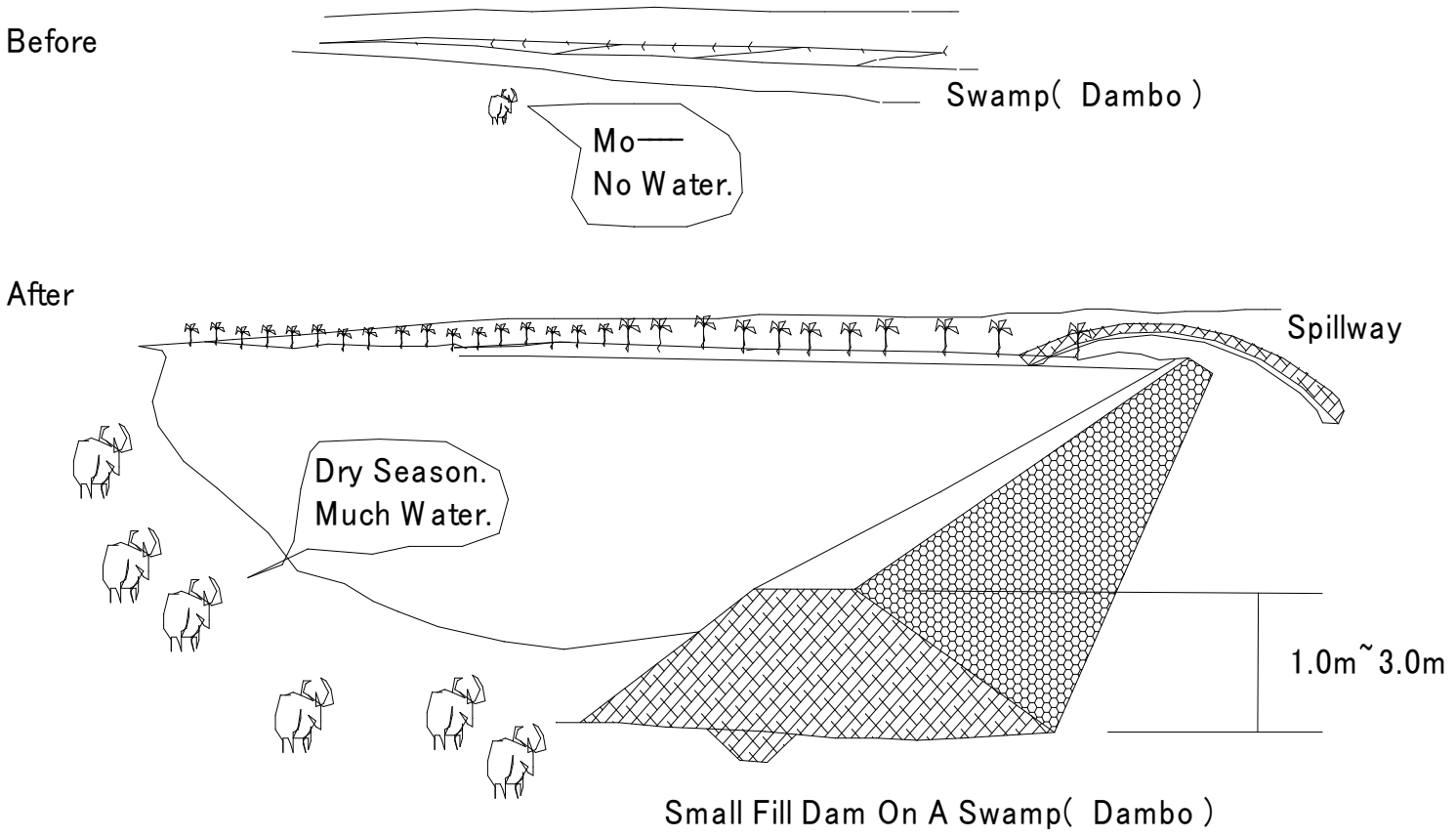
11.Sedimentation can be reduced by protecting waterways with grass and by establishing adequate erosion control practices on watershed.

12.The pond should be inspected for evidence of seepage on the downstream face of the dam,piping,wave action,and damage by animals or humans.

13.Weed growth in the pond can be controlled with suitable chemicals.

14.Trees should not be allowed to grow near the dam.

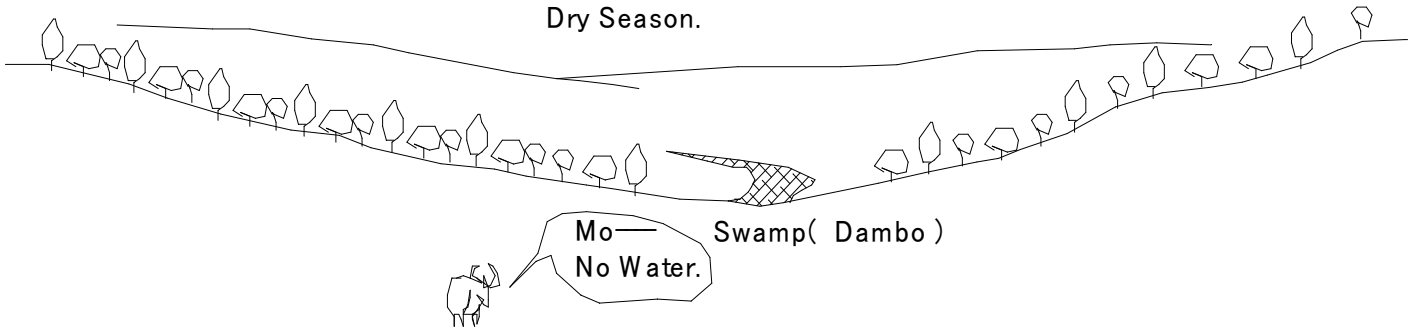
(898) Small Fill Dam On A Swamp(Dambo) (1)



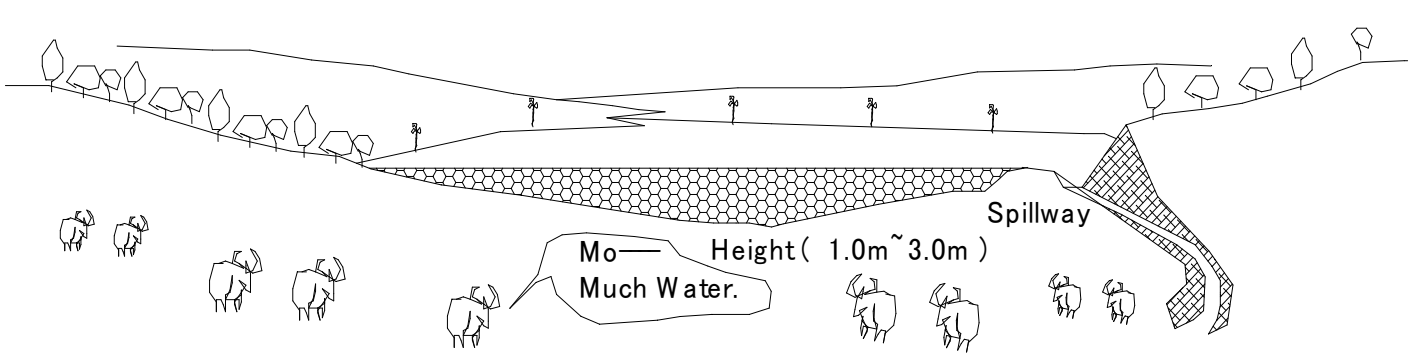
Small Fill Dam On A Swamp(Dambo)

(899) Small Fill Dam On A Swamp(Dambo) (2)

Before

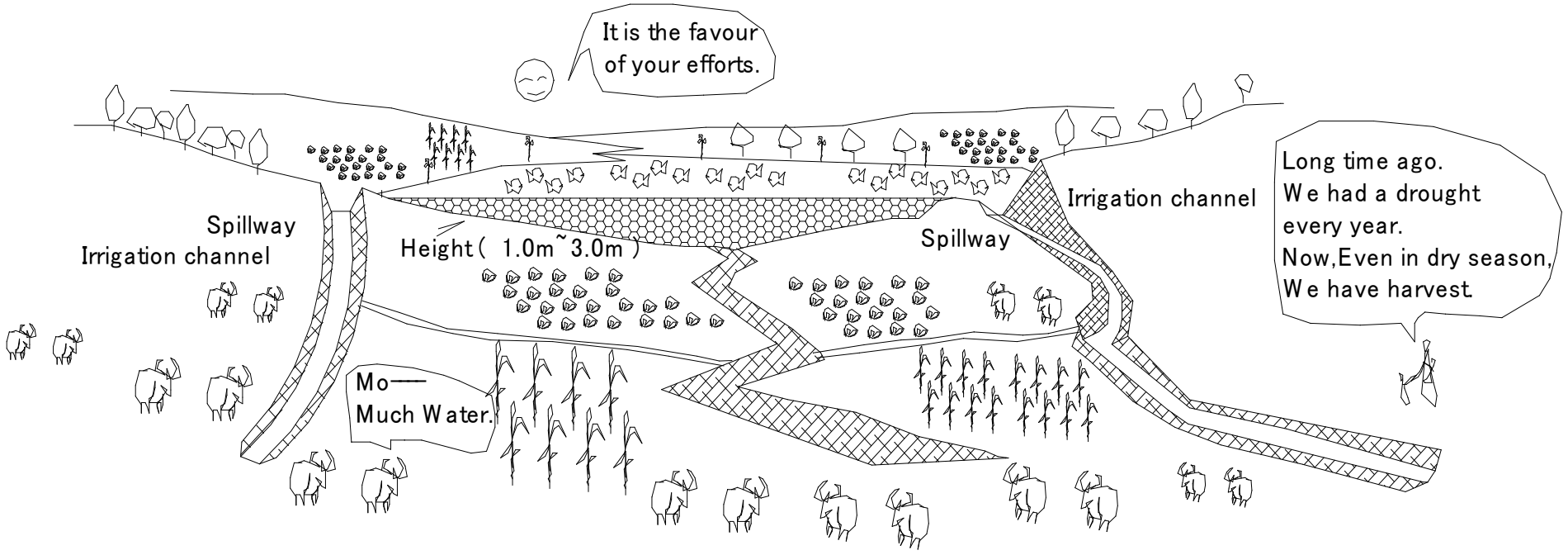


After

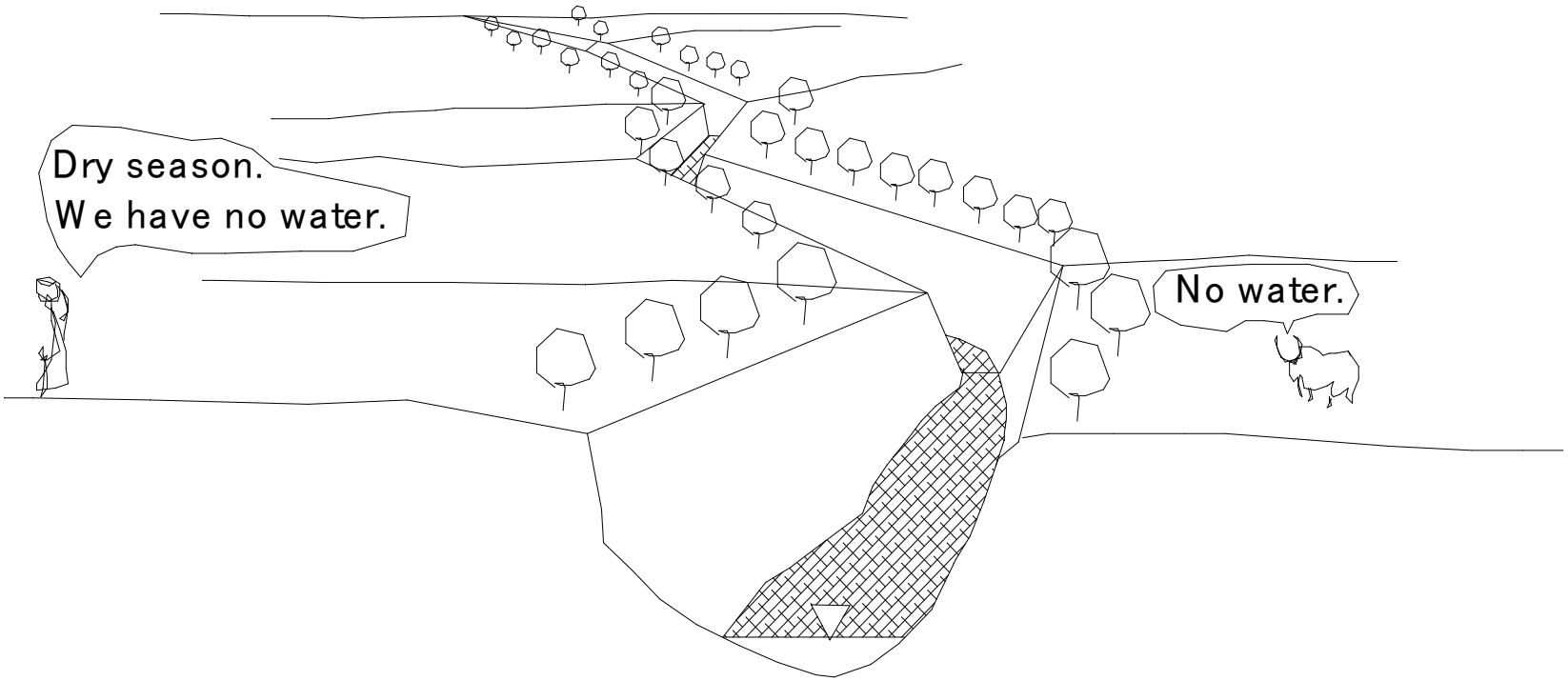


Small Fill Dam On A Swamp(Dambo)

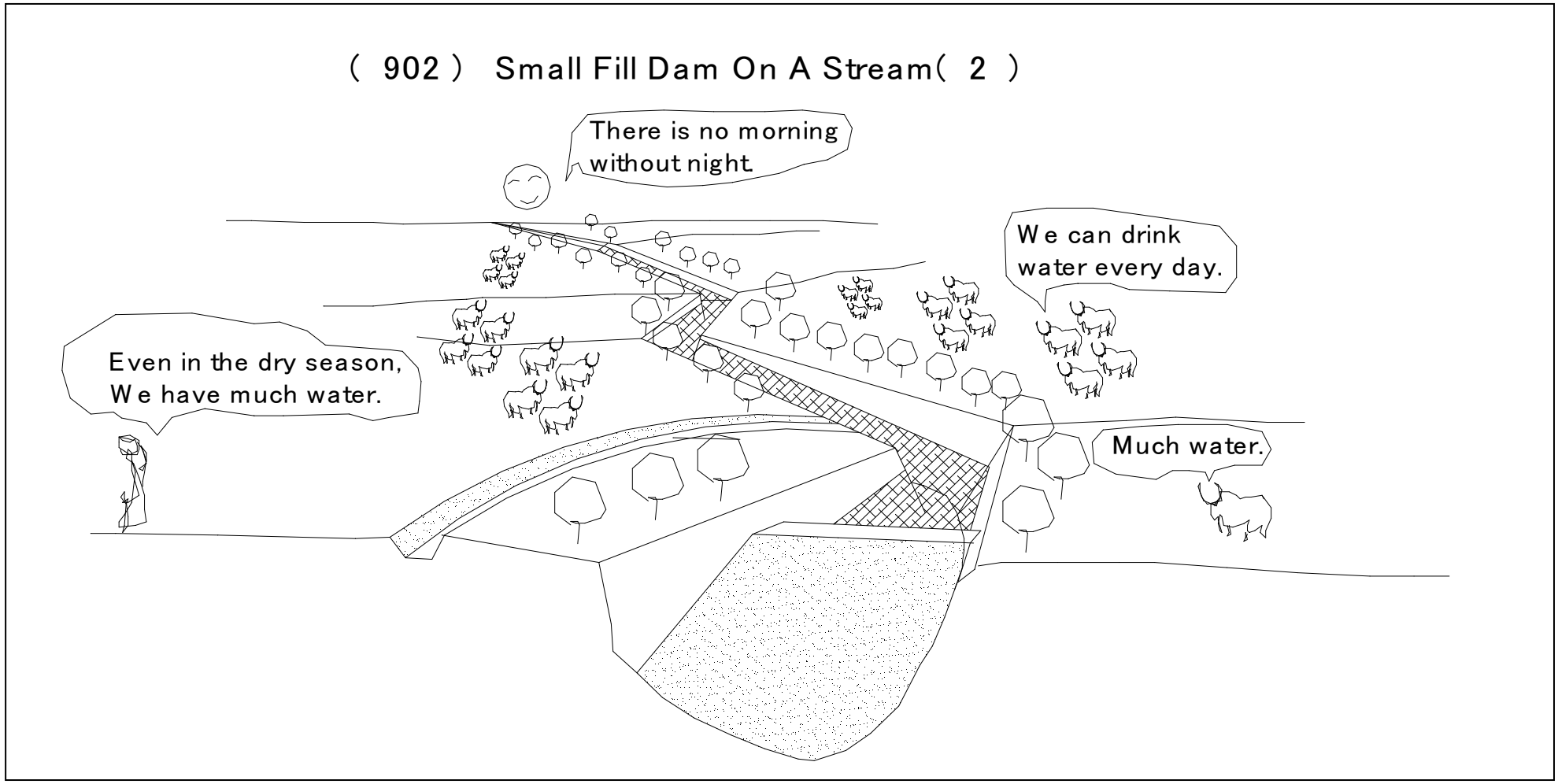
(900) Small Fill Dam On A Swamp(Dambo) (3)



（ 901 ） Small Fill Dam On A Stream（ 1 ）

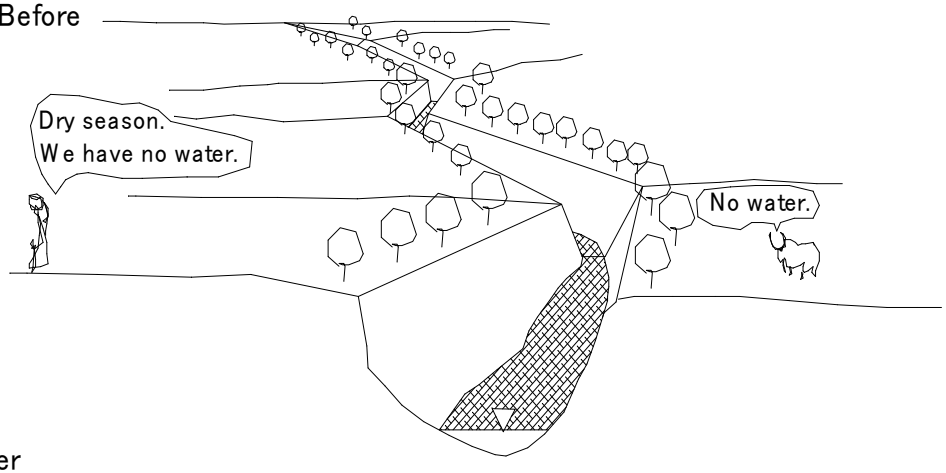


902 Small Fill Dam on A Stream (2)

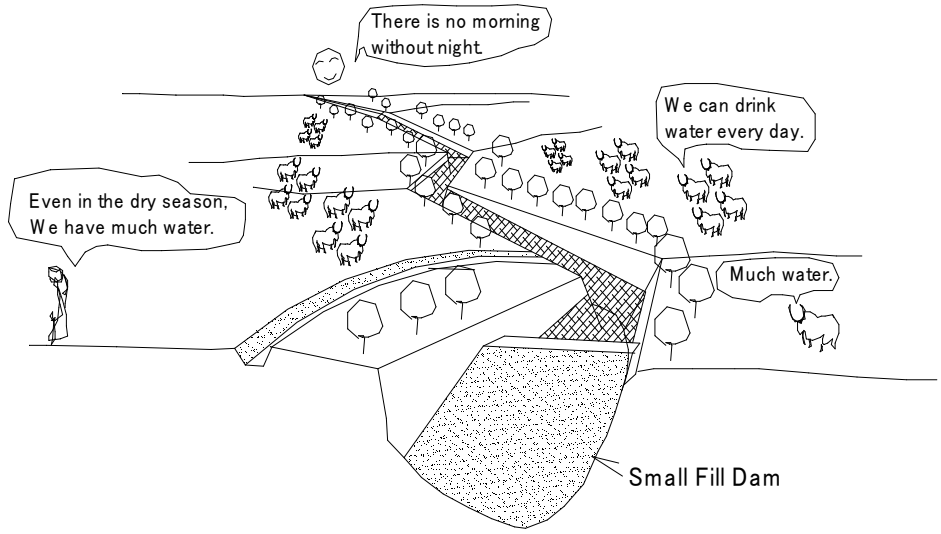


(903) Small Fill Dam On A Stream(3)

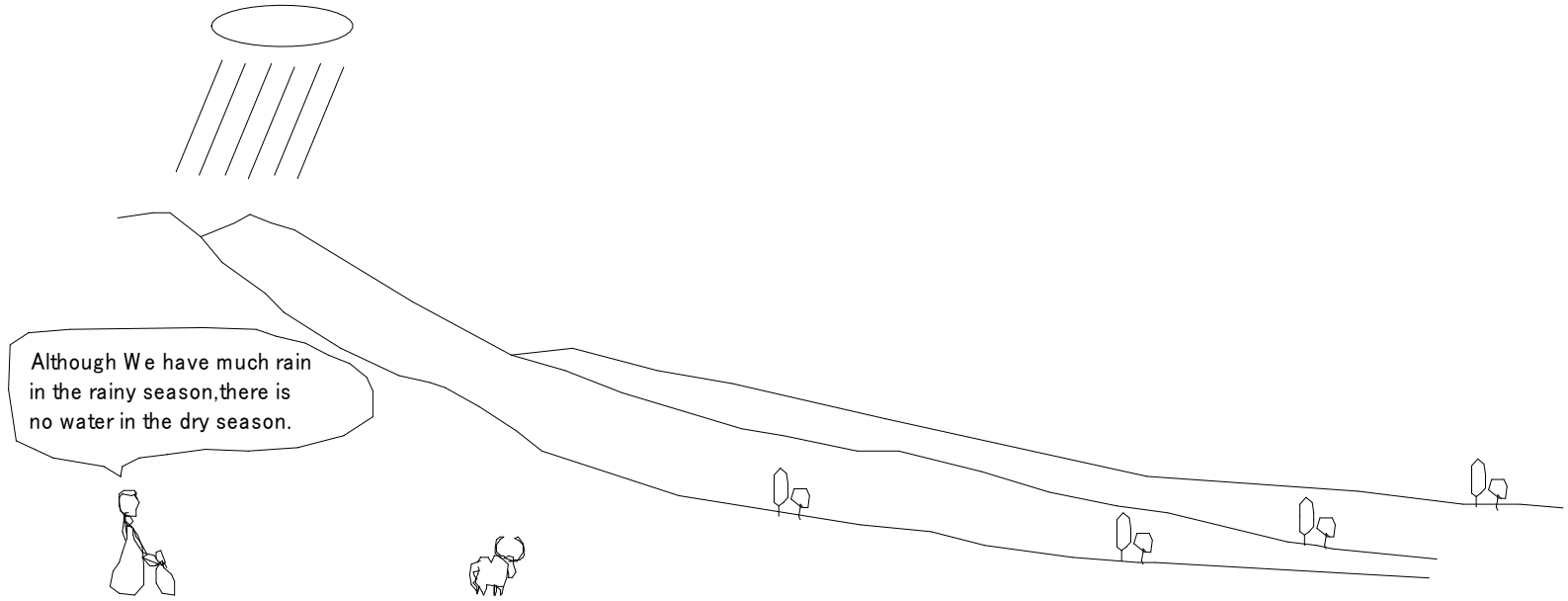
Before



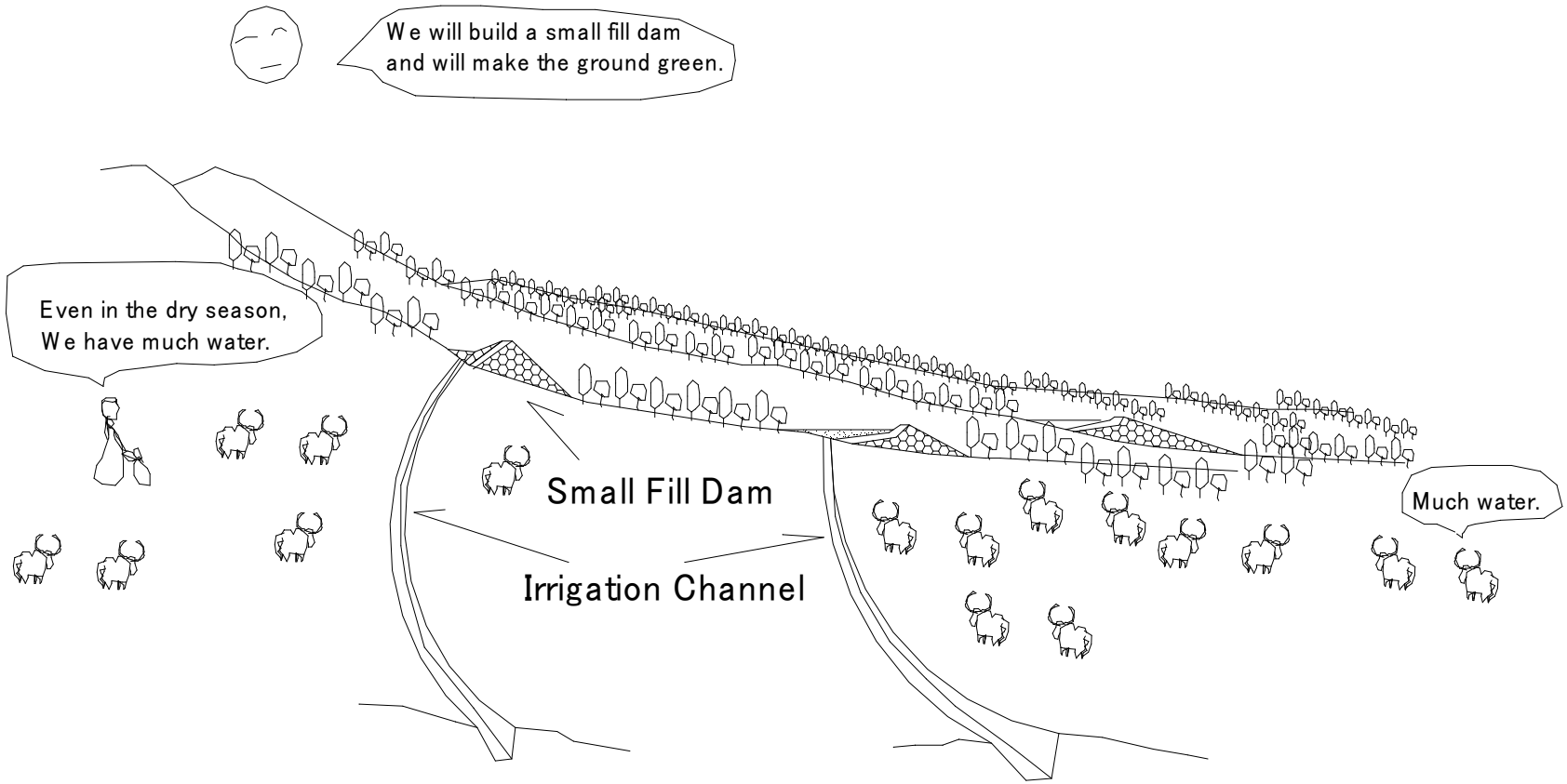
After



（ 904 ） Small Fill Dam On A Hill（ 1 ）

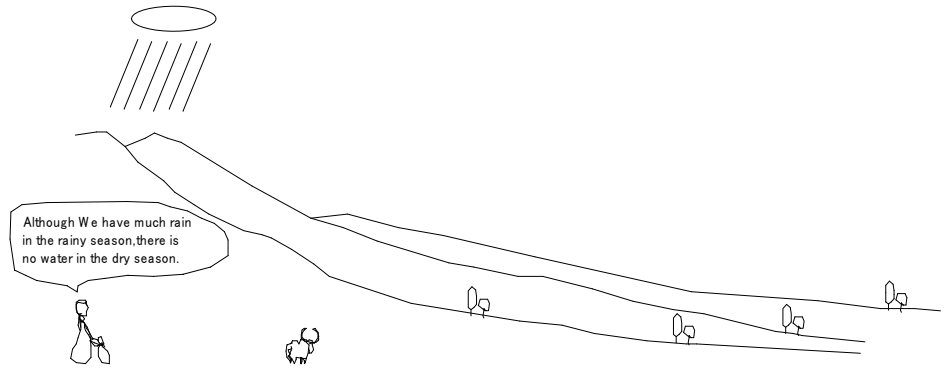


（ 905 ） Small Fill Dam On A Hill（ 2 ）

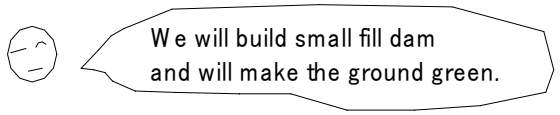


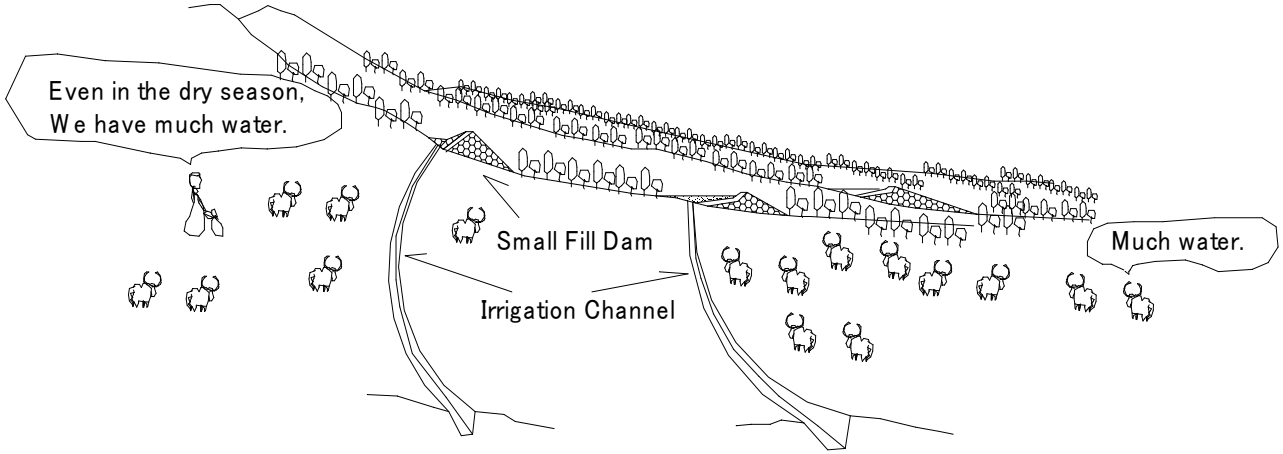
(906) Small Fill Dam On A Hill (3)

Before



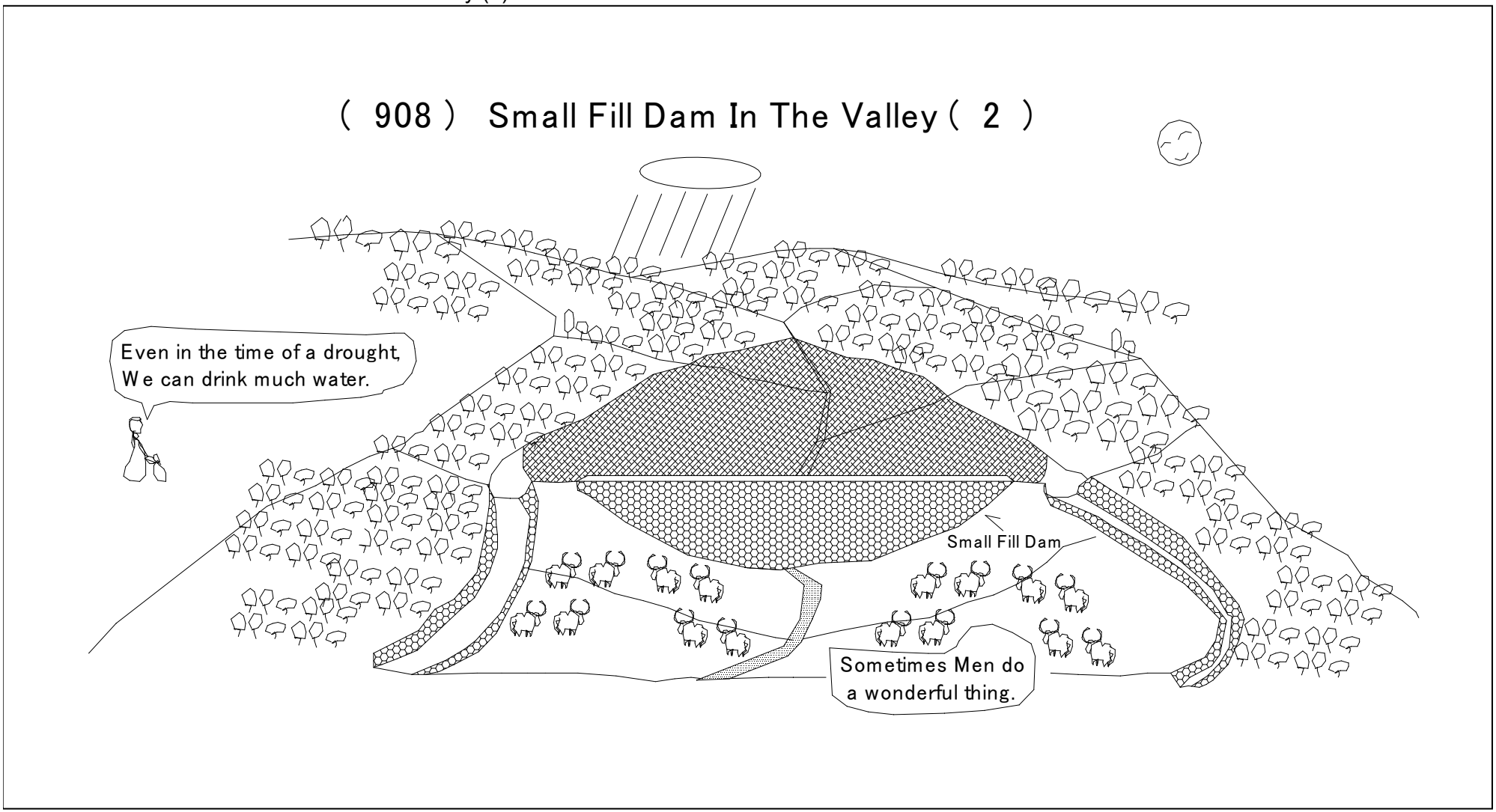
After



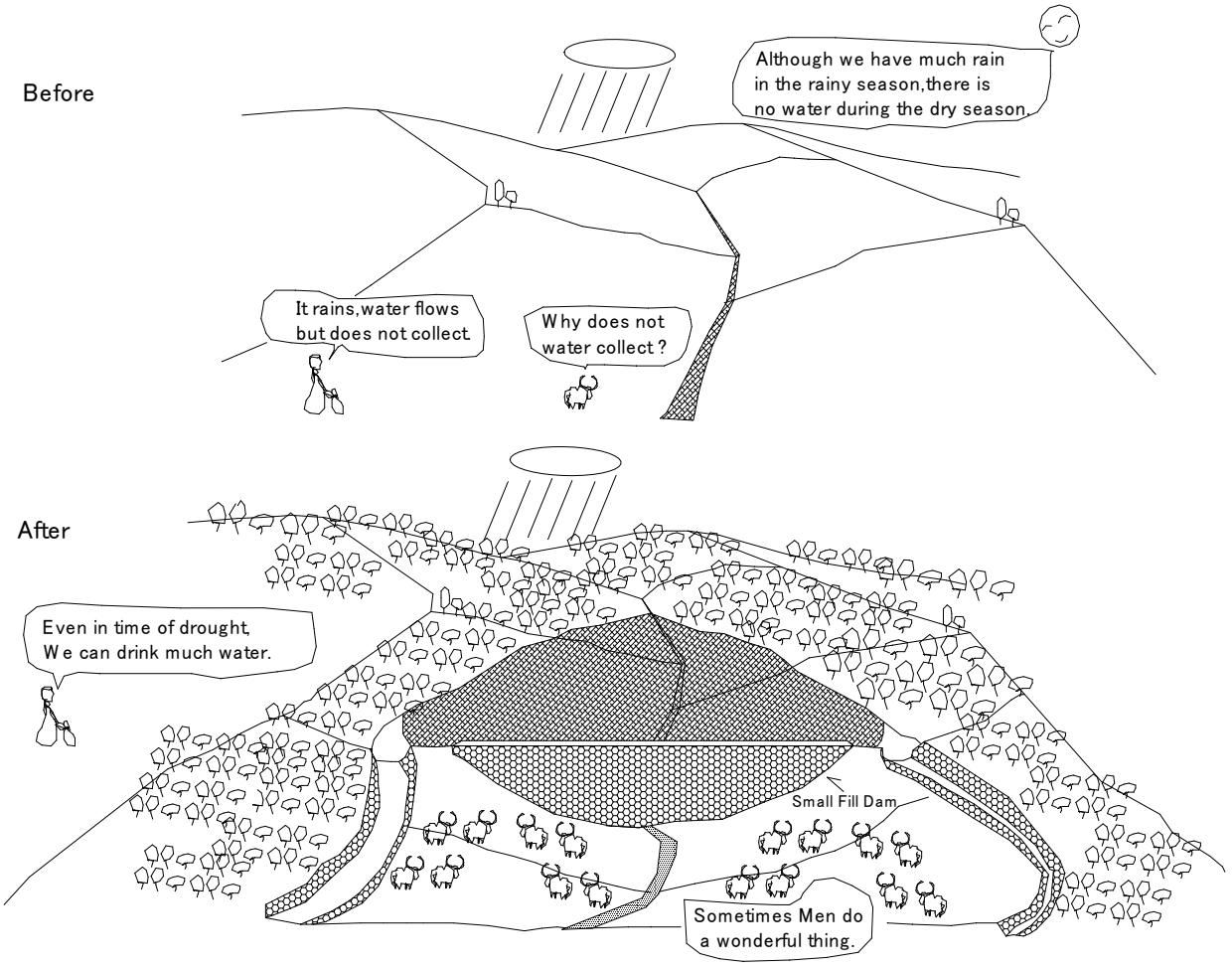


（ 907 ） Small Fill Dam In The Valley（ 1 ）

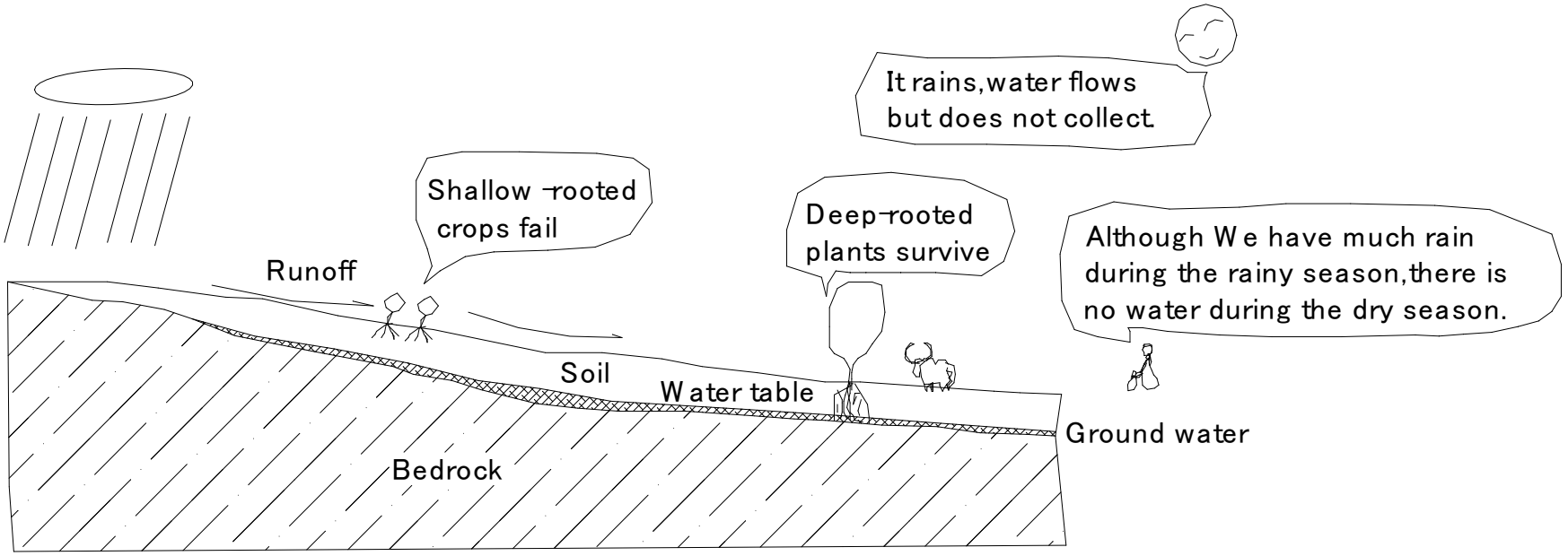
908 Small Fill Dam on Valley (2)



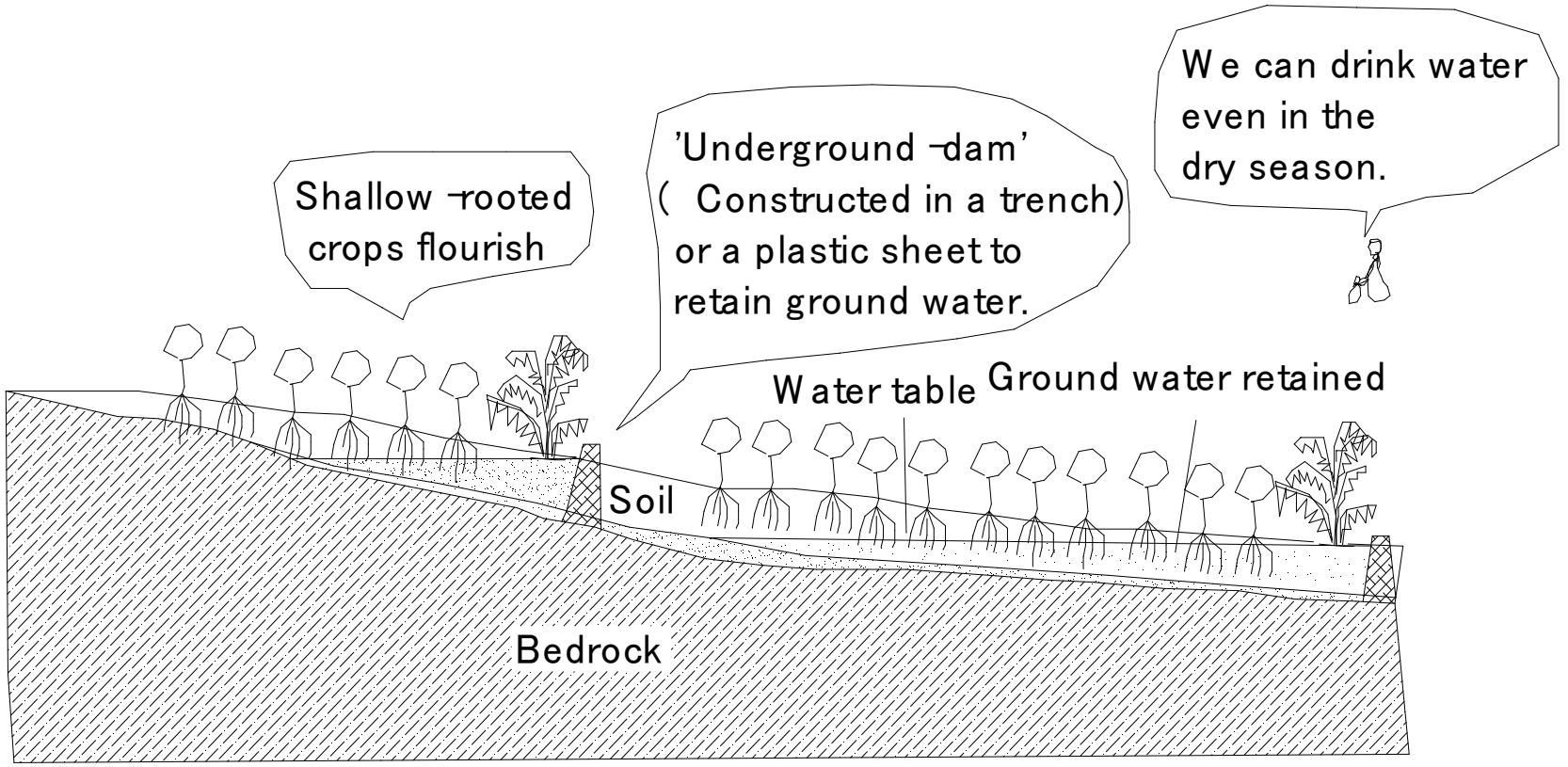
（ 909 ） Small Fill Dam On Valley（ 3 ）



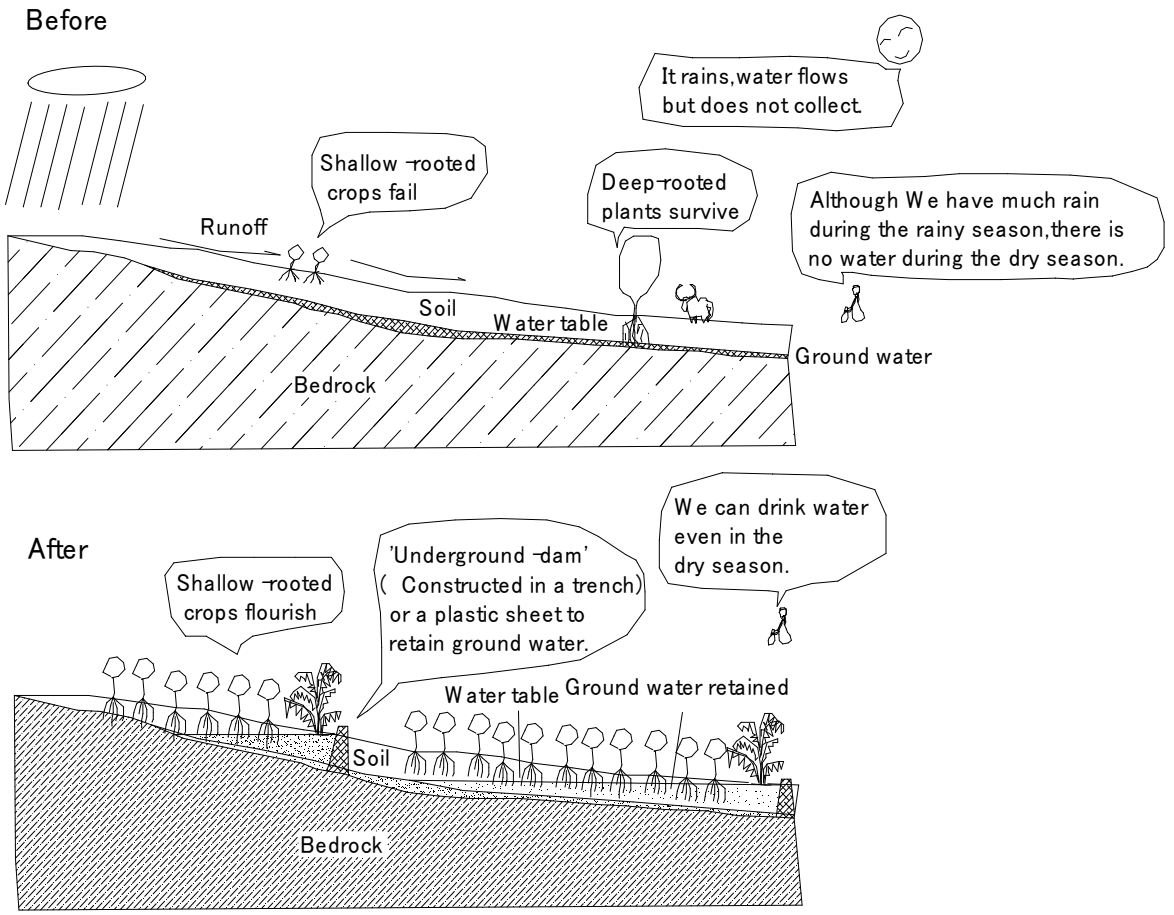
（ 910 ） Use of an 'underground' dam （ 1 ）



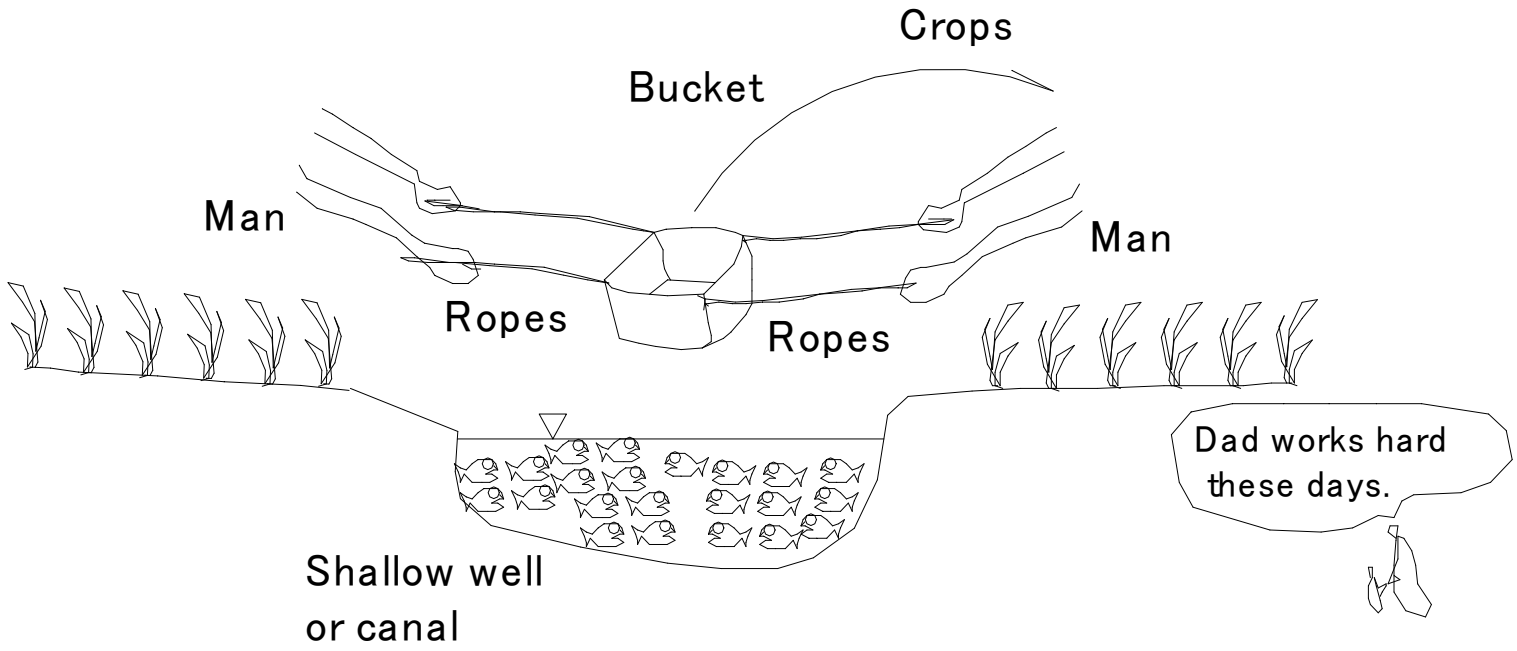
(911) Use of an 'underground' dam (2)



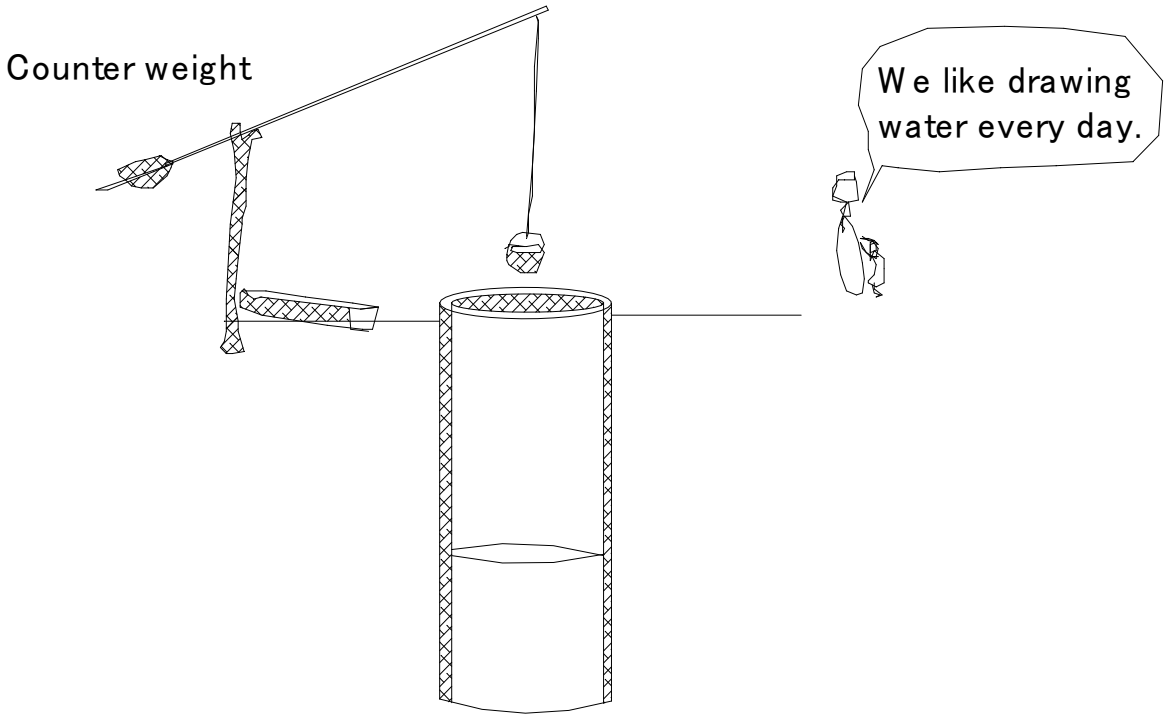
（ 912 ） Use of an 'underground' dam （ 3 ）



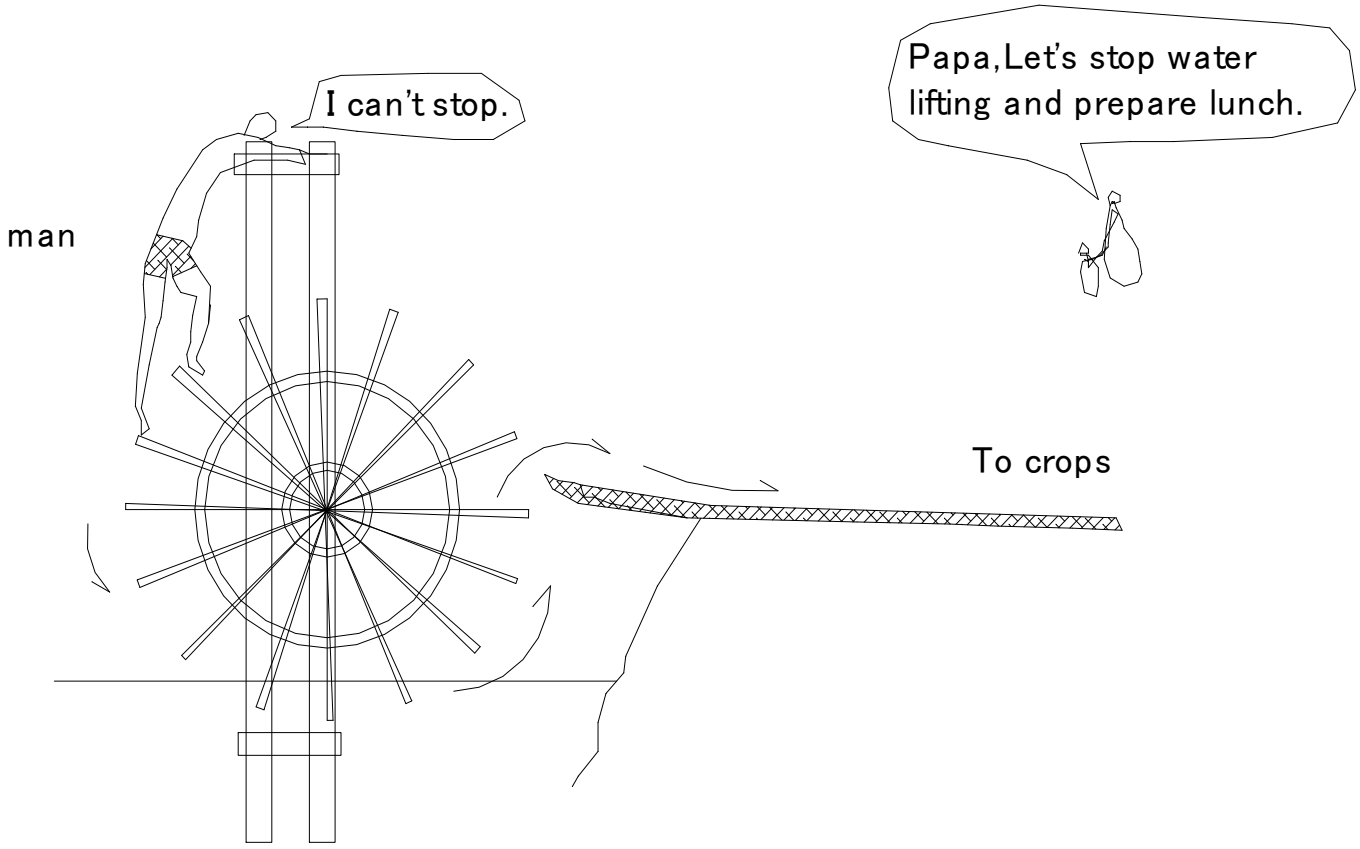
（ 913 ）Water Lifting（ 1 ）



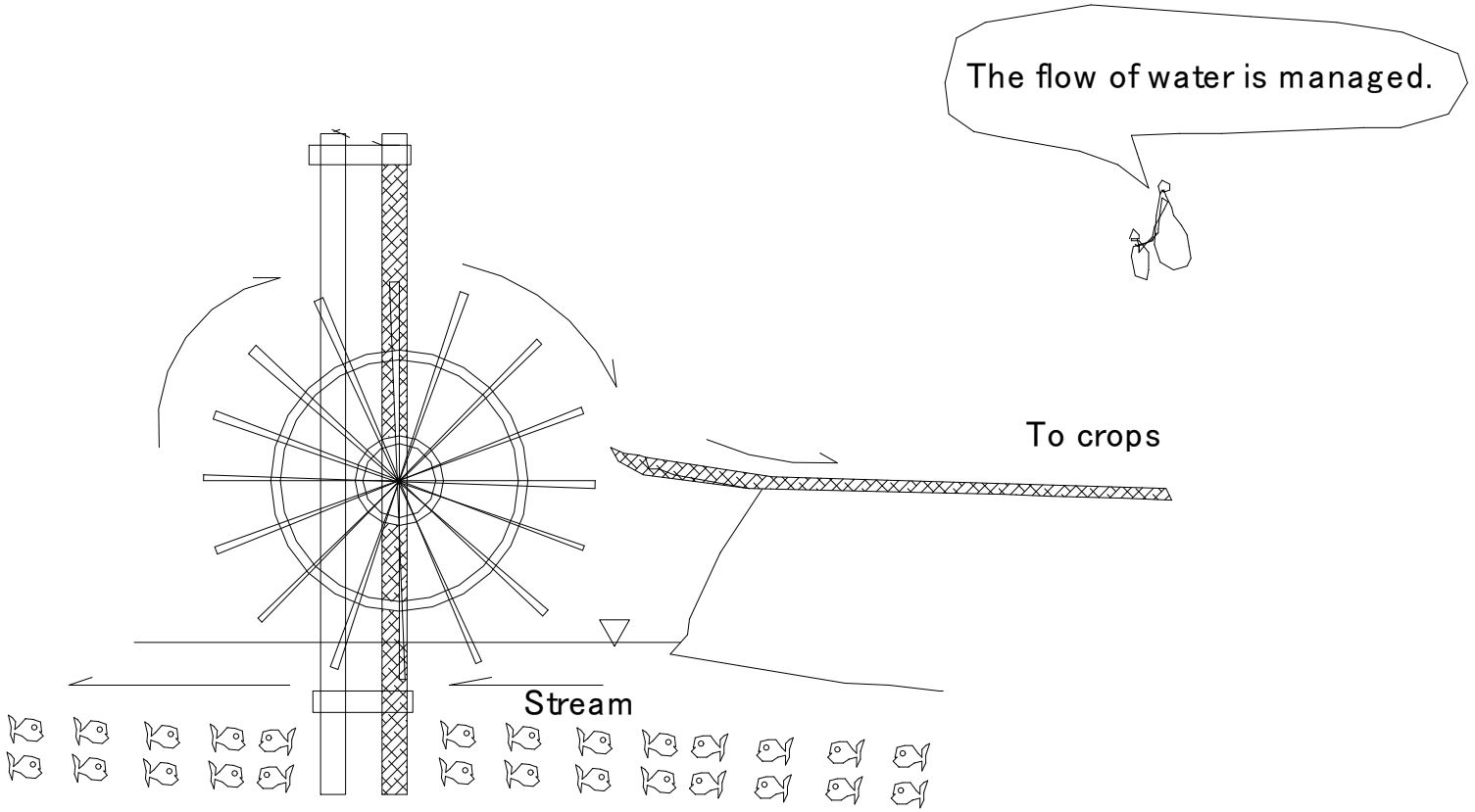
（ 914 ）Water Lifting（ 2 ）



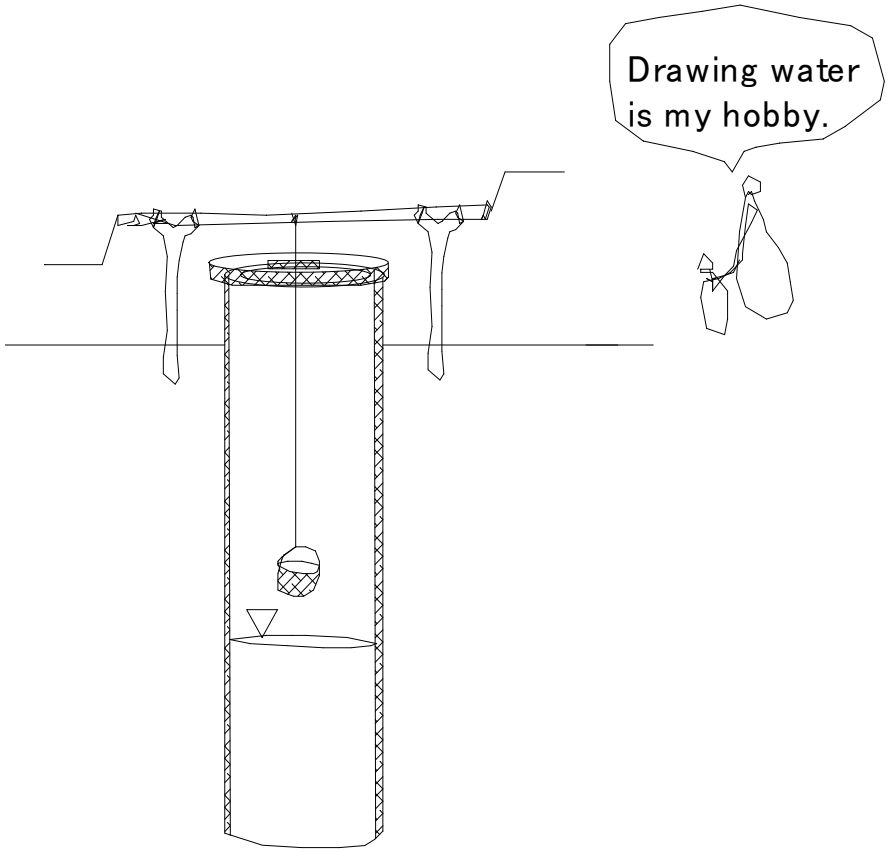
（ 915 ） Water Lifting （ 3 ）



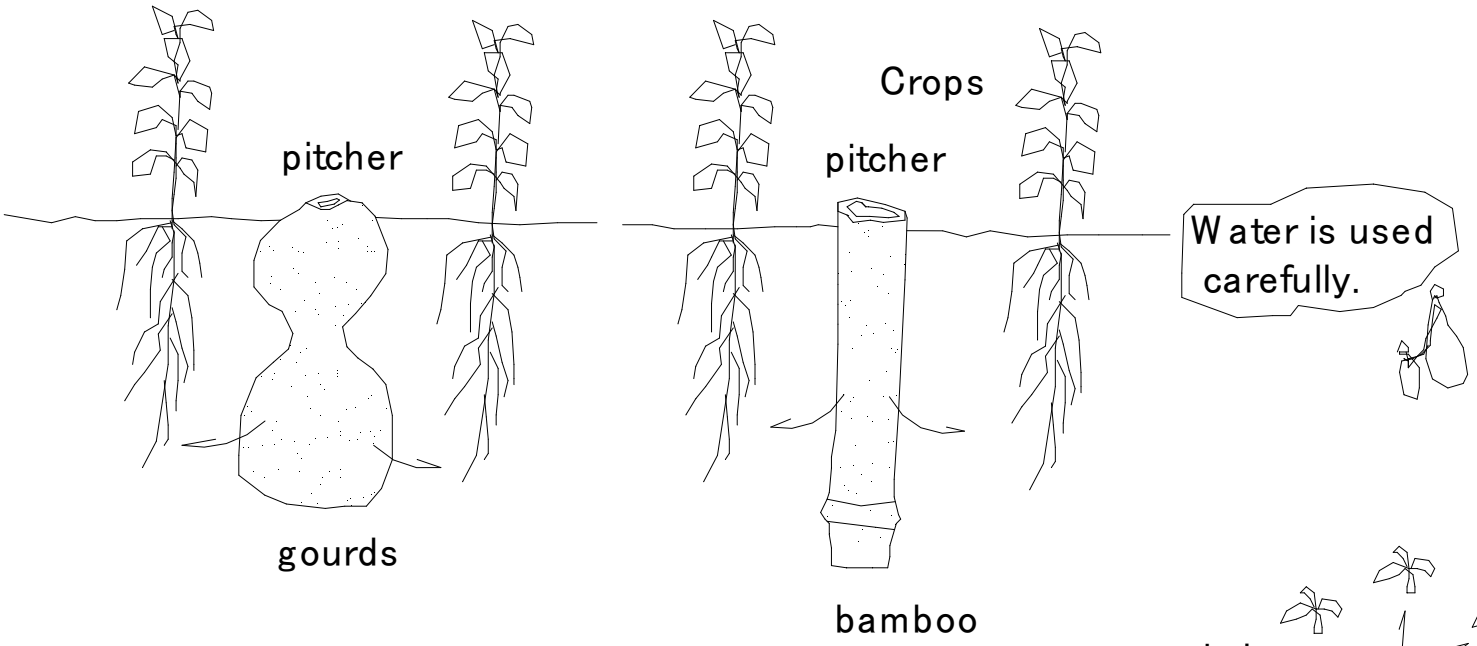
(916) Water Lifting (4)

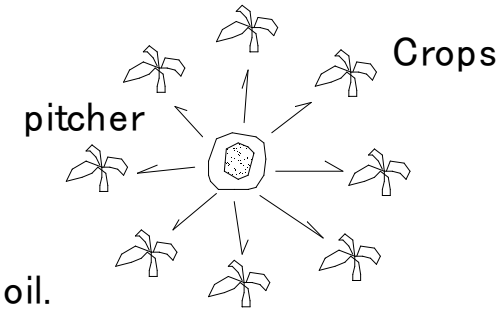


（ 917 ）Water Lifting（ 5 ）



(918) Pitcher irrigation (1)

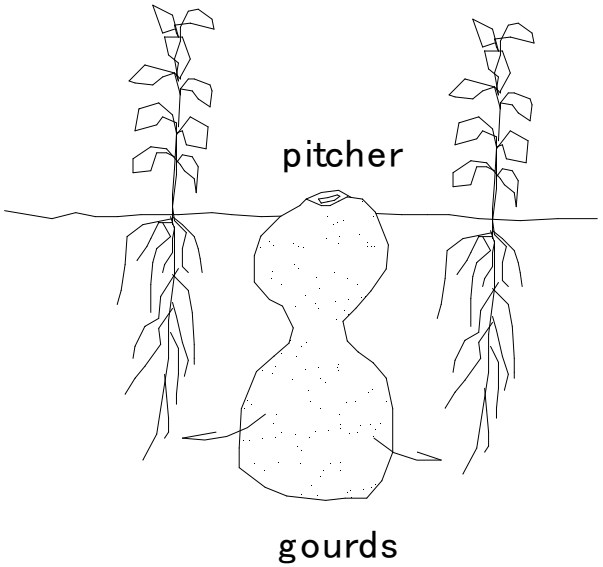


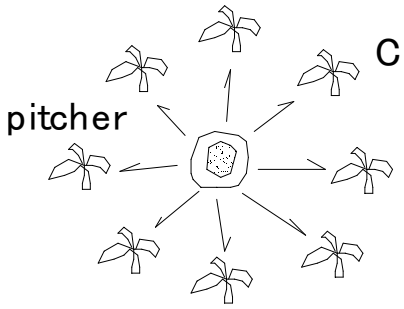


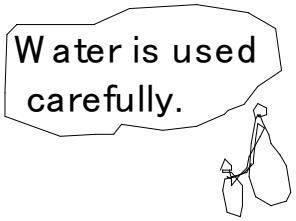
1.Pitcher irrigation is simple,effective,and cheap,reducing water waste, suitable for free-drainage soils,unlikely to promote water-related human diseases(malaria and schistosomiasis) .

2.Material:gourds or bamboo with small holes which are sunk into the soil.

（ 919 ） Pitcher irrigation（ 2 ）



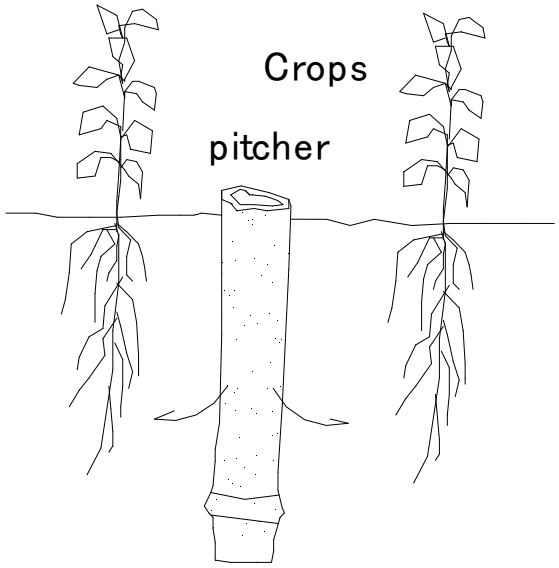


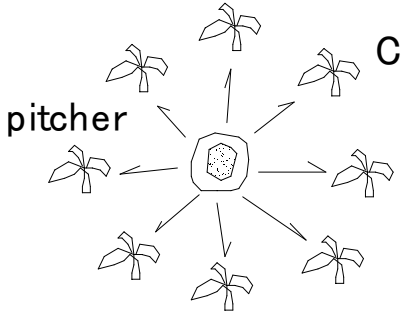


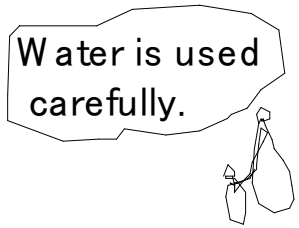
1.Pitcher irrigation is simple,effective,and cheap,reducing water waste, suitable for free-drainage soils,unlikely to promote water-related human diseases（ malaria and schistosomiasis ） .

2.Material:gourds or bamboo with small holes which are sunk into the soil.

（ 920 ） Pitcher irrigation（ 3 ）



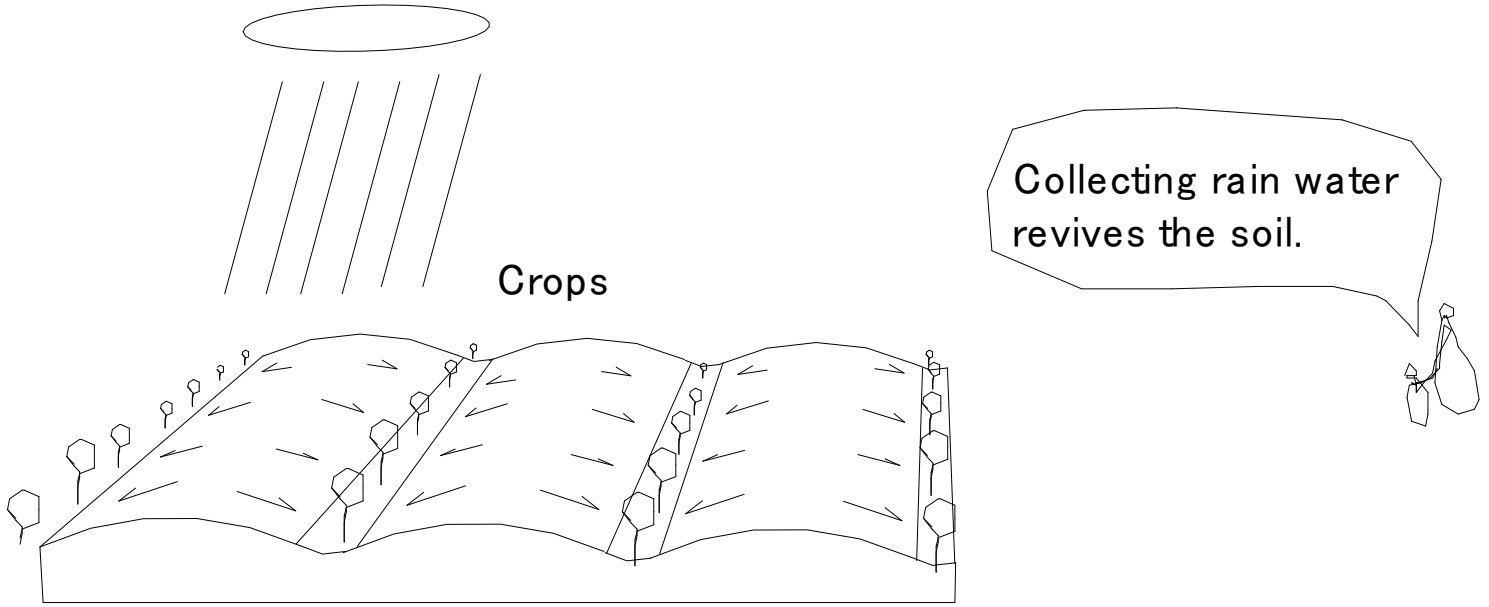




1.Pitcher irrigation is simple,effective,and cheap,reducing water waste, suitable for free-drainage soils,unlikely to promote water-related human diseases（ malaria and schistosomiasis ） .

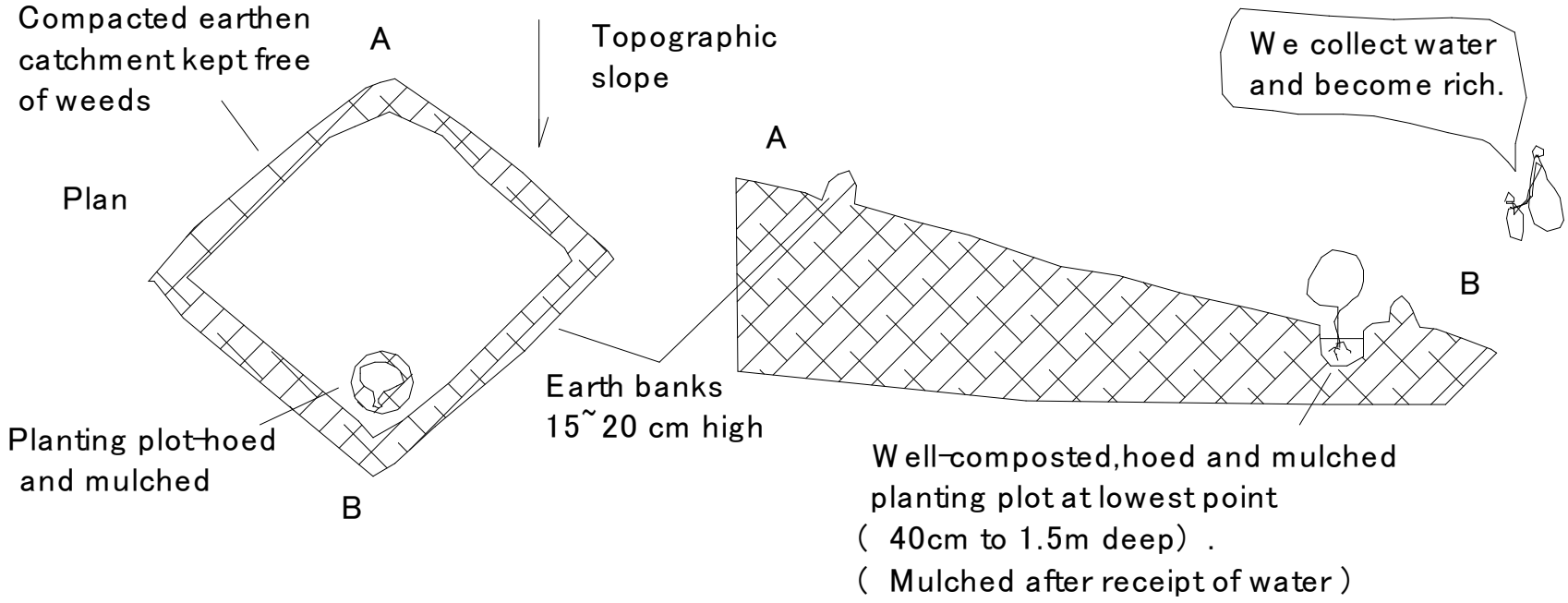
2.Material:gourds or bamboo with small holes which are sunk into the soil.

(921) Microcatchments (Roaded-type microcatchment) (1)

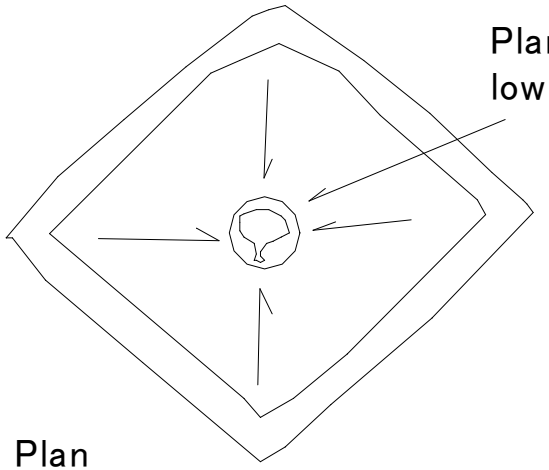


Roaded-type microcatchment

(922) Microcatchments easily constructed on sloping terrain with a hoe (2)

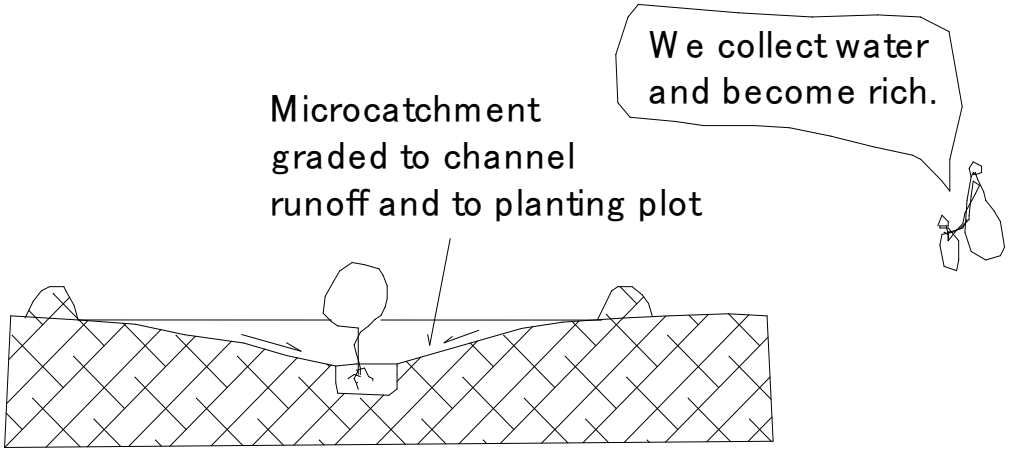


(923) Microcatchments easily constructed on sloping terrain with a hoe (3)



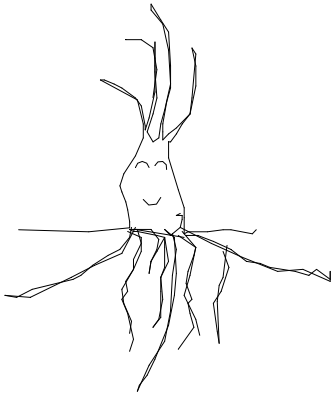
Planting plot at lowest point

Plan



Cross-section

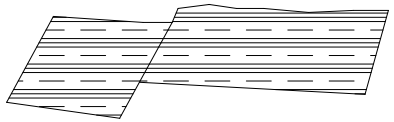
（ 925 ） How to find underground water



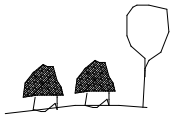
Acacia,Baobab
and Fig Tree

Quartz
Sandstone

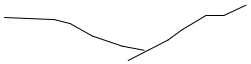
The colour of the
ground is changed



Fault



Former villages



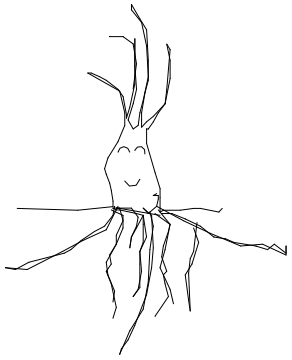
Valley bottom

Near River

Near Dam,pond,and swamp

(925)　How to find underground water

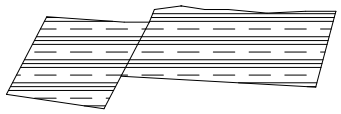
（ 925 ） How to find underground water



Acacia,Baobab
and Fig Tree

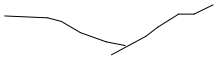
Quartz
Sandstone

The colour of the
ground is changed



Fault

Former villages



Valley bottom

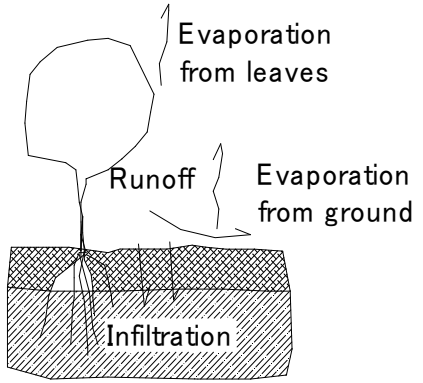
Near River

Near Dam,pond,and swamp

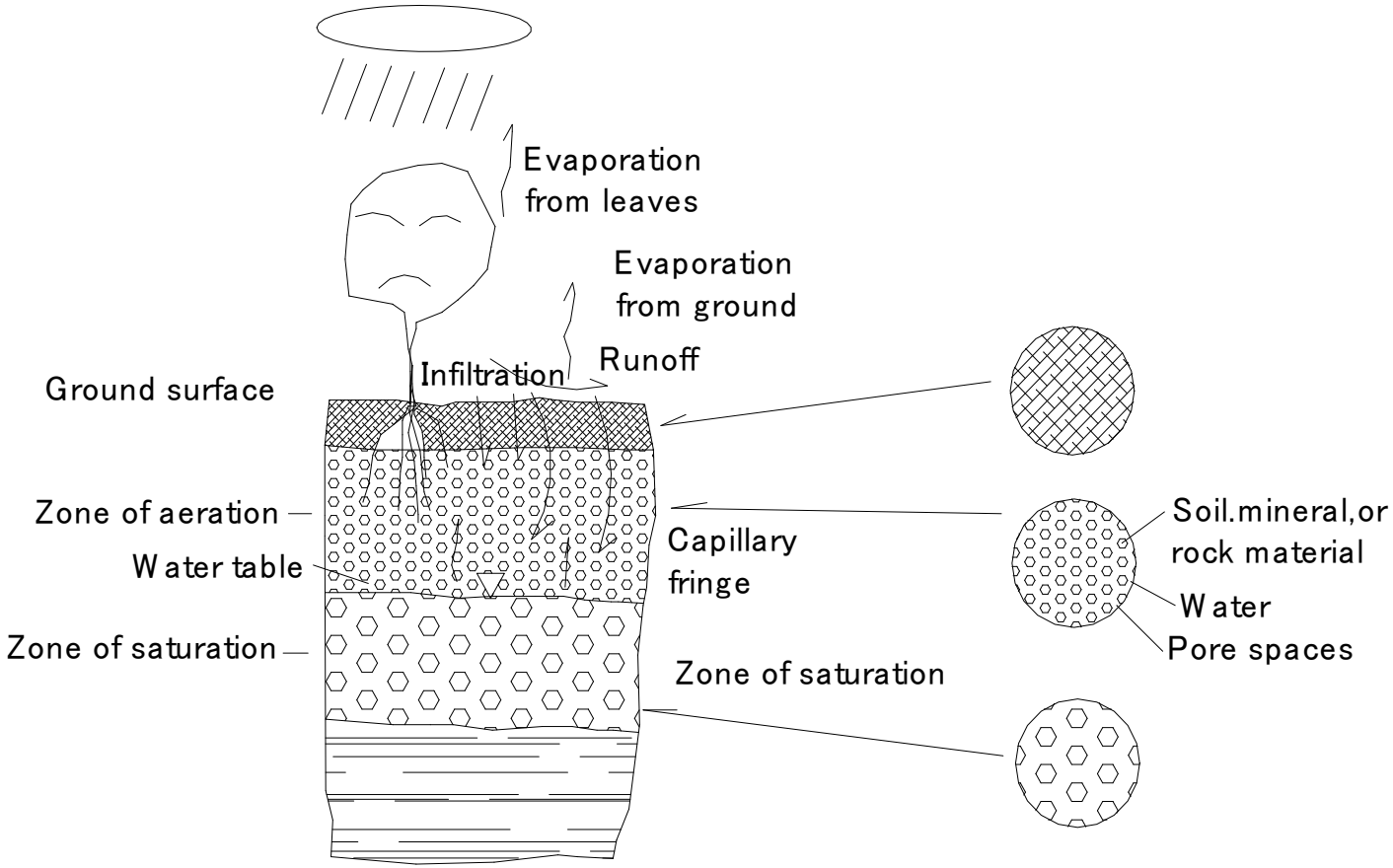
(926) Groundwater Recharge and Flow(2)

The amount of water

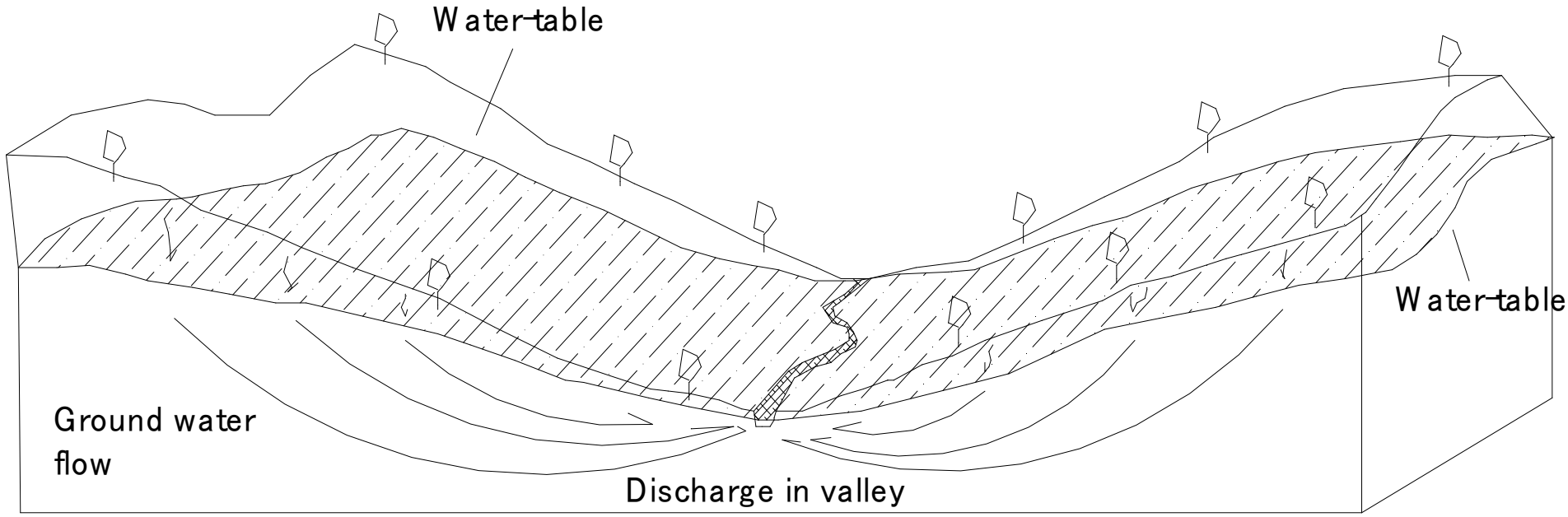
	Runoff	Infiltration
Steep Slope	much	little
Gentle Slope	little	much
Heavy Rain	much	little
Dense Vegetation		little
Sparse Vegetation		much
Clay	much	little
Sand		much
Gravel		much
loose soil		much
Fractured bedrock		much



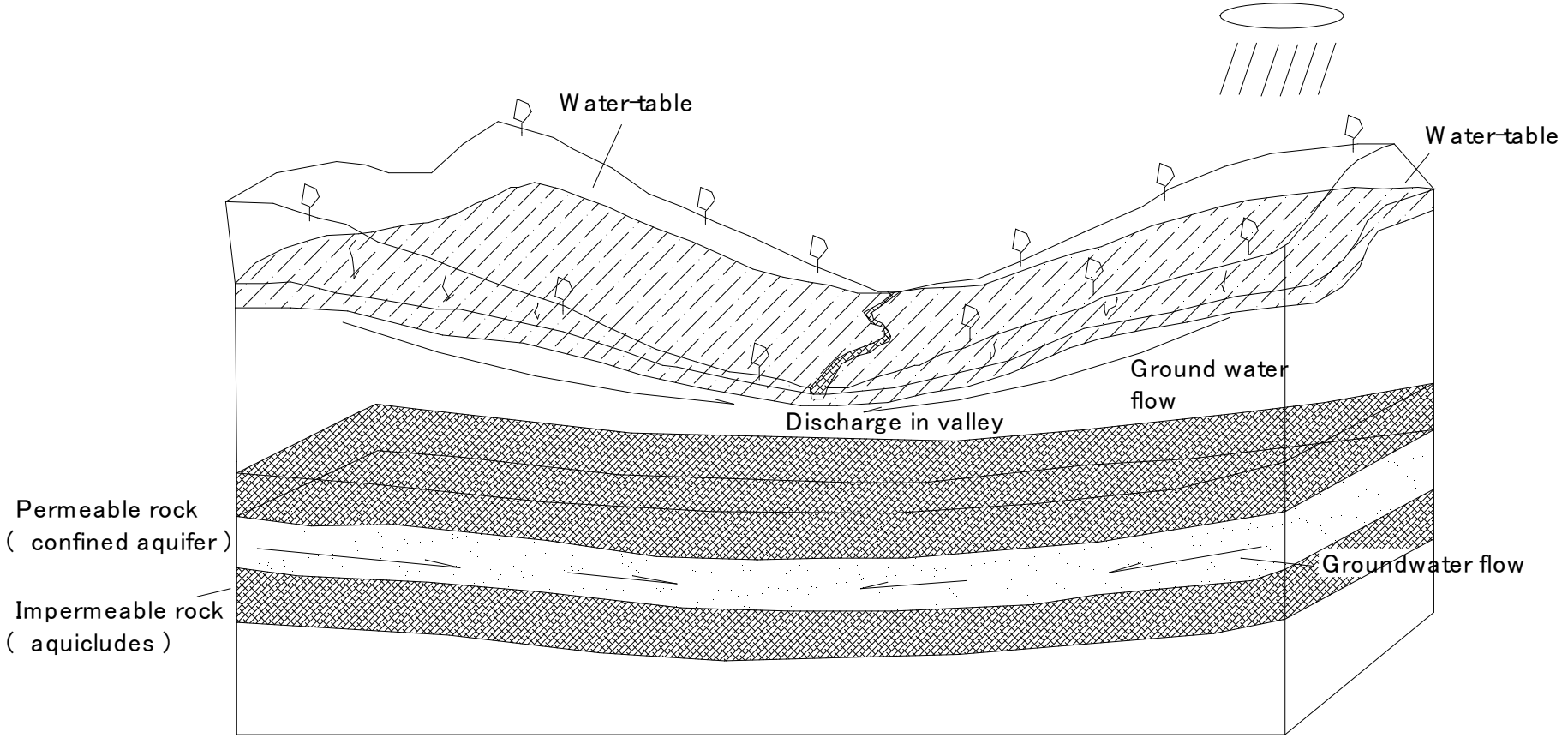
(927) The subsurface distribution of ground water (1)



(928) Water-table(1)

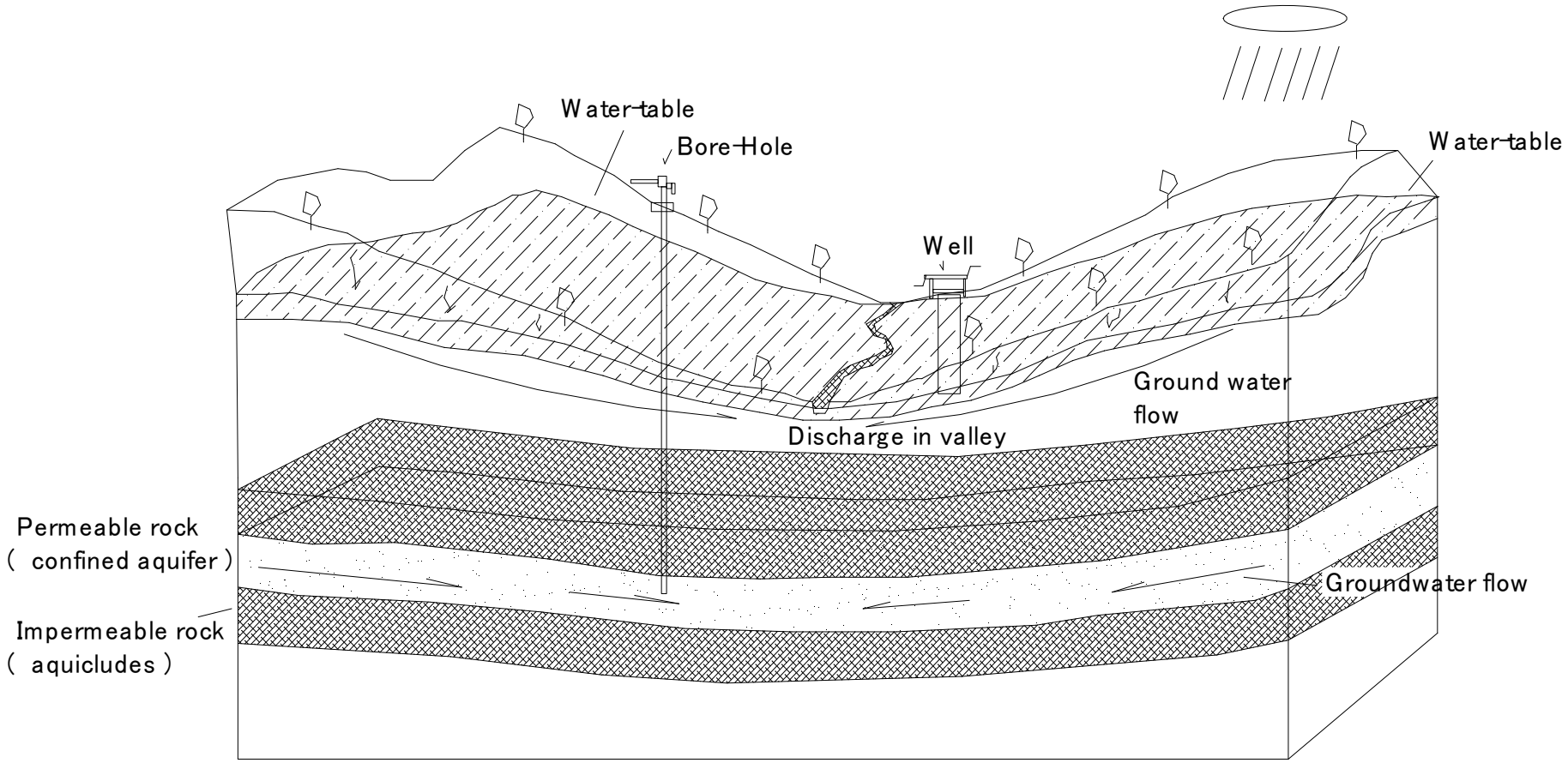


(929) Water-table(2)



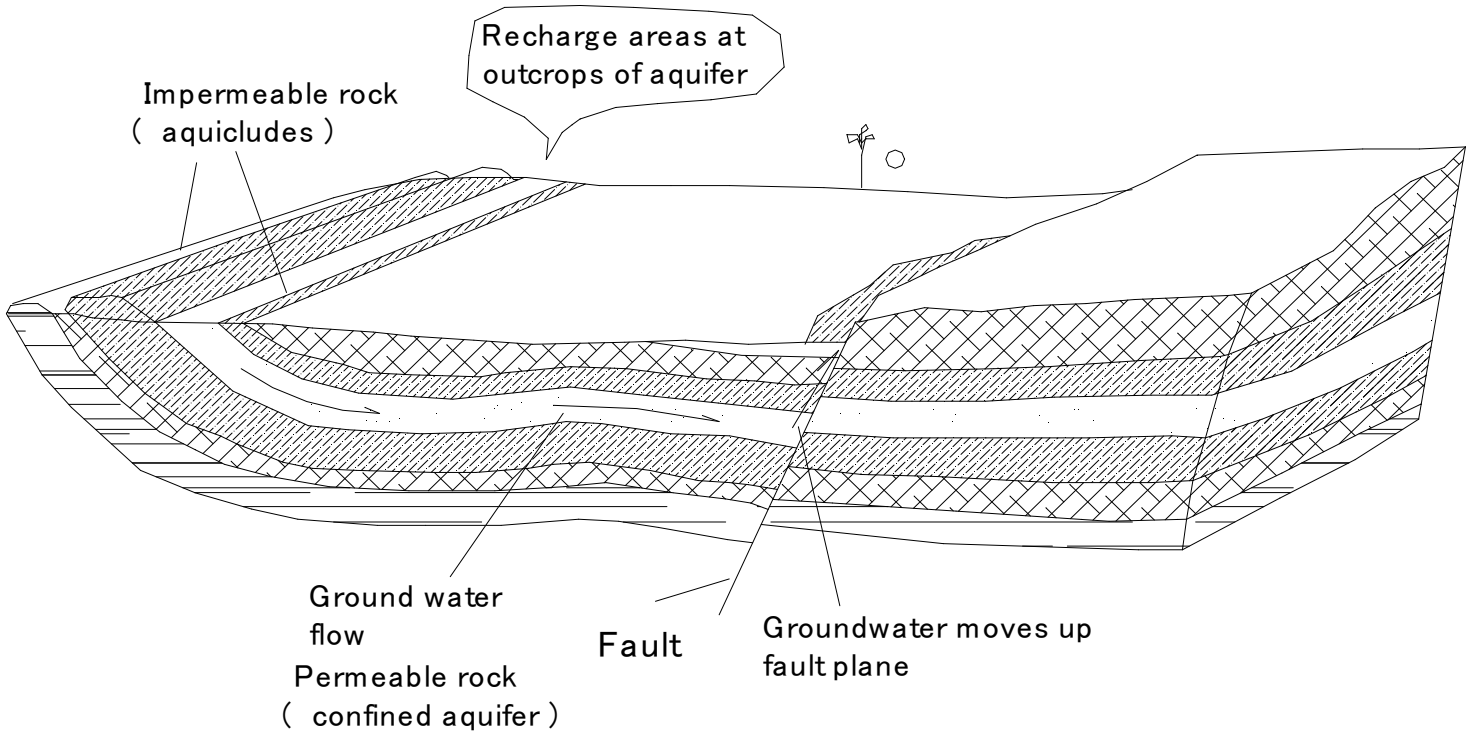
930 Water-table(3)

(930) Water-table(3)

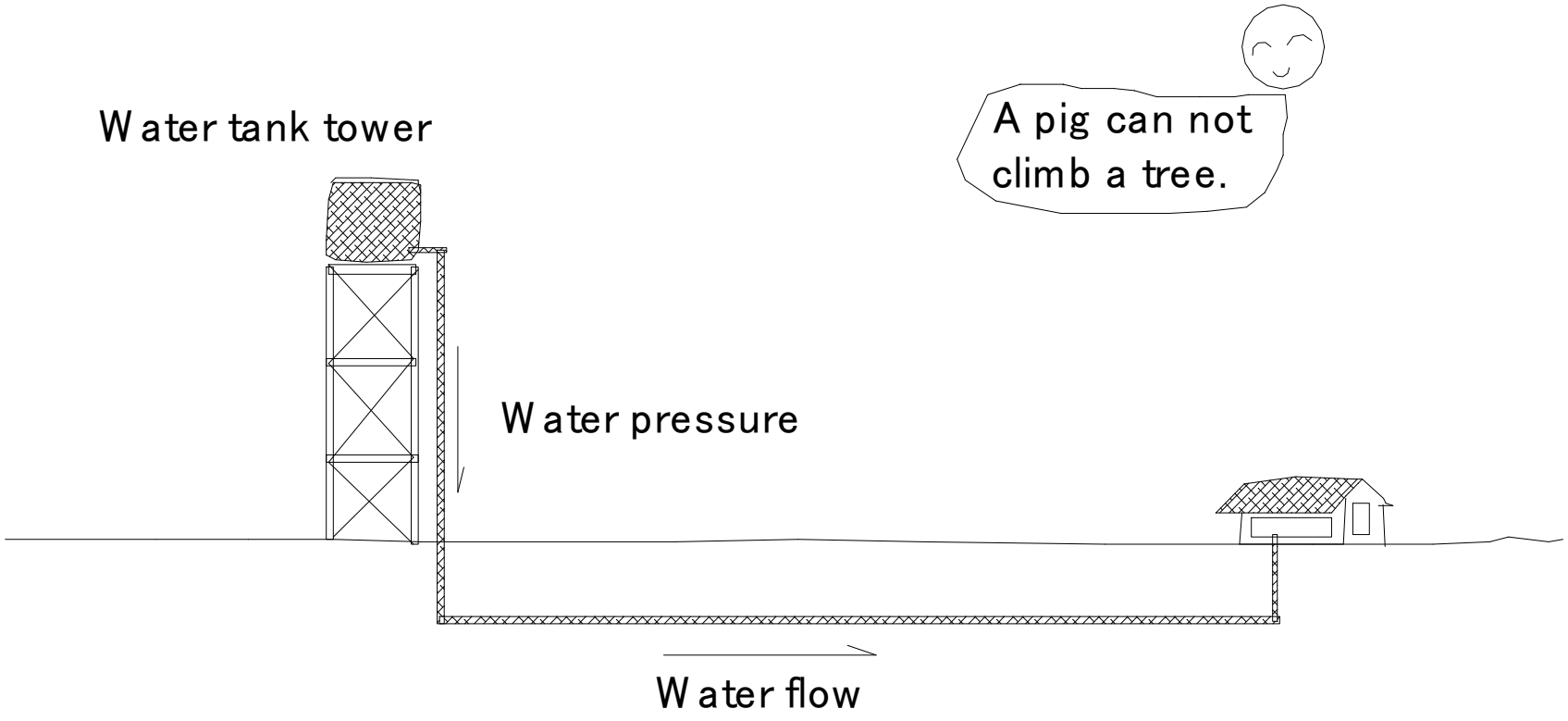


931 Fault (1)

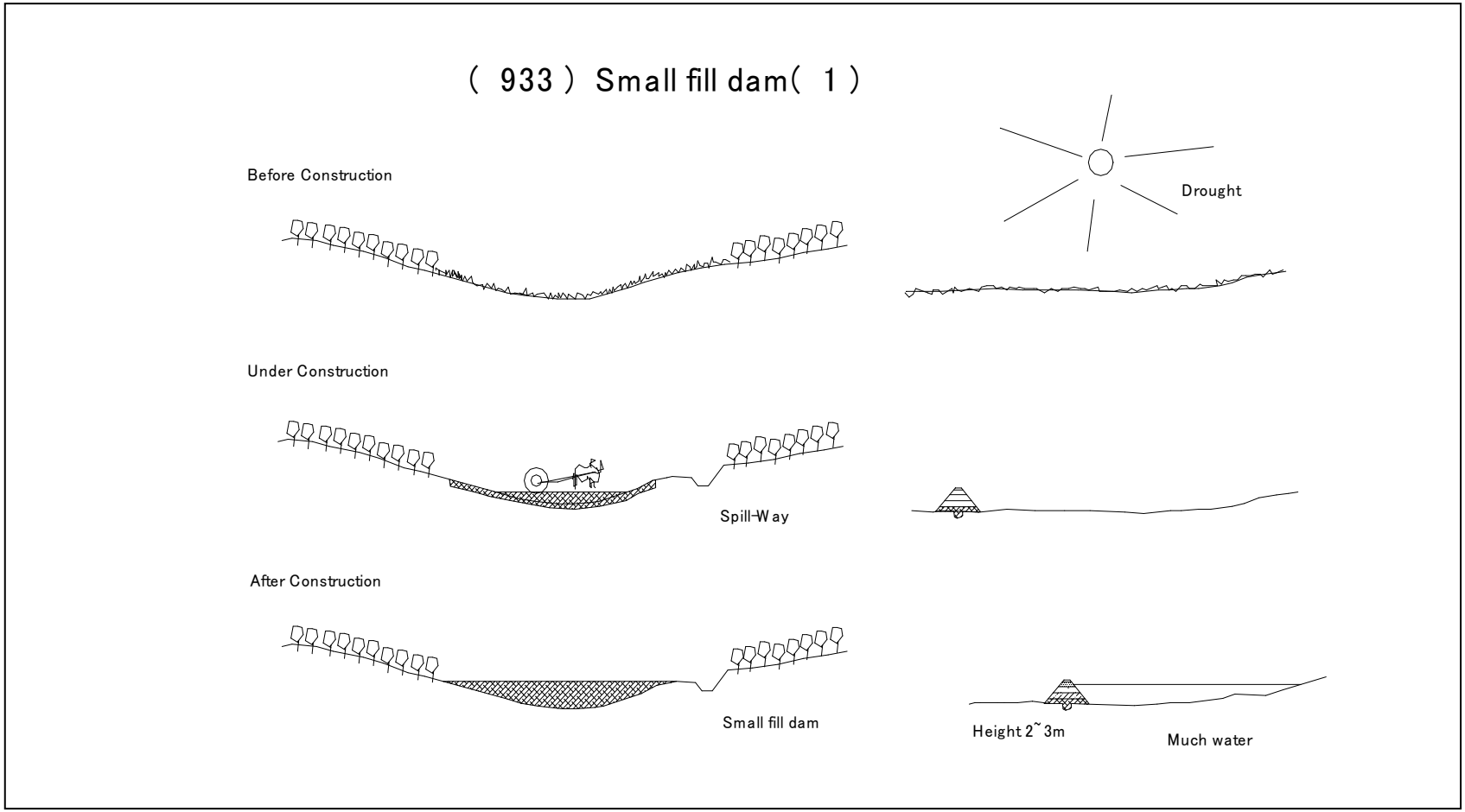
(931) Fault (1)



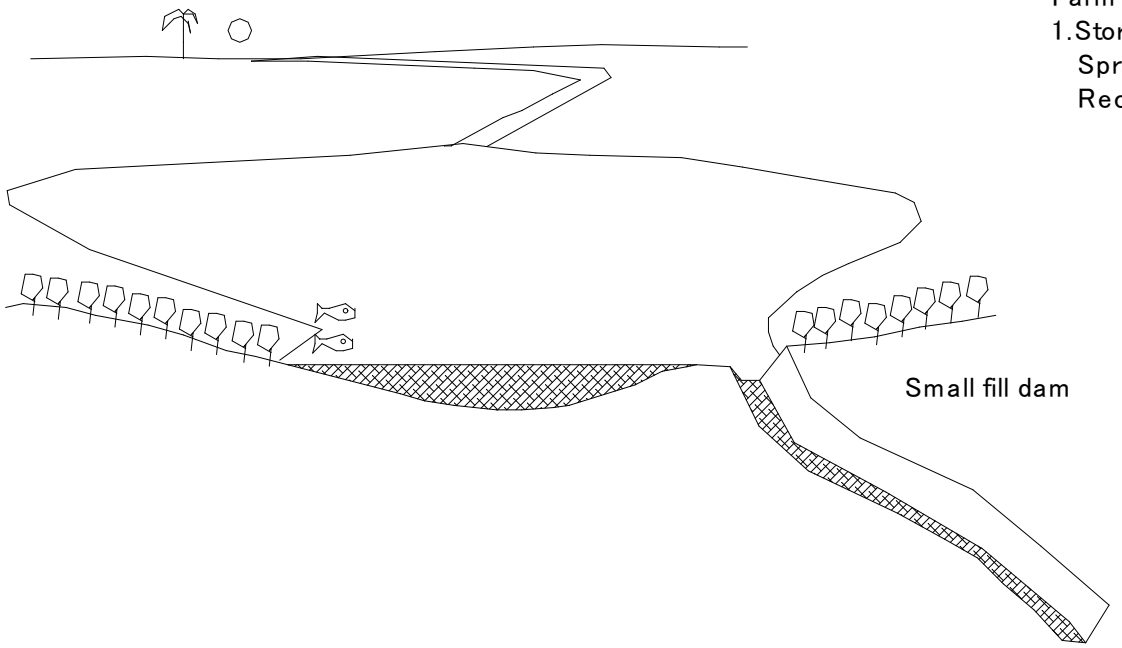
（ 932 ）Water tank tower



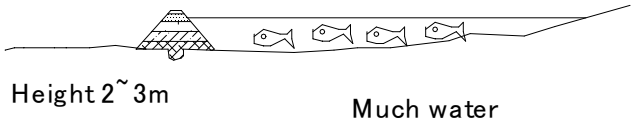
(933) Small fill dam (1)



（ 934 ） Small Fill Dam （ 2 ）



Farm Reservoirs
1.Store Water for Irrigation,Livestock,
Spray,Fish Production,
Recreation,and Fire Protection.



(935) Small fill dam(3)

Site Selection

Topography of the pond site.

1.Storage Capacity.

2.The water depth at least, 2.4m~3.0m.

3.The dam centre line perpendicular to the contour lines.

4.Fill material obtained from the inundated area to give the desired depth of water.

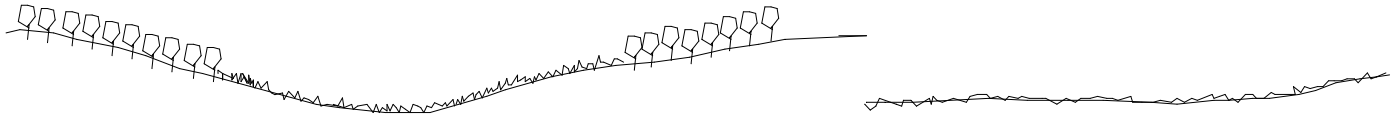
5.Channel slope above the dam should range from 4% to 8% steep.

6.Narrow channels will give a Small surface area and volume.

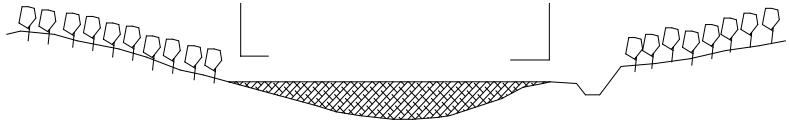
7.Flat and wide channels which produce shallow depths can be eliminated by steeping the side slopes along the water line or by excavation.

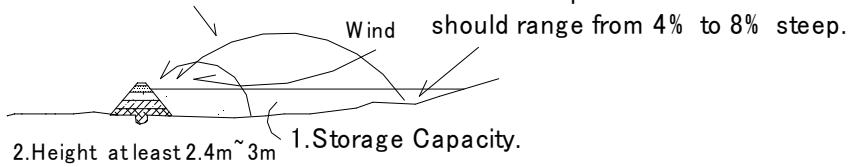
8.On large ponds,wave damage can be reduced by placing the dam so that prevailing winds do not strike directly against the upstream face.

Before Construction



After Construction





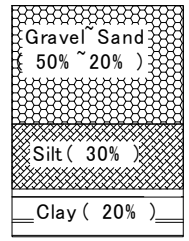
8.On large ponds,wave damage can be reduced by placing the dam so that prevailing winds do not strike directly against the upstream face.

(936) Small fill dam(4)

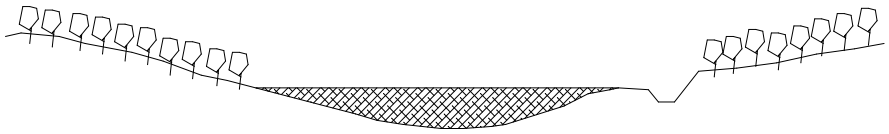
Site Selection

Soil and underlying strata.

1.Foundation material under the dam and under the water surface should be impermeable.
2.Suitable soil should be available near the dam.
3.Fill soil should generally have no more than 20% gravel to 50% sand,less than 30% silt,15% to 25% clay.
4.Surface soil can easily be removed.
5.Deep peat ,sand,gravel,or marl should be avoided as foundation material.
6.Horizontal strata of sand and gravel or fractured rock at shallow depth may result in high seepage losses.
7.Soil conditions prior to construction must be carefully evaluated.
8.Control of seepage after construction is much more difficult.

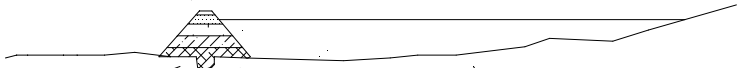


Small fill dam



5.Deep peat ,sand,gravel,or marl should be avoided as foundation material.

1.Foundation material under the dam and under the water surface should be impermeable.



7.Soil conditions prior to construction must be carefully evaluated.
8.Control of seepage after construction is much more difficult.

4.Surface soil can easily be removed.

2.Suitable soil should be available near the dam.

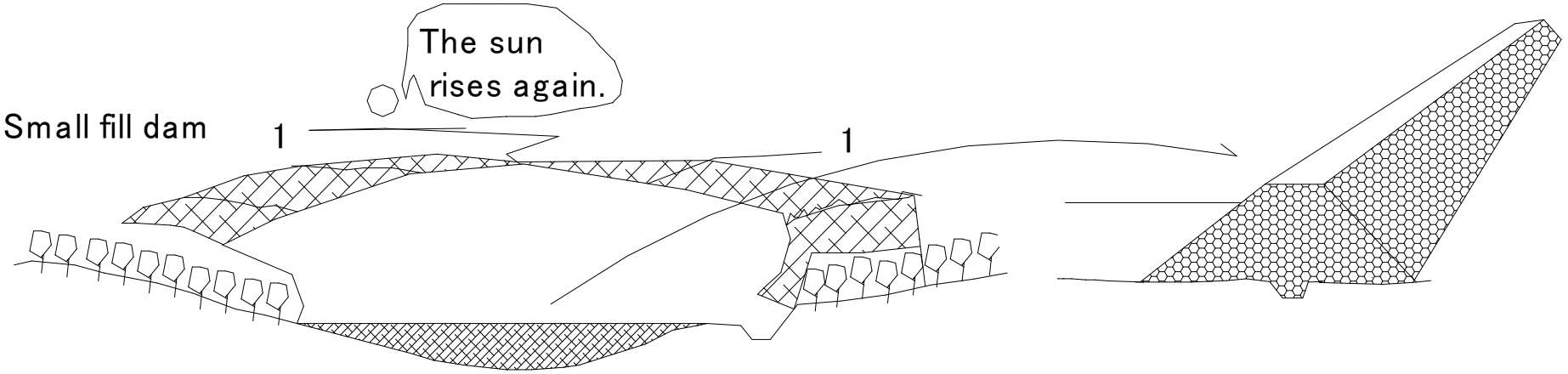
5.Deep peat ,sand,gravel,or marl should be avoided as foundation material.
6.Horizontal strata of sand and gravel or fractured rock at shallow depth may result in high seepage losses.

(937) Small fill dam(5)

Site Selection

Watershed Area.

1. Well-sodded grass waterways and grass cover around the pond will greatly reduce sediment in flow.
2. Water from barnyards and other sources of pollution should be diverted away from the pond.

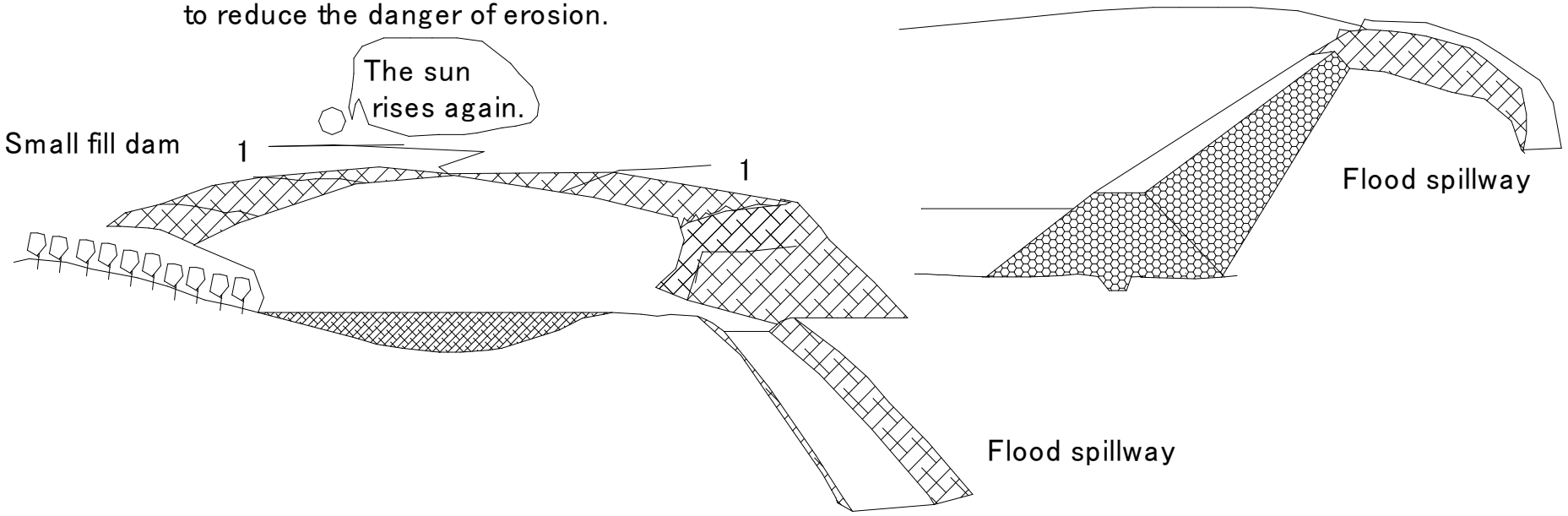


(938) Small fill dam(6)

Site Selection

Flood spillway location.

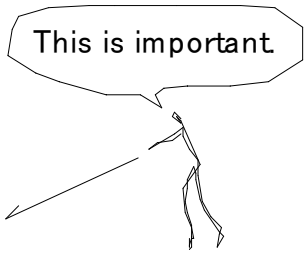
1. The most economical spillway is a grassed waterway around the end of the dam or across an adjacent ridge and into another natural channel.
2. Steep slopes along the waterway should be avoided where possible, to reduce the danger of erosion.

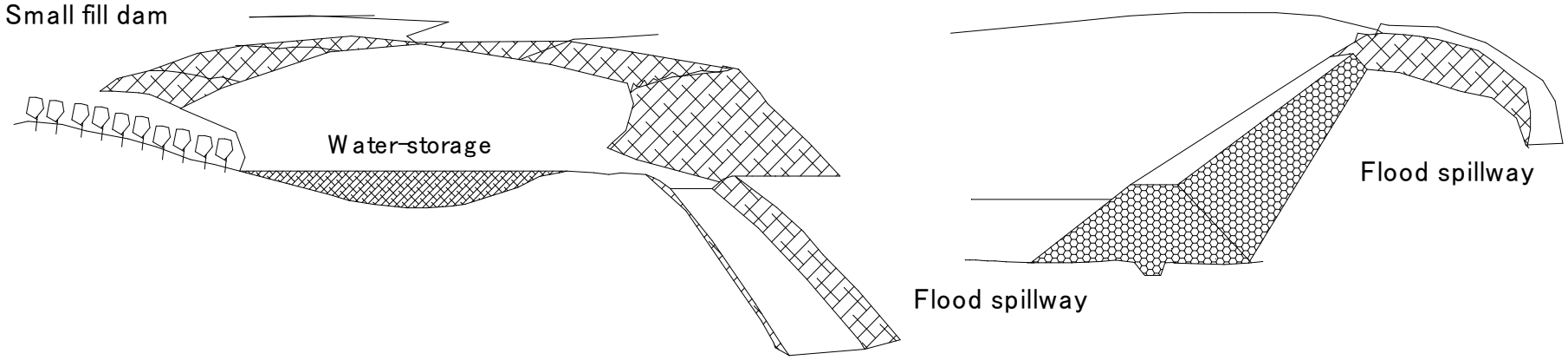


(939) Small fill dam(7)

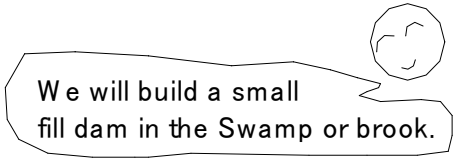
Water-storage requirements

1. The storage capacity of a pond will depend on the water needs, evaporation from the water surface, seepage into the soil or through the dam, storage allowed for sedimentation.
2. At least 1.0m of depth is needed for fish to survive .
3. Water needs for domestic uses, livestock, spraying, irrigation, and fire protection .
4. Evaporation can be reduced by selecting a site having small surface area and deep depth.
5. Seepage losses depend on the soil and construction techniques.



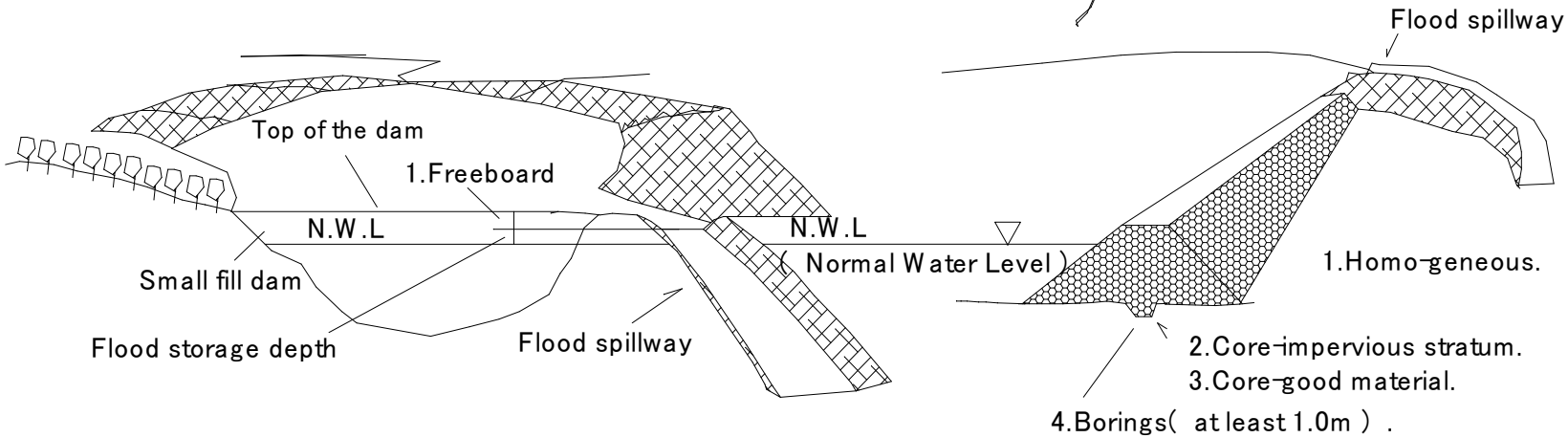


(940) Small fill dam(8)

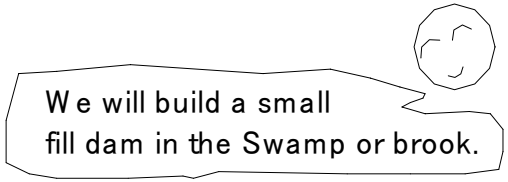


Earth Dam Design

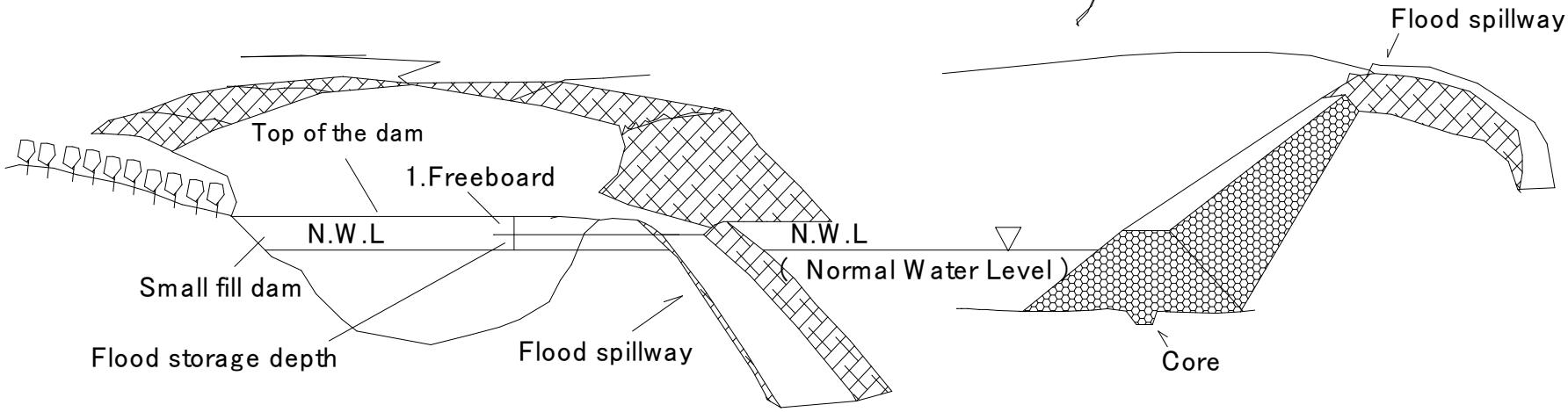
1.The most common type is a homo-geneous dam.
2.A core extends down to an impervious stratum.
3.Good fill material is placed in the core or center section dam.
4.Borings at the dam site should be taken at least 1.0m below the lowest level in the reservoir.
5.Soil or geological conditions indicate possible seepage or foundation hazards.
6.The height of the dam is determined from estimated storage require-ments plus an allowance for flood storage and freeboard.



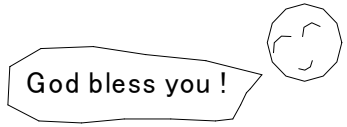
(941) Small fill dam(9)



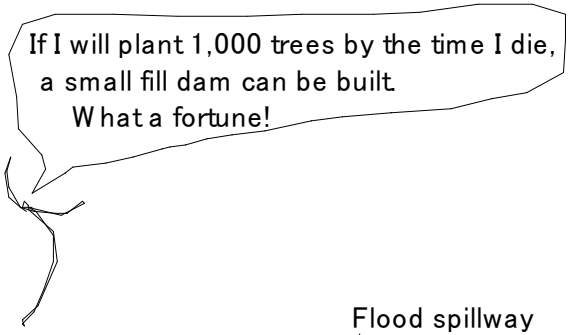
Earth Dam Design
Freeboard
1.The bottom of the flood spillway to top of the dam.
2.A depth of flow in the freeboard of 0.3m.
Allowance of 0.15m. At least 0.45m.

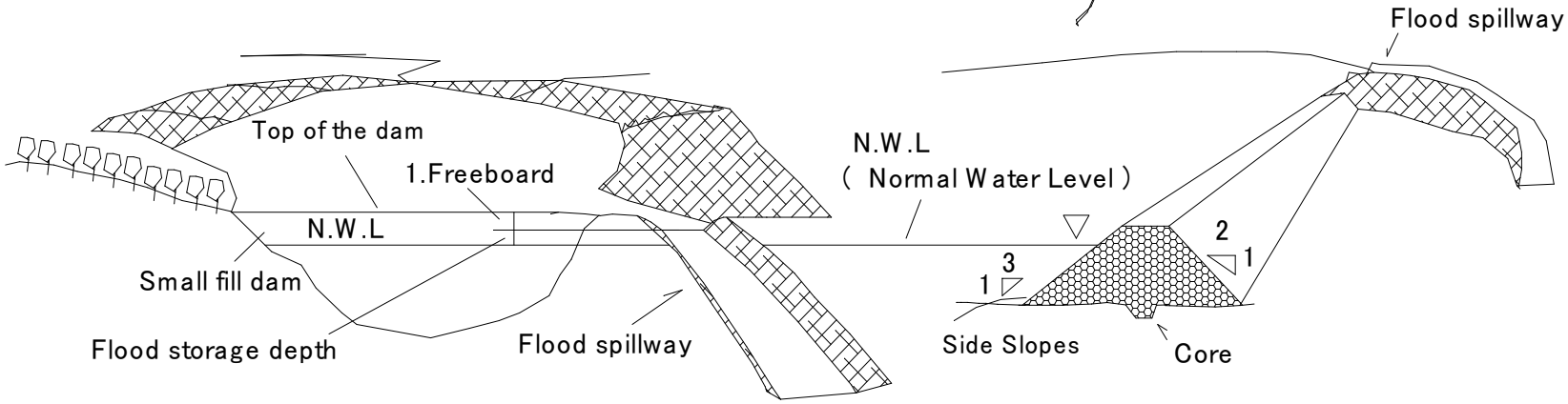


(942) Small fill dam(10)

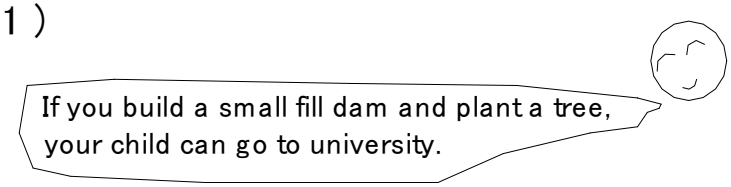


Earth Dam Design
Side Slopes
1.The side slopes should not be steeper than 3:1(horizontal to vertical)
on the upstream face and 2:1 on the downstream side.





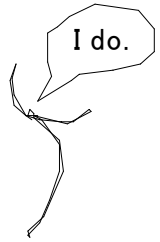
(943) Small fill dam(11)

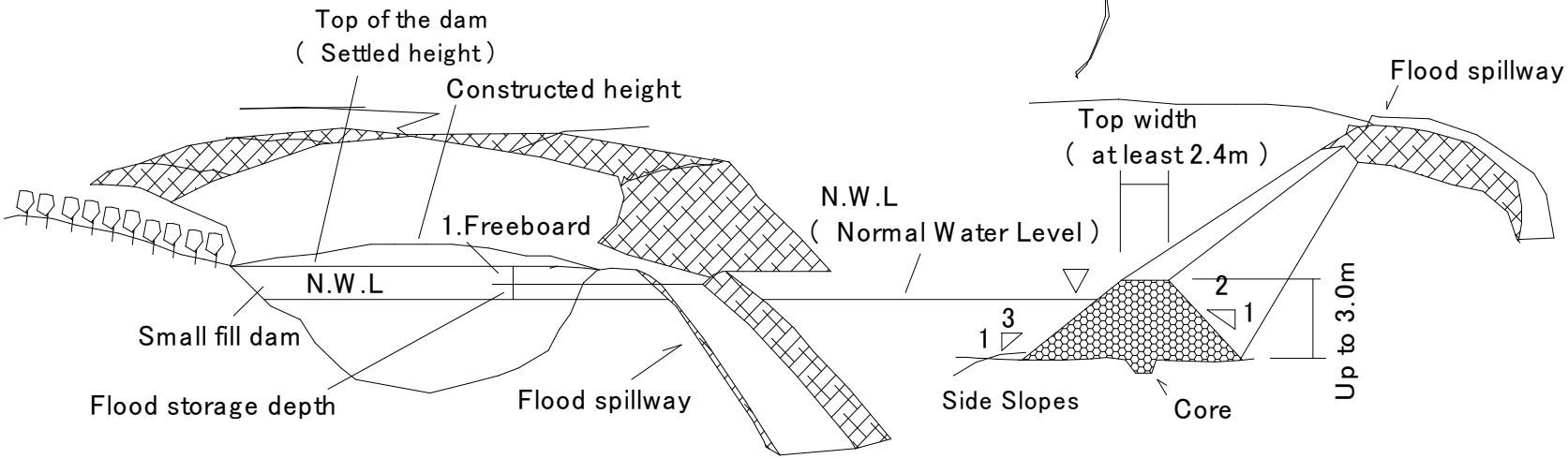


Earth Dam Design

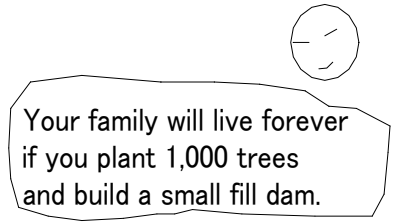
Top Width

1.The minimum top width for dams up to 3.0m in height should be about 2.4m.

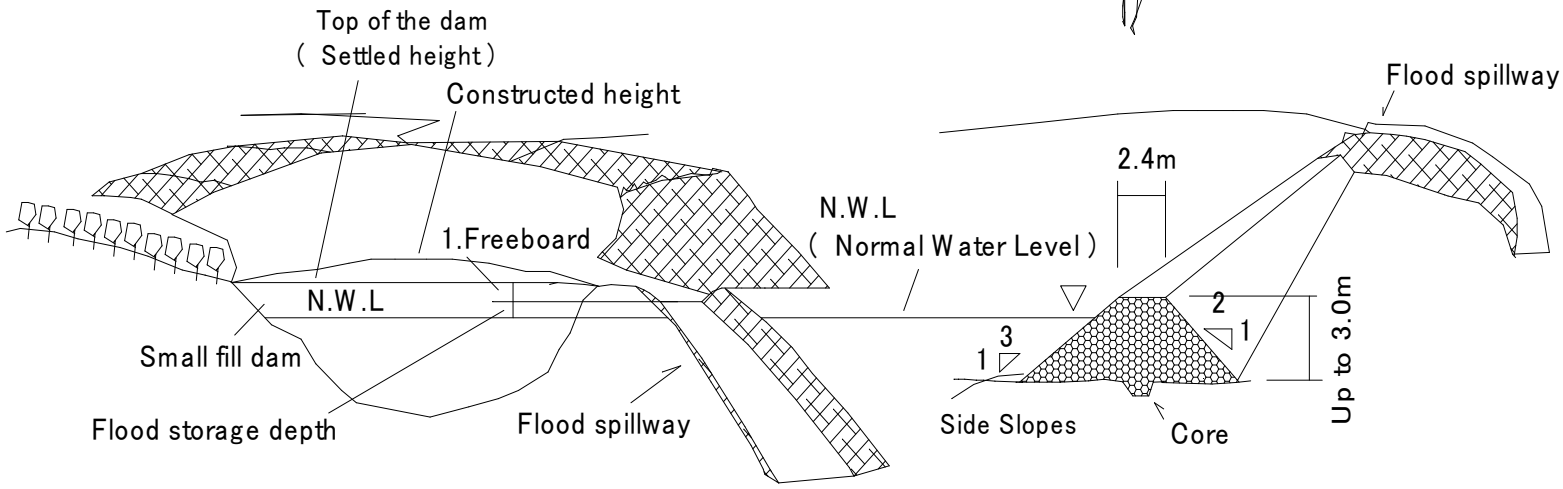




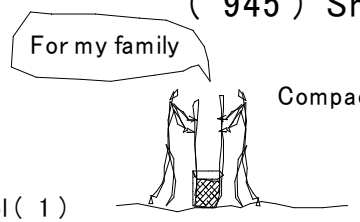
(944)Small fill dam(12)

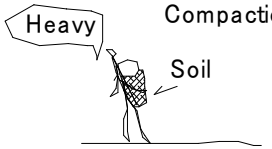


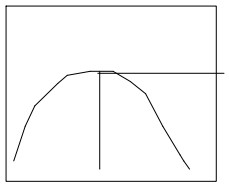
Earth Dam Design
Settlement Allowance
1.Earthfills compacted in thin layers at optimum moisture conditions.
2.An allowance of 5% to 10% of the settled height should be added to the top of the fill during construction.



(945) Small fill dam(13)

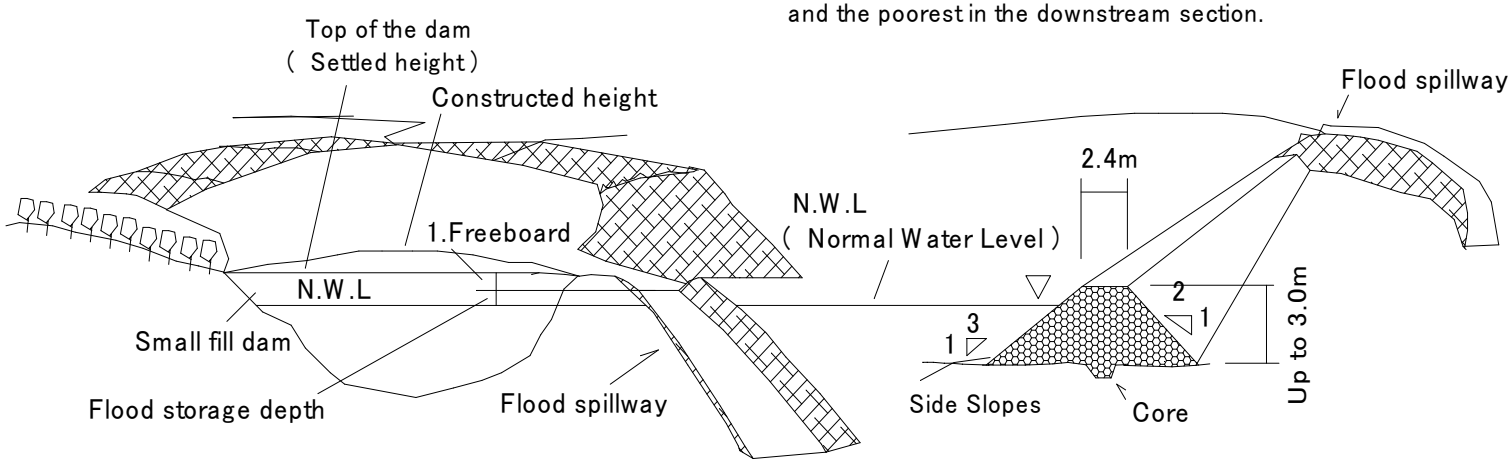




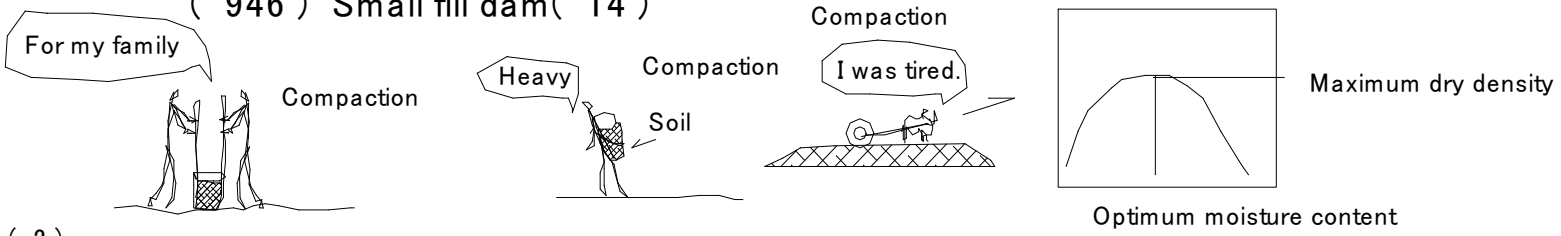


Seepage Control (1)

1. Seepage control can best be achieved by proper design and construction.
2. Seepage may occur through the dam or when the pond area is underlaid by rock,sand,and gravel strata.
3. Knowledge of the soil conditions can best be obtained by soil borings at the site.
4. A limited amount of good fill soil is placed in the center section of the dam and in the core trench,which should extend down to an impermable layer.
5. The core trench should have side slopes of 1:1.
6. Before the fill is placed,the topsoil or other permeable material under the dam should be removed.
7. Maximum density of the fill should be obtained by compaction at the optimum moisture content.
8. During the construction,free water cannot be squeezed.
9. Soil should be carefully compacted around structures through dam.
10. The core of good material should be as wide as possible.
11. The next-best fill material should be placed upstream in the face of the dam, and the poorest in the downstream section.



(946) Small fill dam(14)



Seepage Control (2)

12.Sealing of the reservoir area above the dam to prevent seepage may be accomplished by

(1) compaction of the area to be covered by water,either with the soil in place or with a blanket of locally occuring heavy clay.

(2) dispersion of clay soil with chemicals.

(3) application of swelling clays,such as bentonite.

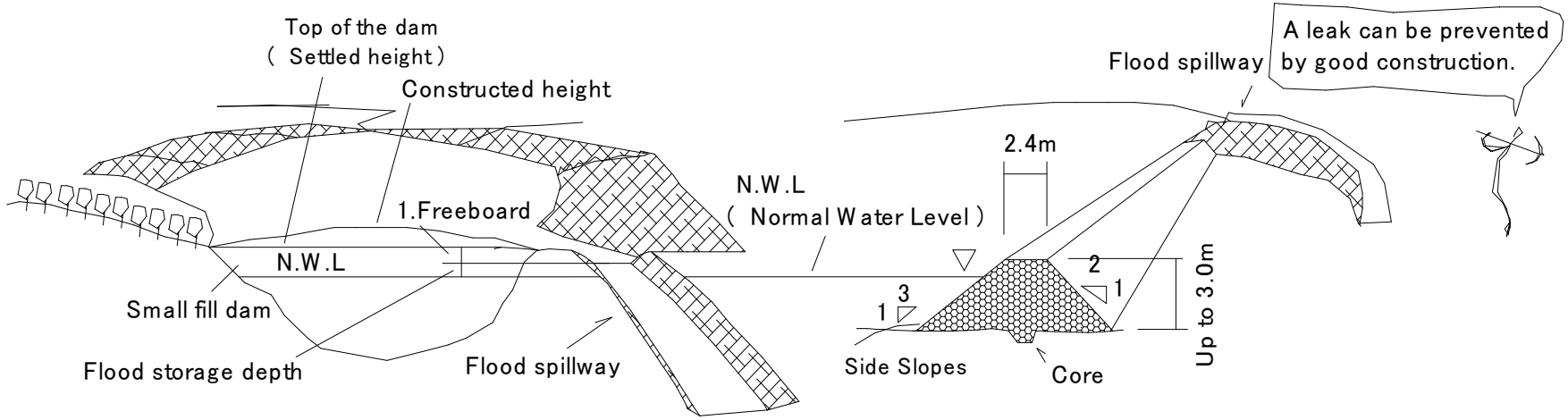
(4) lining with plastic,butyl,or asphaltic materials.

13.Where rock ,gravel,or other strata are exposed,the area should be covered in layers 0.1m~0.2m.

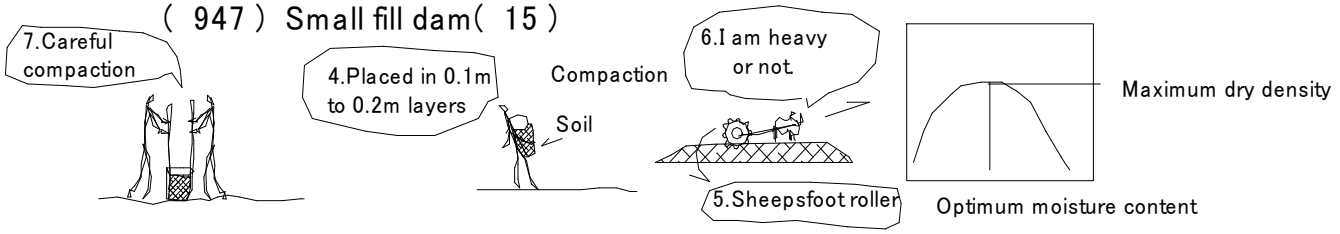
14.Thick and compacted with a sheepfoot roller.

15.Bentonite or other high-swelling clays should be thoroughly mixed into the soil and then compacted.

16.Soil should have 10% to 15% sand to provide the necessary soil strength.

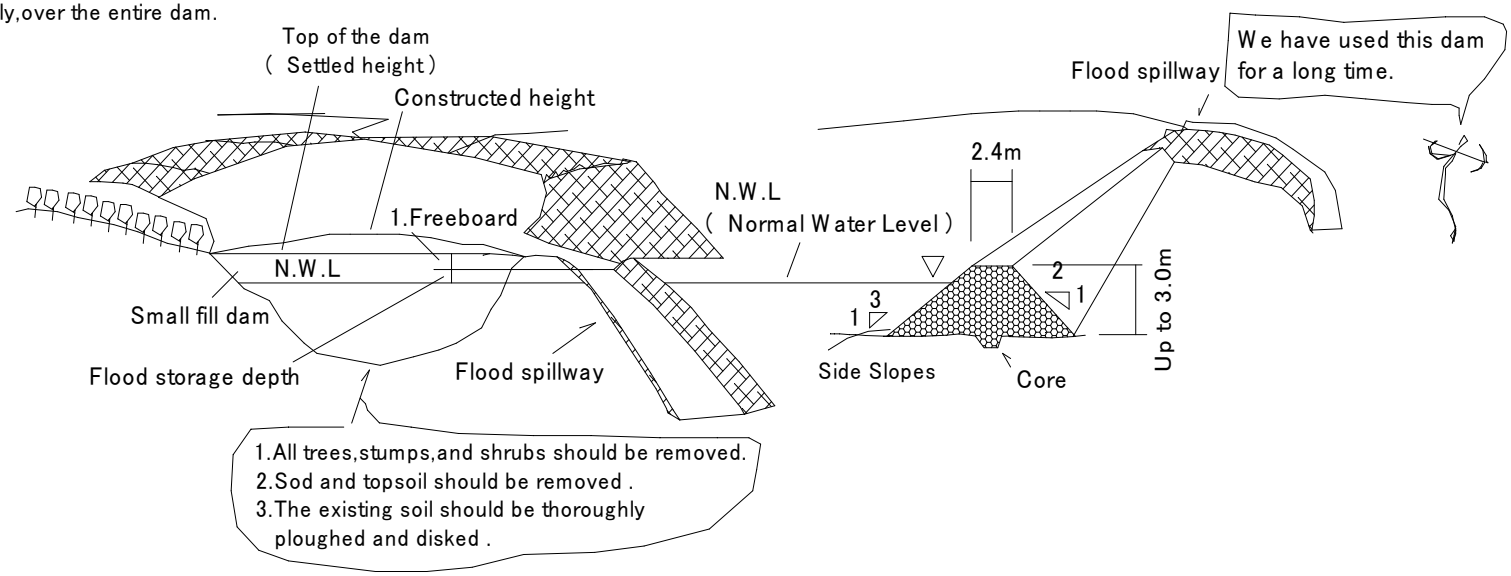


(947) Small fill dam(15)



Construction and maintenance (1)

1.All trees,stumps,and shrubs should be removed from the dam site and from the area to be inundated.
2.Sod and topsoil should be removed and stock piled.
3.Before placement of fill in the dam,the existing soil should be thoroughly ploughed and disked and be near optimum moisture content.
4.The fill material should be placed in 0.1m to 0.2m layers, evenly,over the entire dam.
5.The sheepsfoot roller is best suited for compacting the fill.
6.Heavy hauling equipment should use varied travel paths so as to avoid over compaction.
7.Hand-operated pneumatic or motor tampers are best for compacting around pipes or other structures.



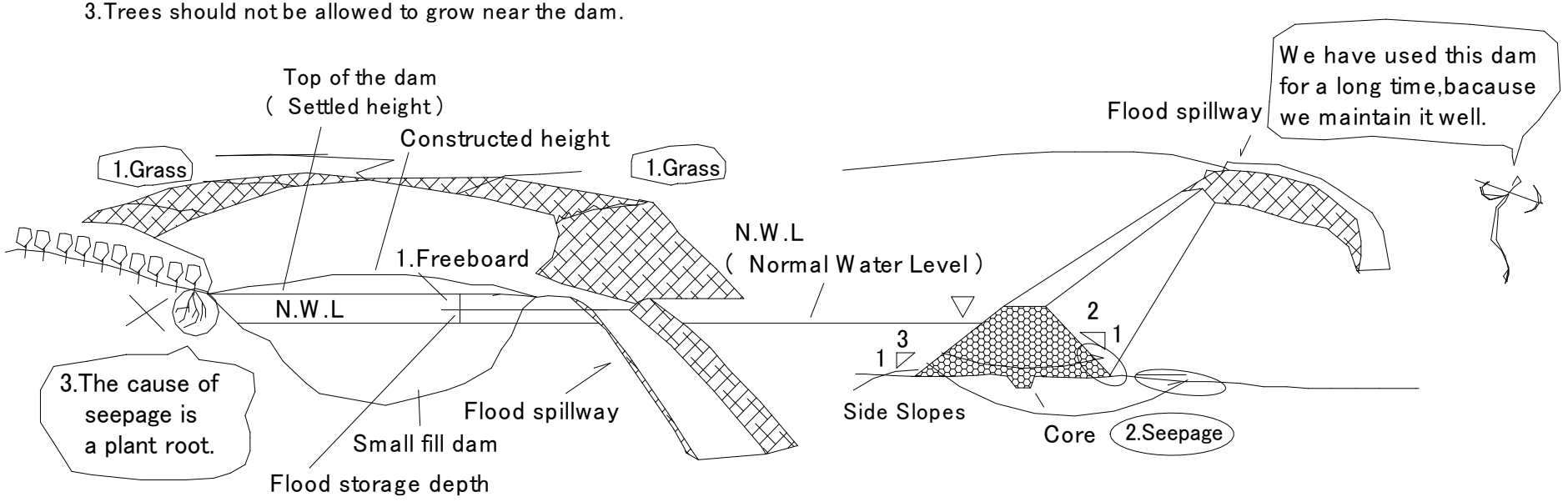
(948)Small fill dam(16)

Construction and maintenance (2)

1.Sedimentation can be reduced by protecting waterways with grass and by establishing adequate erosion-control practices on the watershed.

2.The ponds should be inspected occasionally for evidence of seepage on the downstream face of the dam,piping ,wave action,and damage by animals or humans.

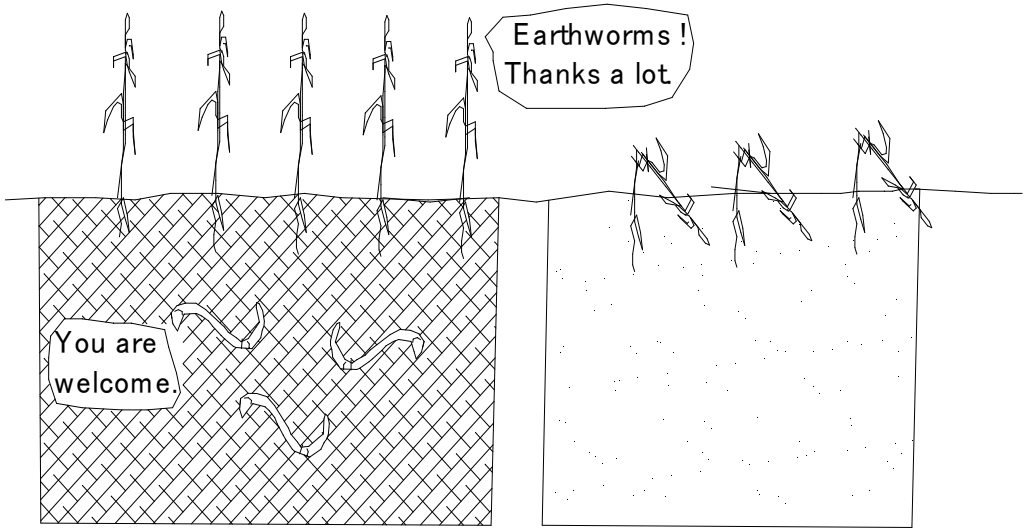
3.Trees should not be allowed to grow near the dam.



(949) Earthworms (1)

Earthworms are good for soils.

1.Earthworms like wet dark places.
2.They make burrows and live in holes in the soil.
3.They need wet places to stop themselves from drying out.
4.Air and water can enter the soil through their burrows.
5.They mix up the layers of the soil.
6.They take dead leaves from the top of the soil into their burrows.
7.the leaves rot and mix with the soil .
8.this makes the soil good for our crops.



（ 950 ） Earthworms（ 2 ）

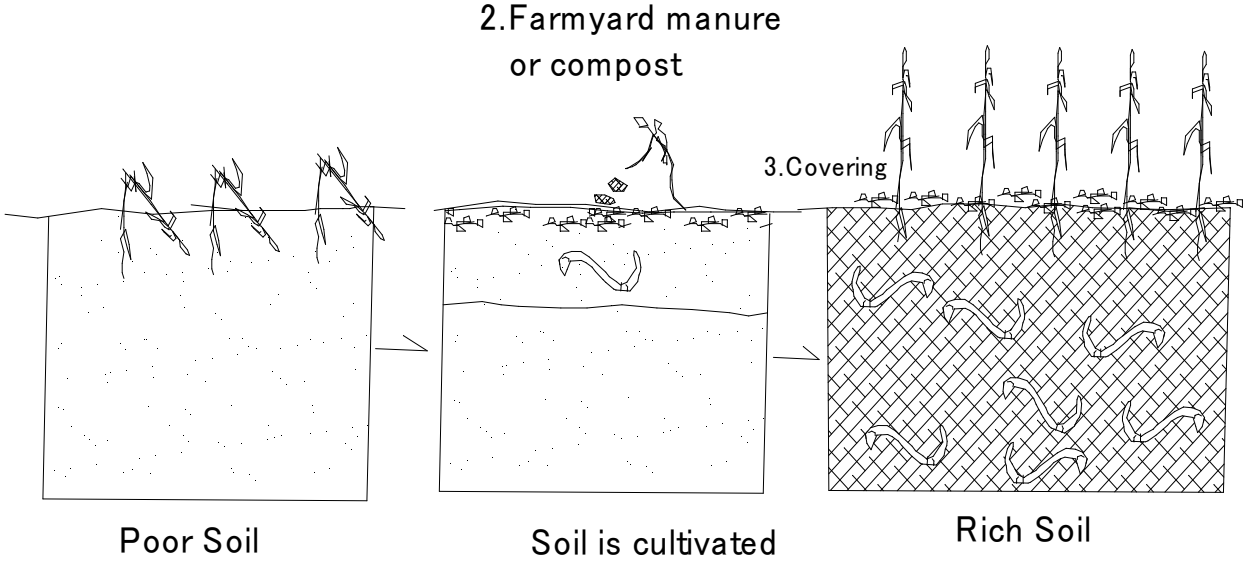
Looking after earthworms.

1.The best way we can protect earthworms is by looking after the soil.

2.Apply plenty of farmyard manure or compost into your gardens.

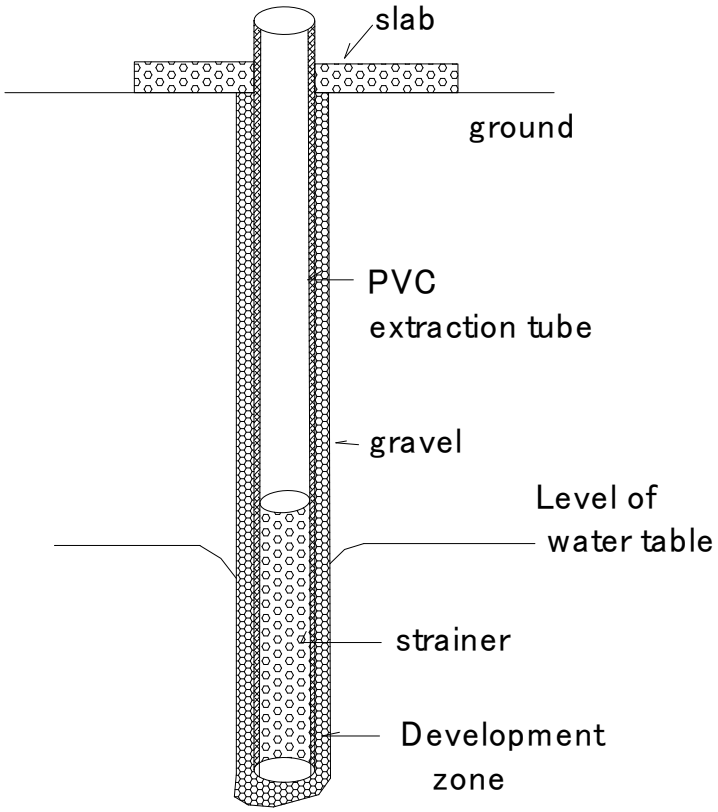
3.We can protect this soil by covering it with left over plant materials.

4.This helps to stop the soil from drying out.



(951) Bores (1)

Component of a borehole



Bore sinking is done in four stages:

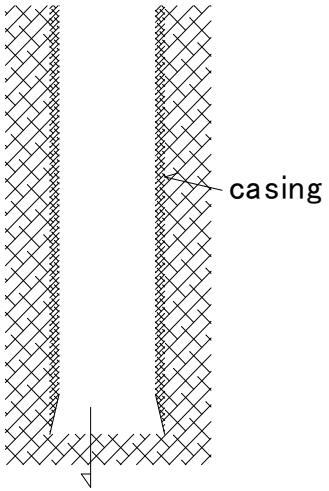
1. The hole must be excavated and the casing sunk into the ground.
2. The strainer and PVC tube that remain permanently in the hole are now positioned.
3. Next, the casing is removed.
4. Lastly, the bore head must be laid out and water lifting equipment installed.

(952) Bores (2)

Three stages of boring

Stage 1

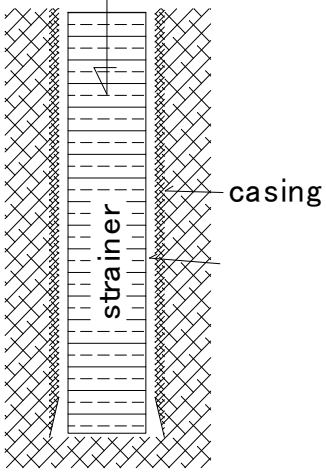
Drilling and reaming



Position and sink the casing until it reaches the water table.

Stage 2

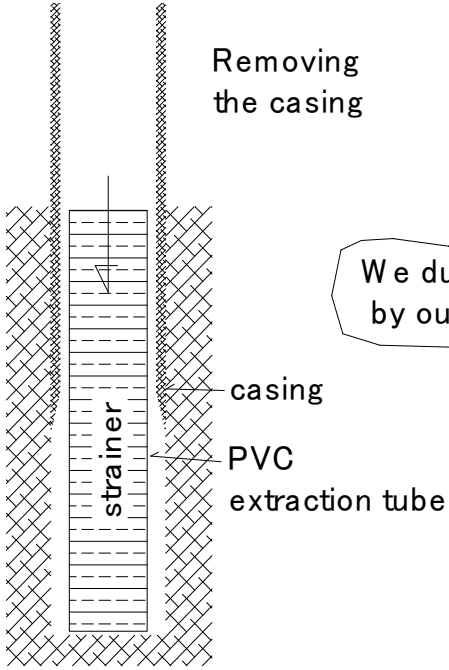
Positioning the extraction tube



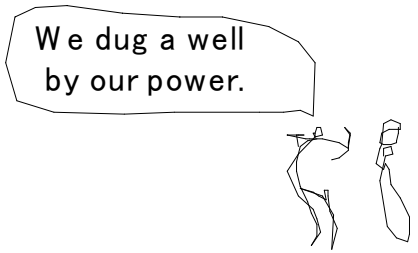
Place the strainer and PVC extraction tube inside the casing.

Stage 3

Removing the casing

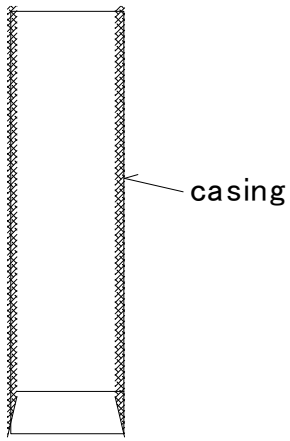


Remove the casing; leave the extraction tube in place and develop the bore.

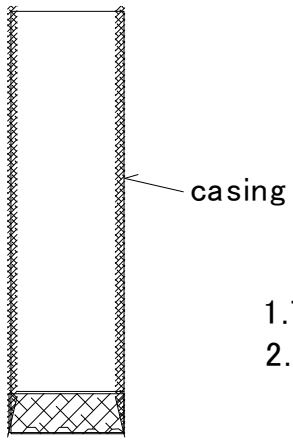


(953) Bores (3)
Equipment and tools for boring

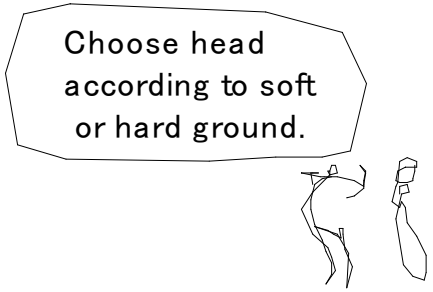
Casing with cutting heads



bevelled bit for reaming in soft soils



toothed bit for reaming into rock

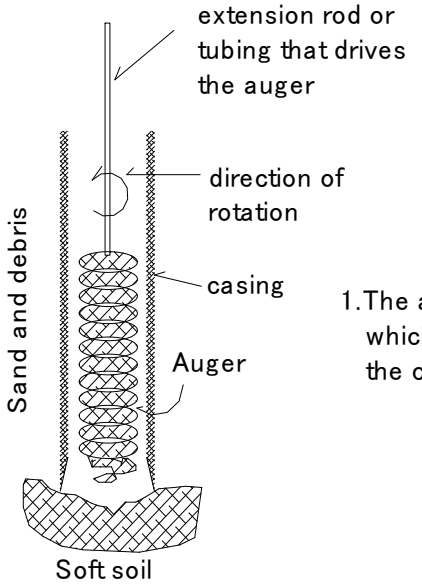


1. The casing is a tube made of steel.
2. The bottom end of the casing is equipped with a very hard cutting piece.

(954) Bores (4)

Tools for excavating and drilling

Casing with cutting heads
Bore tools
Auger



1.The auger, a kind of large helical screw, which cuts into soft soil as it is rotated inside the casing surface.

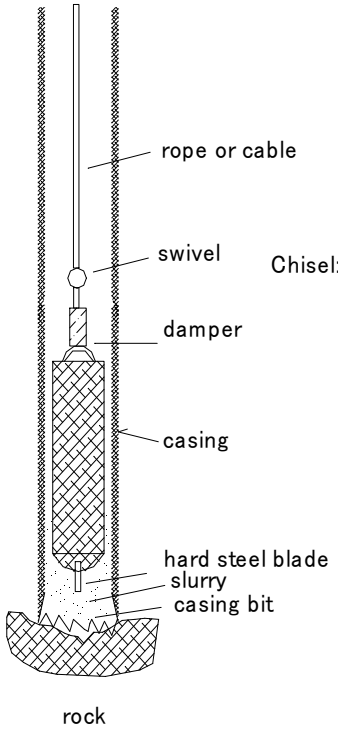
(955) Bores (5)

Tools for excavating and drilling

Casing with cutting heads

Bore tools

Chisel



Chisel:40kg to 60kg

1.The chisel used for drilling rock .
2.A small amount of water, to which clay is sometimes added,is left at the bottom of the hole where it mixes with the powdered rock to form a kind of slurry that is removed from the casing with a shell.

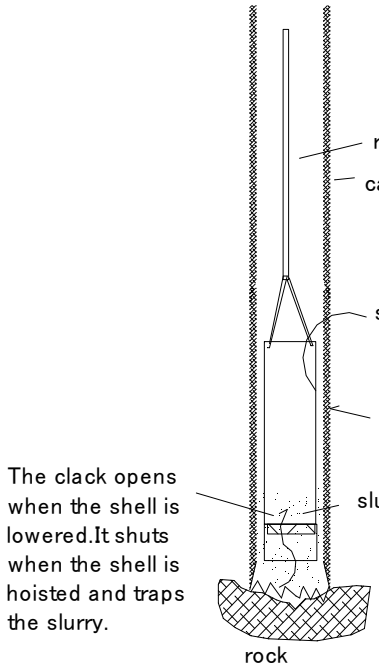
(956) Bores (6)

Tools for excavating and drilling

Casing with cutting heads

Bore tools

shell



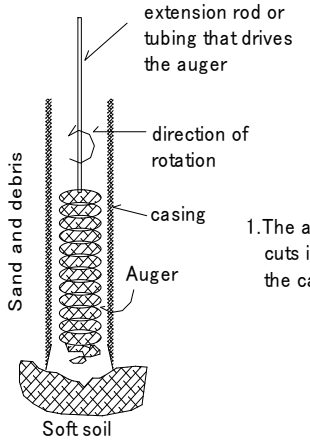
Chisel:40kg to 60kg

1.The shell is a tool for removing the mud formed at the bottom of the hole by the chisel.

The clack opens when the shell is lowered.It shuts when the shell is hoisted and traps the slurry.

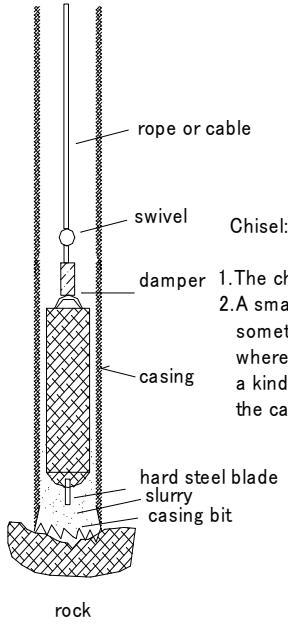
(957) Bores (7)
Tools for excavating and drilling
Casing with cutting heads
Bore tools

Auger



1.The auger, a kind of large helical screw, cuts into soft soil as it is rotated inside the casing surface.

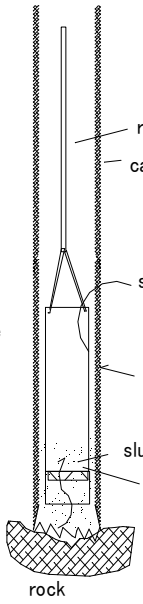
Chisel



Chisel:40kg to 60kg

1.The chisel used for drilling rock .
2.A small amount of water, to which clay is sometimes added,is left at the bottom of the hole where it mixes with the powdered rock to form a kind of slurry that is removed from the casing with a shell.

shell



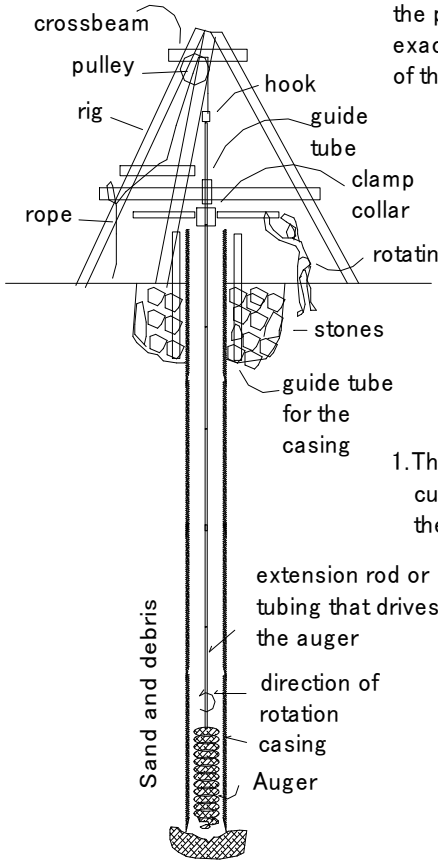
Chisel:40kg to 60kg

1.The shell is a tool for removing the mud formed at the bottom of the hole by the chisel.

The clack opens when the shell is lowered.It shuts when the shell is hoisted and traps the slurry.

(958) Bores (8)

Drilling and reaming
Auger

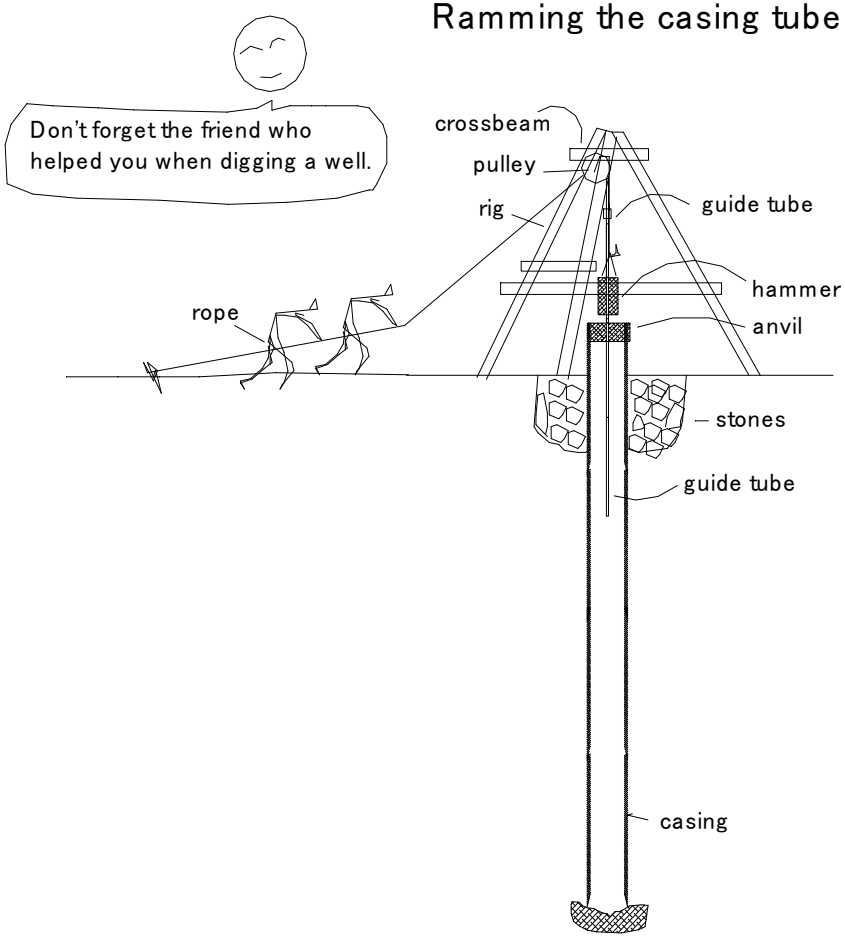


The edge (tangent) of the pulley wheel is placed exactly over the centre point of the borehole.

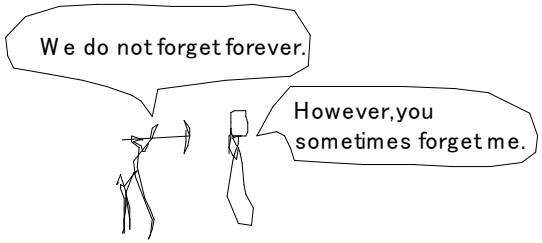
1. The auger, a kind of large helical screw, cuts into soft soil as it is rotated inside the casing surface.

(959) Bores (9)

Ramming the casing tube

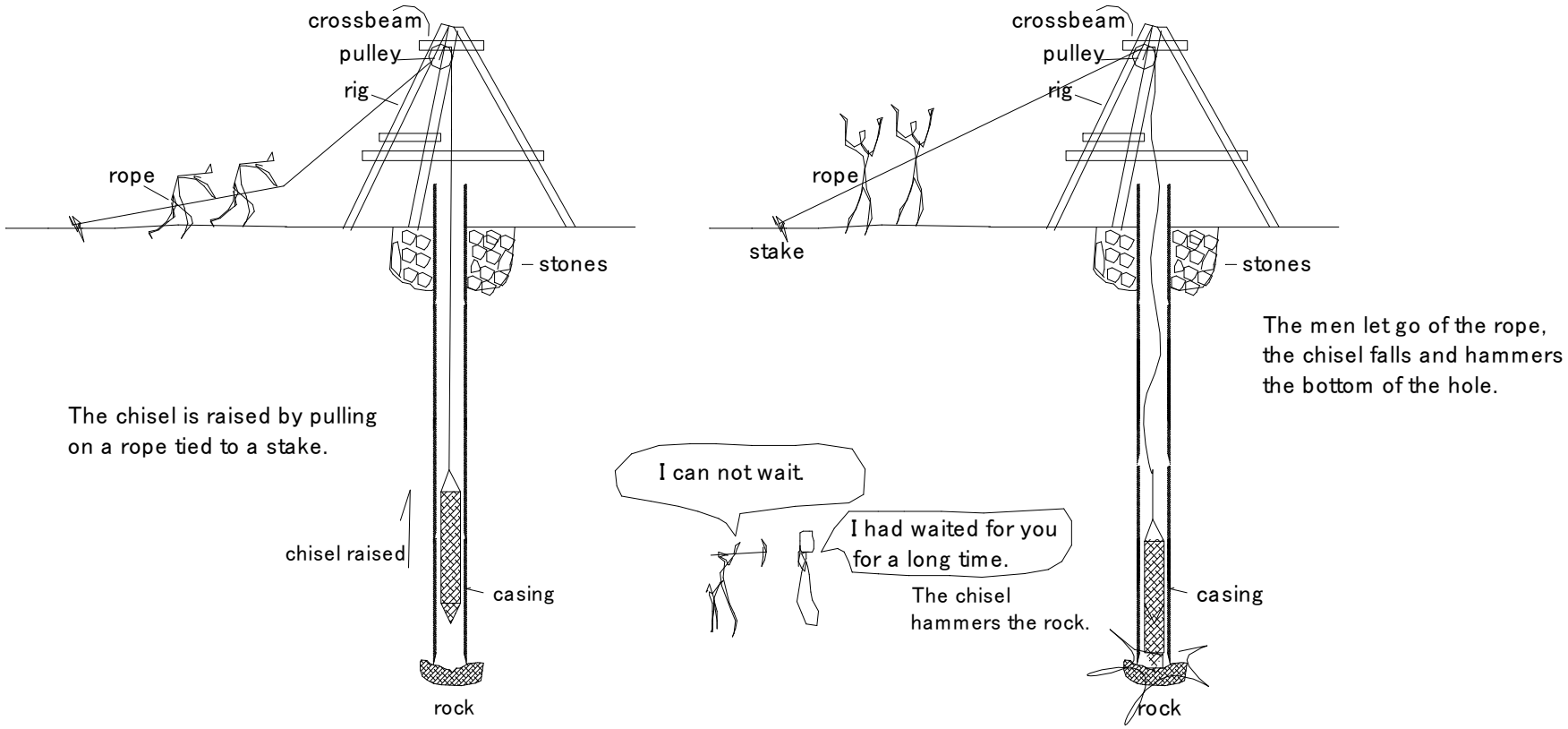


In order to ream the hole,
the auger or chisel is removed,
and the guide tube ,
hammer and anvil are positioned.
When the casing is
level with the bottom of the hole,
the percussion equipment is
replaced by the cutting tool.

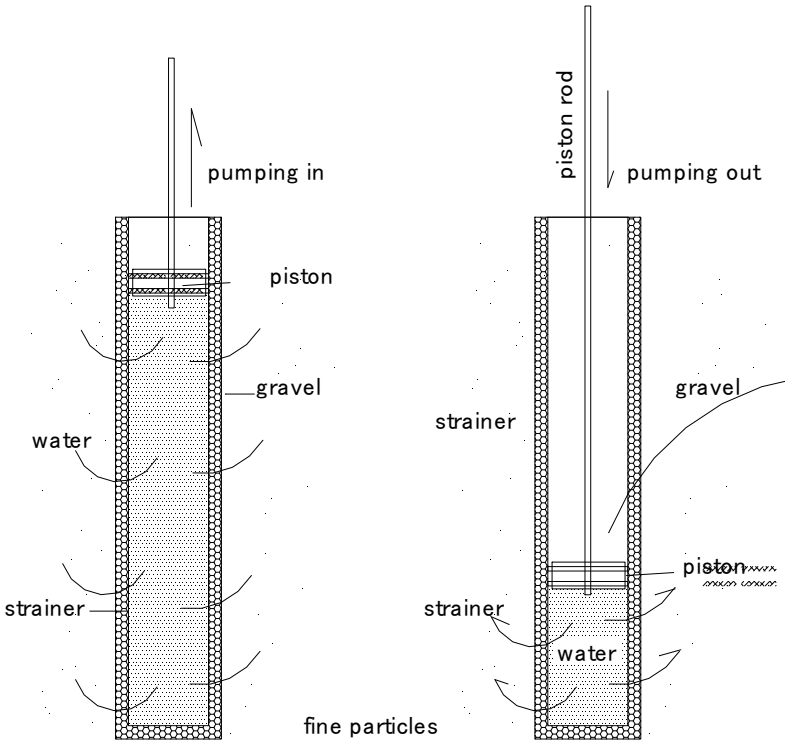


(960) Bores (10)

Percussion drilling with a chisel

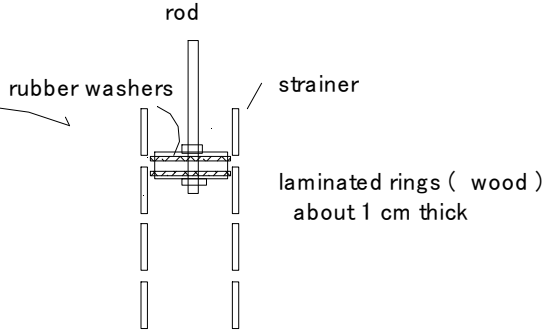


(961) Bores (11)
Developing a borehole



1.As it rises,the piston quickly pumps up the water in the tube through the slits in the strainer.
The rapid flow of water picks up the fine soil particles round the tube and deposits them in the bottom of the strainer from where they are scooped up.

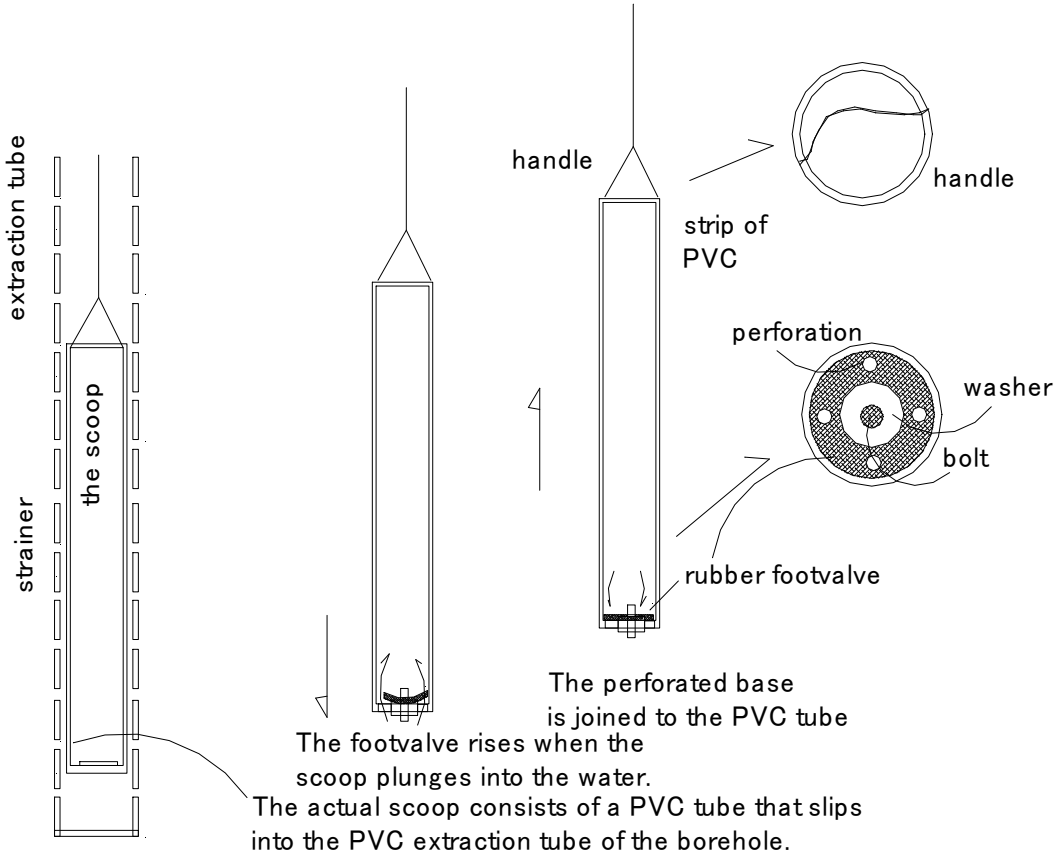
2 When the piston pumps out,it forces water outside the strainer.the water sinks into soil fissures and sweeps up the fine particles that are sucked into the strainer with the upward movement of the piston.



The piston used for developing the borehole

(962) Bores (12)

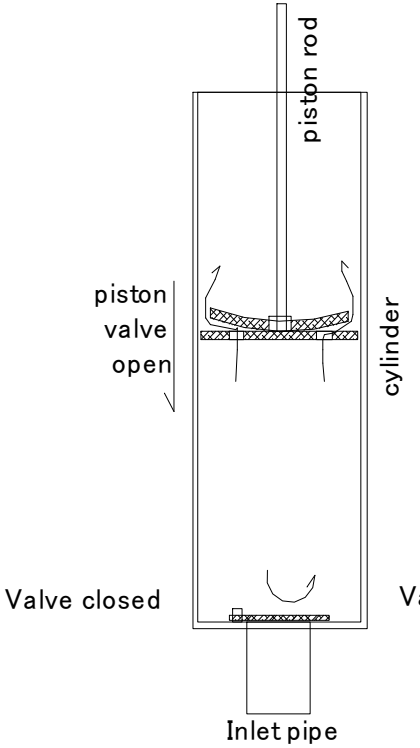
GARY scoop designed for lifting water from wells and bores



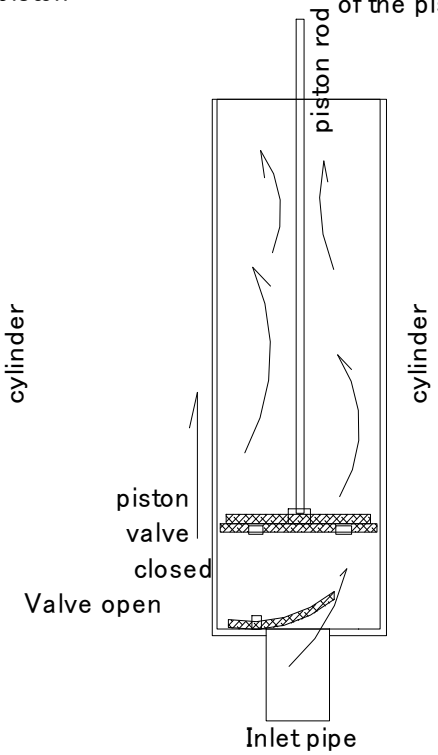
(963) Bores (13)

The mechanism of a piston pump

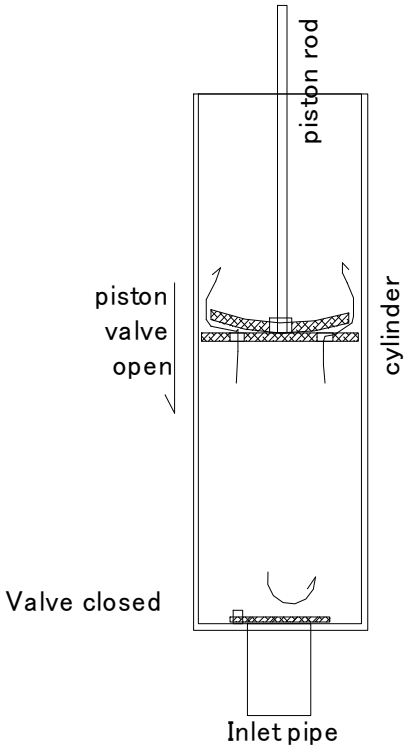
1.The downward movement of the piston

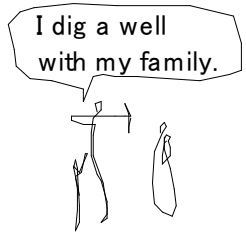


2.The upward movement of the piston

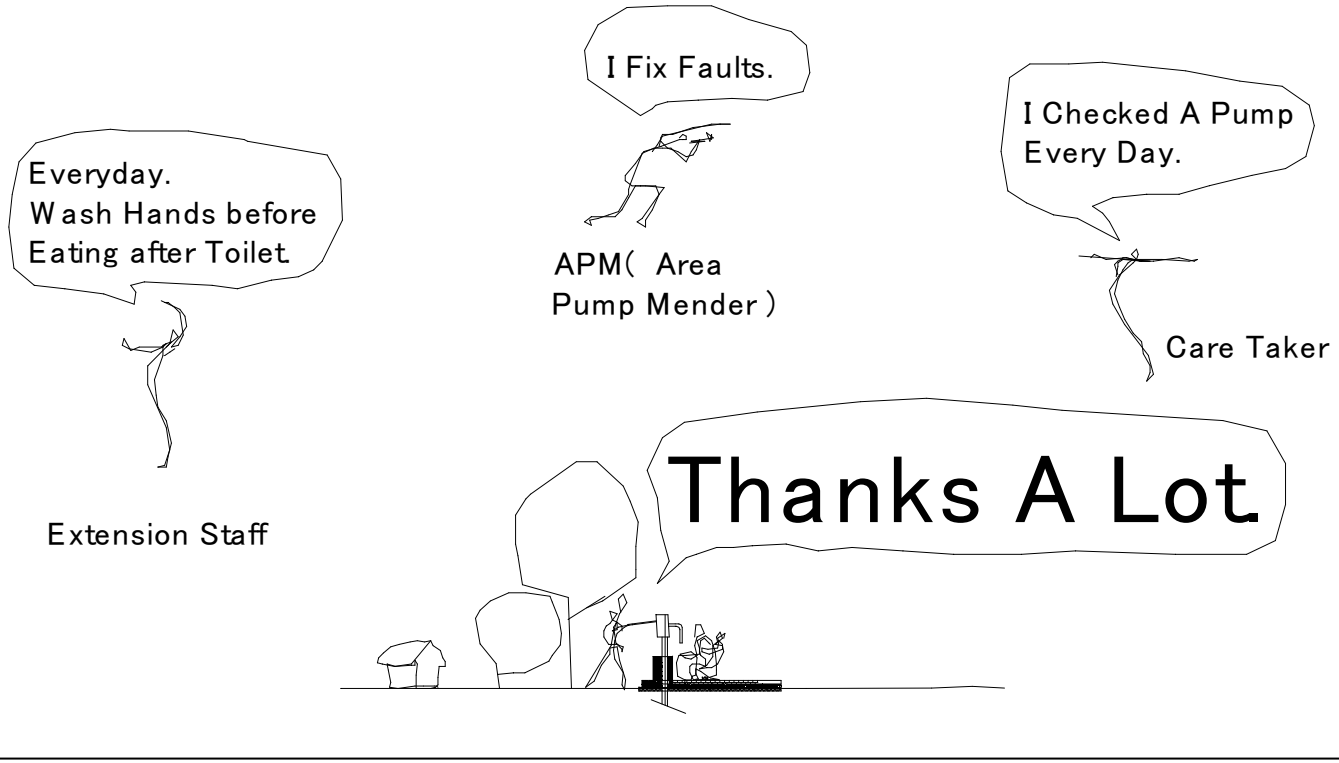


3.The downward movement of the piston





(979) Soft Component (2)



（ 980 ） Soft Component（ 3 ）

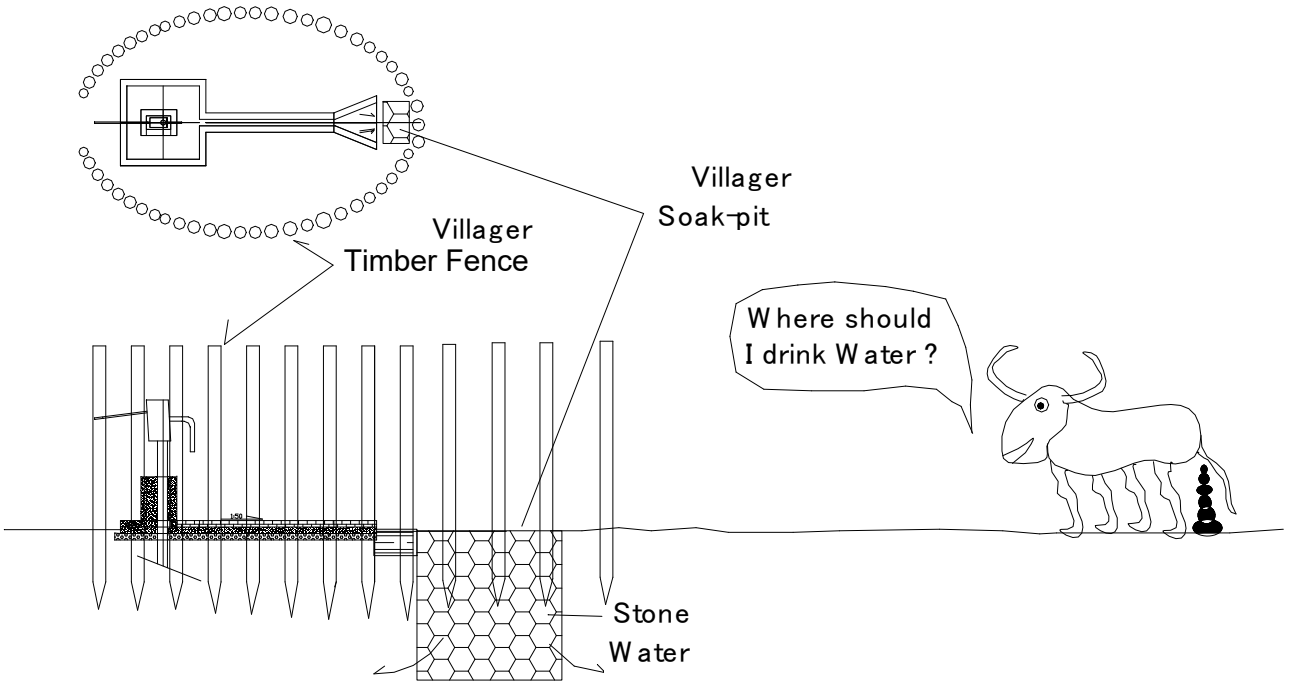
Sanitation Education

Who teaches ?

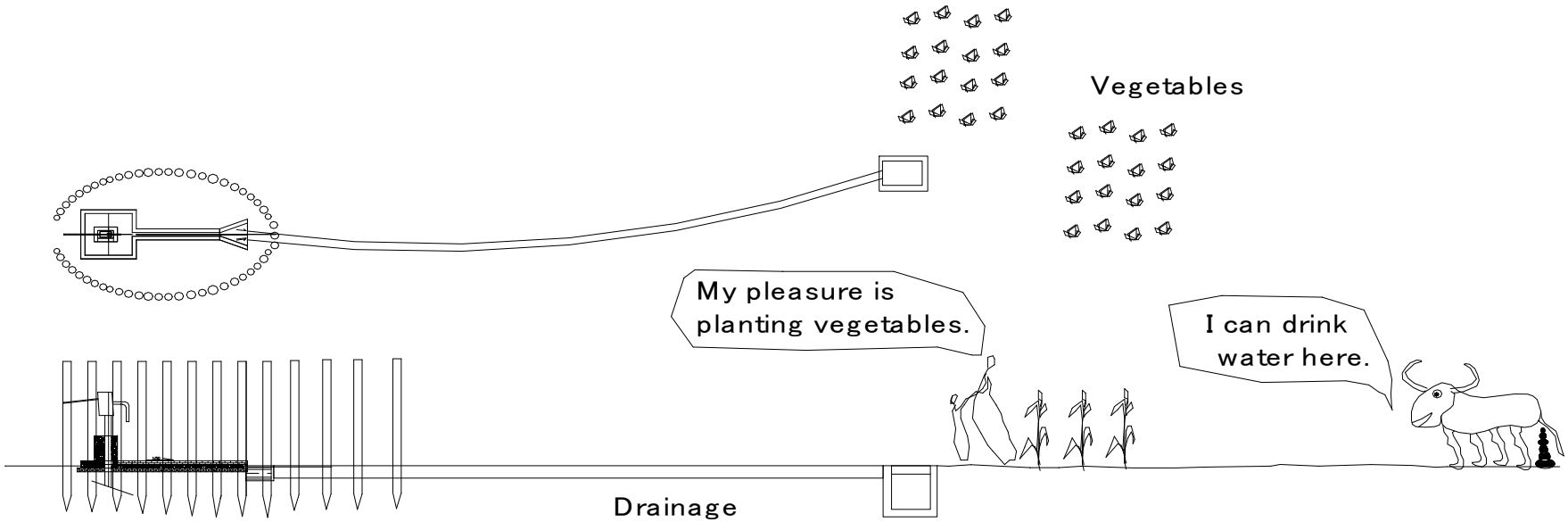
You.

1.Wash hands.
2.Wash plates.
3.Bath a child.
4.Clean a house.

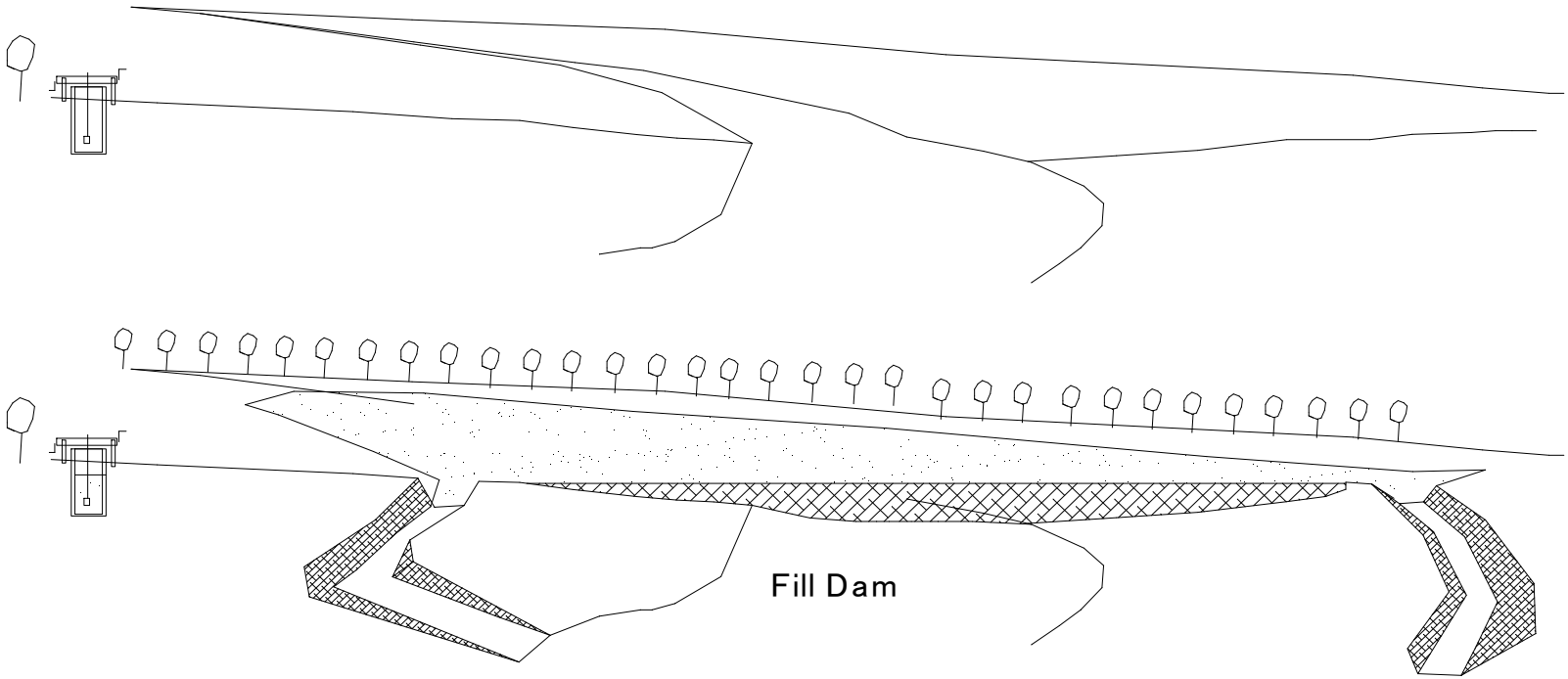
(981) Soft Component (4)



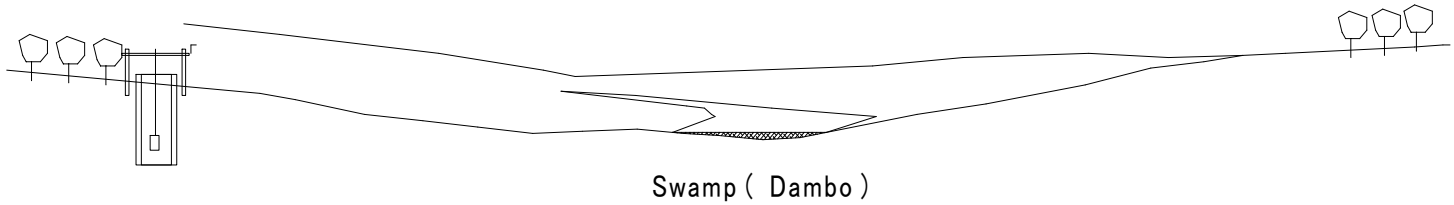
(982) Soft Component (5)

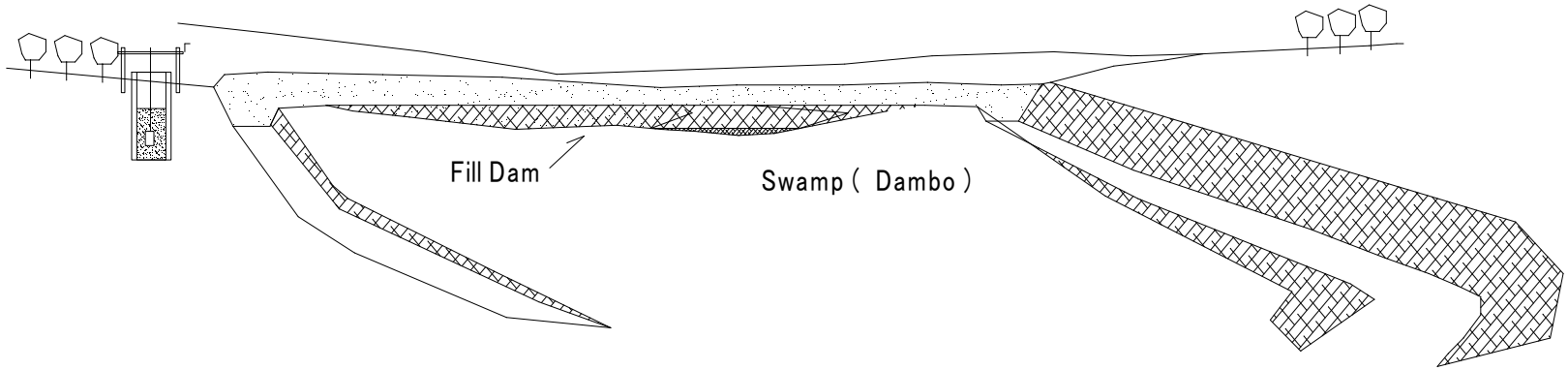


（ 987 ） Fill Dam（ 1 ）

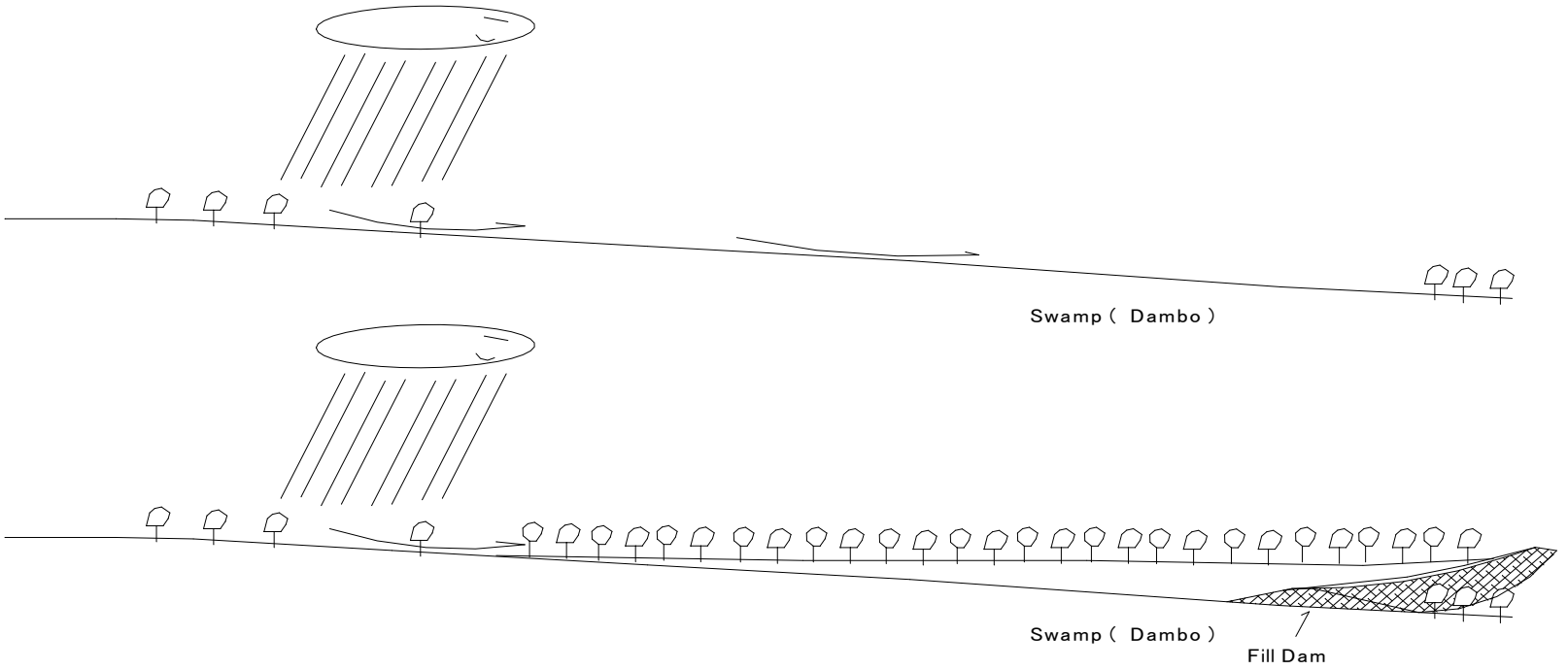


(988) Fill Dam (2)

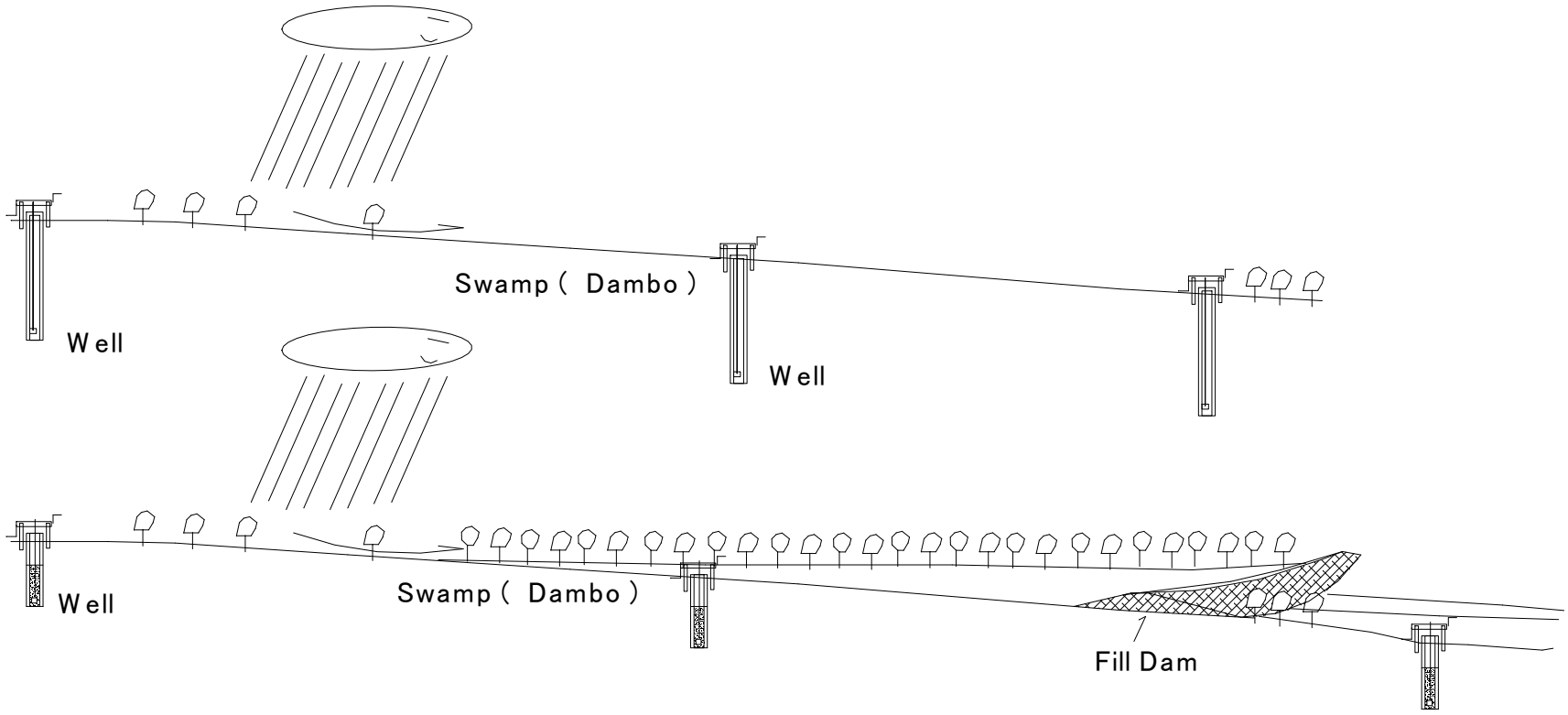




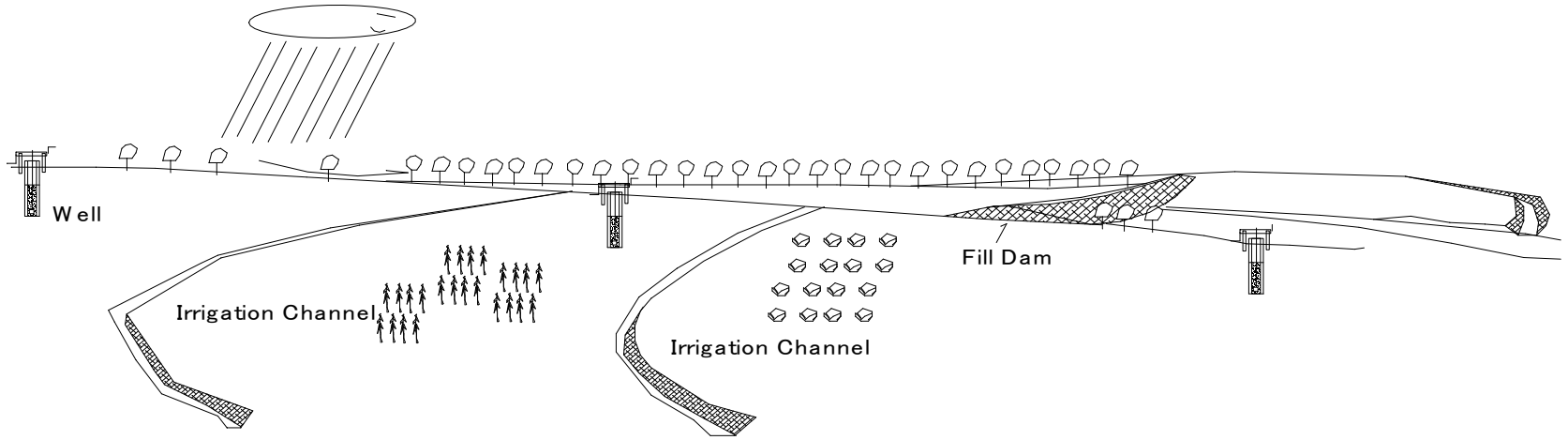
（ 989 ） Fill Dam（ 3 ）



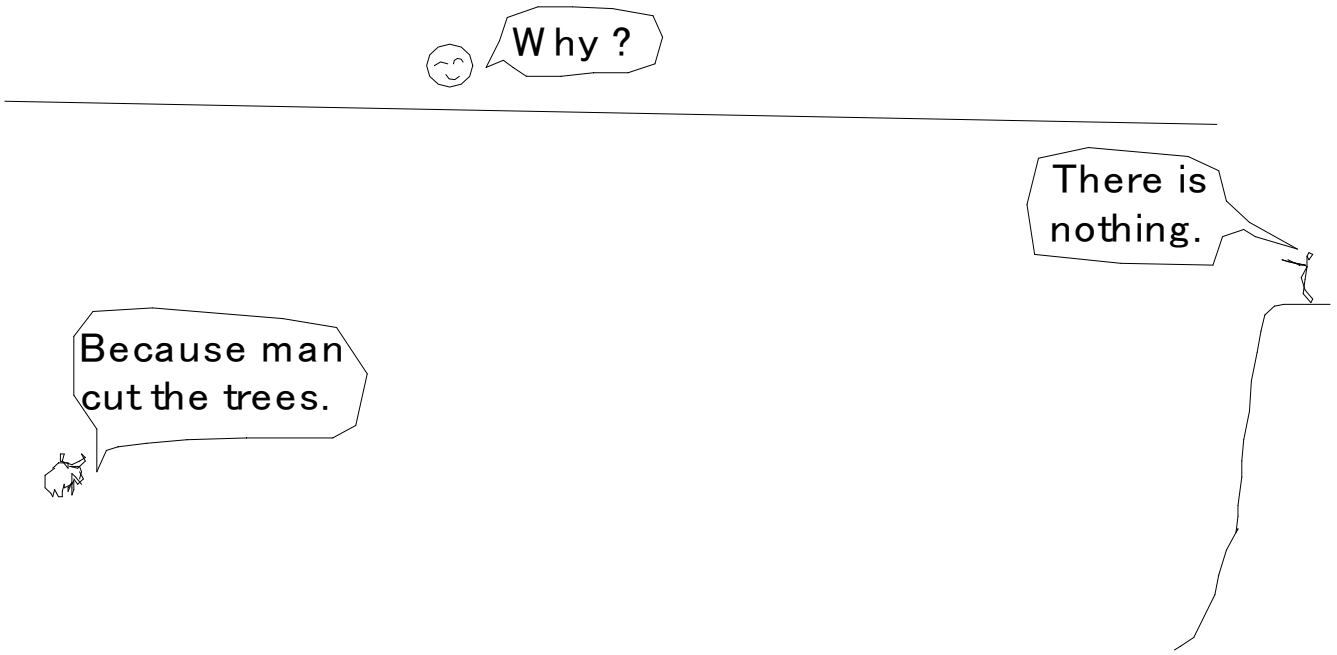
（ 990 ） Fill Dam（ 4 ）



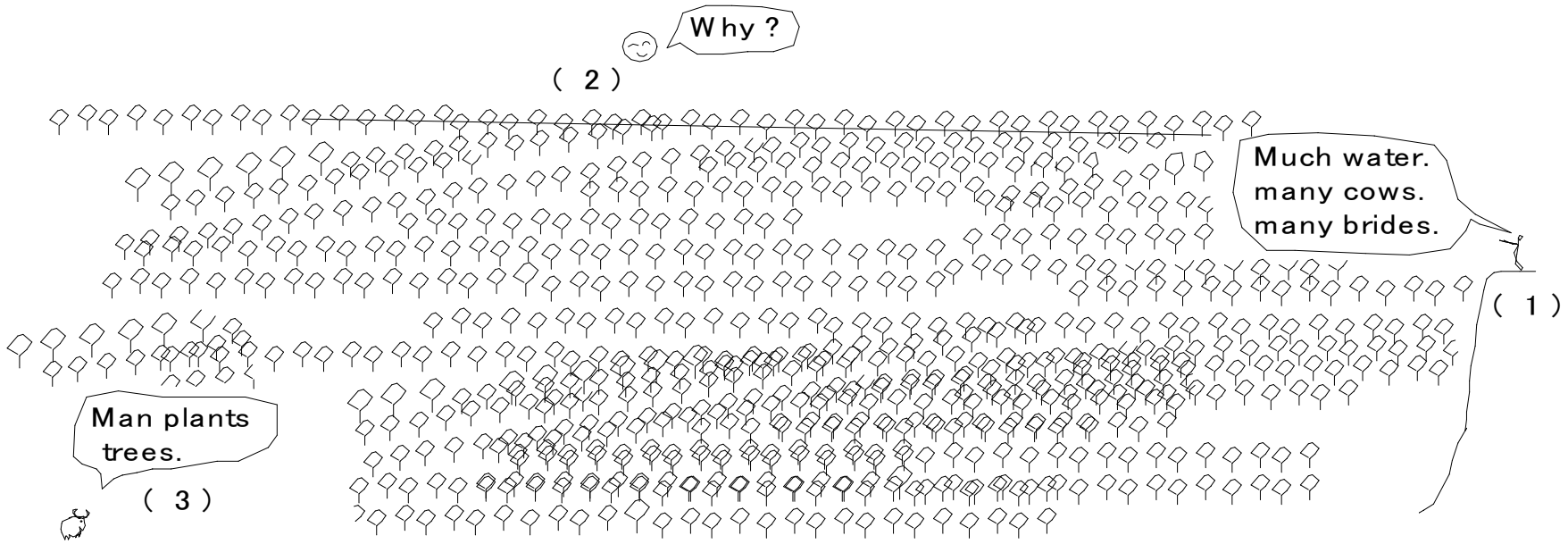
（ 991 ） Fill Dam（ 5 ）



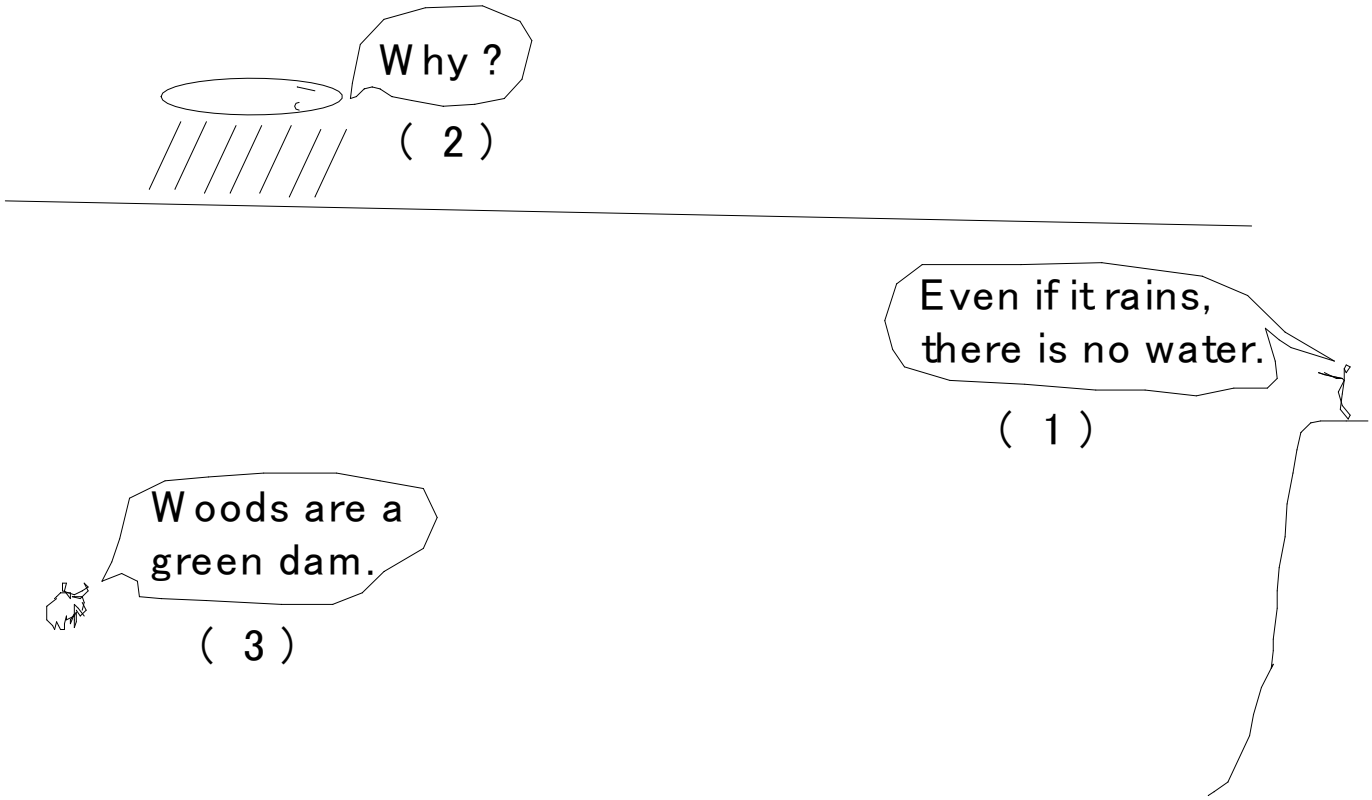
(992) Why do we need to plant trees(1)



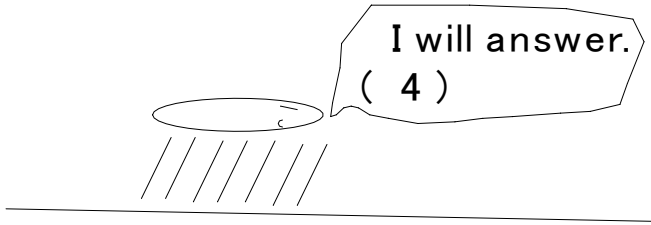
(993) Why do we need to plant trees(2)



(994) Why do we need to plant trees(3)



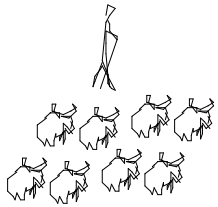
(995) Who is the greatest person ?



(1)

The man who has a happy home.

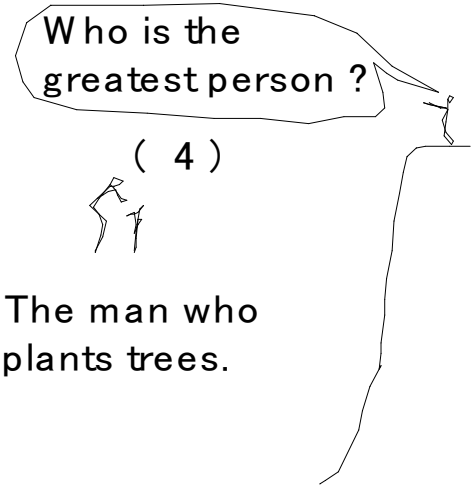
(2)



The man who keeps a lot of cattle.

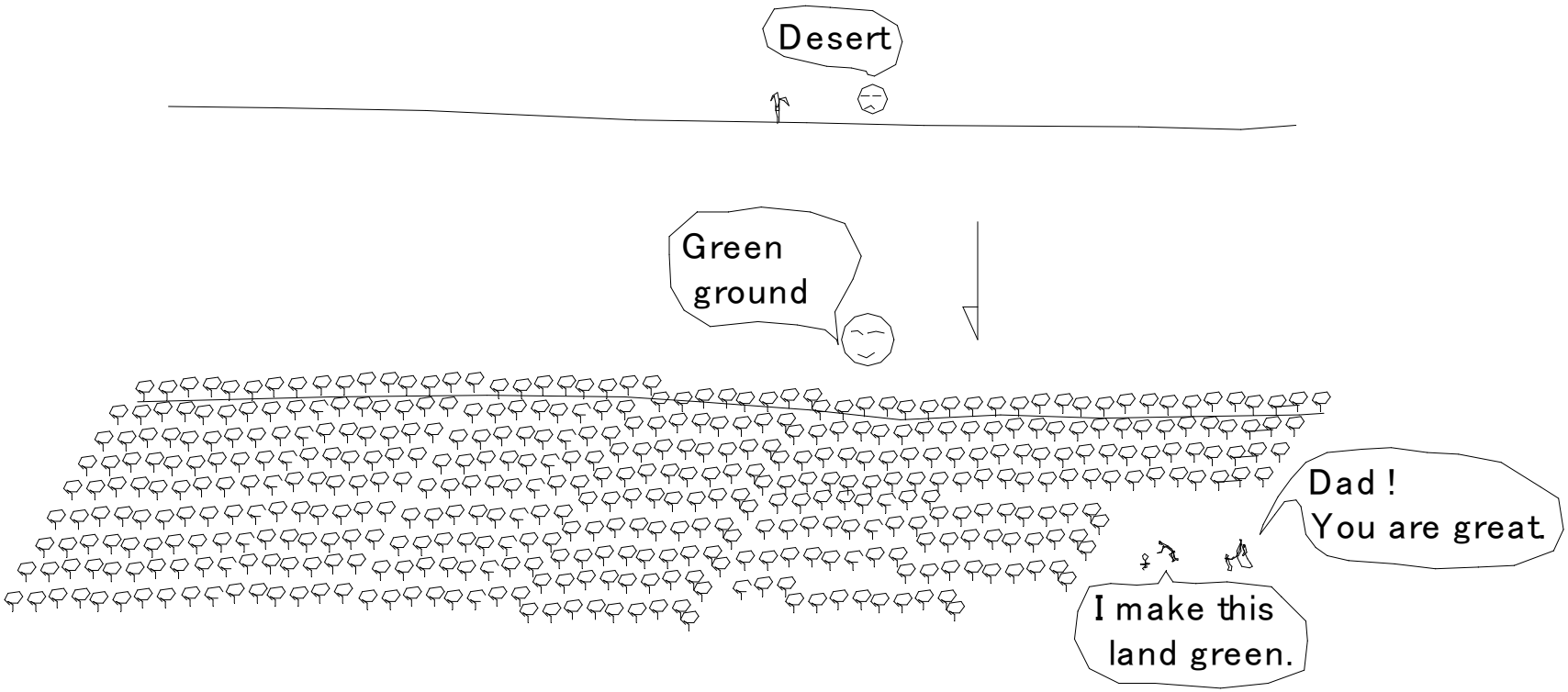
(3)

A politician.

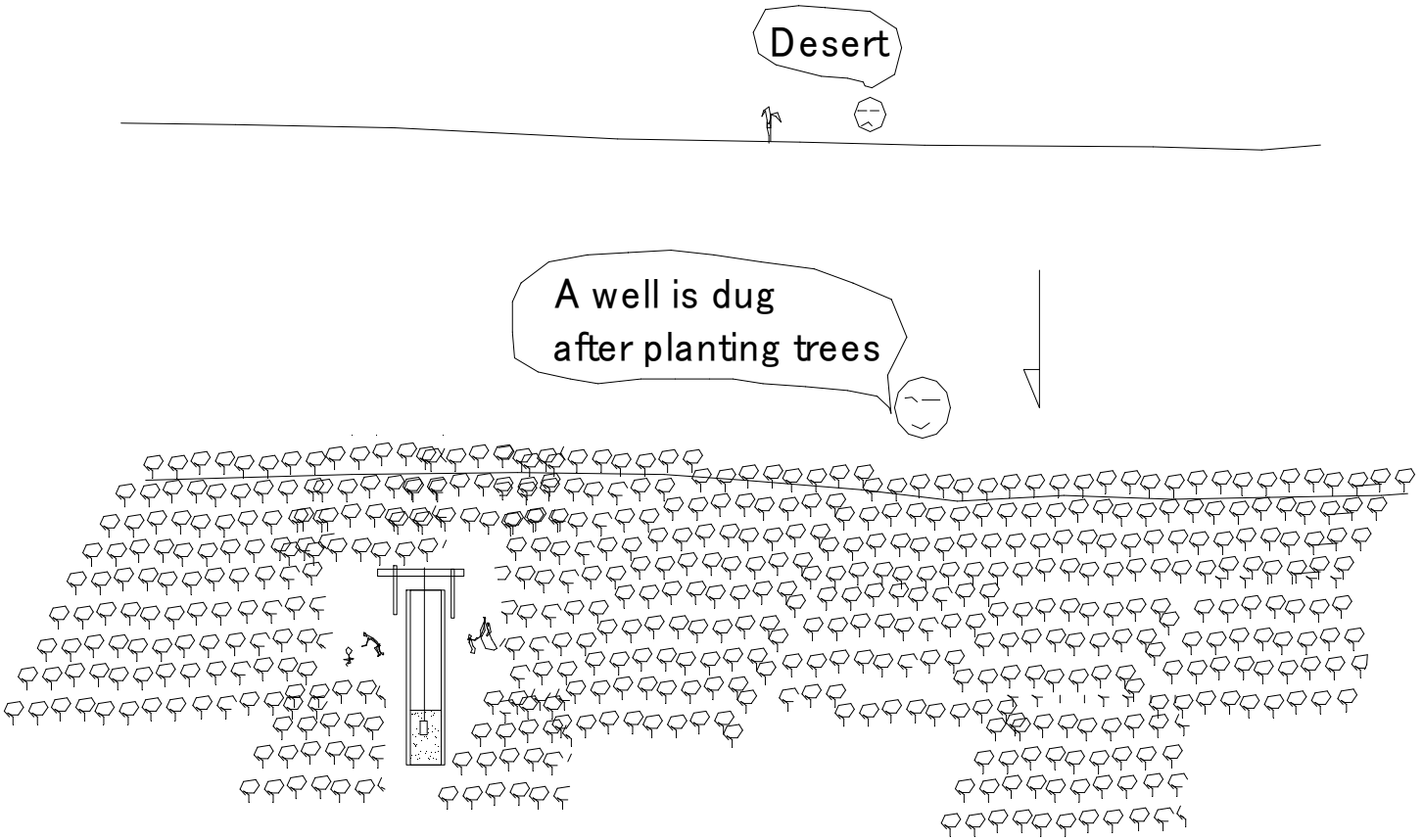


The man who plants trees.

(996) Why do we need to plant trees(4)

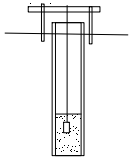


(997) Why do we need to plant trees(5)



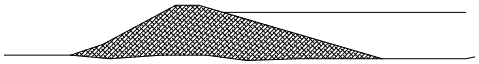
(998) How to become rich (1)

Plant trees.



Dig a well.

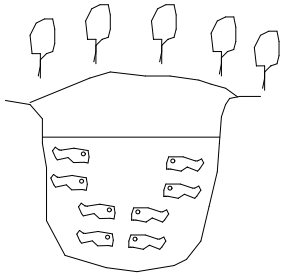
Educate a child.



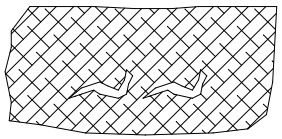
Build a fill dam

Cultivate a field

（ 999 ） How to become rich（ 2 ）



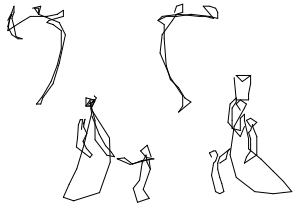
Build a pond.



Keep earthworms.

Look after
a child.

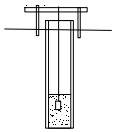
Keep cattle.



A family is rewarded.

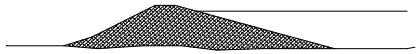
（ 1000 ） How to become rich（ 3 ）

Plant trees.



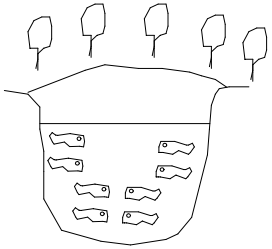
Dig a well.

Educate a child.

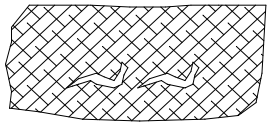


Build a fill dam

Cultivate a field.



Build a pond.



Keep earthworms.

Look after
a child.

Keep cattle.

A family is rewarded.