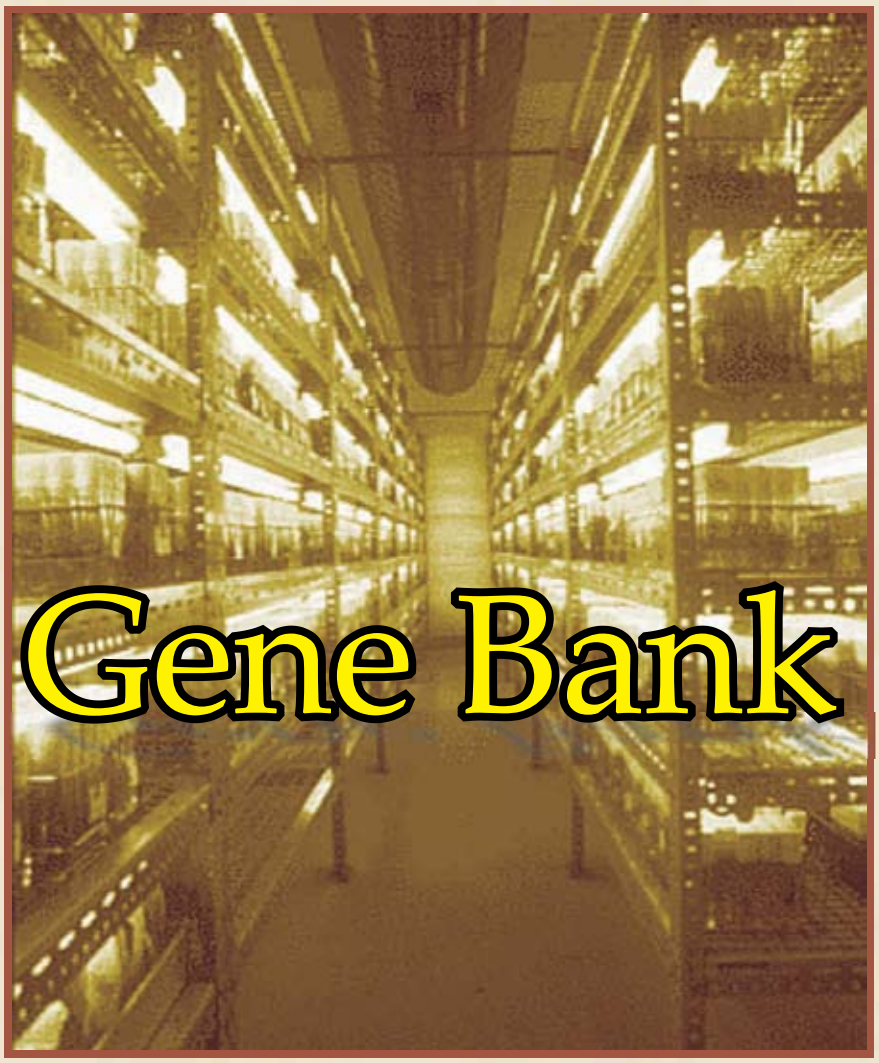
Scene Four



Monday afternoon

Scene Four: Monday afternoon

Place: Classroom

Characters: Students & biology teacher

Situation: Discussion on plant genetic resources (PGR) and conservation

Gene banks

Sorghum varieties

Maize varieties

Seeds in gene bank

The seeds conserved and stored may be those of food crops, or those of a rare species, all saved to protect biodiversity.

Scene Four:
Monday afternoon

Place:
Classroom

Characters:
Students & biology teacher

Situation:
Discussion on plant genetic resources (PGR) and conservation

Teacher:


Teacher

Today in our biology class we will learn about how we can save, store and use plants that give us our food. I want you to follow every new term and concept we talk about very carefully. I will ask you to prepare a presentation on the topics when we have finished discussing this subject. The presentation can be a poster, a painting, a poem, a slide show, a skit, or any other idea that you can come up with. You have to be creative.
Now, can anyone tell me anything about the terms I have written on the board?

Gamba:


Gamba

Conservation means "to save."

Teacher:


Teacher

Good! Does anyone know why we might want to save something?

Kunto:


Kunto

Yes, we should save things so that they are available for use when we need them in the future.

Teacher:


Teacher

Good. Can we save plants for future use? And if so, which parts of a plant can we save and for how long?

Gamba:


Gamba

Well, we can save vegetables, fruits and leaves in the refrigerator for some time.

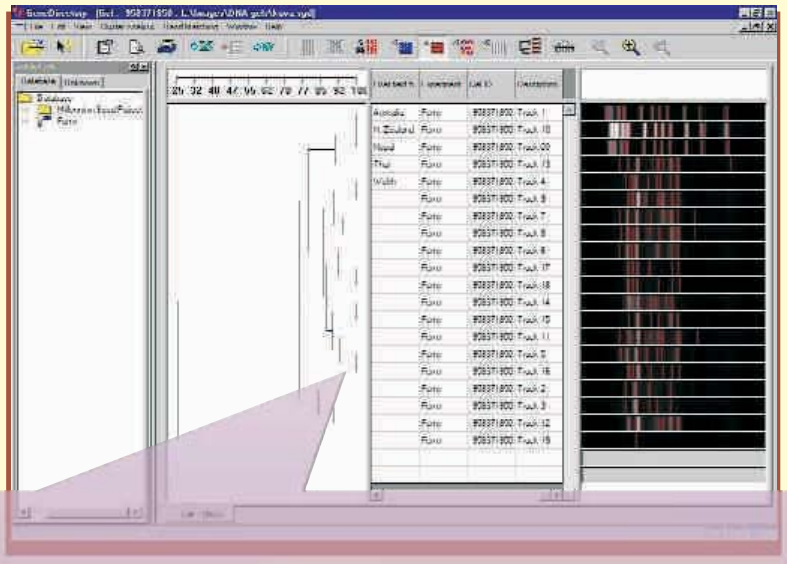
Kunto:


Kunto

We can also save plant seeds and use them to grow new plants the

Regenerating seeds for the gene bank is not a simple process. With cross-pollinated crops valuable genetic traits can easily be lost forever.

When distributed, as much of the available genetic diversity as possible is included in samples.



Gene directory gel data storage and analysis software is used as a tool, to assist rapid and precise identification of seeds to preserve some of the world's rarest plant species.

following year. But they have to be kept in a cold, dry place.


Teacher

Teacher:

That's correct. And how do you think seeds save the huge plants inside them selves and make sure that they will grow when they are sown in the soil?


Thandiwe

Thandiwe:

Seeds carry, in their genes, all the information necessary for a new plant to grow. When the seed is left under ideal conditions with water, it can grow into a plant.


Teacher

Teacher:

Yes. All the information needed to grow a full plant is stored in the seed. The structure within the seed that stores this information is called the plant's genome. Genes are inherited, so you can say that the "genetic" make-up of the plant is conserved inside the seed.

Can anyone tell me how seeds in large quantities are stored for future seeding in large fields and how these seeds can be saved from natural disaster?


Ekow

Ekow:

Under natural conditions, seeds are protected from the sun and heat because they have a protective cover, and sometimes they are covered by the soil.


Teacher

Teacher:

You are right, Ekow. This is true for the seeds that fall from the trees and grow again in the following season. However, how about the seeds that farmers store for future use? Natural disaster is when there is unexpected heavy rain, flood, extremely hot sun, fire or sometimes even the destruction of seeds by animals. Do you know how the seeds can be saved from this damage and conserved for future use?


Gamba

Gamba:

Does the word "conserved" also mean "stored"?


Teacher

Teacher:

Yes Gamba. However, the word conserved means stored for a long time.


Ekow

Ekow:

I know. Seeds are stored in seed banks under ideal conditions to protect them from natural disasters. But I am not sure for how long they can store seeds in a seed bank.


Teacher

Teacher:

Correct, Ekow. Seeds are stored in the dark at ideal temperatures in seed banks, where the seeds are kind of sleeping until the farmers use them for seeding. However, there are also places called plant gene banks where plant genetic resources can be stored for a very long time. Can you tell me what is stored in a plant gene bank?


Efia

Efia:

Yes! My dad told me that a plant gene bank is a safe repository for crop varieties. It is a very important place because it is one of the storage places for plant genetic resources.


Teacher

Teacher:

Very good, Efia. You have mentioned a few important words to remember. Can you tell the class what you mean by "repository" and "plant genetic resources"?


Thandiwe

Thandiwe:

Efia, may I answer this question please? A repository is a place where something can be stored safely. The plant's genetic resources are the genetic material that the plants carry in their cells. These can be reproduced into new plants. Am I right?


Efia

Efia:

Does your dad also work in a plant genetic resources center?
(*Thandiwe winks and both Ekow and Thandiwe laugh*.)

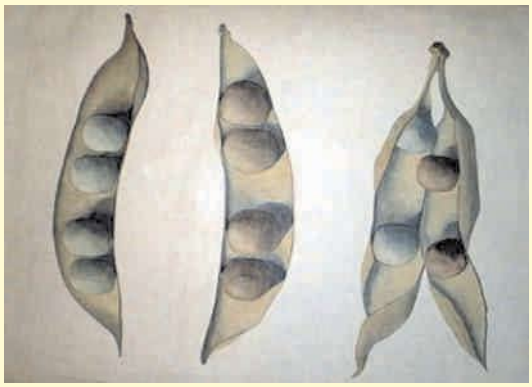

Teacher

Teacher:

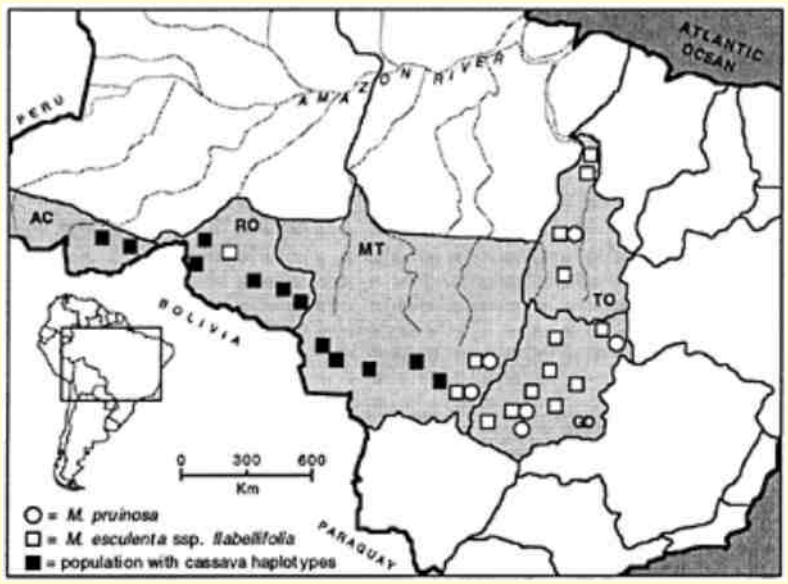
Yes, a plant genetic resource, includes any genetic material of a plant that has value and can be reproduced. It is the basic raw material for research and an important source for food production. Plant seeds are one of these resources.

Can you tell me about any other genetic resource of a plant? Can a new plant be grown from a plant in any other way?

Genetic variation within a species (size and shape differences)



Genetic diversity of cassava in South America



The locations of populations of *M. esculenta* subspecies *flabellifolia* (squares) and *M. pruinosa* (circles). The shaded squares indicate populations containing one or more haplotypes found in domesticated cassava accessions.

Original source: Olsen and Schaal (1999).

Source: The National Academe Press/Openbook (2000)
Title: Variation and Evolution in Plants and Microorganisms
By MICHAEL T. CLEGG AND MARY L. DURBIN

Efia

Efia:

Yes, it is possible to grow some plants by cutting their stems into small pieces and planting the pieces in the soil. But I am not sure whether short branches of plants can be stored in the gene bank.

Teacher

Teacher:

Well, a piece of branch cannot be stored forever in a gene bank. However, do you know what this type of propagation is called, Efia?

Efia

Efia:

Mmmmm ……, yes, I remember. It is called asexual reproduction or vegetative reproduction.

Teacher

Teacher:

Correct. We will talk about vegetative reproduction or "propagation" a little later. Now we know that the genetic resource of a plant is any part of the plant that has the ability to reproduce that plant as a whole new plant. Is it clear now?

Runako

Runako:

Is it true that plant genetic resources can also be called PGR?

Teacher

Teacher:

Yes, PGR is the abbreviation of plant genetic resources. Shall we use the abbreviation PGR from now on?

(*The students nod their heads in agreement*.)

Teacher

Teacher:

PGR has a broad meaning because it includes the genetic material contained in all plant varieties found on earth.

Runako

Runako:

Do you mean that PGR includes the genetic information of all plants from all over the world?

Teacher

Teacher:

Yes. For example, the PGR of a particular species includes not only the genetic information of that species but also that of its relatives and traditional and modern varieties. All these together make the genetic diversity of a plant species.


Efia

Efia:

What is genetic diversity? Is this the same as the gene pool of that species?


Teacher

Teacher:

Genetic diversity means the genetic variation within a population of a species. The genetic diversity of a species is a crucial indicator of how that species copes over time within its environment. The genetic diversity constitutes the gene pool of a species.


Runako

Runako:

So, a gene pool is made up of all the genes in a population of a particular species and its relatives.


Teacher

Teacher:

Very good! So, let me see. Who can give us a brief note on PGR; Ekow?


Ekow

Ekow:

I understand that plant genetic resources in short, is called PGR and that PGR means the collection of plant "genetic" material from various plants and their relatives all over the world. This collection of PGR contributes to plant genetic diversity. The genetic diversity of a species is a crucial indicator of how that species will survive any change in the environment.


Teacher

Teacher:

Very good, Ekow.


Kunto

Kunto:

So, genetic diversity means a variety of gene material that belongs to only one species?


Teacher

Teacher:

No. There is genetic variability among the populations and the individuals of the same species. Genetic diversity of any species is the diversity of genes within that species and all its relatives, including the wild and domesticated relatives and all new improved varieties. The extent of diversity in a plant species depends upon the number of individual plants, where they grow and how far apart the individual populations of plants are separated from each other.

(The school bell rings and everybody gets ready to go to the next class.)

Scene Five

Wednesday morning

Scene Five: Wednesday morning

Place: Classroom

Characters: Students & biology teacher

Situation: A discussion on the importance of PGR

Cassava plant growing in a test tube

Cassava plant growing from callus

Cassava plant

Cassava root growing

Cassava seeds

Cassava root

Source: Floridata.com

Cassava shoot growing root

Scene Five:
Wednesday morning

Place:
Classroom

Characters:
Students & biology teacher

Situation:
A discussion on the importance of PGR


Teacher

Teacher:

Good morning class. Shall we continue our conversation on PGR conservation and use?


Efia

Efia:

Yes, but first I have a different question; is the genetic variety of plants useful in any way?


Teacher

Teacher:

Your question is not so unrelated to PGR conservation and use as you may think, Efia. Genetic variety is essential for a species and its populations to be able to adapt to changing environmental conditions and is therefore a prerequisite for their survival.


Ekow

Ekow:

Just like asking questions is a prerequisite for being inquisitive, Efia. **(*Giggles.*)**


Teacher

Teacher:

Ekow! Pay attention, please. Let us take the example of the cassava you were talking about. By the way, do you know the botanical name for it?


Ekow

Ekow:

No.


Teacher

Teacher:

It is called *Manihot esculenta* Crantz. Now, think of all the different types of cassava you see in gardens or markets; thin and long, thick and short, with a dark brown skin or a light colour skin and so on. All these varieties contribute to cassava genetic diversity.

Cassava field in Zambia

Cassava field in Venezuela

Cassava field in India

Cassava field in Brazil

Gathi:

I know we have many varieties of cassava in our country.


Gathi

Teacher:

Gathi, cassava does not only grow here in our country. Different varieties of cassava grow in many parts of the world. For example, cassava grows in Brazil, Colombia, India and many other places. Some cassava varieties grow under wild conditions. Some are domesticated and are grown as a crop. Some cassava plants are transformed in the lab to develop new or improved characteristics. All the genes belonging to this species contribute to the cassava gene pool and therefore to the cassava genetic resources.


Teacher

Mandisa:

If PGR is just the genetic material of all the plant species we have in the world, why should we conserve it? After all, these plants are present everywhere and, as far as cassava plants are concerned, we have lots of them.


Mandisa

Teacher:

Let me tell you about a real life experience to explain why we need to conserve PGR.


Teacher

In 1983, a scientist from Brazil led an expedition to collect some of the wild relatives of cassava from Mexico. He was looking for a cassava wild relative called *Manihotoides pausiflora*. He discovered that this variety was in danger of becoming extinct. This means that once we lose it we will never be able to grow it again.

Hadiya:

Is this how a variety becomes extinct?


Hadiya

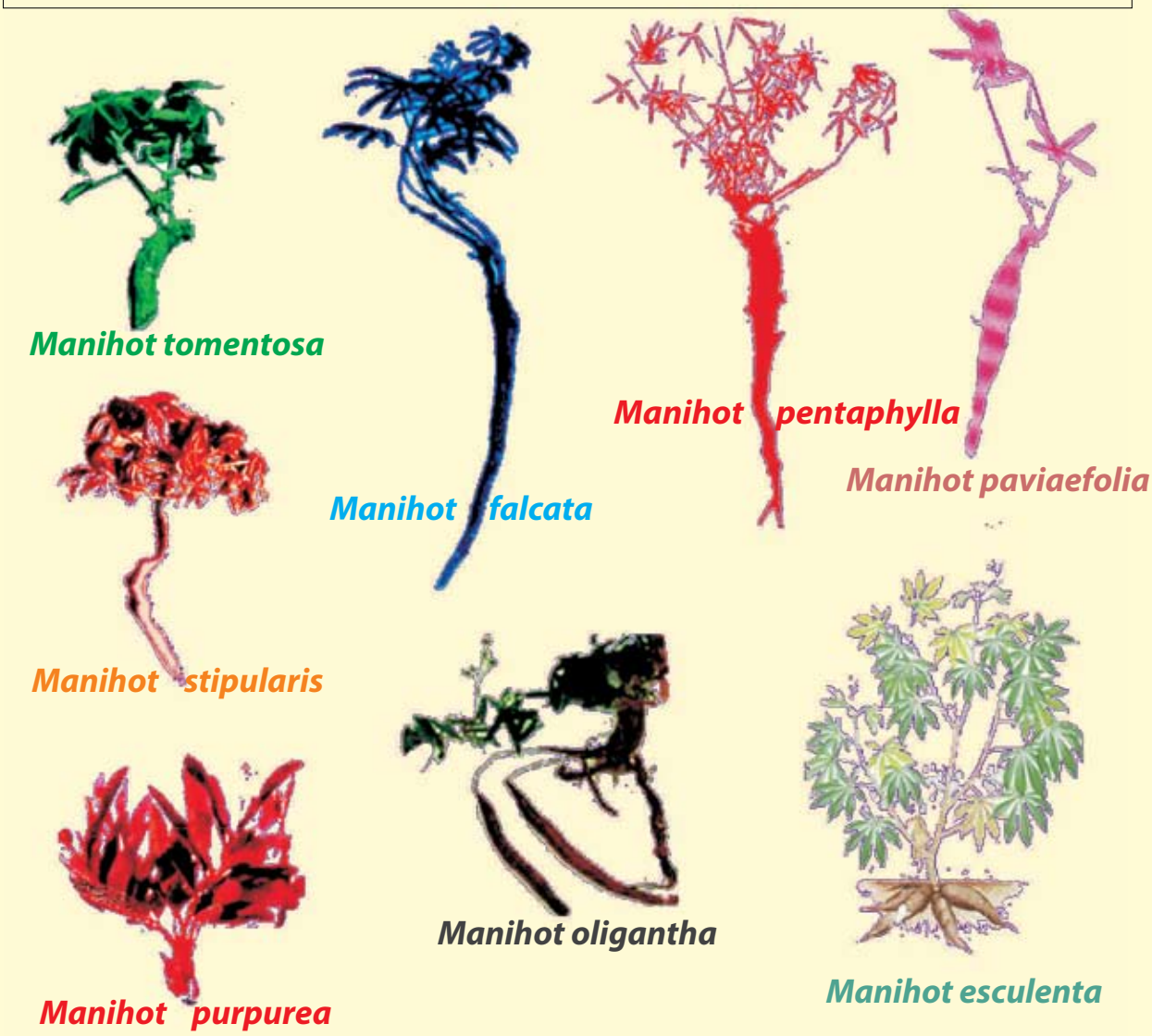
Teacher:

Yes, Hadiya, that is correct. However, we must be very careful before we declare a species extinct. This is because all species try to adapt to any bad conditions and will try to survive in different parts of the world until it is impossible for them to survive at all. Therefore, we must carefully search for the variety and verify its complete absence before condemning a species to extinction. On the other hand, you are right in saying that a species is lost to us if we can not find it when we need it. This is why we have to conserve it in a place where we can find it again. Therefore, a gene bank is a good place for storage.


Teacher

Genetic diversity in Cassava

Photo source: Geneconserve/ By Nagib M. A. Nassar



Variation in cassava leaf structure and appearance

Photo source: FAO

Ekow:

Tell us about the scientist, please. Why was he looking for wild cassava?

Teacher:

The scientist was interested in finding a specific species of cassava because this variety has three-lobed pubescent leaves which make it tolerant to both drought and insects. These primitive characteristics make it a strong candidate as a reputed ancestor of the genus Manihot. It can adapt to very dry habitats.

Efia:

Excuse me teacher, what does "pubescent" mean?

Teacher:

Pubescent means that the leaves are covered with fine, hair-like structures. These leaves can retain water better than those that do not have these structures.

Now, to get back to our story, the scientist had heard that this plant had last been seen in the period from 1921 to 1960 in a place called Tehuacan in Mexico. He went to visit the site and found that a road had been constructed near the area and all these plants had almost disappeared. He knew that many varieties of crops such as cassava were disappearing as a result of pests and diseases, natural catastrophes and rapid socio-economic changes, such as changes in diet or urban migration. Yet, this endangered diversity is vitally important. Each variety has particular characteristics, requirements, advantages and disadvantages. We need the genetic information from a particular plant variety in order to crossbreed this plant with another variety. For example, a cassava plant with characteristics such as disease resistance can be crossbred with a variety of a cassava plant that has drought-resistant characteristics.

That is why it is important to know the genetic information of all available cassava varieties and to try to conserve their genetic resources.

Now, it is time for the next class. I will see you all again on Friday. In our next class we will talk about how the knowledge of biotechnology helps in PGR conservation.