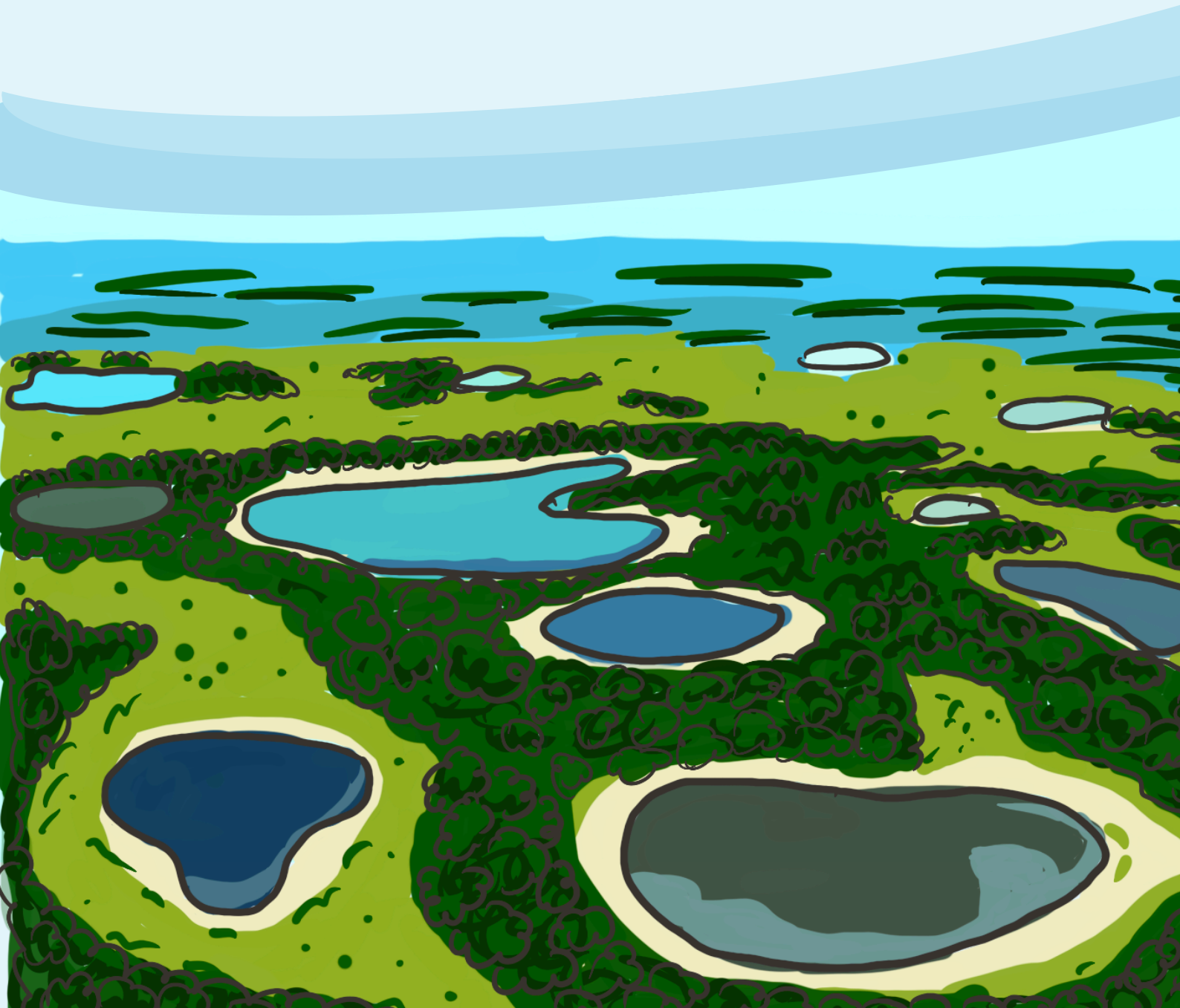


Solinho in the
Pantana

Soil and water: sources of life





Departamento de Ciência do Solo
Programa Ponte Solo na Escola



2nd edition

Book produced for the [Children's Book Contest 2023](#) promoted by the United Nations Food and Agriculture Organization (FAO), International Union of Soil Sciences (IUSS) and Global Soil Partnership (GSP) about soil and water: a source of life.

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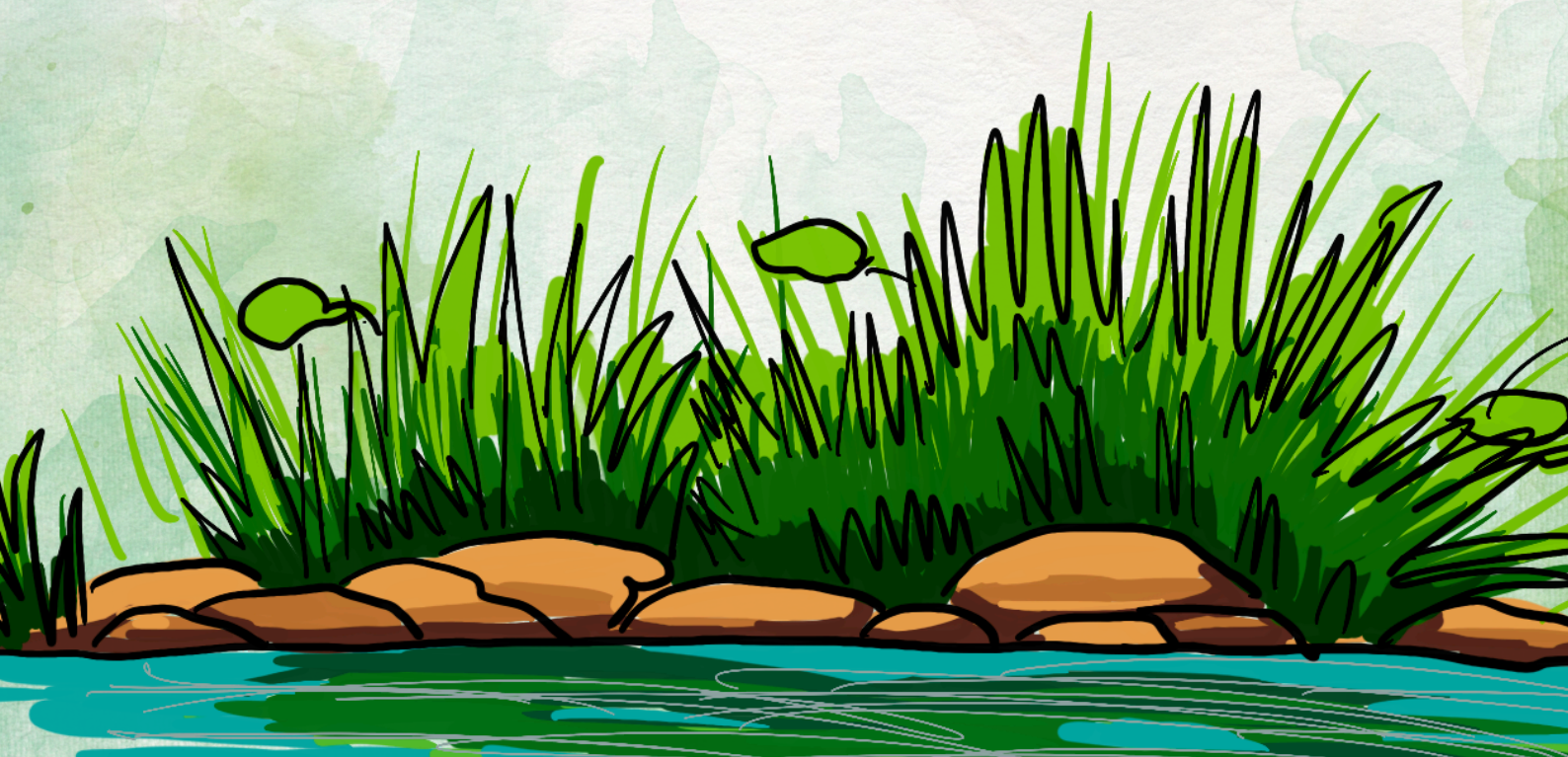
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Introduction

This story is set in the **Brazilian Pantanal**, the largest floodplain on the planet.

Water is vital to the functioning of this ecosystem. When there isn't enough water, there are changes in the physical, chemical and biological dynamics of this place, affecting the flora, fauna and human beings who live there.



Tuiuiú is known as the great sage of the Pantanal, due to his experience and knowledge about the region, passed down from generation to generation over time.



Reflecting on the edge of a small pond, Tuiuiú realized that there were no plants there.

Curious, he flew over the Pantanal. He saw very few plants. Next to a jaguar that was quenching their thirst in a small pond, he stopped to talk to some friends, who ate plants as their main source of food.



They were dejected, they hadn't found their favorite food in a long time. It seemed to them that they were all disappearing from the Pantanal.

Really, it was a mystery. Looking around, he noticed that several plant species were disappearing.

Perhaps Solinho could help to solve the mystery.

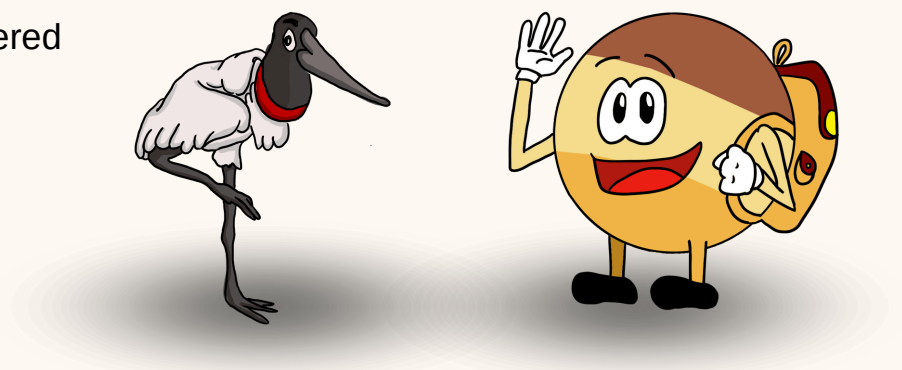


Solino, still in the Cerrado, said goodbye to that adventure and went straight to the Pantanal, curiously answering the call of his old friend Tuiuiú, who asked for help to solve a mystery.

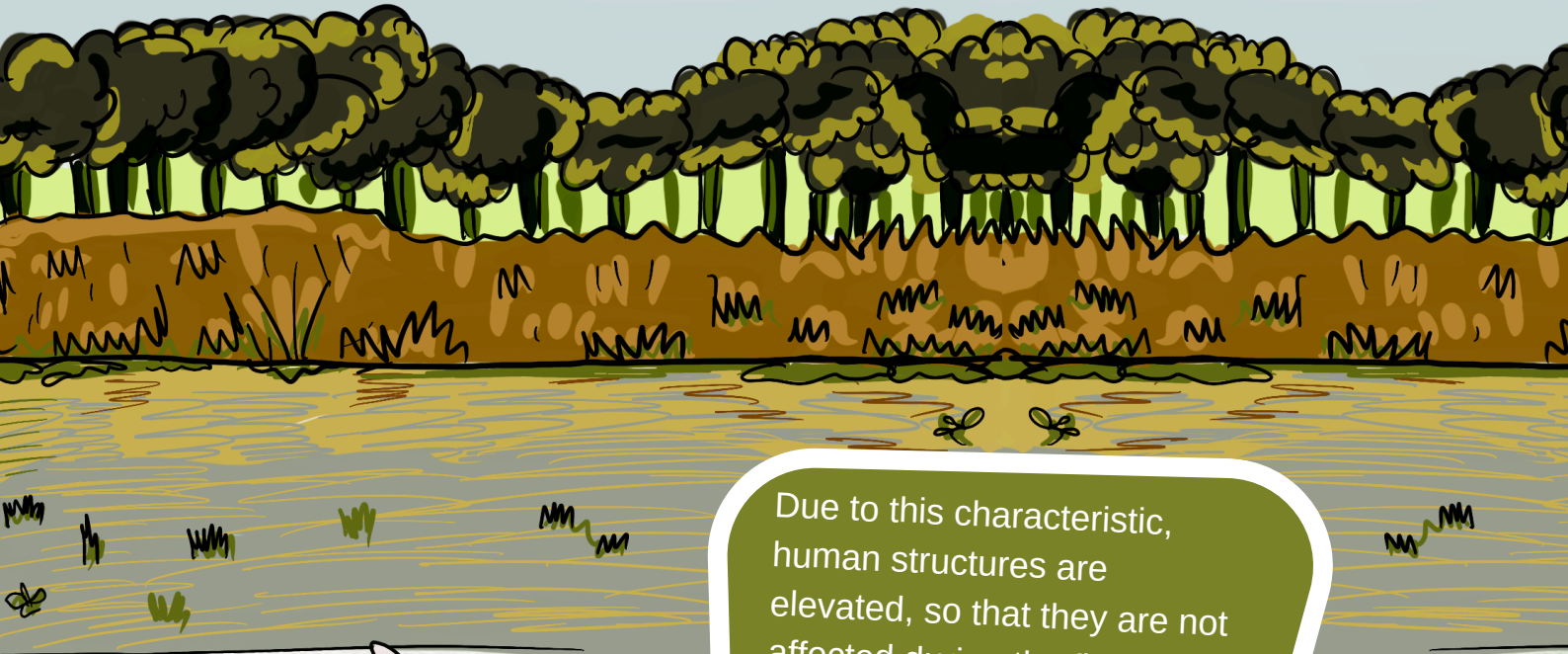
Along the way, he observed that the Pantanal landscape had changed since the last time he was there, a few years ago. Is that the mystery?



Full of joy at meeting again, Tuiuiú and Solinho remembered Solinho's last visit to the Pantanal.



The **Pantanal** naturally has two characteristic landscapes: some regions where the soils are constantly underwater and others that go between dry and wet, with about 5 months of rainfall and 7 months of drought.

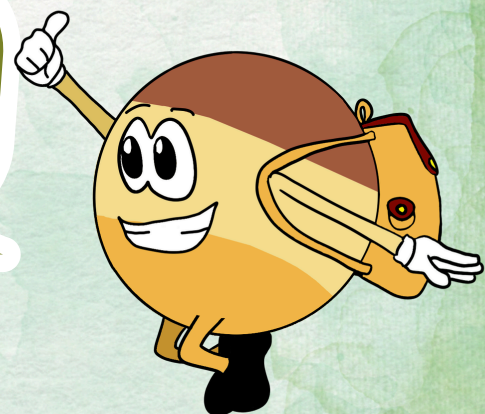


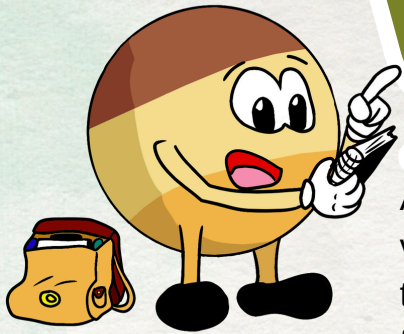
Due to this characteristic, human structures are elevated, so that they are not affected during the flood season.



Solinho marvelled at the thought of all the reactions that water causes in the different components of the landscape and soil, such as organic matter.

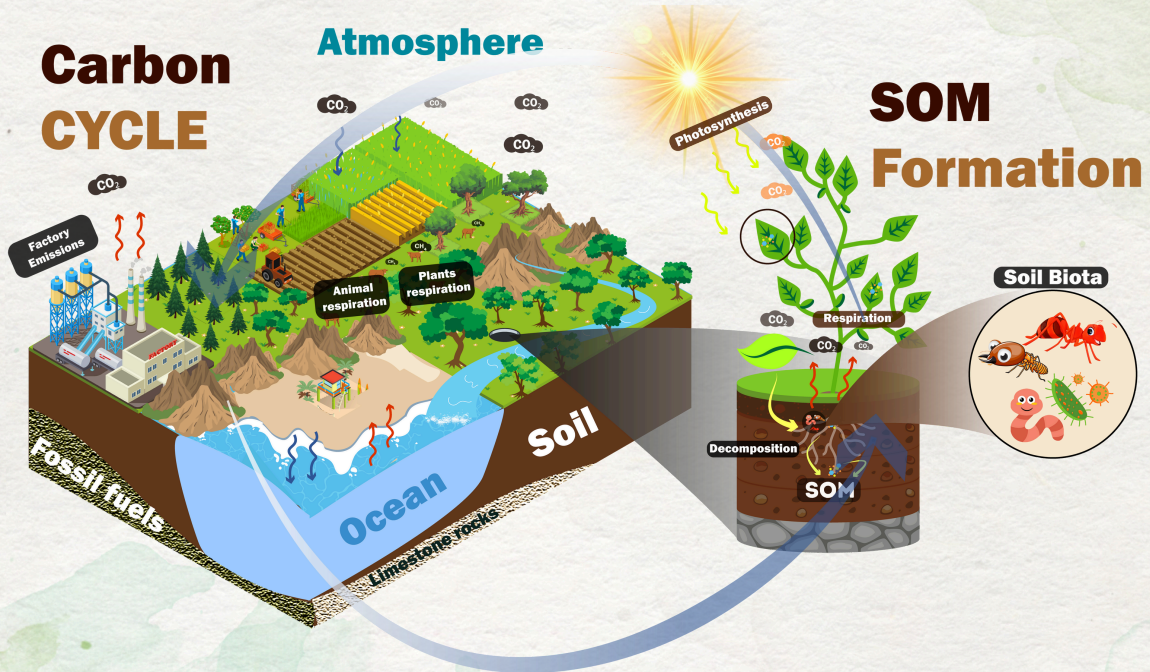
To understand the dynamics of these soils, it is necessary to understand the carbon and water cycles.





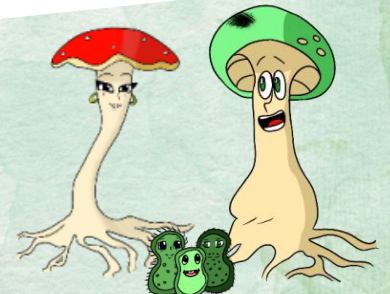
Organic matter is material composed of carbon, such as the leaves from trees that fall to the ground.

All **organic matter** is broken down by the various organisms in the soil, such as earthworms, termites, and beetles. The process is finished off by fungi and bacteria.

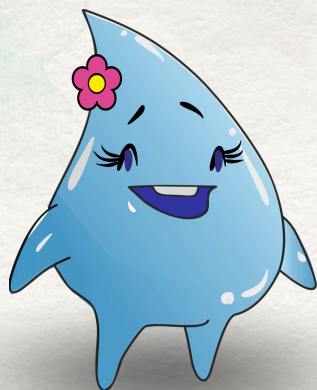


These organisms need air to breathe. When the soil is waterlogged, they run out of oxygen and the process of decomposing organic matter becomes very slow.

The process of decomposition leads to the build-up of organic matter in the soil and at the bottom of ponds, making it an important nutrient store.



In addition, to understand the dynamics of water in the Pantanal, it is also important to understand the connection between biomes, which are environments that are home to different types of plants and animals. And to help with the explanation, Solinho called Aguinha.



In the Pantanal region, a very interesting kind of magic occurs...

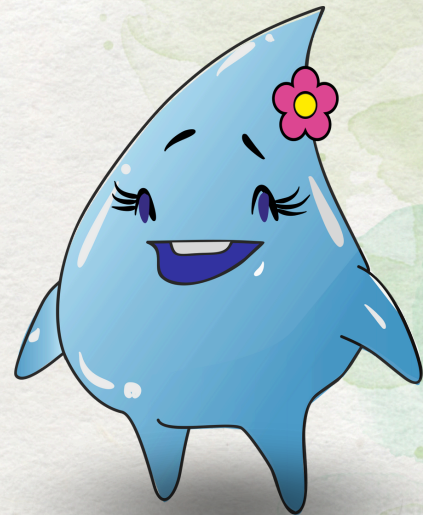
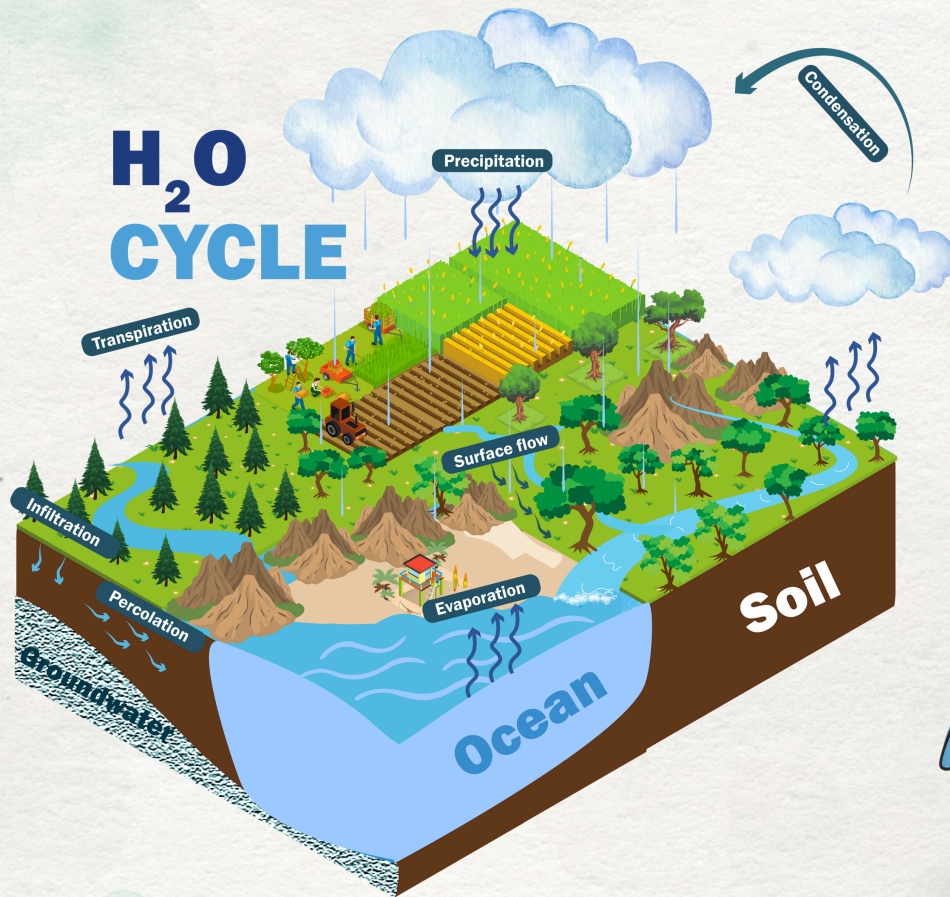
Aguinha went on to explain that the Pantanal is supplied by water that drains through the soil from other places, especially the Cerrado. The water of the Cerrado, in turn, depends on transpiration from the Amazon Rainforest. The more water the forest puts into the atmosphere, the more rain falls in the Cerrado and the more water drains into the Pantanal, forming a unique landscape. A flying river (as it has been dubbed by scientists) made of water droplets forms over the forest and flows into the Cerrado, where it falls down as rain, and it is there that the magic happens.



During the Ice Ages, all of these regions were interconnected.

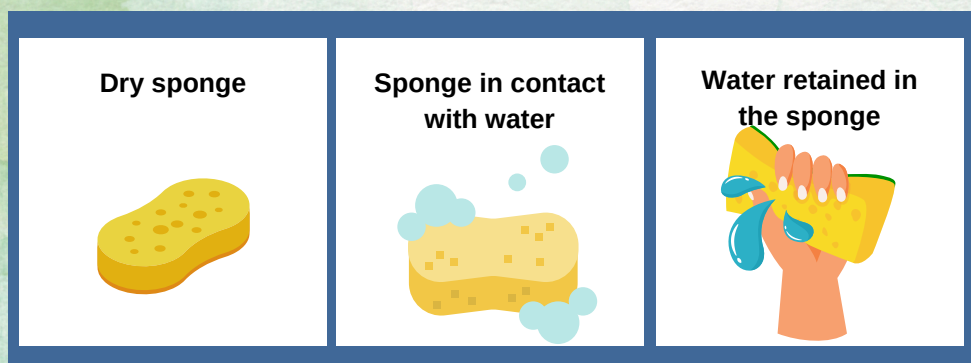
To learn more, [click here.](#)

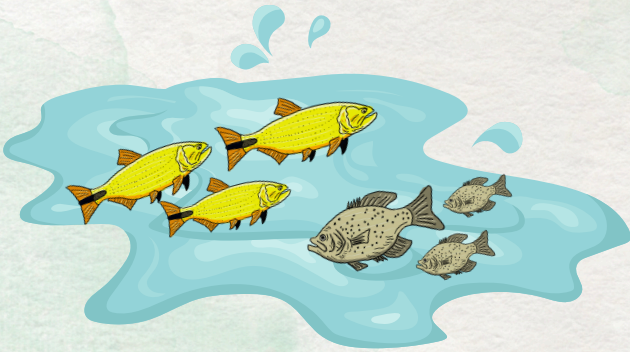
Water that falls from the sky in the form of rain can be trapped in the treetops or fall to the ground. The drops that reach the ground can go into the soil, by a process called infiltration, or flow over the surface, in a process called surface runoff.



Water that enters the soil can be stored in very small pores, called micropores, or reach deeper layers in the percolation process.

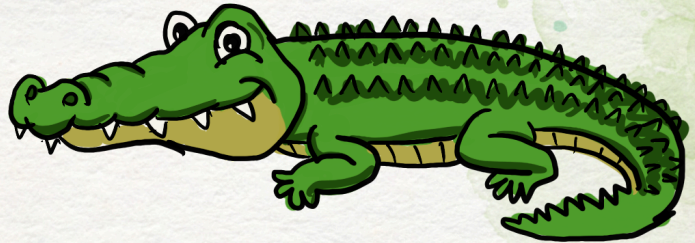
Experiment: to understand the soil porosity





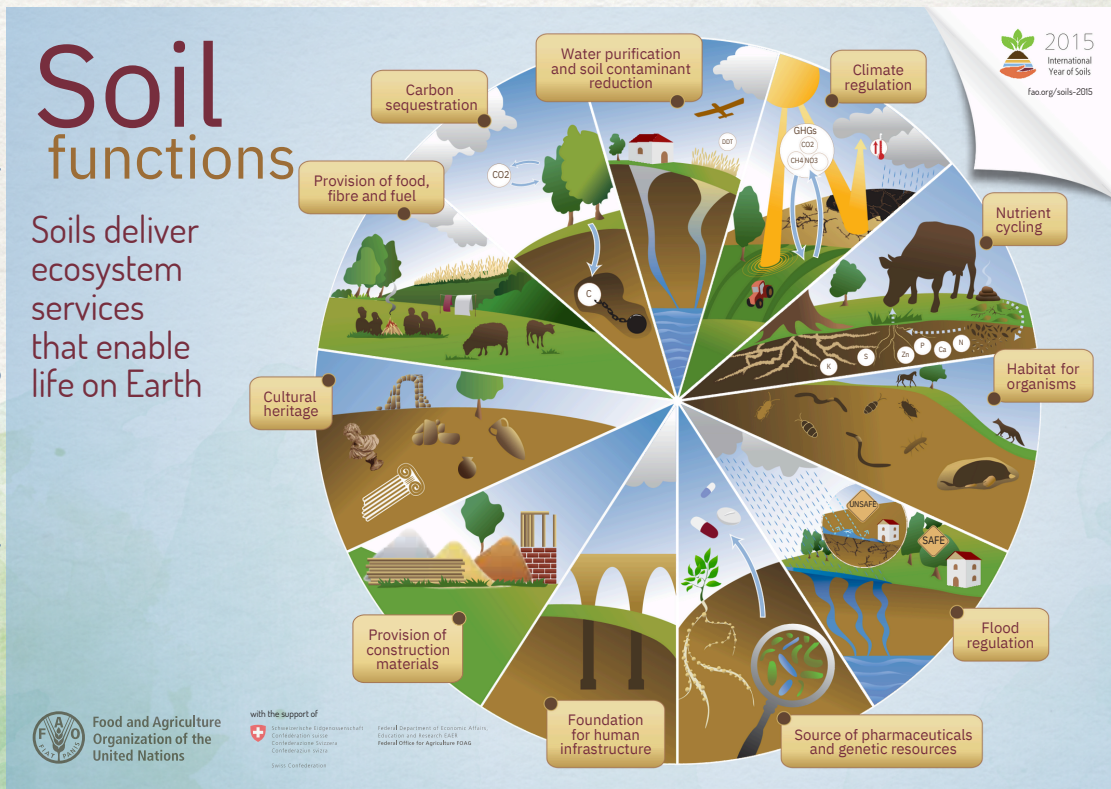
In times of flooding, fish migrate to the Pantanal – where they form a kind of nursery. In the next flood, the hatchlings leave the lagoons and move to the Pantanal rivers.

In the dry season, animals like our friend alligator are concentrated in the lagoons full of food. When the rainy season arrives, the fish scatter.



Aguinha also explained the functions of soil in the hydrological cycle and the influence of soil on the quality and quantity of water available to plants.

Source: <https://www.fao.org/3/ax374e/ax374e.pdf>



Thus, soil and water provide several important environmental services for the maintenance of life on Earth.

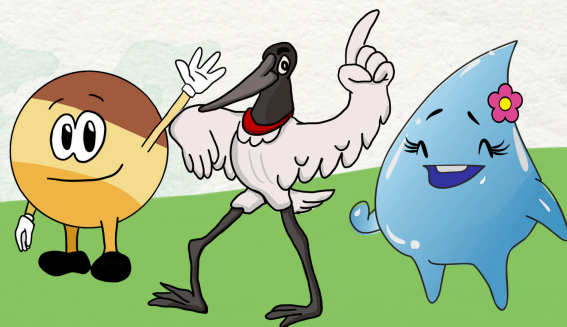


There is more water stored in the soil than in ponds and rivers.

Each type of **soil** has a certain water holding capacity, which is important for plants, and also varies in the amount of water it will drain. The water it drains supplies aquifers (groundwater), springs and rivers.

Water from rivers, oceans and soils evaporates, contributing to the formation of clouds. Plants, on the other hand, have the ability to transpire water, where the water comes up from the roots, through the plant and out of the leaves. The two processes together are called evapotranspiration.

This magic has been happening for billions of years, where water meets the soil, returns to the atmosphere and falls back to the earth again, and makes the cycle of life happen.





Tuiuiú reflected on the conversation about organic matter and water, then told Solinho and Aguinha that plants only grew consistently in regions that were flooded for a long time. This brought him back to the reason for his call to Solinho.

“Yes, but the Pantanal no longer follows this magical cycle. Many of the soils that were once always flooded are now dry. And some places where there was once a lot of rain are dry now too. It seems that the water is disappearing.

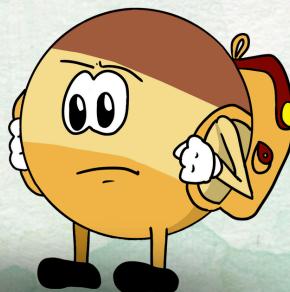
On my flights over the Pantanal forests and lagoons, I noticed that rainfall is also scarce. The ponds have begun to dry up and there aren't as many fish as before.



There are also fewer fruits on the trees and diving in the lagoon is no longer enough to cool off the jaguars.

And it is these areas that, in recent years, have suffered the most from water scarcity.”

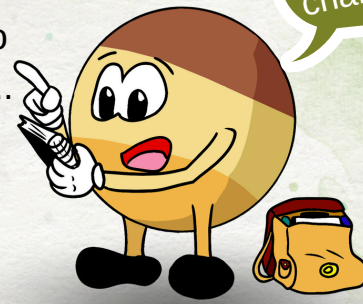
If the water is not coming here to the Pantanal, does it mean that the Amazon Rainforest is no longer transpiring?



It is still transpiring, but much less than before, so the rainfall in the Cerrado has been reduced, and less water is reaching the Pantanal.

These **changes** have been driven by events such as fires, the reduction of vegetation on the banks of rivers and lagoons, emission of greenhouse gases into the atmosphere, pollution of water sources...

Climate change is a significant transformation in the planet's climate patterns over time.



In 2020, the Pantanal suffered from fires that affected 30% of the area of this biome. These fires have caused habitat destruction and the death of several species of animals.

In the southern region of Brazil, there is more rain than has ever been seen before.



Solino then remembered a conversation he had with the Maçaricos, who brought news from different parts of Brazil. They told Solinho that these changes are also taking place in other parts of Brazil.



In the Amazon, for example, there are many areas being cut down and burned. There is less evaporation of water into the atmosphere, which reduces the level of rainfall. As a result, the fire spreads quickly through the dry land.



Record fires in the Pantanal in 2020

There were 2,534 wildfires in the Pantanal in the first half of 2020, an increase of 158% over the same period in 2019 according to data from the Brazilian National Institute for Space Research (INPE). Analyses by...

 Revista Pesquisa Fapesp

To learn more, click here.

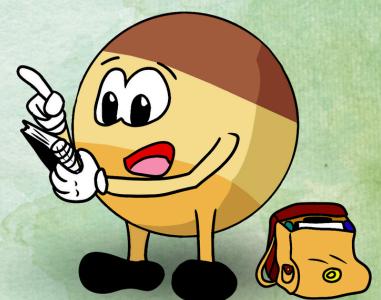


Pantanal wildfires killed 17 million animals

The unprecedented number of wildfires in the Pantanal in 2020 left an extensive trail of destruction, taking the lives of nearly 17 million animals. A group led by veterinarians Walfrido Tomas from EMBRAPA...

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The **news** was not good, the future of his generation and of the entire Pantanal ecosystem and other regions were at risk.

Direct effect

The drying up of the ponds can cause the loss of the organic matter accumulated in the soil, releasing carbon into the atmosphere in the form of carbon dioxide and contributing even more to global warming.

Indirect effect

Burning reduces the soil organic matter, consequently reducing the water-holding capacity of the soil.

Friends reflect on the consequences of these changes.

Climatic events are becoming more and more intense with a lack of rainfall in some parts and excess in others.



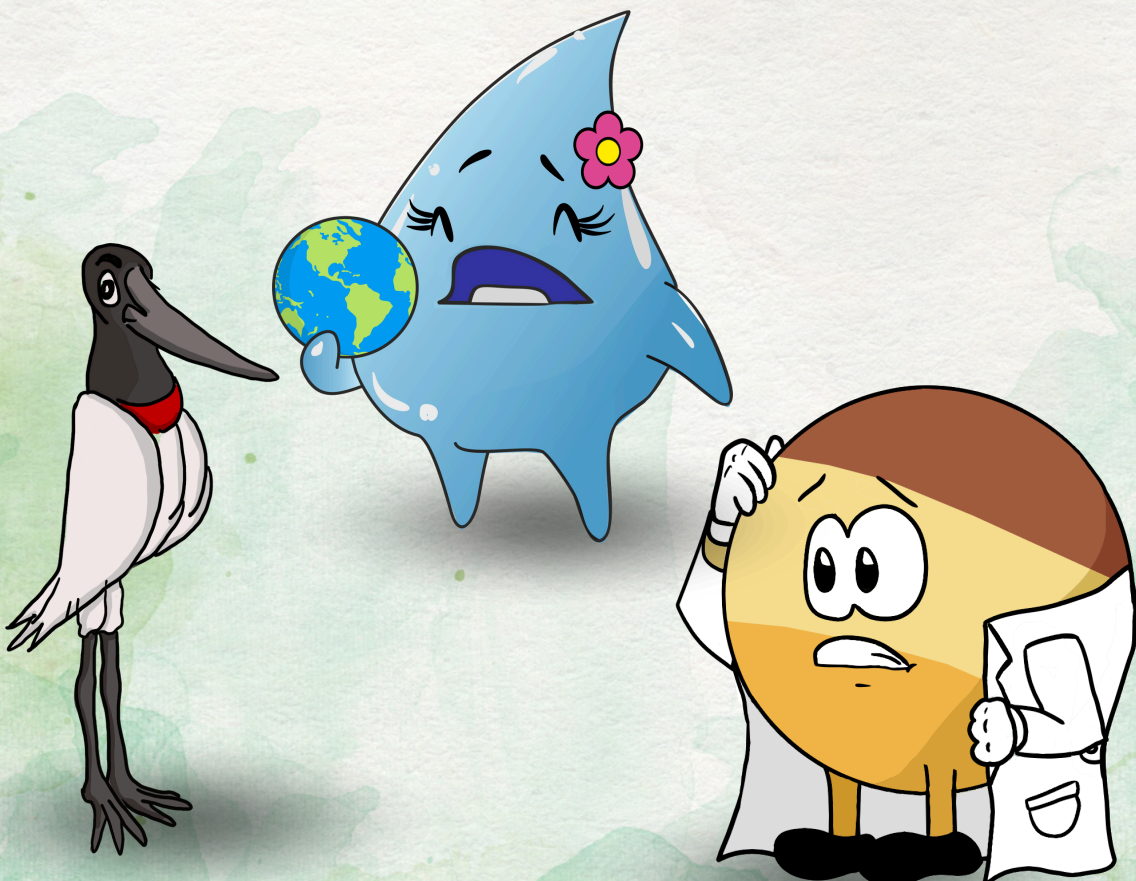
Aguinha listened attentively, then reflected: "What happens in the Amazon and the Cerrado has repercussions here and in many other regions."



Deforestation, fires, the indiscriminate use of natural resources and the emission of greenhouse gases affect the balance of the climate, causing an increase in temperature and changes in the rainfall regime in different biomes of Brazil and in different regions of the planet.

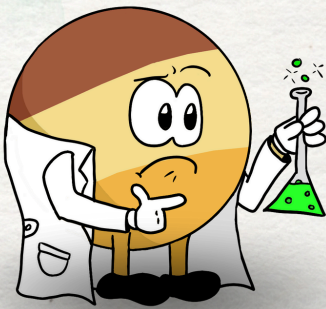
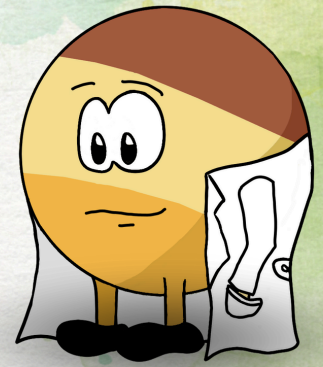
All these poorly planned actions can cause the extinction of different species, such as the plants that are disappearing here in the Pantanal. These changes can cause irreversible damage to ecosystems if everyone doesn't come together to protect them and do everything they can to help recover those areas that are already degraded.

A long silence fell between the friends.





But **Solinho** and **Aguinha** knew they needed to reassure their friends that there is hope.



So, Solinho highlighted the importance of knowing the secrets of nature and commented that his scientist friends have sought to understand them, including through invisible phenomena, for example by using equipment capable of measuring the emission of greenhouse gases into the atmosphere.

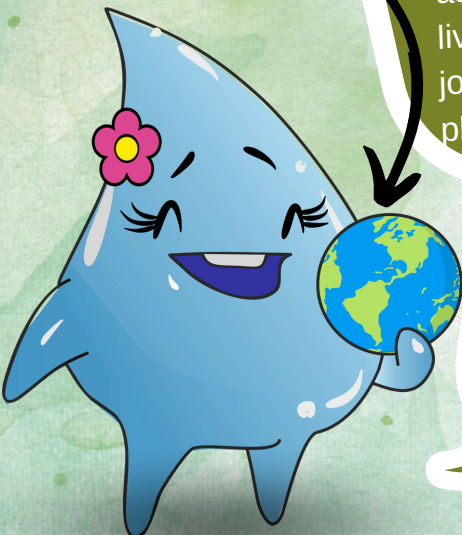
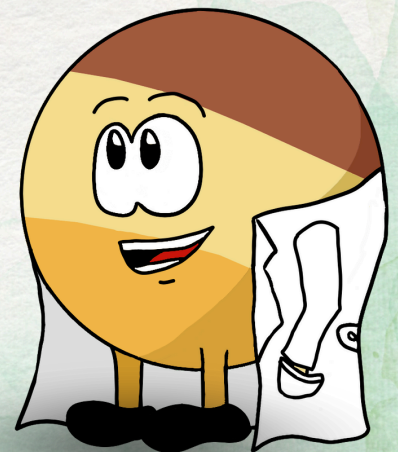
It is possible to reverse what is happening. To do this, it is necessary to develop actions and practices that ensure that soil and water remain in balance. Only then will they be sources of life.

But it is necessary that all the organisms that inhabit planet Earth unite and do their part. This is especially for humans, because when their actions are poorly planned, they end up affecting animals and plants, who can do nothing, but are the ones who suffer the most from the consequences of climate change.

To learn more, click here.

Many humans have already started to make a difference through positive initiatives that are succeeding, such as the integrated use of crops and livestock and networks that seek to join forces for the balance of the planet.

Everyone needs to come together to find the global solution, as the different ecosystems are interconnected and affect each other.



Returning to balance, the plants and animals that are disappearing from the Pantanal and other regions of Brazil and the planet will be able to grow and develop again.

Solino, Aguinha and Tuiuiú know that reaching balance again takes time and persistence. But the first steps must be done as soon as possible!

The end

