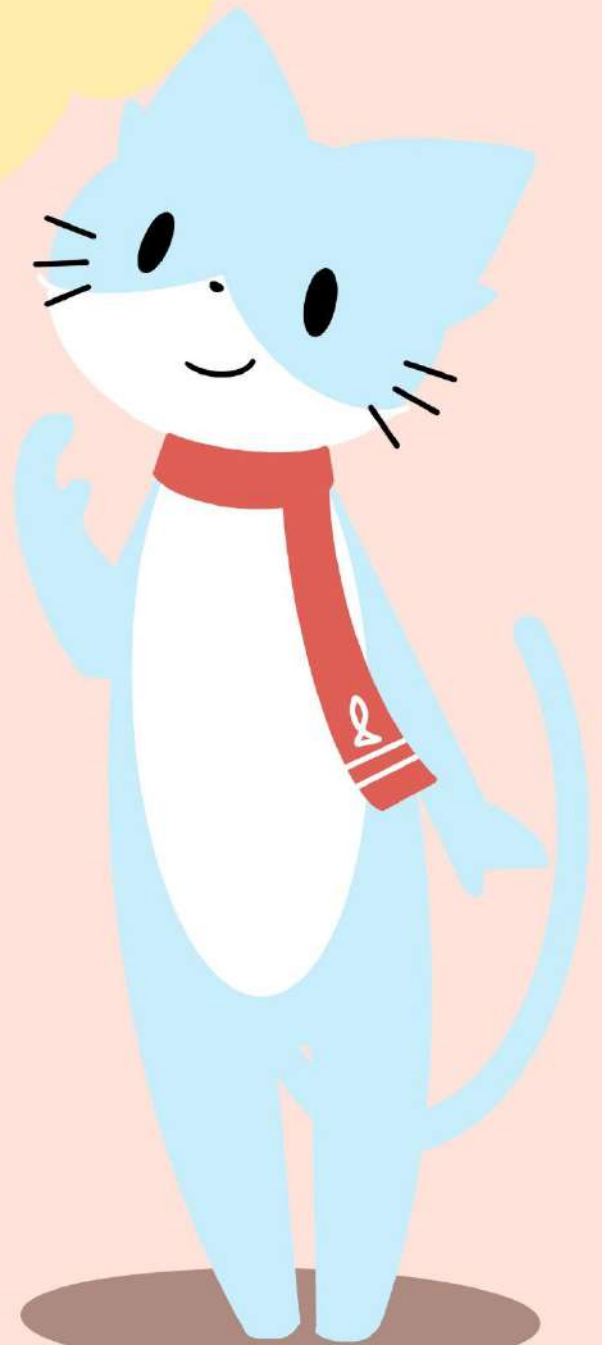
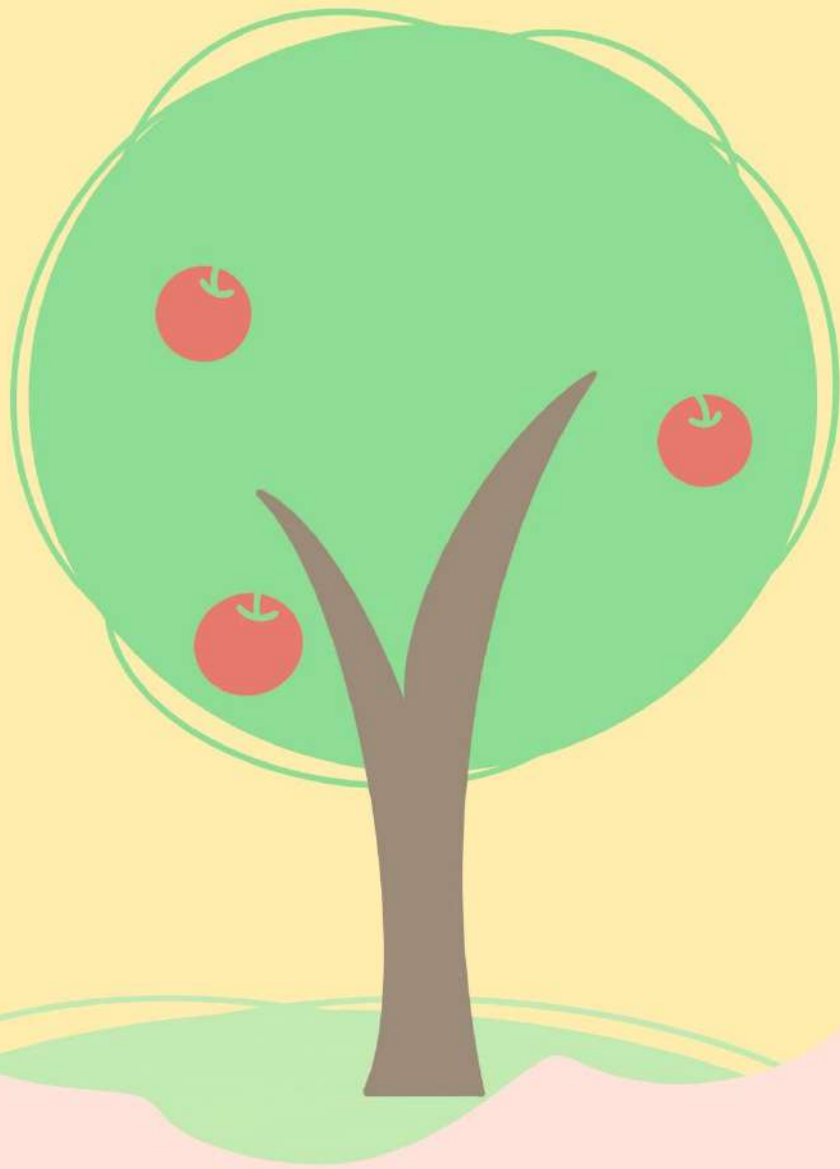


Cookie's Apple Dream



Written by Frederick Asankom Dadzie, Chen Han
Illustrated by Ao Chen Art designed by Chen Han



Cookie is a cat and her favourite foods are fish and apples. She likes apples because they are sweet, juicy, and full of Vitamin C!

Cookie lives with her family and many friends in a small coastal city. Her parents have a farm which is not doing very well. So, she decided to plant an apple tree in spring so that she can eat apples at all times and also sell to earn money. She will use the money to buy fish.

That is cookie's apple dream: she wants to plant a big apple tree.

In spring, Cookie is excited to buy an apple tree from uncle giraffe's tree store. She has chosen a lively one with green leaves.



With the help from daddy and mommy, the apple tree was planted in the corner of their farm.

However, when they were planting the apple tree, Cookie found that the soil was very dry and looked white. The other plants also looked sickly.



Cookie worried about the situation, as she really wanted the apple tree to grow. She put some chemical fertilizer, and water from a nearby stream to water the apple tree.





One night, cookie had an apple dream. In her dream, the apple tree grew very tall from the earth to the moon. There were red, green, and yellow apples on the tree. Cookie ate so many apples and she was very happy.



In the morning, cookie quickly woke up to check on the apple tree.

But when she arrived to the farm, the sight made her sad. The apple tree looked sick, and the leaves curly, dry and many fallen off.

Cookie wanted to save the apple tree and her apple dream. She went to explain the situation to her science teacher Elephant.



Teacher Elephant: Cookie, what you see in your farm is a perfect example of the effect of soil salinization on plant. If you want to save your apple tree, you need to save the soil first. Our soil is facing salinization problem now.

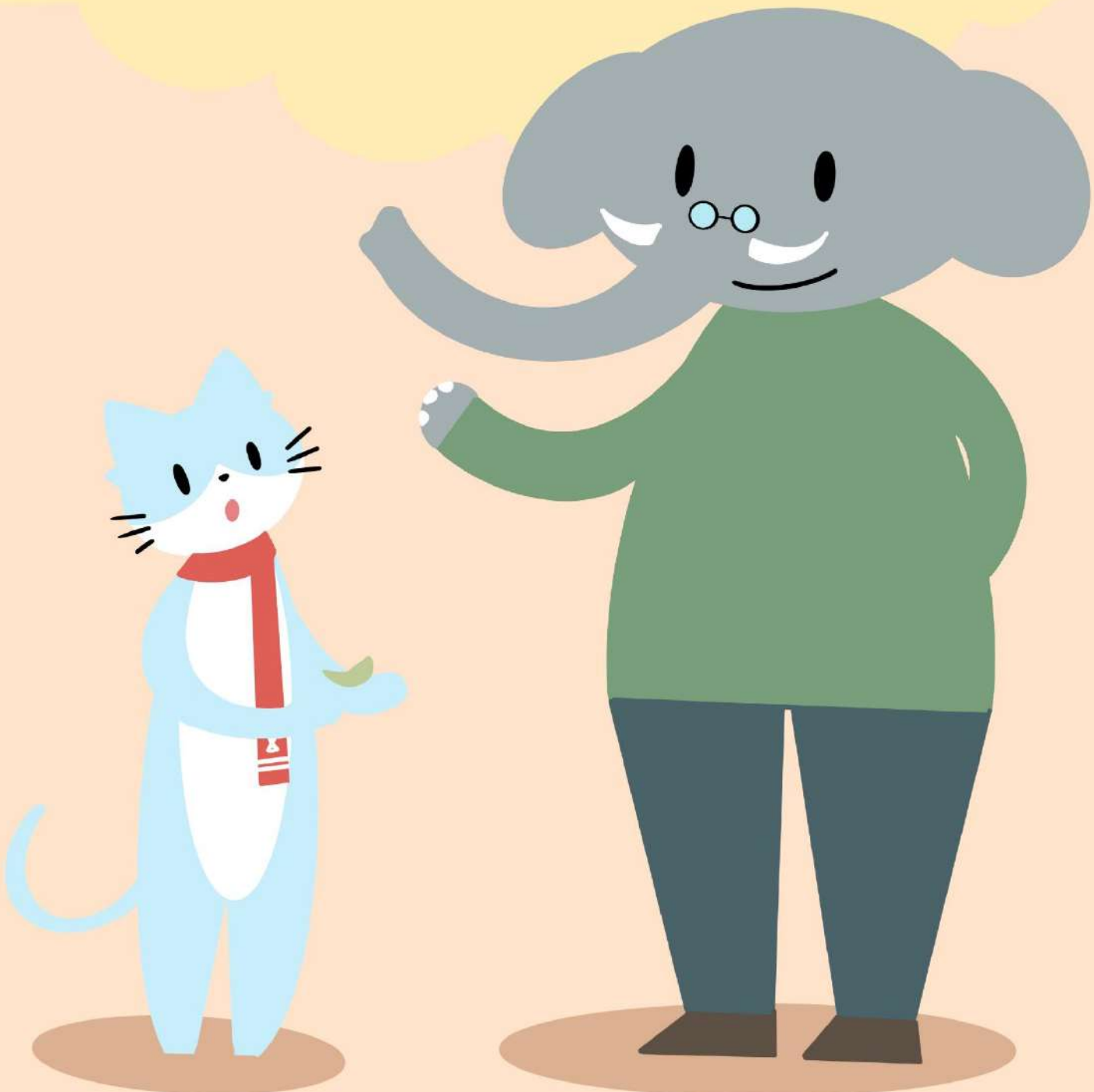
Cookie: What do you mean by soil salinization?

Teacher Elephant: soil salinization is when the soil contains excess salt such that it negatively affects soil productivity and plant growth¹.

Cookie: How does this happen?

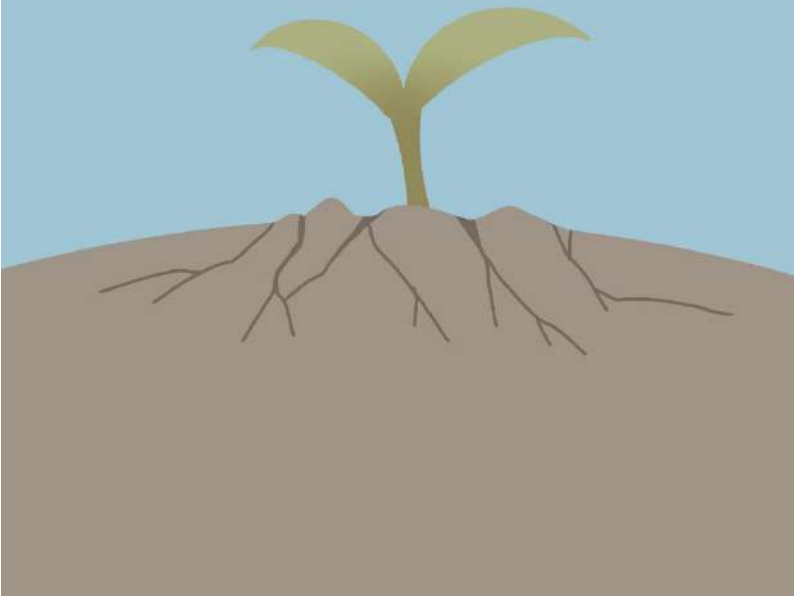
Teacher elephant: Breeze from the ocean can transport salt to the land² or rising sea level can intrude into the land³. Because we live in a coastal area, these two might be possible.

Teacher elephant: Sometimes, wind-blown aeolian dust can be a source of salty soil⁴. Also, when you have salty underground water, it can rise to the land surface and make the soil saline⁵. All these are natural processes that make the soil saline. But humans can also cause the soil to be saline. As an assignment, find out how humans cause soil salination and how to prevent it.



Cookie discussed the problem with her friends.

Cookie: Hello friends! Do you know how humans can make the soil saline? I want to prevent it!



Fox: Hmm!!! I know that, in winter, people use salt to thaw the ice from the streets. This salt can enter and remain in our soil⁶.

Rabbit: Chemical fertilizer are made in salt form, so when we apply to the soil, it can make the soil saline⁷.



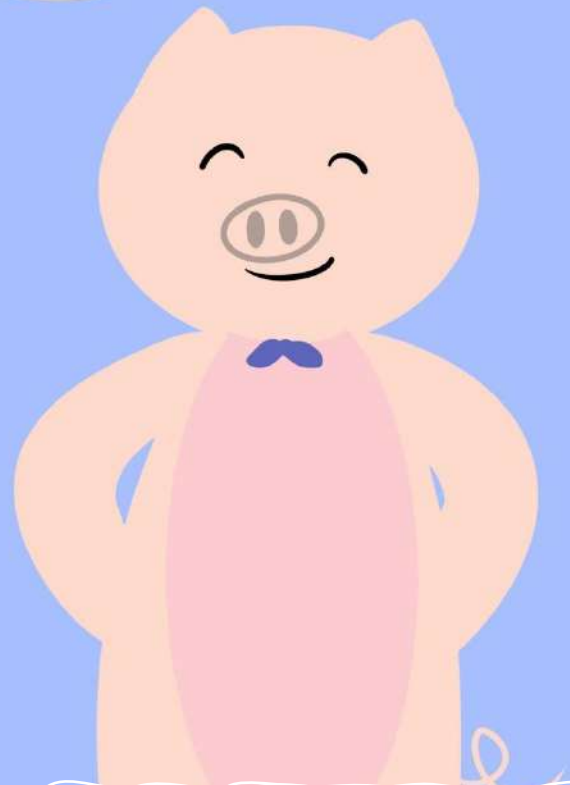
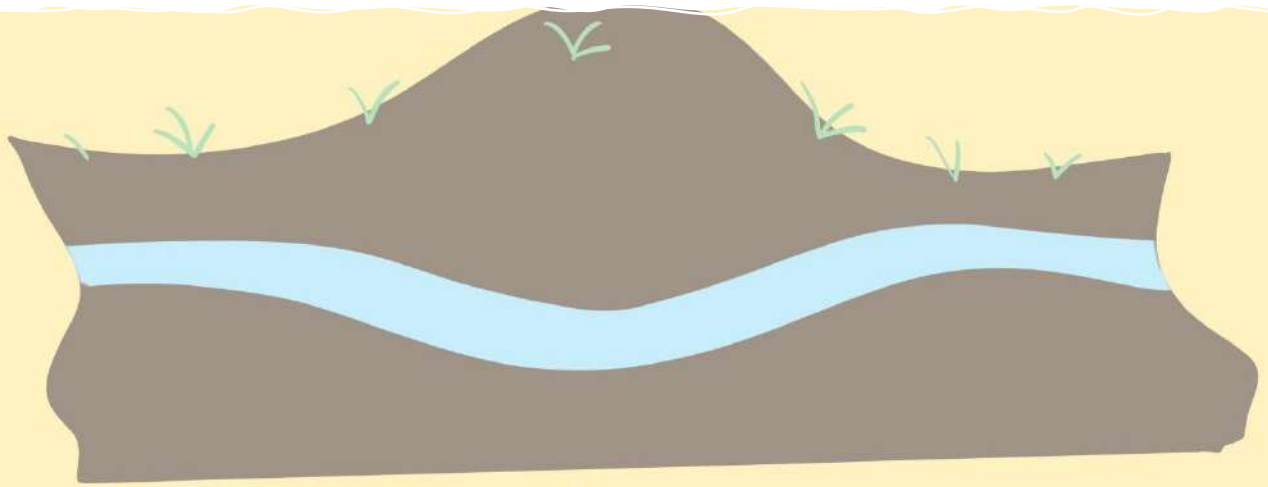
Raccoon: When we irrigate plants with waste water containing salt, this can also make the soil saline⁸.

Pig: Cutting down deep-rooted trees can also cause soil salinity.

Cookie: How does cutting trees affect soil salinity?

Pig: Trees with big roots prevents underground water from rising to the soil surface. When the trees are removed, salty underground water easily rises to the soil surface to make it saline⁹.

Earthworm: That is brilliant Pig. Where did you learn that?



Pig: Haha!! I care about our planet so I like to read things that I can do to make our planets a better place to live. Afterall, we only have one planet to live on.

Cookie: Where do you read them?

Pig: When I am free, I go to FAO website ([Food and Agriculture Organization of the United Nations \(fao.org\)](http://www.fao.org)) to learn about the soil, plants, and many other things.

Cookie: Amazing!! But I am still confused. When mommy cooks, she uses salt to make the food taste better. Why does having salt in the soil make the soil worse?

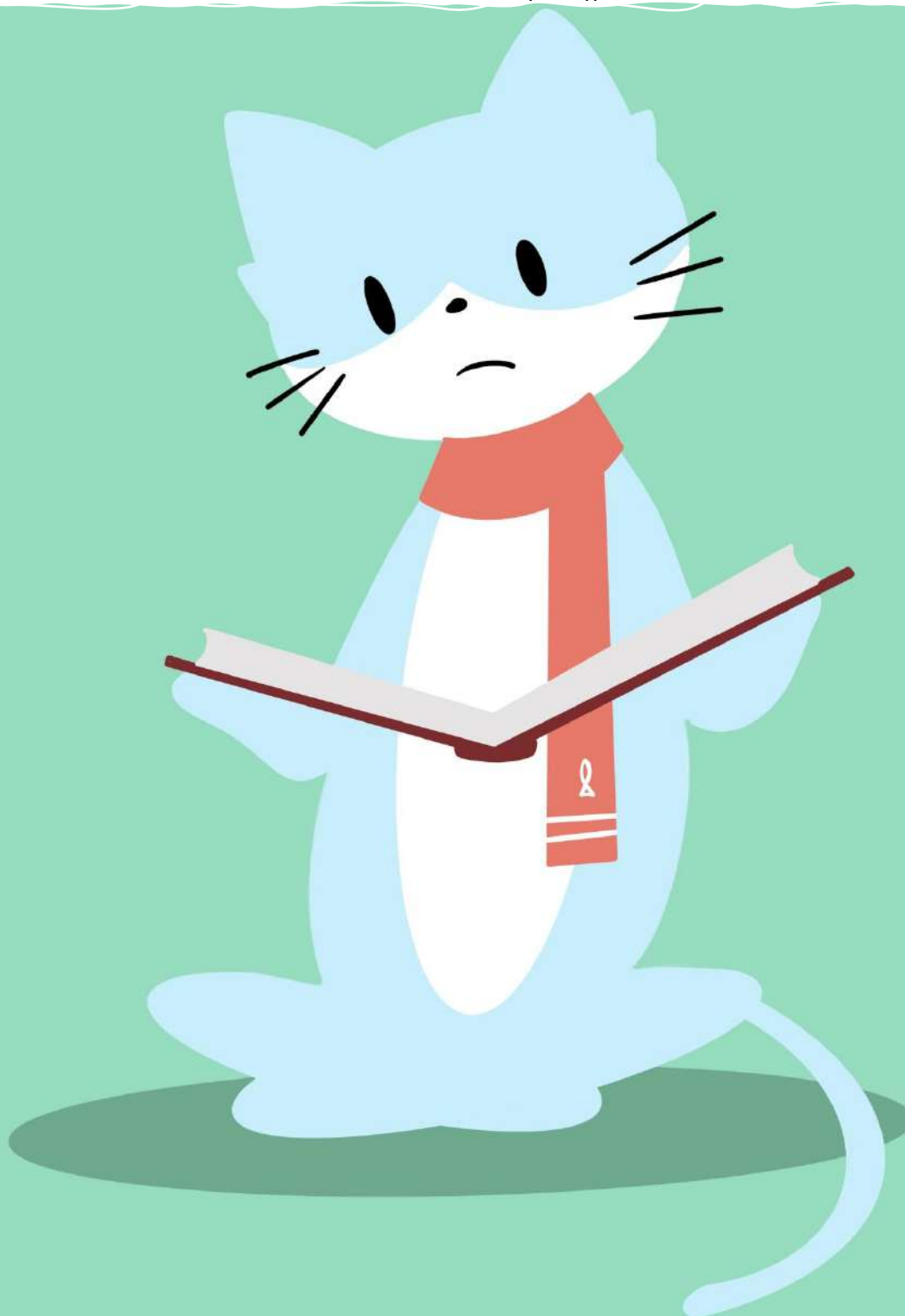
Earthworm: Cookie! what tastes good for humans is not always good for the soil. Excessive salts may not be good for the soil. Soil salination changes the soil ion balance, destroys the soil structure, makes the soil friable and dry¹⁰. Many microorganisms are unable to live in these saline conditions¹¹. Do you realise that even me (earthworm), I changed my house from the farm to live in the compost nearby? Too much salt in the soil makes me sick¹². Not only me, but plants also find it hard to live in such soil and can easily dehydrate¹³. As a result, the soil will have less productivity and affect the livelihood, ecosystems, and economy of the people. I think Cookie, you did all the things to make the soil worse, that's why your apple tree can't grow.

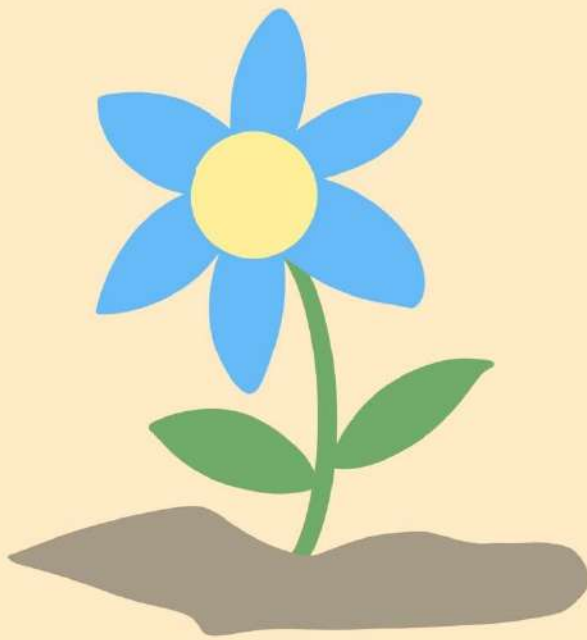
Cookie: What can I do to make my apple grow?

Pig: Okay friends, let us go to the FAO website to read more about how to 'halt soil salinization and boost soil productivity'.

Cookie and her friends research on ways to repair saline soils and found the following methods:

- Replace chemical fertilizer with organic fertilizer
- Use clean water to irrigate the farm.
- Plant trees in the land to keep the water table low
- Add gypsum to the saline soils
- Plant salt tolerant species
- If the salinity is in a small area, flush with lots of water
- Improve the soil structure by adding biochar
- Use cyanobacteria or salt tolerant bacteria as an inoculant plant growth





Cookie: We have so many options to choose from. Which one can we do now to save my apple tree?

Dog: Sure!!! The first one says we should replace chemical fertilizer with organic fertilizer.

Cookie: Isn't organic fertilizer very expensive?

Dog: No. When you buy and use cheap chemical fertilizer, you will spend more money again to repair the soil when it becomes saline. But if you use organic fertilizer, you will not have the extra cost of repairing the soil. So organic fertilizer is cheaper in the long term compared to chemical fertilizer.

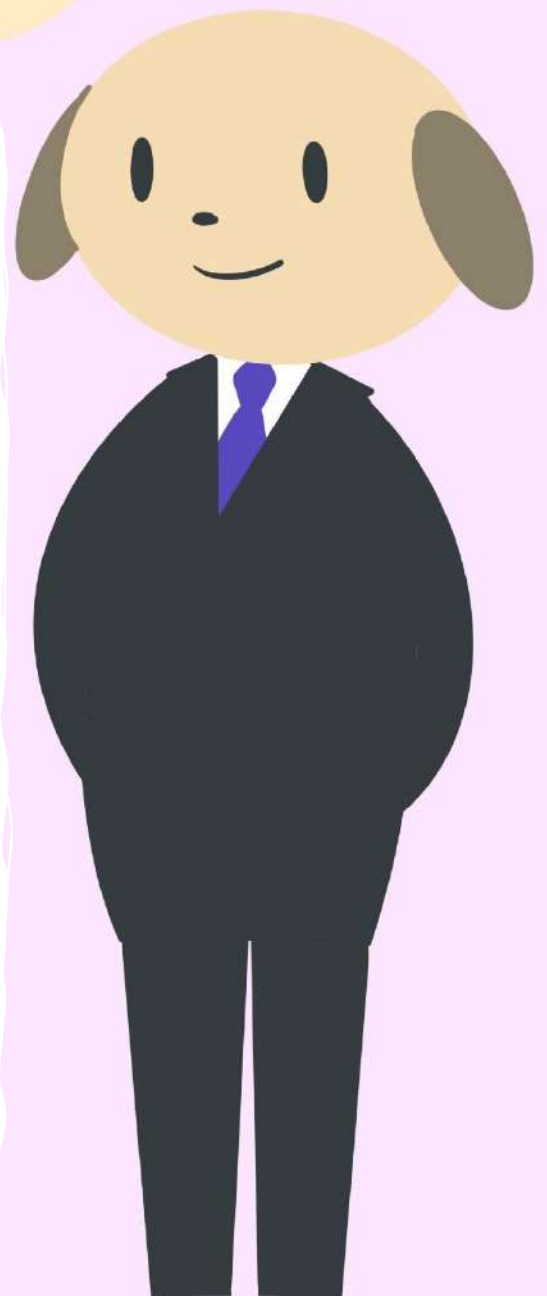
Rabbit: You explain it so well Dog, but you can make compost at home and apply to the soil as well. This is super cheap and easy to do.

Earthworm: Yes!!! Adding organic fertilizer or compost is similar to adding biochar to the soil. They both can attach to the salt ions in the soil and make it unavailable to the plant. So the plant will grow well and not feel the salinity effect.

Fox: Another option is to prevent salt from building up in the soil by irrigating with good quality water. It is better to prevent than to repair. So, we should make sure we avoid salt from building up in the soil.

Pig: Good point Fox. Prevention is always better. Also, there is water scarcity around the world so we should use water wisely.

Cookie: I will not waste water again. I will tell my father to do rain harvesting so that he can use it to irrigate his farm.





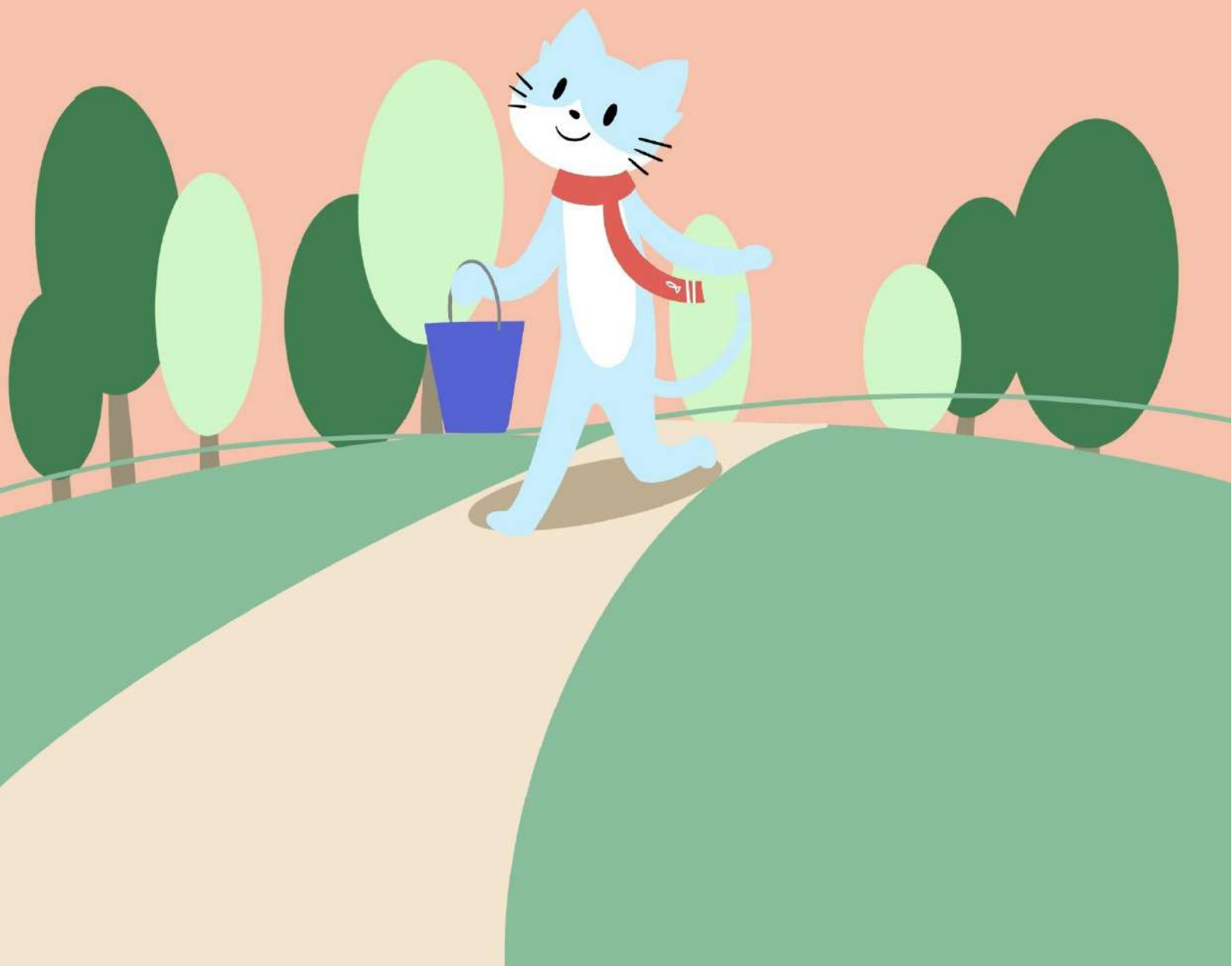
Raccoon: How about planting trees in the farm to keep the salty water table low.

Pig: Amazing idea Raccoon. I read in the FAO article that we can combine food crops and trees in the same piece of land. It is called agroforestry¹⁴.

Dog: I think Cookie can tell his dad to practise agroforestry. It will help to improve the soil in his farm. He can also plant crops that are tolerant to salinity so that his farm will still maintain productivity and there will be lots of food to sell.

Bee: Do you know that cyanobacteria and halophiles are excellent microorganisms that can help plants to grow in saline soils? We can apply cyanobacteria when we are planting seeds in the farm. The cyanobacteria will help the plants to grow well and absorb some salinity¹⁵.

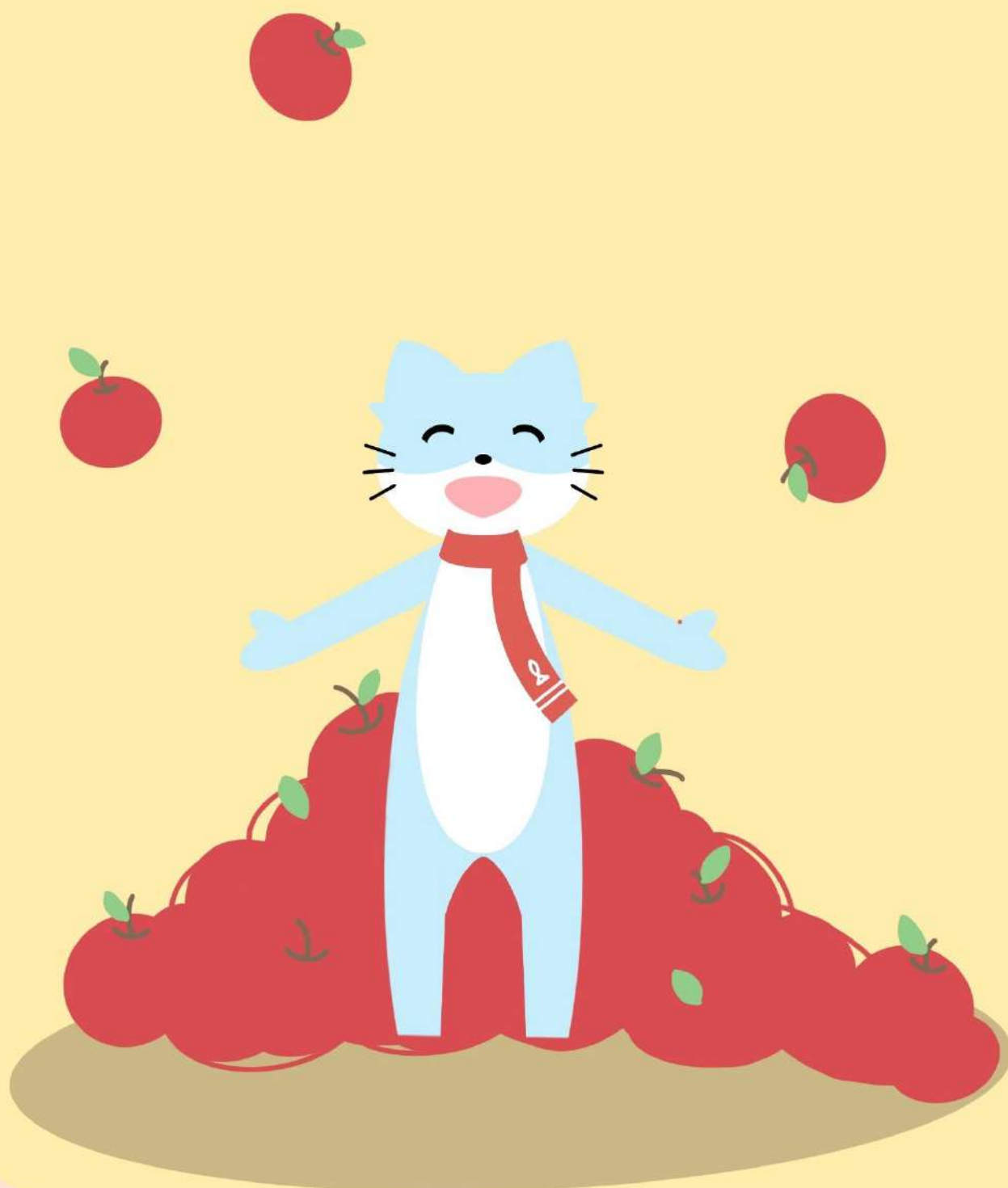
Cookie: Thank you guys! I will practise all of them.



With these efforts from Cookie, the apple tree and farm gradually recovered. In the second autumn, cookie harvested many sweet apples.

Now Cookie's apple dream comes true.

Let us ***“Halt soil salinization, Boost soil productivity”***



Activity

We collected some children's paintings from different places. Their works showed cares about salt-affected soils and best wishes to future.



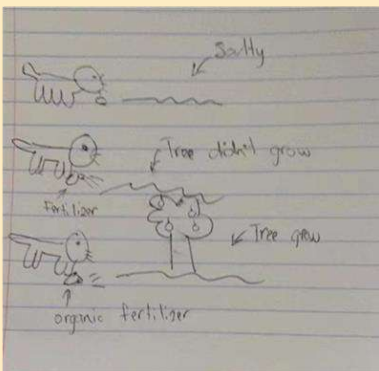
Mark Bogdanović-Muñoz, Y 5, Australia



Kevin Chen, Y 10, USA



Xiaoxuan Jiang, Y 8, China



Samuel Kojo Prah Gaisie, Y 11, Australia

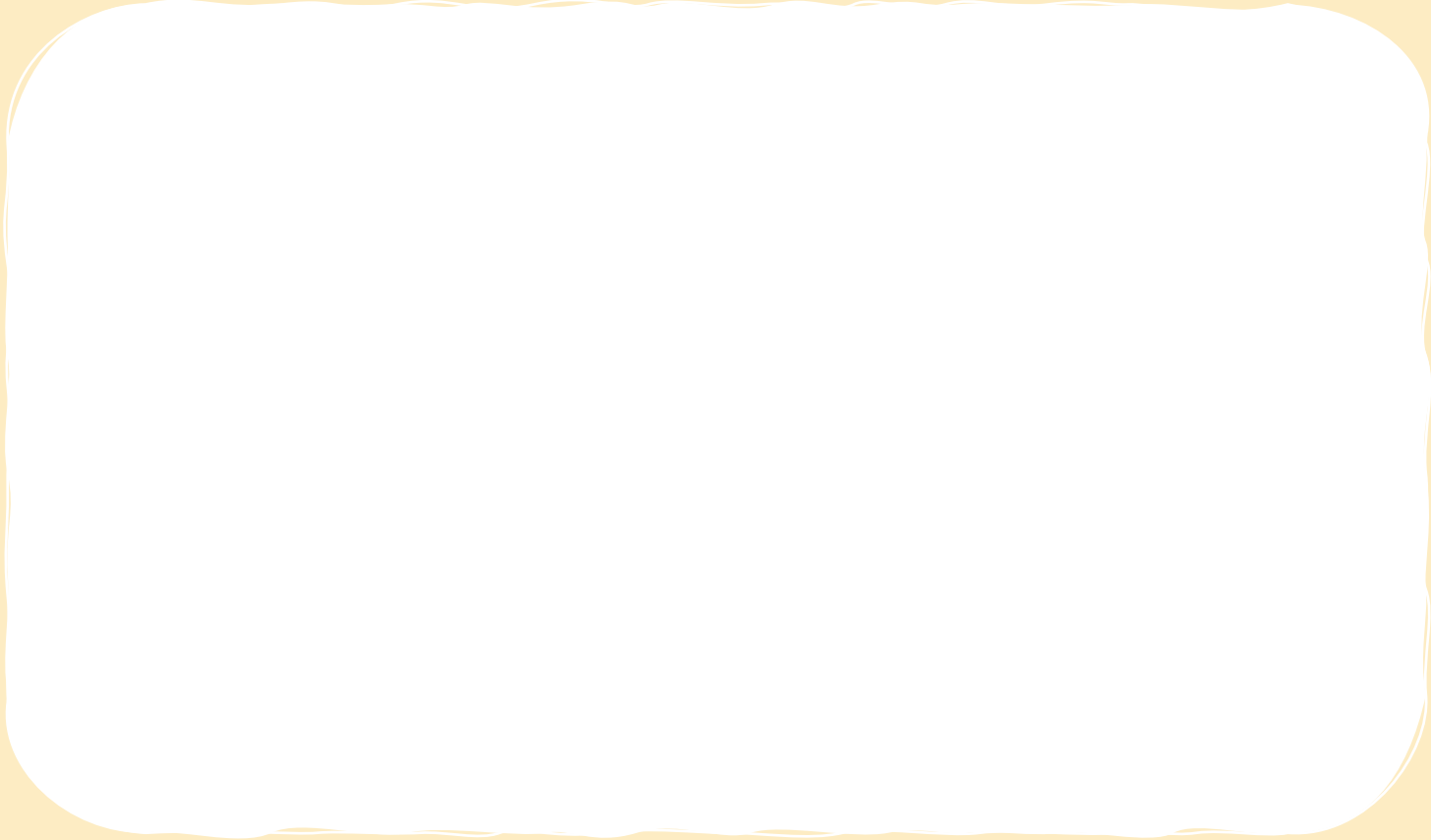


Anne Chen, Y 5, USA



Luqingqing Wang, Y 7, China

Now, it is your time to draw a creative painting about ***“Halting soil salinization, Boosting soil productivity”***



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