

REGREEN THE DESERT

Teacher's Guide



practicalaction.org/schools/regreen-the-desert

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ACTION**

The Regreen the desert STEM challenge is an exciting hands-on challenge for pupils aged 8-16 years. It enables them to develop their own solutions to the problem of how to grow food in drought conditions caused by climate change in Sudan.

Pupils will develop solutions to help combat the impact of climate change in Sudan by designing and building model systems to capture then disperse rainwater to irrigate crops. Regreen the desert can be used to deliver parts of the science, design and technology and maths curriculum in regular lessons, as an enrichment day, in a STEM/science club or part

of a primary-secondary transition activity. Pupils can also gain a CREST Discovery Award through taking part in the challenge.

This challenge would make a great outdoor learning activity and could be extended into building an irrigation system for a school garden.

The challenge supports pupils' learning about global issues, with particular reference to the Sustainable Development Goals (SDGs) also known as the Global Goals.

This teacher's guide is supported by a PowerPoint presentation, pupil activity sheets, a poster and certificates. They can all be downloaded for free from practicalaction.org/schools/regreen-the-desert

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Learning objectives

Through engaging with the Regreen the desert challenge pupils will:

- Gain an understanding of how water pressure works.
- Develop problem solving, team working and presentation skills.
- Discover how STEM can help solve global issues around food security and achieve the UN Sustainable Development Goals.

Curriculum links

STEM subjects provide great opportunities for teachers to include authentic global contexts and global learning in their teaching.

To see where the Regreen the desert challenge supports the delivery of the formal science curriculum for England, Northern Ireland, Scotland and Wales please go to: practicalaction.org/science-curriculum.

Overview of Regreen the desert

Outline	Teaching material	Timing (mins)
Introduction to the context	PPT slides 1-4	10 mins
Starter activities		
a. Khadija's story	PPT slides 6-7 Pupil activity sheets (one per pair) - <i>Khadija's story</i> - <i>True or false cards</i>	20 mins
b. Sustainable Development Goals	PPT slides 8-10 Pupil activity sheet (one per pair) - <i>Sustainable Development Goals</i> Additional activities - <i>Global Goals string activity</i> - <i>Who's responsible?</i>	10 mins 30 mins 30 mins
c. Under pressure	To find these activities go to: practicalaction.org/schools/global-goals PPT slides 11-12 Pupil activity sheet (one per group) - <i>Under pressure</i>	30 mins
Main Activity – Regreen the desert	PPT slides 13-14 Pupil activity sheets (one per group) - <i>Design sheets</i>	60 - 120 mins
Feedback	PPT slides 15-16 Pupil activity sheet (one per pupil) - <i>Team feedback</i>	5 mins
Irrigation solutions	PPT slides 17-19	5 mins
Celebrating success	PPT slides 20-22	5 mins

Introduction to the context

Introduce the challenge. Explain that pupils will be using their STEM skills to develop a solution to a problem caused by climate change being faced right now by a community in Sudan.

Use PPT slides 2-4 to introduce the context of North Darfur, Sudan, and problems faced by farmers and their families who live there, with a focus on the story of Khadija.

Extension/Homework activity

Set pupils the task to find out about the different crops farmers in drought prone areas like North Darfur grow and some of the problems they face.

Starter activities

We recommend that you work through the starter activities to both help pupils understand the context of the challenge and give them a basic knowledge of water pressure that will help them with their designs.

a. Khadija's story

Show PPT slides 5-6

Hand out the pupil activity sheet *Khadija's story*. Allow time for pupils to read then discuss what they have learnt about Sudan, Khadija and some of the ways in which farmers in Sudan can be helped. Did anything surprise them? Hand out the *True or false cards* to find out what they have remembered.

Answers are on PPT slide 7.

Resources

Pupil activity sheets (one per pair)

- *Khadija's story*
- *True or false cards*

b. Sustainable Development Goals

Use PPT slides 8-10 to introduce the Sustainable Development Goals (SDGs) start by saying that having enough water to grow crops is just one problem faced by people around the world like

Khadija and her family. Explain that in 2015 the United Nations identified some problems that would need to be solved to eradicate world poverty.

Hand out the *Sustainable Development Goals* sheet and ask pupils to tick any they think link to problems Khadija and her children face in Sudan, e.g.

Global Goal 1 - Farmers like Khadija who cannot grow enough food to eat or to sell to buy other life essentials are living in poverty.

Global Goal 2 - Families like Khadija and others in her community often go to bed hungry.

Global Goal 3 - You cannot be healthy if you don't have enough food or a variety of food to eat.

Global Goal 4 and 5 - Often girls have to walk up to four hours a day to collect water. This reduces the time they can spend in school.

Global Goal 8 - Because Khadija has to spend so much time collecting water, she has little time to spend on doing work that could earn her and her family income.

Resources

Pupil activity sheets (one per pair)

- *Sustainable Development Goals*

If you wish to explore the Sustainable Development Goals in more detail, you could carry out our *Global Goals string activity* to help improve pupils' understanding of how the Global Goals interdependent, and *Who's responsible?* which explores who is responsible for making them happen.

To find these activities and some great display materials go to:

practicalaction.org/schools/global-goals



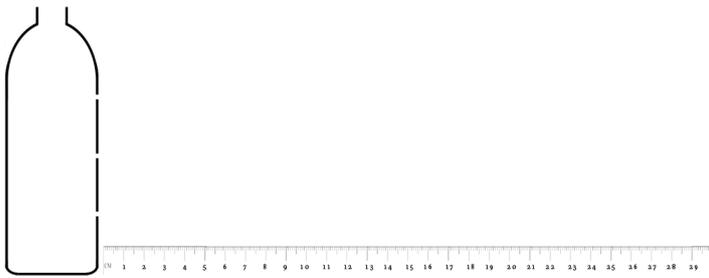
c. Under pressure

Explain to pupils that later on they are going to work on developing an ingenious solution that could help Khadija grow more crops and enable her family to succeed and not just struggle to survive. To help them do this they are going to find out more about water pressure.

Divide the class into groups of 4-5 pupils. Hand out the *Under pressure* pupil activity sheet, and one set of resources (listed below) per group. The idea of the activity is for them to find how a number of variables including the size and position of holes could have an impact on how far the water will squirt out.

You may want to prepare the holes for younger pupils.

Go to CLEAPSS.org.uk then select either primary or technology tab and search 'drilling plastic' for guidance on how to do this safely.



NB. We are aware that this activity and the main challenge do use single use plastic, which some teachers might rightly feel uncomfortable with. Please do only use plastic containers that that have previously been used for another reason. Use this as an opportunity to raise issues around plastics, and ensure that all plastic is recycled after the activity.

Prompt questions

- Is the position of the hole important?
- Is the size of the hole important?
- Can you think of any other factors that might change how far the water will squirt out?
- Do the size and position of the hole change how fast the water flows out of the container?

Ask groups to feedback informally on what worked best for them.

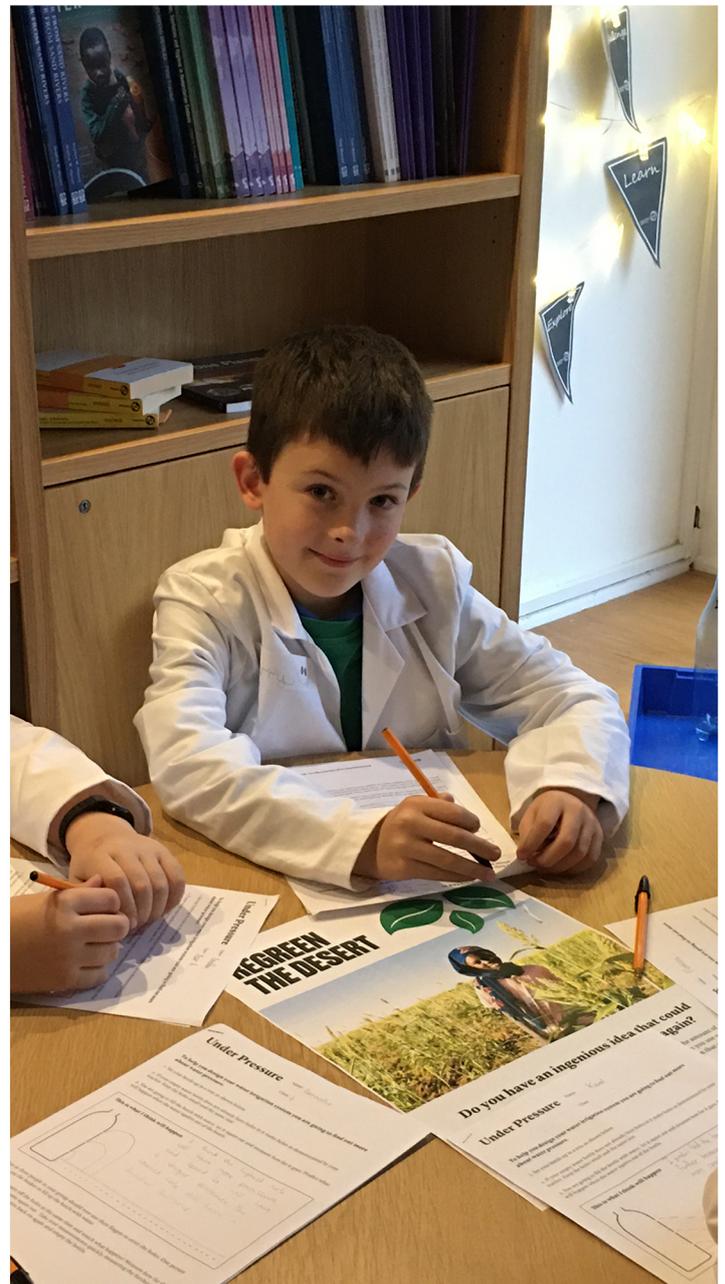
Resources

Equipment (for each group)

- 2-5 bottles (at least 1 litre)
- Tray (or an outdoor space)
- Equipment to make holes (see CLEAPSS for guidance)
- 500 ml beaker
- Water
- Ruler

Pupil activity sheet (one per group)

- *Under pressure*



Main activity - Regreen the desert

By now, your pupils should have a good understanding of the importance of irrigating crops and know the basic principles of water pressure. Discuss how they could use what they have learnt to design an irrigation system. Ask them to think about how precious rainwater could be captured and then used in the system.

Extension/homework activity

Ask pupils to research different irrigation systems.

This challenge focuses on designing a simple system to capture and dispense rainwater. Older pupils could consider alternative ways of collecting water e.g. solar powered water pump, and include this in their design.

Divide the class into small teams of up to 4 pupils then introduce the challenge with PPT slides 13-15. Hand out the *Design sheets*, one per group. Ask pupils to design two different systems between them and then choose one.

When pupils have finished designing their systems ask them to fill out the third sheet to help them reflect on what they have done and help them prepare for their feedback.

Main ground rules for the challenge

- The object of the challenge is to design a model that could water at least 6 different plants, one of which is at least 30cm away from the container that collects the water.
- The design must be able to both capture water and dispense it.
- The flow of water needs to be able to be turned on and off.
- In their design pupils should consider how best to preserve the water that is captured in a country that is very hot and suffers from drought.

Prompt questions during Under pressure

- Why is it important to be able to turn an irrigation system on and off?
- Is the height of the container relevant?
- What might you need to consider when storing rain water in a hot country?

Resources

Pupil activity sheet (one per group)

- *Design sheets*

Modelling equipment, e.g.

Plastic bottles, buckets, plastic containers of different shapes, thin straws, wide straws, tubing e.g. Bunsen burner tubing with different diameters.

Joining and cutting equipment, e.g.

Plasticine, glue-gun, glue, masking tape, craft knives, dowels, scissors, sellotape, gimlet, drill (see CLEAPSS for materials appropriate to age).

Testing

Water, cloths, jugs, trays.

Extension activity

You could ask GCSE students to calculate the pressure (in Pascals) at each of the holes on their design.

$P = \text{density of water} \times \text{acceleration due to gravity} \times \text{depth}$ e.g. a hole that is at a depth of 5 cm below the surface of the water would have a water pressure of :

$$P = 1000 \times 10 \times 0.05 = 500 \text{ Pa}$$

Higher level students can compare the results of their from the *Under Pressure* activity e.g. hole size with the equation above and note that actually only the depth of the hole (below the surface of the water) should have a big effect.

The water will obviously travel further horizontally when the bottle is raised but this is due to its higher potential energy and projectile motion rather than a change in the water pressure. (In actual fact there will be a very small change in pressure due to the reduction in atmospheric pressure but this is too small a change and subtle an effect to be seen in this experiment).

Feedback

We suggest that after testing their models pupils present to the rest of the class. They should reflect on how well they worked together, problems they solved etc. (this is necessary if you are planning for your pupils to gain a CREST Discovery Award). PPT slide 16 gives more information on feedback to share with pupils. Allow time for pupils to work on their presentations as well as building their model.

Resources

Pupil activity sheet (one per pupil)

– *Team feedback*

Irrigation solutions

Once pupils have shared their own solutions it's time to share the solutions that scientists and engineers around the world have come up with. Show PPT slides 17–19 and the video clips below.

You and your pupils may also like to follow what is happening with Khadija and her community on Practical Action's website:
practicalaction.org/turn-the-tables

Resources

Video clips

- Water pump in Nepal
www.youtube.com/watch?v=smK3KaHtHcY
- Solar powered Irrigation in Zimbabwe
www.youtube.com/watch?v=nvJMkIninVk

Celebrating success

CREST Awards

Taking part in the Regreen the desert is a great way for pupils to gain a CREST Award. The challenge is aligned to the Discovery Award, but can be used towards achieving Superstar Award or as the starting point for a Bronze, Silver or Gold Award.

The CREST Discovery Award is generally undertaken by 9–14 year olds. It can be achieved in 3–5 hours. CREST Bronze, Silver and Gold Awards are designed for pupils aged 11–18.

For more information on CREST Awards go to:
crestawards.org

practicalaction.org/schools/regreen-the-desert

For further ideas for Bronze, Silver and Gold projects linked to global issues go to:
practicalaction.org/global-project-ideas

Big Bang Competition

Pupils aged 11–18 and in full time education/training who have taken part in a STEM challenge can enter their work into the UK wide Big Bang Competition.

Prizes include industry/scientific site visits, and a chance to represent the UK at international contests. Being a part of the competition is an inspiring and valuable experience for all young people involved.

To find out more go to:
competition.thebigbangfair.co.uk

Great Science Share for Schools

Having taken part in the challenge pupils can join in the Great Science Share for Schools campaign. It is their chance to share their project with new audiences in or beyond their own schools.

To find out more and register your school go to:
www.greatscienceshare.org

British Science Week

Regreen the desert would be a great activity for your class or year group to do during British Science week in March each year. To find out more go to:
britishscienceweek.org

To find out if your school is eligible for a grant go to:
britishscienceweek.org/about-us/grants

