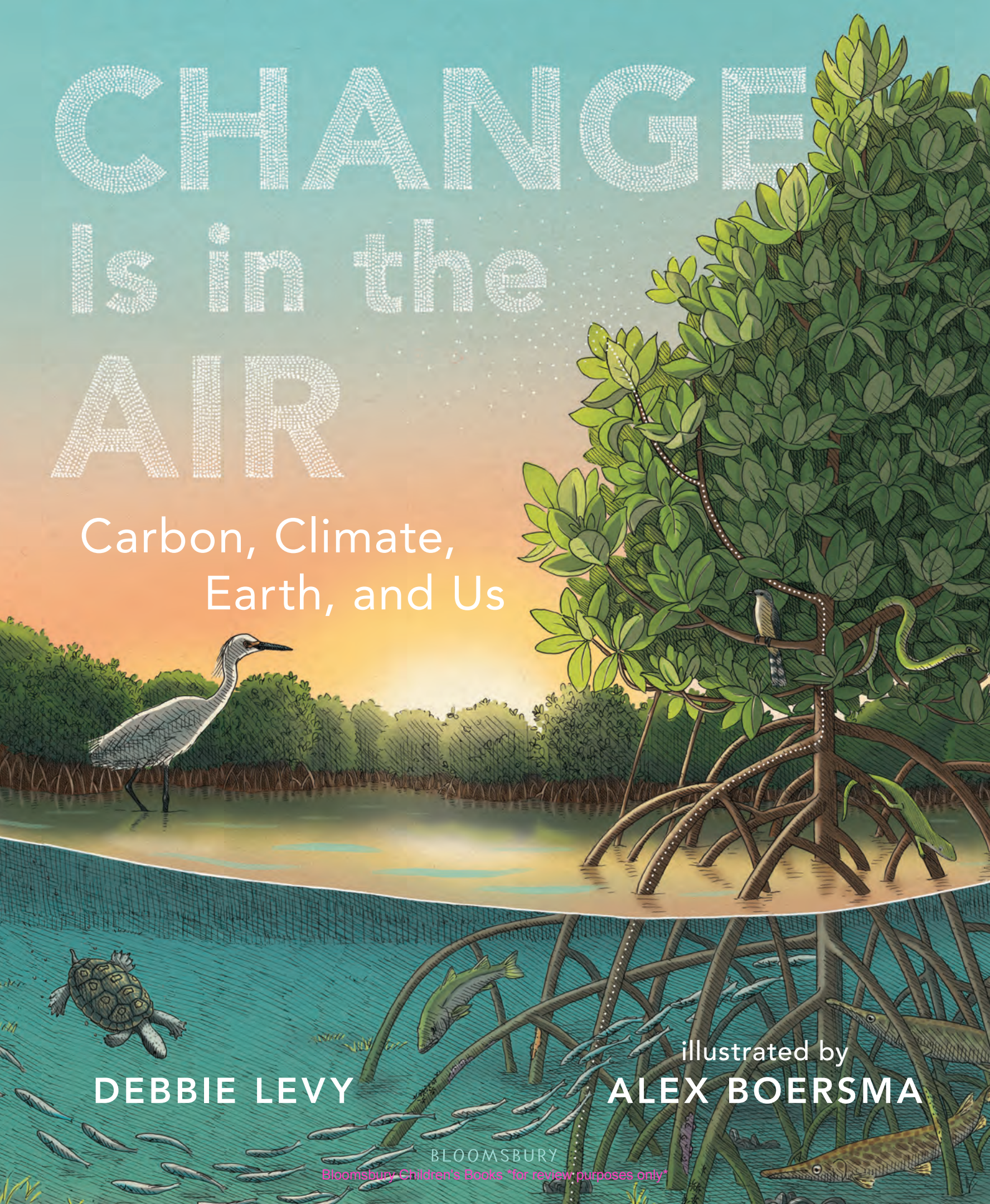


CHANGE Is in the AIR

Carbon, Climate,
Earth, and Us



DEBBIE LEVY

illustrated by
ALEX BOERSMA

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The Earth has a problem: **there's too much carbon in the air.**

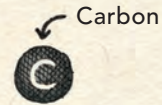
Luckily, the Earth also has amazing powers to remove carbon dioxide from the atmosphere—like the power of **kelp, mangroves,** and **dirt.** Although these powers alone cannot get us out of the climate crisis we're facing, the Earth has another important power: **the power of people!** People have the power to change, protect, innovate, and invent.

Debbie Levy and Alex Boersma paint an encouraging yet honest picture of the problems at hand and some of the ways that we can address them. Thanks to the power of nature and the ingenuity of people, **change is in the air!**





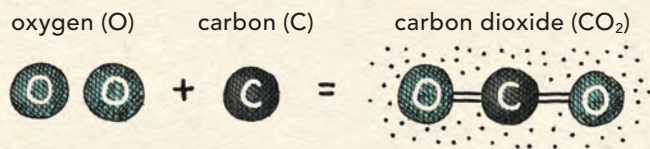
WHAT IS CARBON?



Carbon is a chemical element, and it's the foundation of life on Earth. As an element, carbon is a pure substance made from one type of atom—the carbon atom, known by the symbol C. A diamond is made of pure carbon! But carbon is most often found combined with other substances; these combinations are called carbon compounds. The air, the ocean, and all living things on our planet contain carbon compounds.

WHAT IS CARBON DIOXIDE?

Carbon dioxide, a carbon compound, is a gas made from carbon and oxygen. It's known by the formula CO_2 and is part of the Earth's atmosphere, along with other gases.

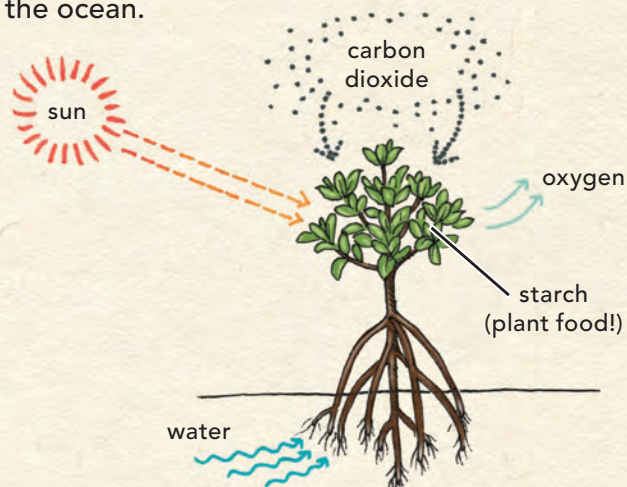


There are many natural sources of carbon dioxide. When we breathe, we expel CO_2 . When volcanoes erupt, they spew CO_2 . When living things die, they release CO_2 .



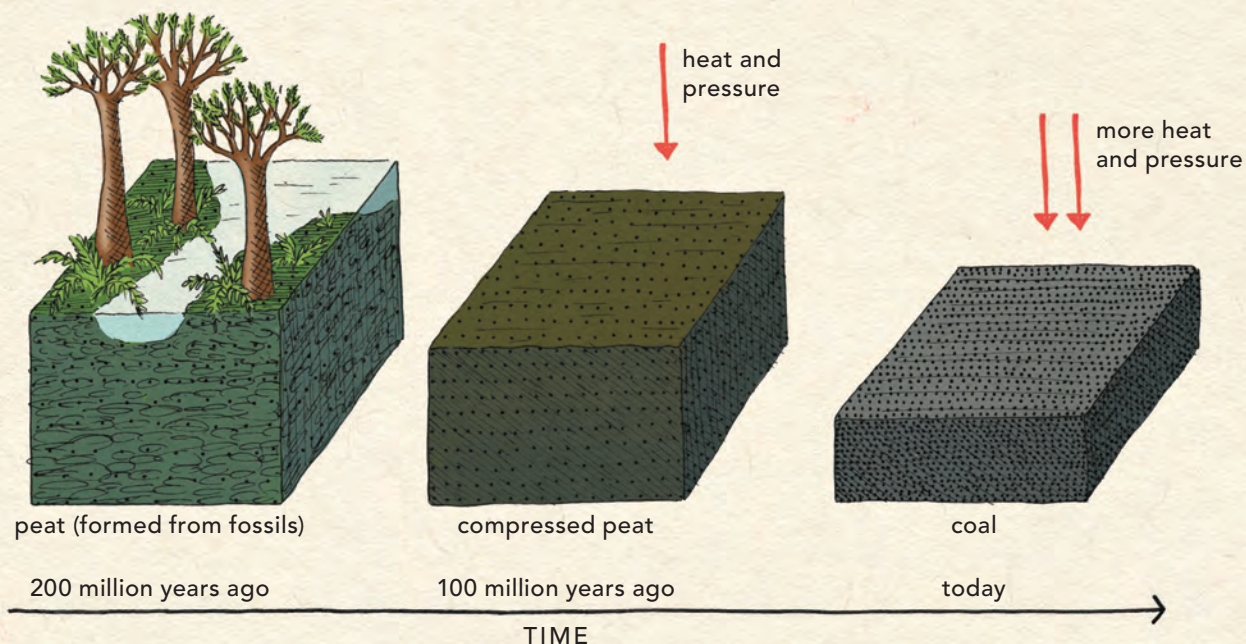
PHOTOSYNTHESIS

Photosynthesis is the process by which plants take in sunlight and carbon dioxide to create food for themselves. Through photosynthesis, plants remove some carbon dioxide from the air and the ocean.



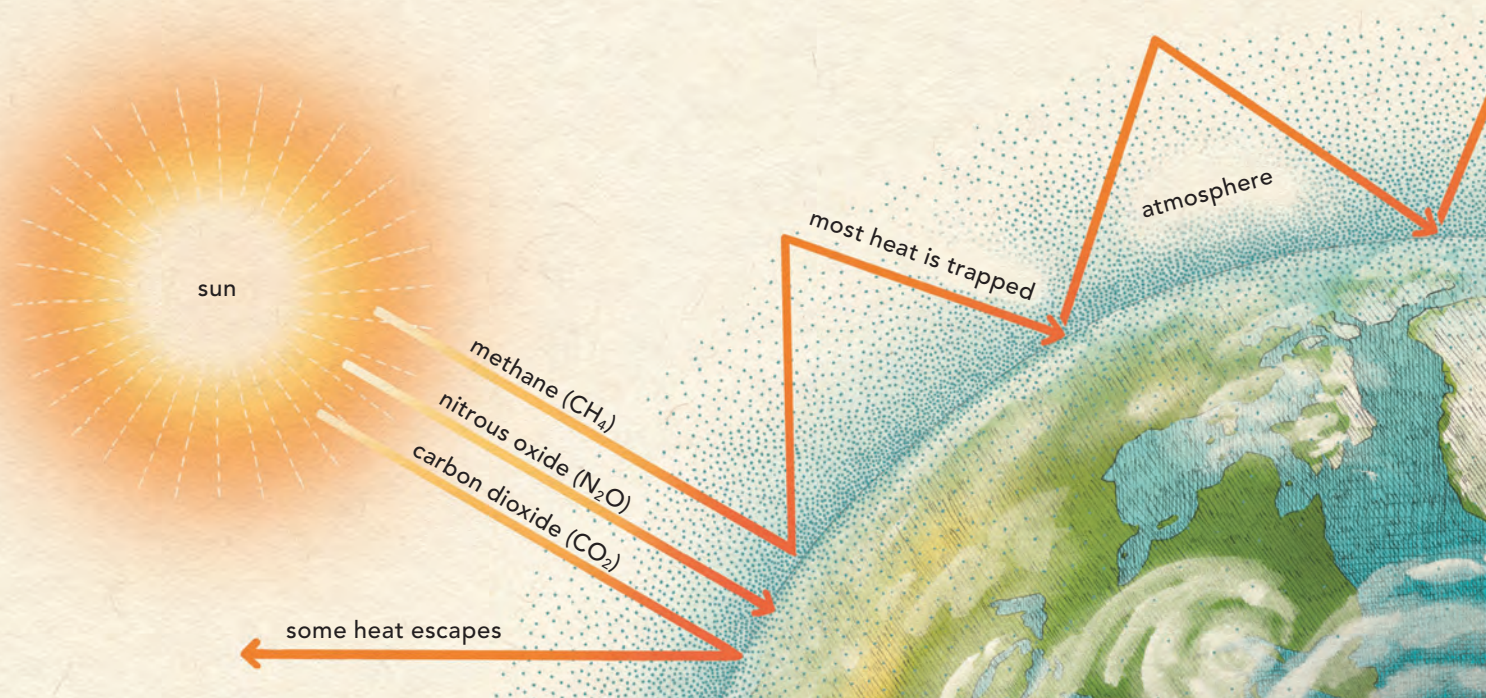
WHAT ARE FOSSIL FUELS?

Coal, oil, and gas are called fossil fuels because they're made from the buried remains of prehistoric plants and animals. These fuels are rich in carbon. When we burn fossil fuels, the stores of carbon that they hold are released into the air as carbon dioxide.



THE GREENHOUSE EFFECT

The Earth's atmosphere absorbs warmth from the sun; it's called the "greenhouse effect." Carbon dioxide and other gases that trap heat are called "greenhouse gases." Without the greenhouse effect, the Earth would be much too cold for human life. But when these gases reach excessive levels, the atmosphere traps too much heat. The result is climate change, which is harmful to human and other life.





To the change makers, protectors, and innovators —D.L.

For the scientists and activists of the future —A.B.

*I am so grateful to Dr. Asmeret Asefaw Berhe, Dr. Samantha Chapman,
and Bailey Moritz for their thoughtful reviews of the manuscript
that became this book. Any errors remain my own.*

—D.L.

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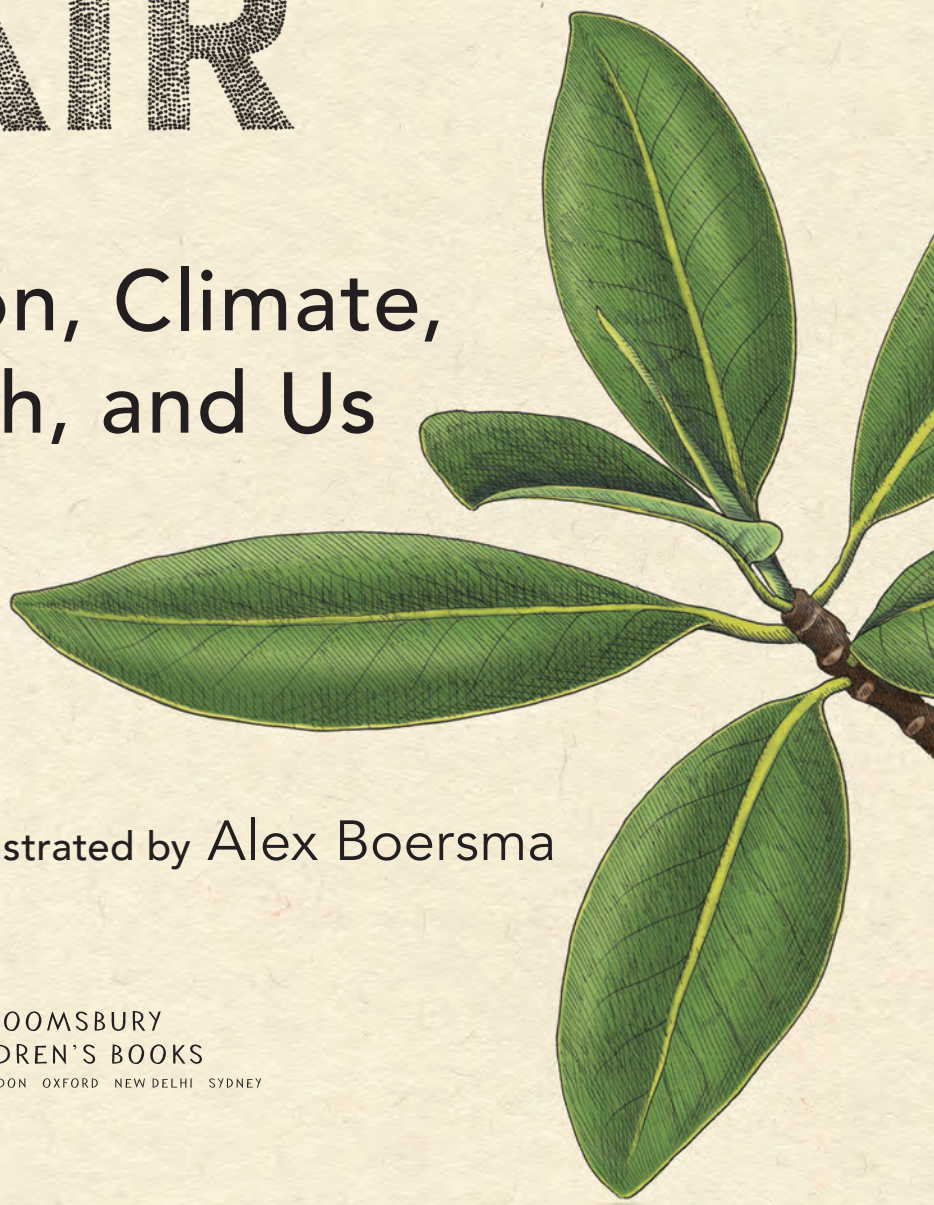


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Carbon.



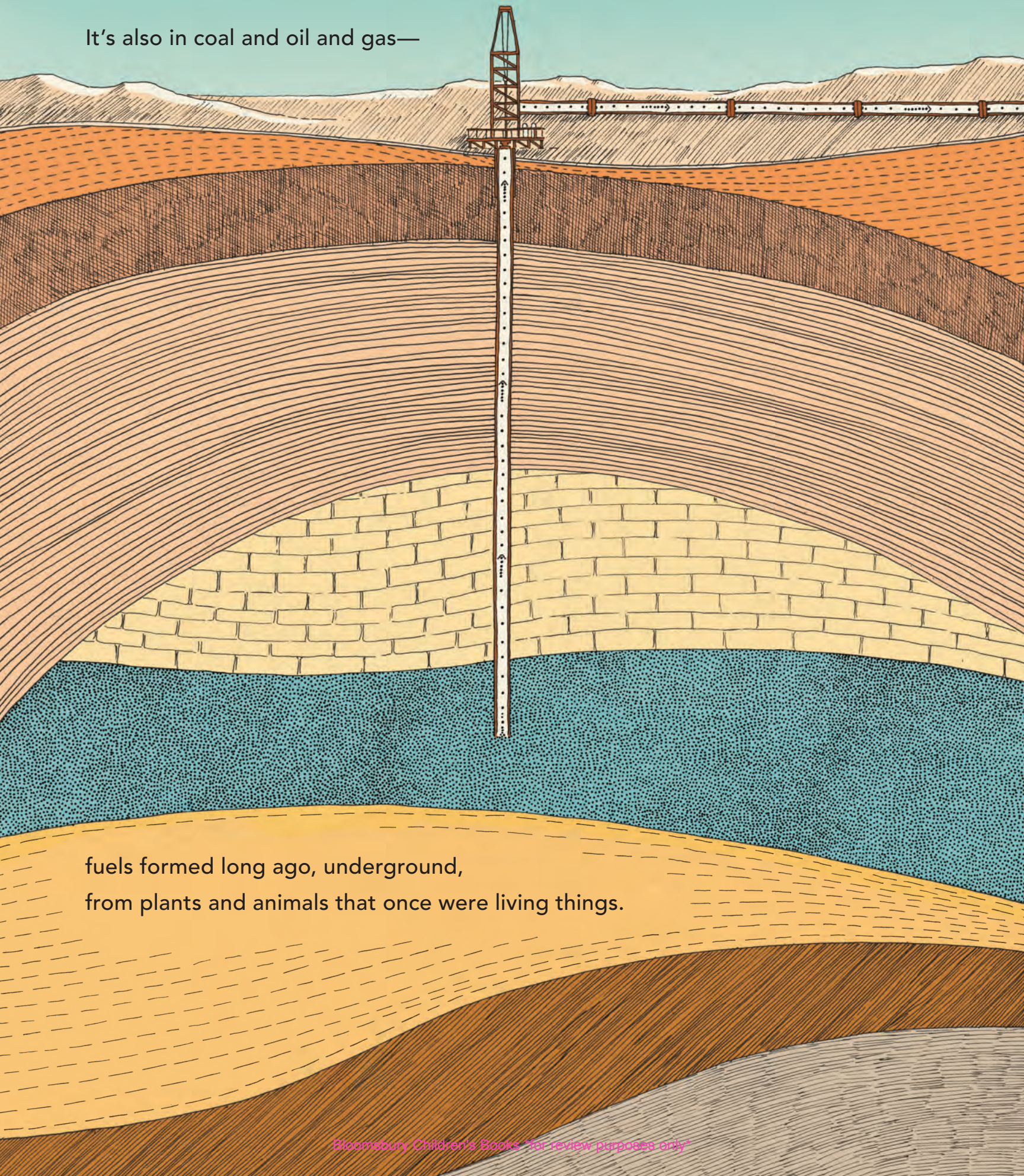
It's in you.

It's in the Earth, it's in the air.

Carbon is in every living thing!

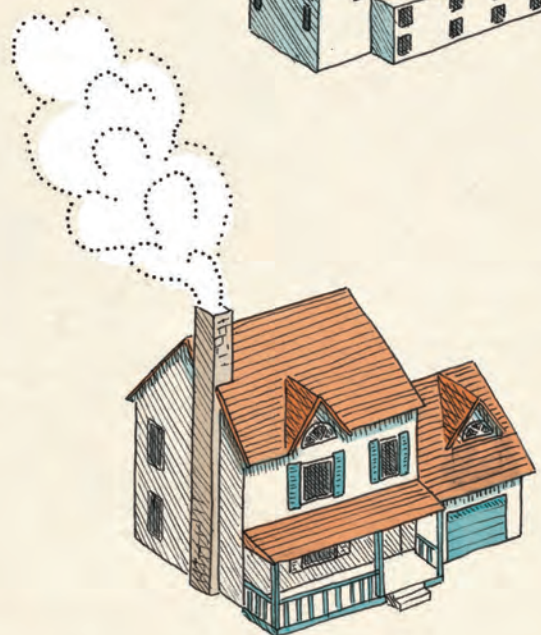
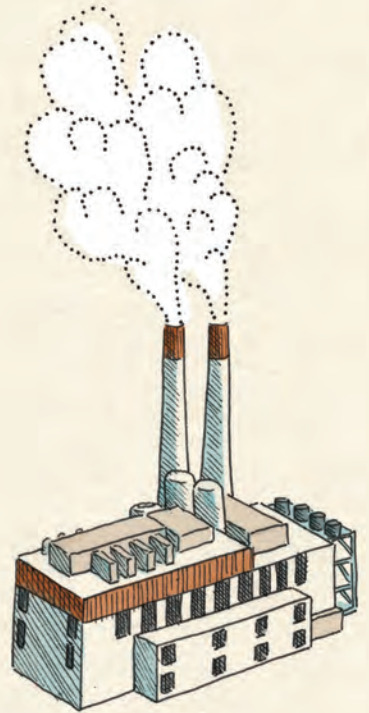
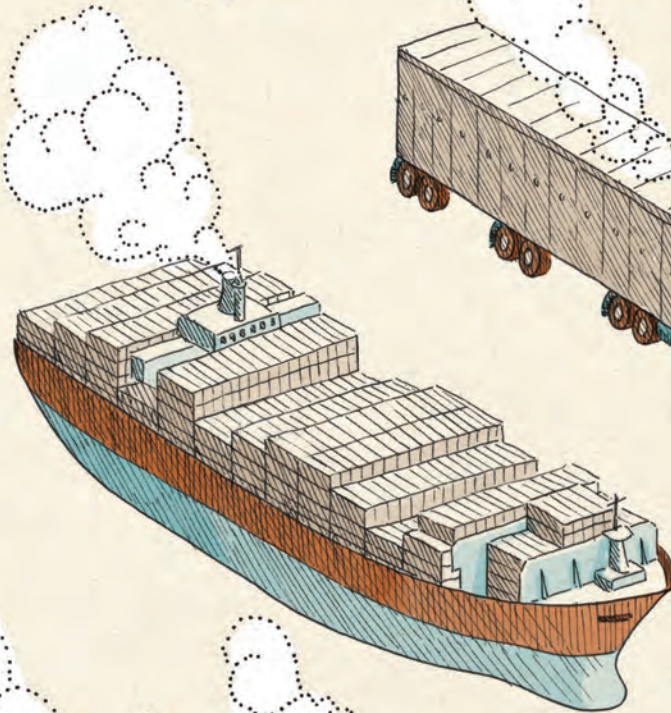
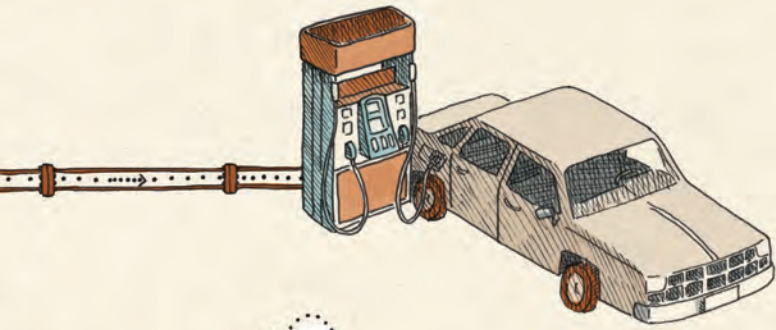


It's also in coal and oil and gas—




fuels formed long ago, underground,
from plants and animals that once were living things.

When we burn those fossil fuels
for heat, electricity, cars, trucks, and planes,
the carbon in them



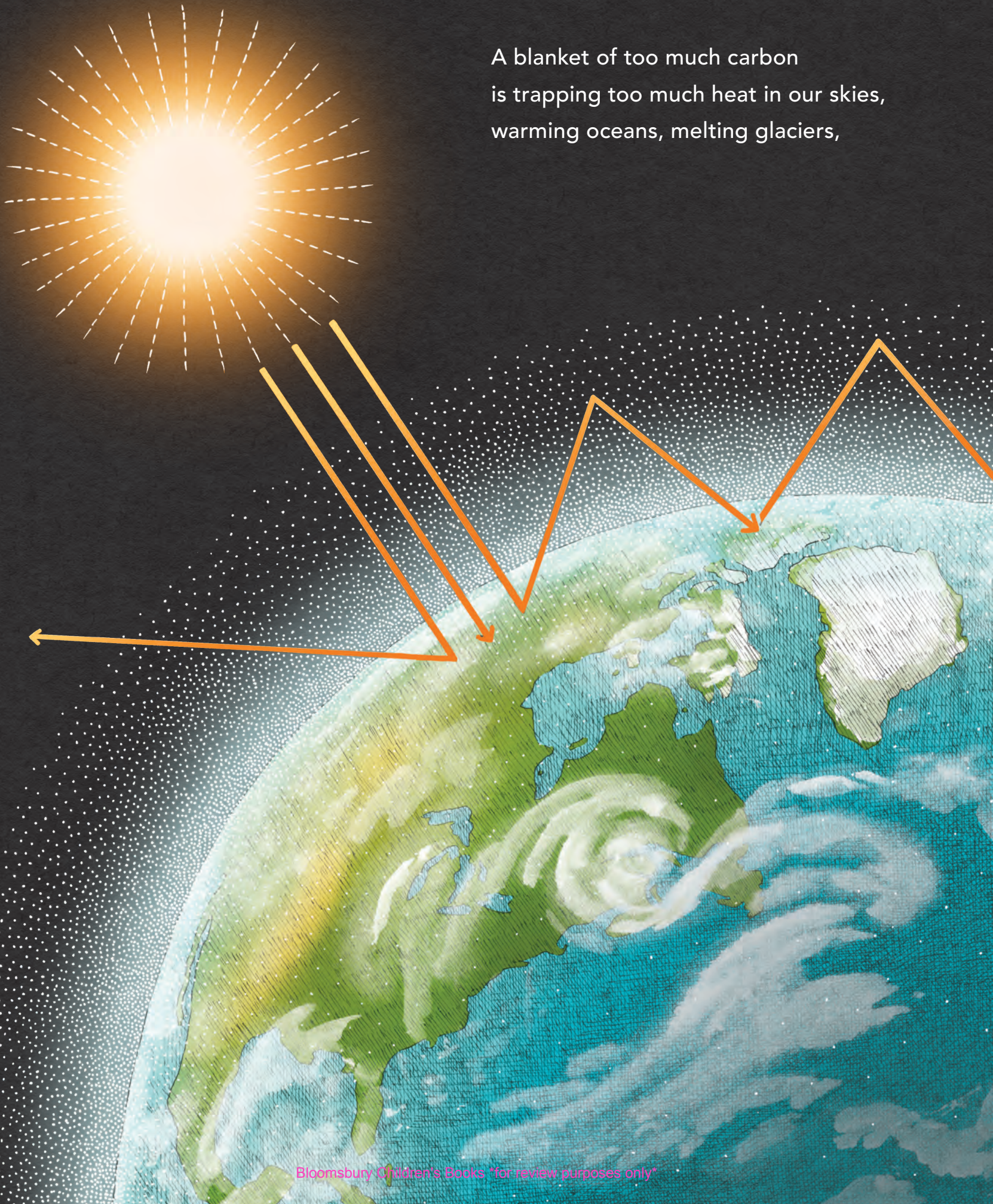
gushes into the air.





After hundreds of years
and billions of people burning fuels,
there's too much carbon in the air!

A blanket of too much carbon
is trapping too much heat in our skies,
warming oceans, melting glaciers,



causing storms
and floods



and drought
and fire.

But . . .

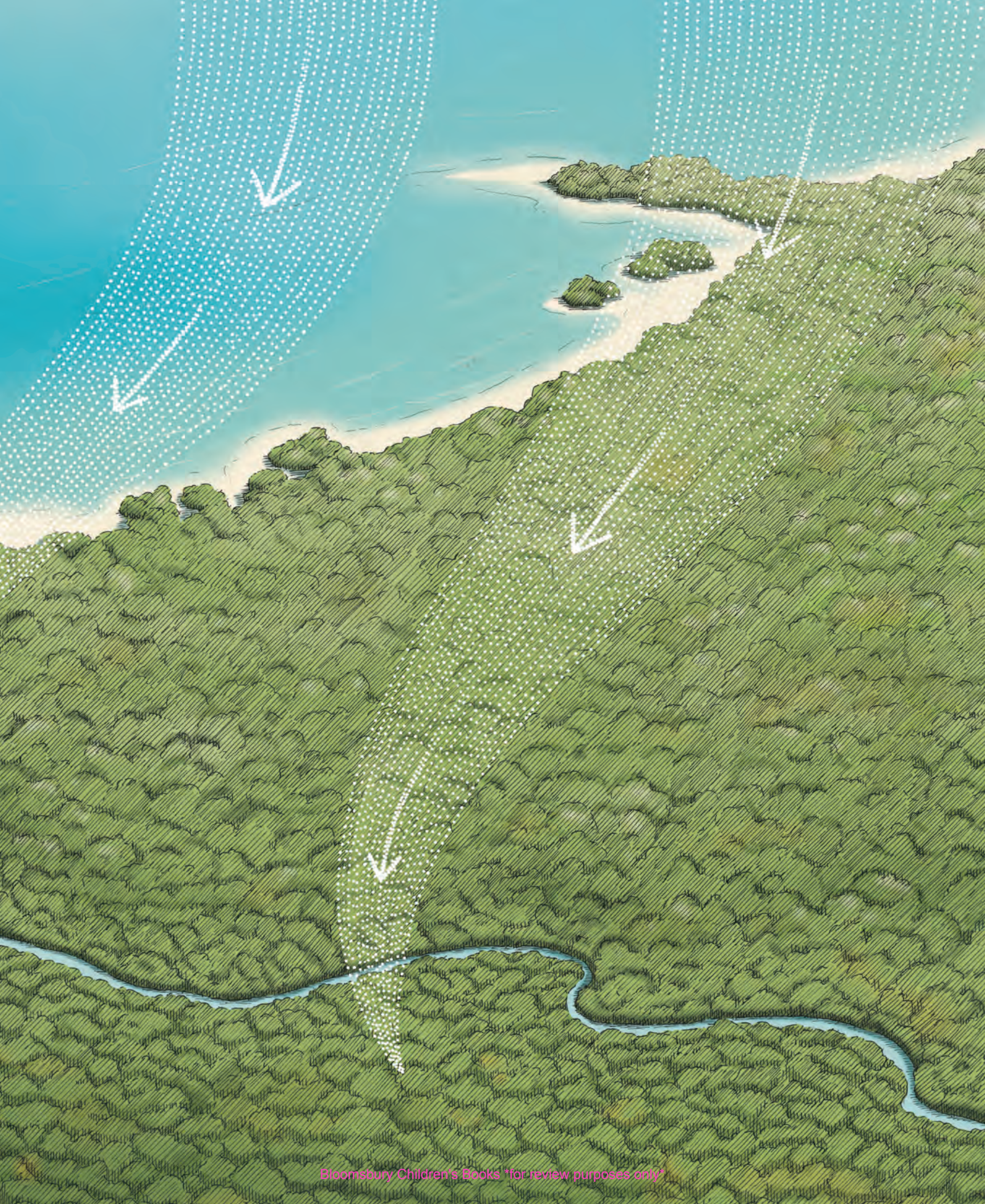
the Earth can help repair the air.
To scrub out carbon *up there*,


our planet has amazing powers
down here—

in the sea,


at the shore,

and on land.





The Earth has the power of
kelp—
seaweed!—
in fast-growing underwater forests.

A detailed illustration of an underwater scene. In the upper right, a yellowish-brown fish with a white stripe swims near a large kelp frond. The kelp has long, blade-like leaves and round, brownish-brown fruits. In the lower left, a grey seal with dark spots swims towards the viewer. The background is a deep blue-green with white speckles representing light or bubbles. The text is positioned on the left side of the image.

A blade of kelp, like a leaf, gulps down carbon
that the ocean has sucked from the air above
until the blade breaks off,
floats away, and sinks,
dragging the carbon it guzzled
to the bottom of the sea.

And—*also!*—

help forests shield shorelines from destructive ocean waves.



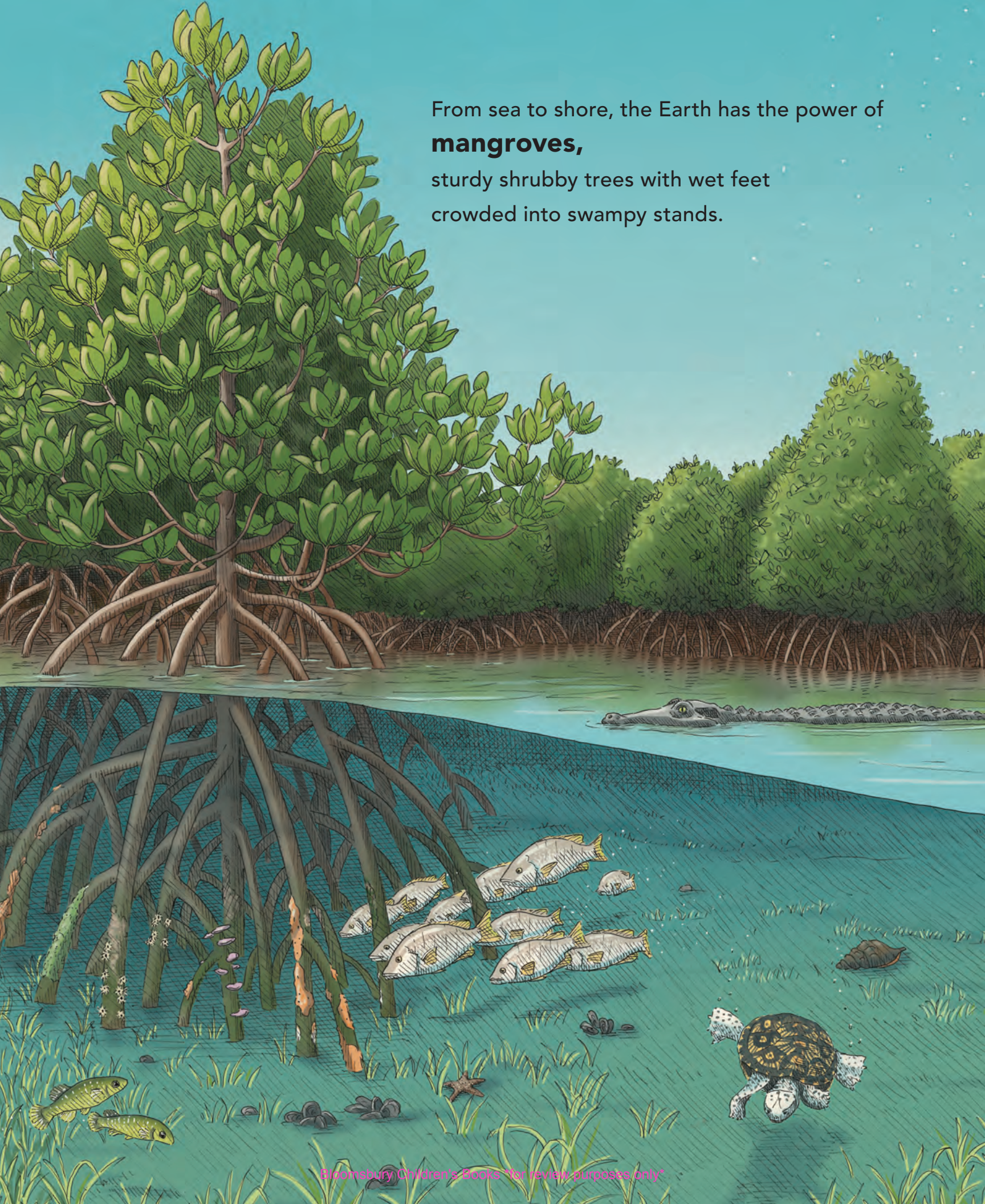
Kelp shelters shellfish and finfish and other sea critters.



Kelp can be good for eating!

Shielding, sheltering, feeding,
air-repairing kelp
can help and help and help,
one blade after another.

From sea to shore, the Earth has the power of **mangroves**, sturdy shrubby trees with wet feet crowded into swampy stands.

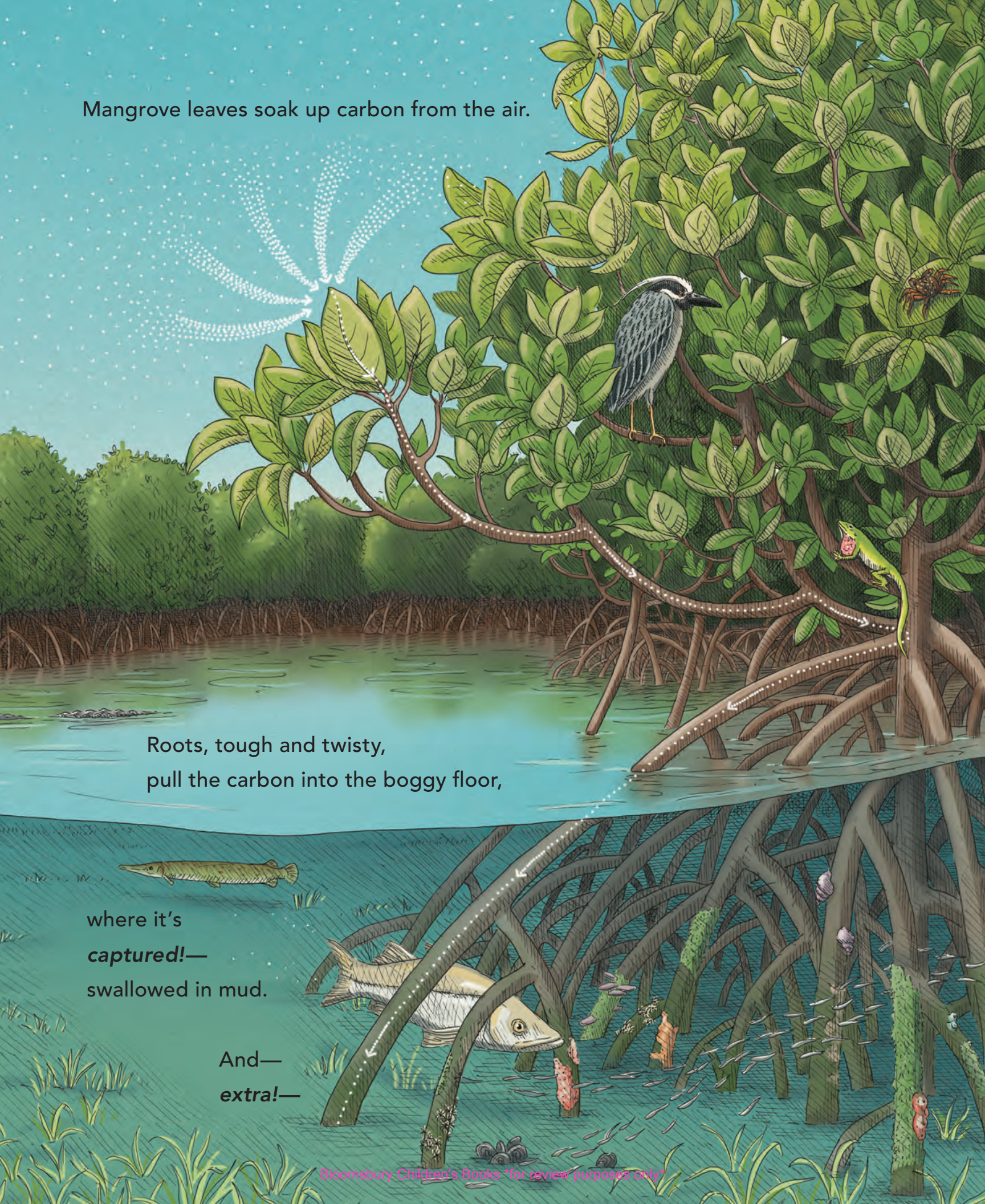


Mangrove leaves soak up carbon from the air.

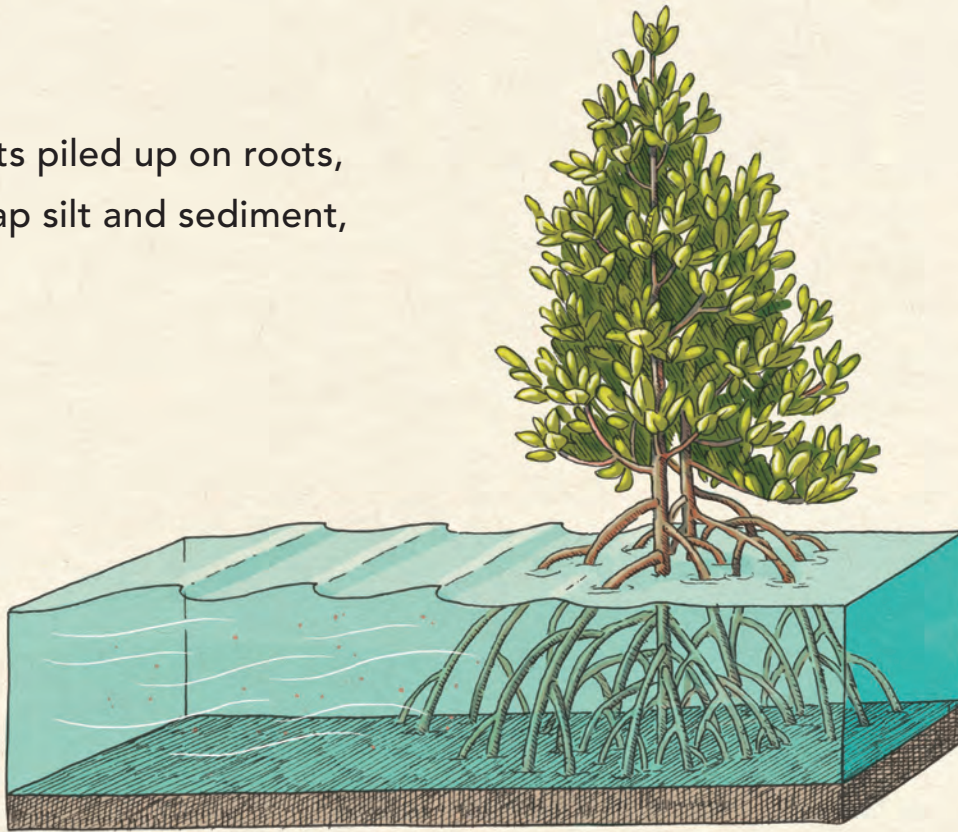
Roots, tough and twisty,
pull the carbon into the boggy floor,

where it's
captured!—
swallowed in mud.

And—
extra!—



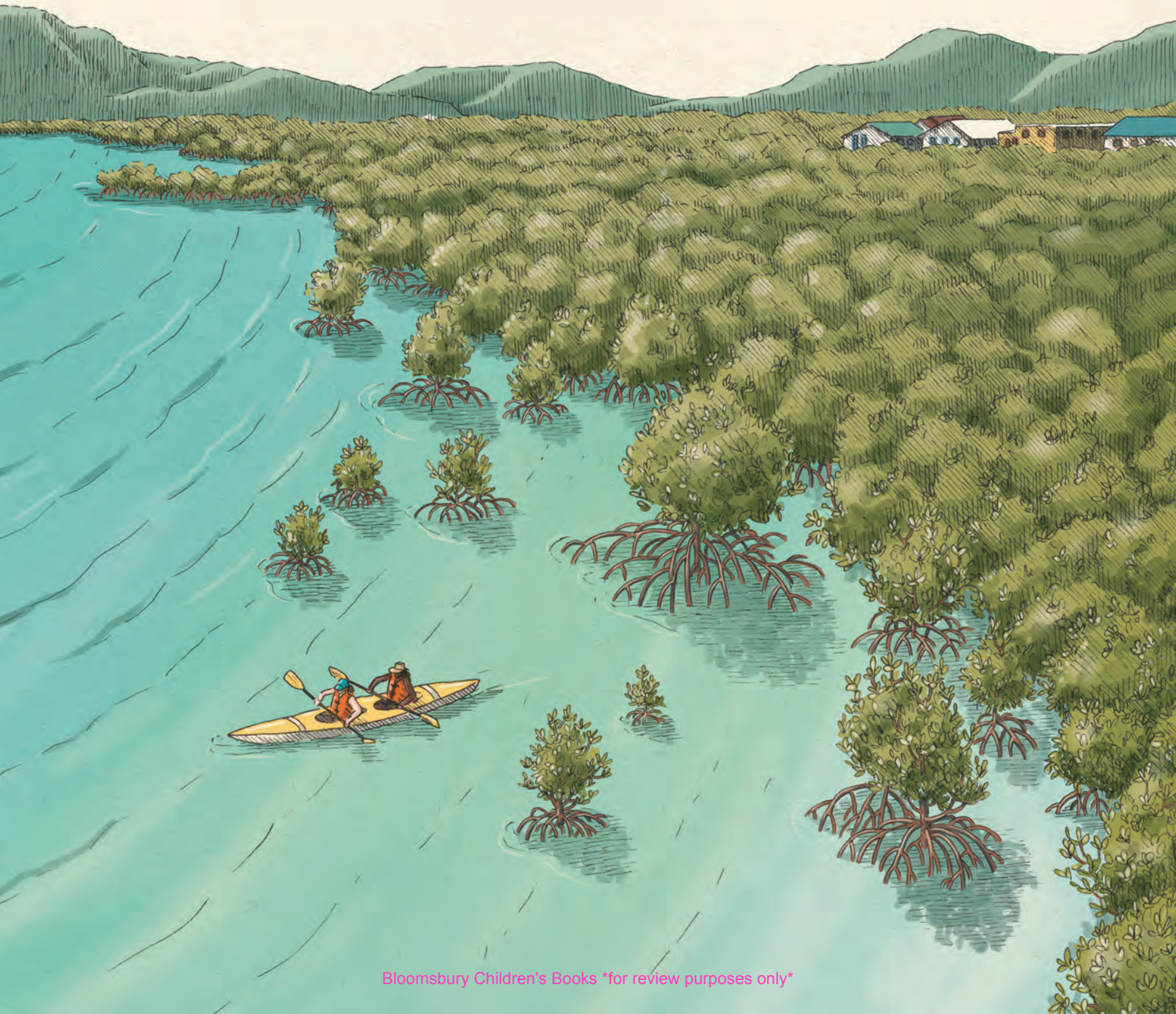
with their roots piled up on roots,
mangroves trap silt and sediment,



building up dirt,
building new wetlands,




building barriers that protect our coastlines and our homes—
all while repairing the air,
one bundle of tangled roots at a time.



From shore to land, the Earth has the power of
dirt,
rich, dark, and damp soil
anchoring trees and grasses
and flowers and food crops.





Leaves drink carbon
from the air,

while roots reach down into the dirt,
burying countless sips of carbon
in the ground.

And—*bonus!*—

the more carbon pulled underground,
the healthier the dirt becomes.

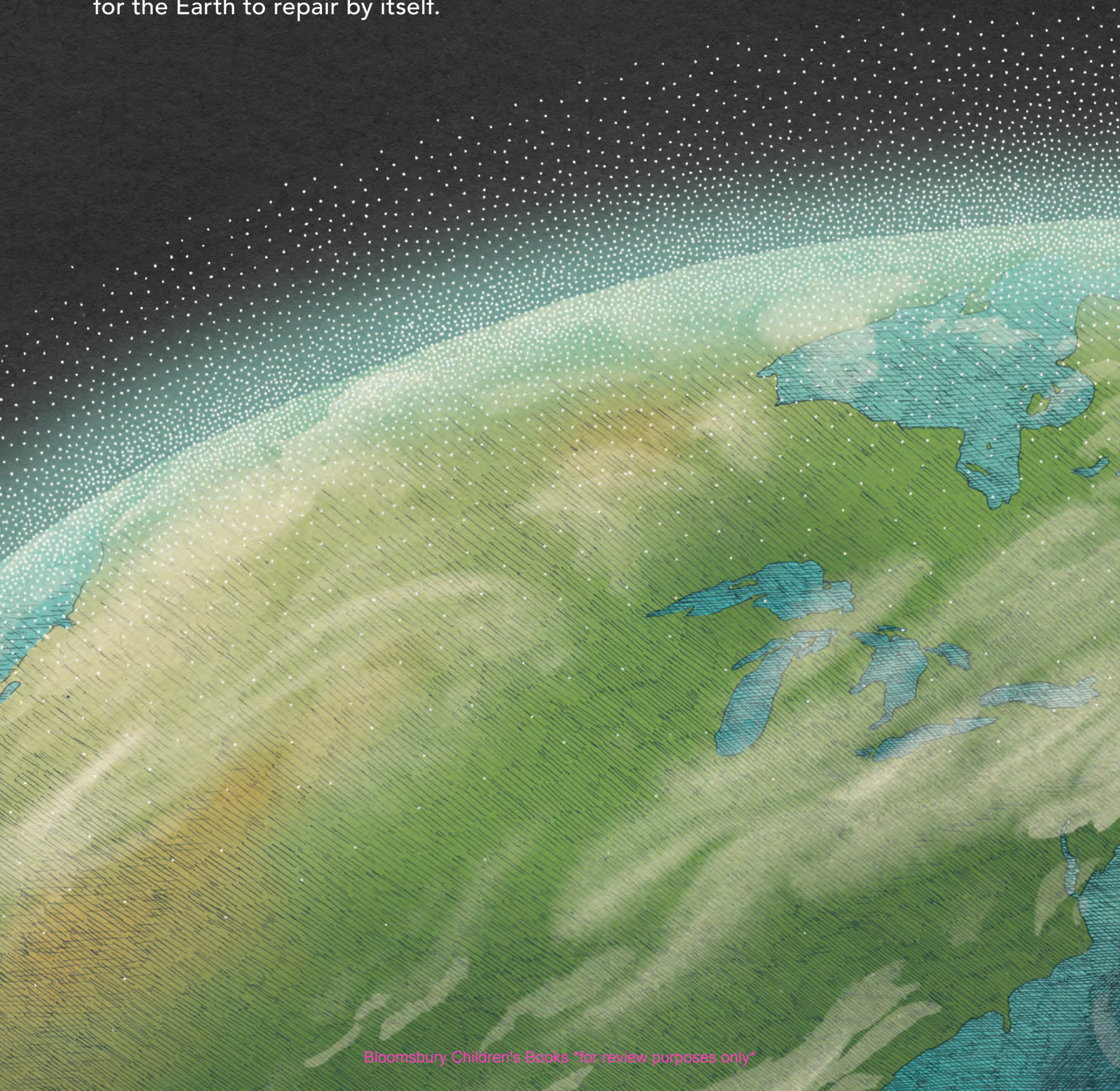


The healthier the dirt—
soft, spongy, and carbon-stuffed—
the better for meadows and woodlands,
the better for farming and for gardening,

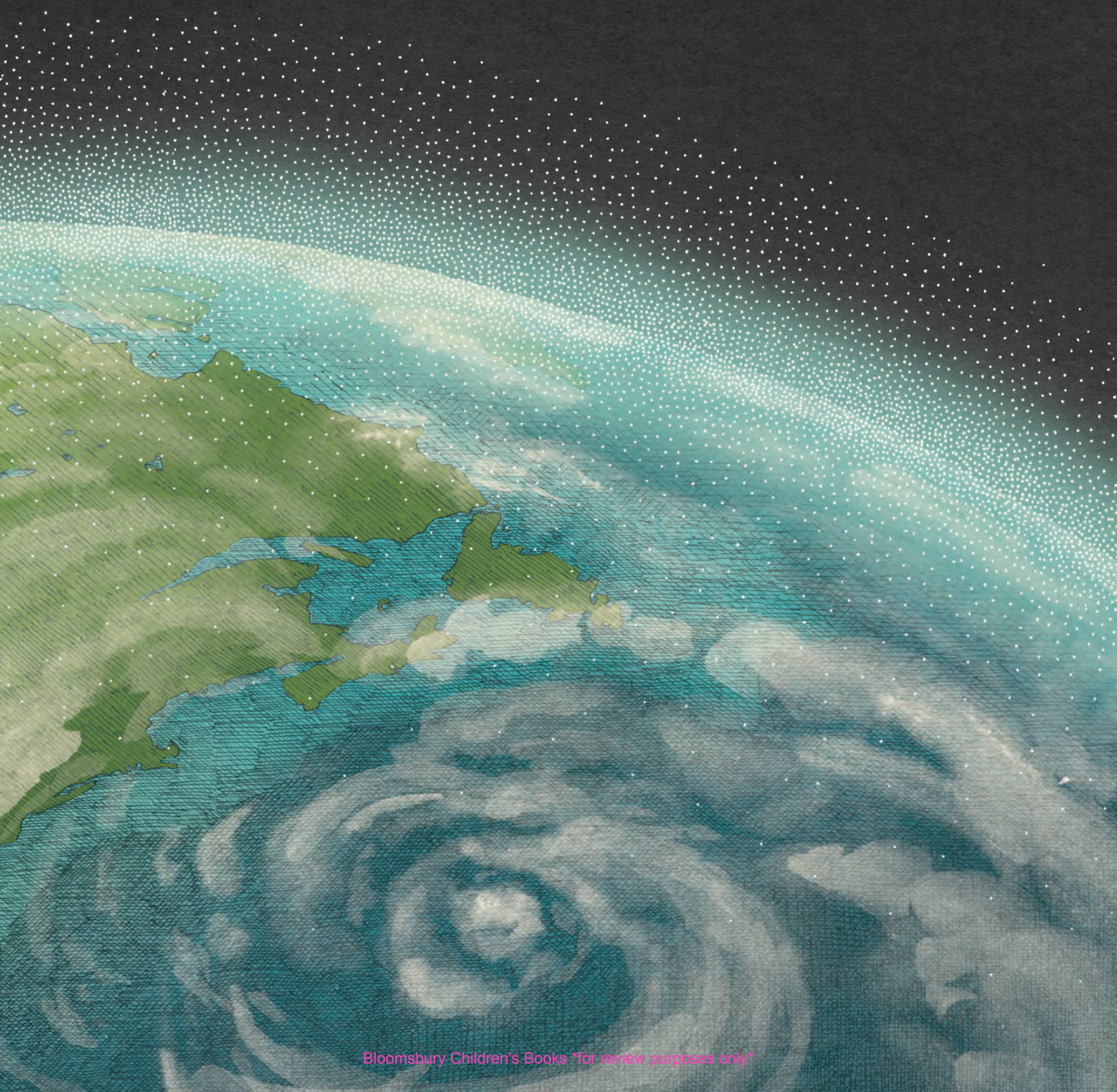


the better for giving us green spaces
and good foods,
one clump of dirt at a time.

At sea, by the shore, on land,
the Earth's powers are mighty.
But they are not enough.
There is too much carbon in the air
for the Earth to repair by itself.

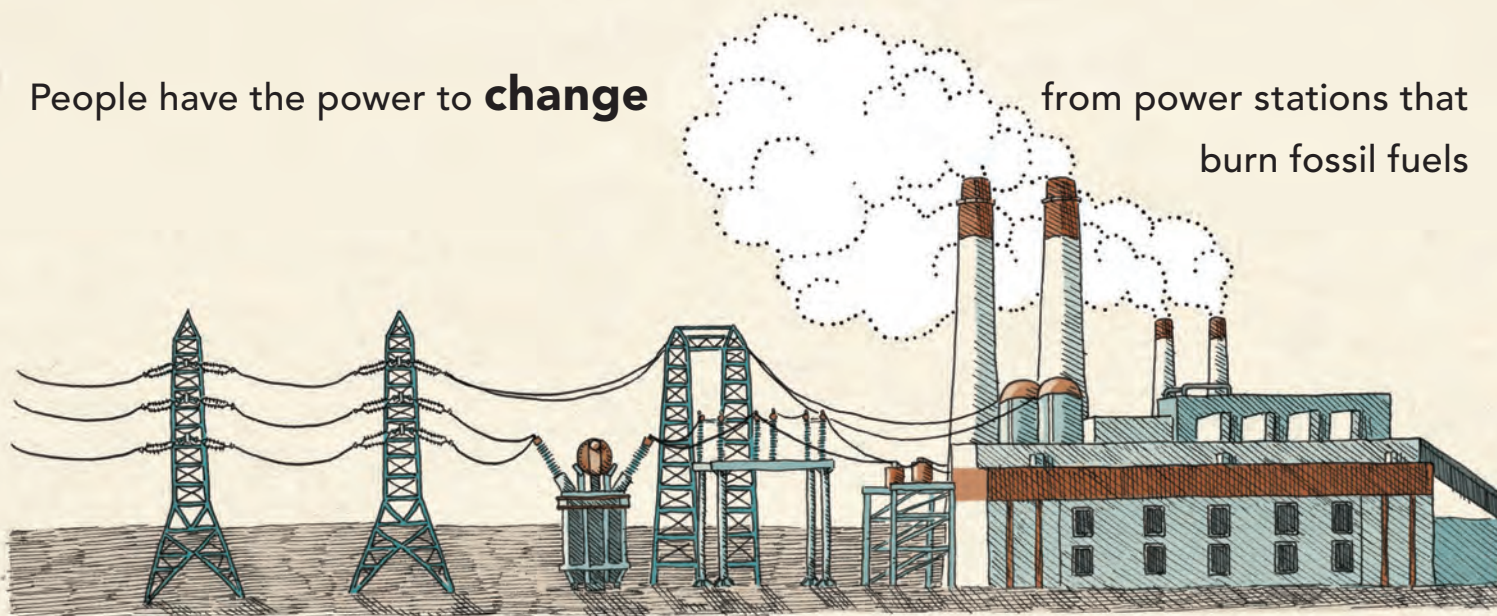


For the Earth to keep helping us,
we must help the Earth.
And **people** have amazing powers to do that.



People have the power to **change**

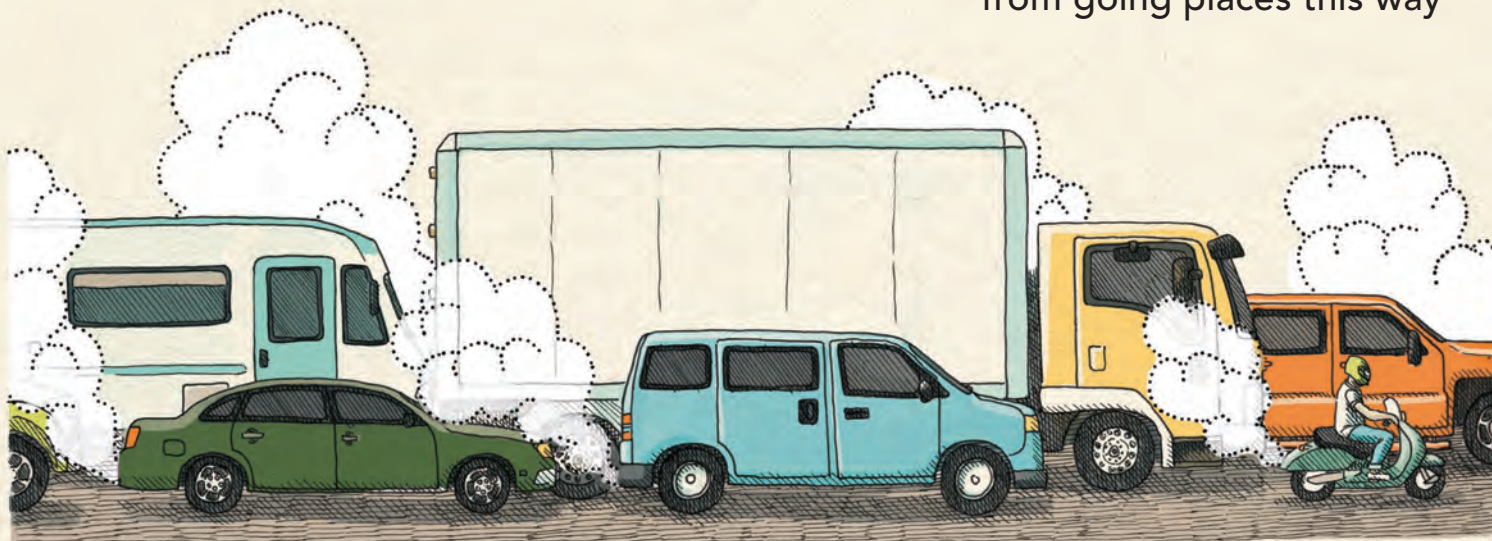
from power stations that
burn fossil fuels



from farms that disturb carbon-rich soil



from going places this way



to power stations that don't,



to farms that don't,



to getting there like this.



People have the power to **protect**.

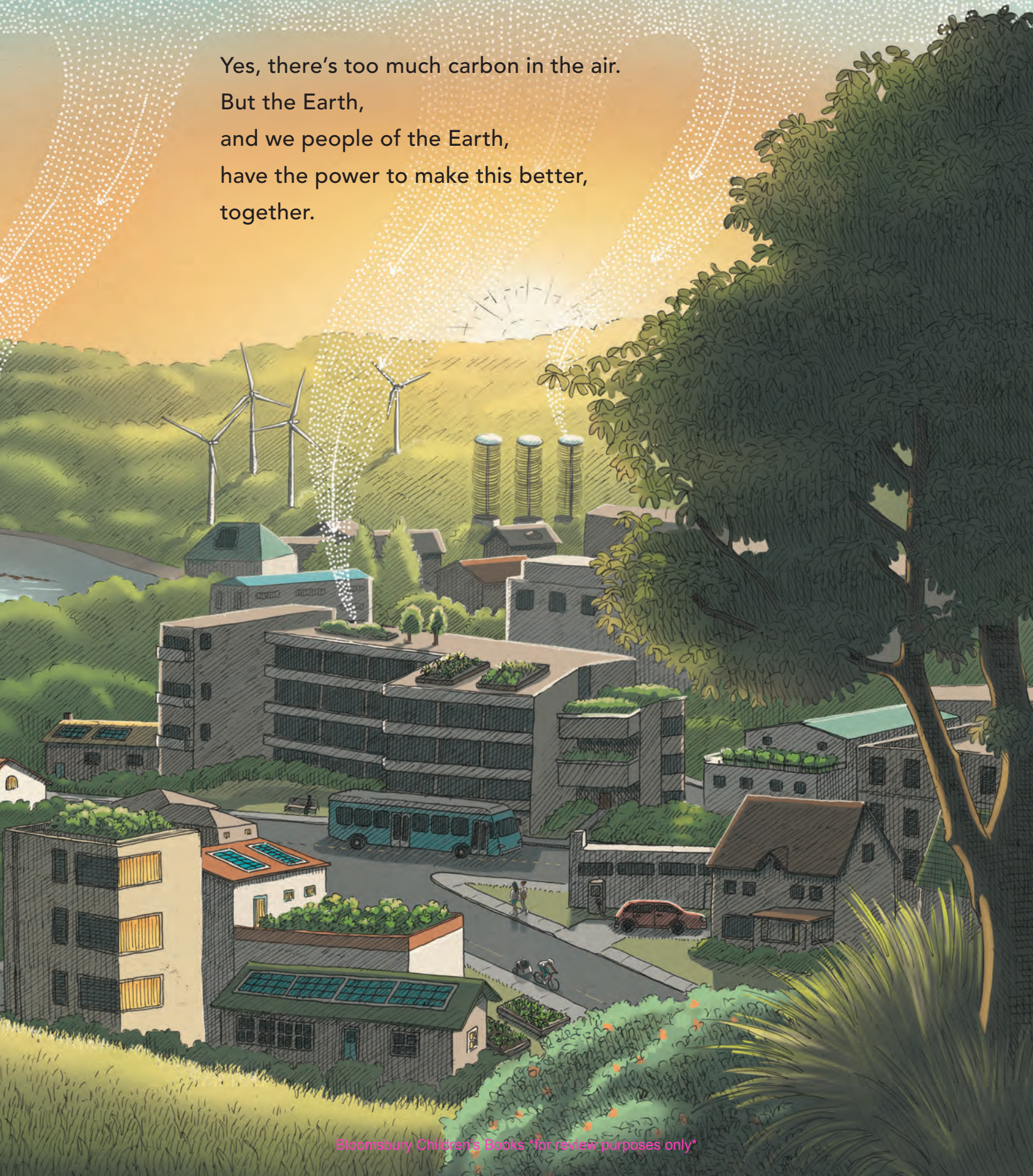


People have the power to **invent**.
We have the power of **science**!





Yes, there's too much carbon in the air.
But the Earth,
and we people of the Earth,
have the power to make this better,
together.



AUTHOR'S NOTE

THE PROBLEM

You can't see it or smell it, but carbon is in the air all around us. It takes the form of carbon dioxide, also known as CO₂. Scientists have instruments that measure the amount of CO₂ in the atmosphere, and that amount has never been higher in human history.

Some carbon dioxide exists in the air naturally. But the high levels of CO₂ that our world is now experiencing didn't happen naturally. They are the result of something people have been doing for a long time: burning coal, oil, and gas.

Of course, the use of these fossil fuels has changed our lives in greatly beneficial ways. We easily heat and cool our buildings. We drive and fly places! We flip a switch and light up the night. We plug in and power up all kinds of machines.

But the benefits have a cost. All that excess CO₂ has caused the Earth's atmosphere to trap too much of the sun's heat. Our climate has changed. Many places are becoming warmer. Some are becoming too dry and some too wet. These changes are causing drought, wildfires, violent storms, and floods. Animals and plants are endangered by climate change. So are we humans.

THE POWERS

The Earth has amazing powers to heal. As you know from reading this book, kelp, mangroves, and dirt are able to heal the Earth by removing carbon dioxide from the atmosphere and oceans. But, as you also now understand, our planet's atmosphere has trapped so much CO₂ that these and other natural CO₂ absorbers, such as

trees, can't clean it up by themselves. So people are working to help the Earth help us, with projects like these:

- Communities are preserving and restoring mangrove, marsh, and kelp ecosystems.
- Aqua farmers are growing carbon-absorbing kelp in the ocean.
- Scientists are experimenting to create plants with deeper, stronger roots that can store carbon underground even more efficiently.
- Farmers are planting cover crops, so their fields always have carbon-storing roots anchored in the soil.

Then there are the people who are building machines to vacuum carbon dioxide right out of the air. Others are designing devices to draw carbon from the ocean—where too much CO₂ is harming sea life such as corals—and turn it into limestone!

Turning CO₂ into stone and vacuuming it out of the air are big, bold ideas we all can hope will succeed. But while efforts to protect and invent our way out of the CO₂ problem are important, they must be coupled with big reductions in the amount of carbon dioxide we add to the air. Manufacturers and agricultural companies can reduce their carbon dioxide emissions by changing the ways they make their products. Power companies can build more plants that generate electricity using alternatives to fossil fuels. Governments can encourage these changes through laws. Individuals can choose climate-friendly products. We can contact business and political leaders and tell them we want change. We can share accurate information about climate change.

There are other ways, too, in which people are pitching in to limit carbon dioxide:

- They're riding bicycles and battery-powered vehicles instead of driving CO₂-emitting cars to work and school.
- In sunny areas, they're putting solar panels on their roofs instead of using electricity generated by coal-fired power plants.



- They're running air conditioners less in the summer and furnaces less in the winter.
- They're having fun in no-till gardens growing flowers, vegetables, and fruits without turning over the dirt—allowing carbon to stay fixed in the ground.
- And they're eating more finfish, shellfish, and edible seaweeds (like kelp!), the harvesting of which can emit less CO₂ and use fewer resources than land-based foods such as beef cattle.

What will you do to help the Earth help us?



SELECTED SOURCES

Many references and resources were consulted in writing this book. What follows is a small sampling.

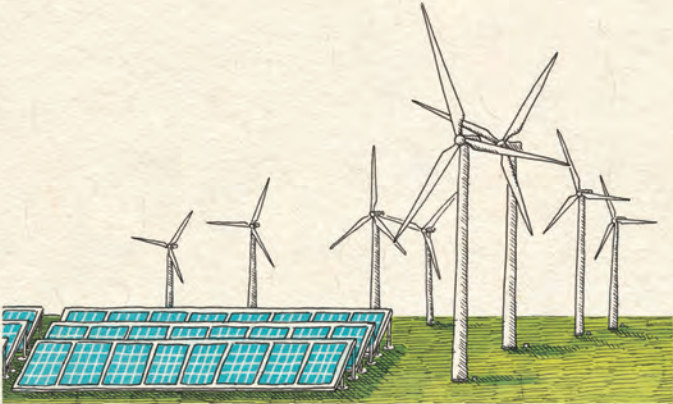
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HOW ARE WE HELPING THE EARTH HELP US?

WE ARE CHANGING!



We are getting around by electric vehicles, public transportation, bicycles, and walking—which means fewer gas-powered, CO₂-emitting cars.



By generating electricity from solar and wind power instead of fossil fuels, we get more energy with fewer CO₂ emissions.



We are eating more finfish, shellfish, and edible seaweed. Harvesting these healthy and tasty foods from the ocean and other waterways can produce fewer greenhouse gas emissions than raising livestock for food.



We are growing food crops in ways that keep more carbon buried in the soil.

WE ARE PROTECTING!

When we preserve and restore carbon-absorbing habitats, such as marshes and woodlands and mangrove forests, we give the Earth more chances to exercise its own amazing powers to repair the air.



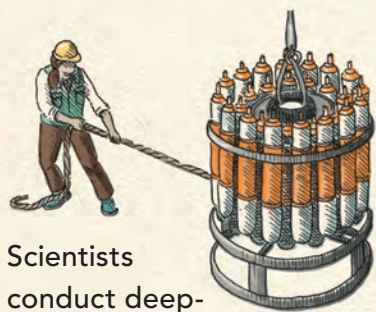
reforestation and planting trees



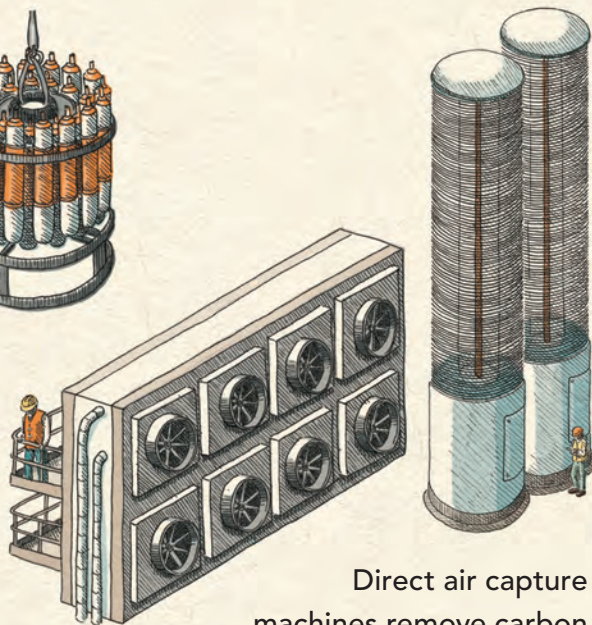
protecting existing green space

WE ARE INNOVATING AND INVENTING!

Human ingenuity and determination can bring about big change for the better! Researchers and inventors are experimenting with new technologies and practices that could help reduce carbon in the atmosphere and in the ocean.



Scientists conduct deep-water tests at sea as part of their research into carbon dioxide in the ocean.



Direct air capture machines remove carbon dioxide from the air. The captured CO₂ can be stored deep below the Earth's surface or used in some types of manufacturing.

Aqua farmers are growing kelp to capture carbon and to produce food for people and animals.



Researchers use special tools to measure the amount of CO₂ in the air.

Botanists are developing plants with roots that are deeper, stronger, and better at holding carbon in the ground than ordinary plants.





DEBBIE LEVY is the author of many award-winning books for children, including the *New York Times*

bestseller *I Dissent*; the Boston Globe–Horn Book Award winner *This Promise of Change* with Jo Ann Allen Boyce; *The Year of Goodbyes: A True Story of Friendship, Family, and Farewells*; and *Imperfect Spiral*. She lives in the Chesapeake Bay area.

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