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opening extract from

Countdown to Disaster: A World in Danger

written by

David Burnie

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Introduction

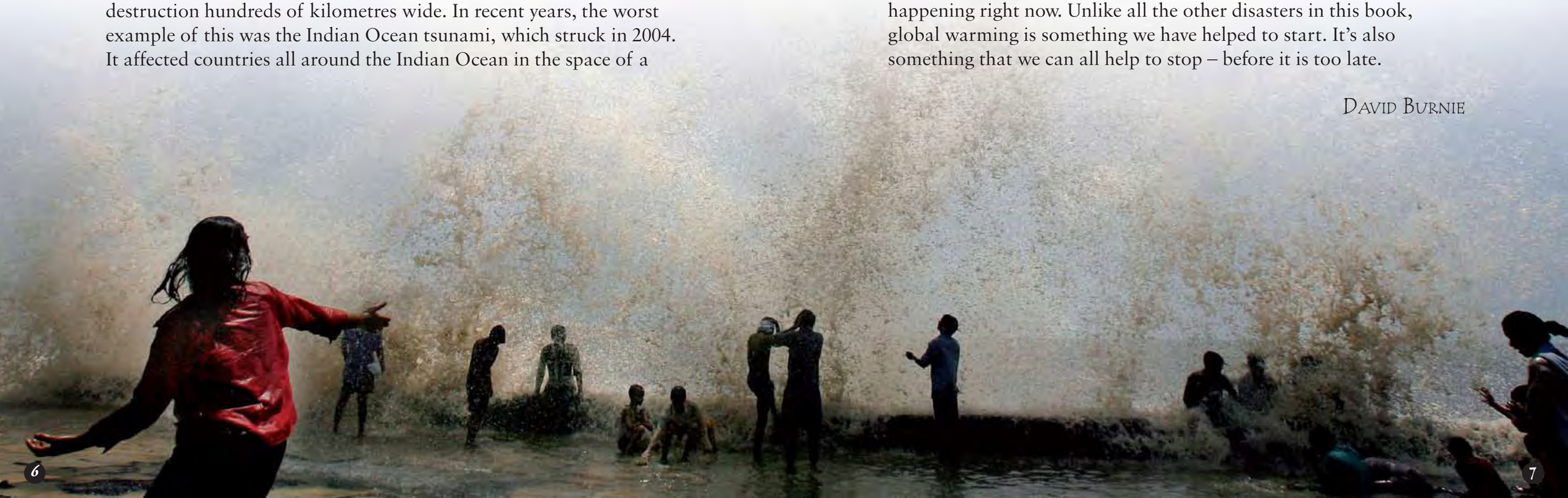
Most people like a good scare, which is why disaster stories make gripping films. But this book isn't about imaginary disasters: it's about ones that can happen in real life. Even with modern technology, many of them still strike without warning, and once they have happened, their after-effects can last for months or even years.

Natural disasters happen on many different scales. Tornadoes are some of the smallest, but that doesn't stop them being deadly. These incredibly violent storms strike with the sharpness of a knife, sometimes destroying houses on one side of a street, while leaving others almost untouched. At the other extreme, the world's biggest disasters can affect many countries at once, leaving a trail of destruction hundreds of kilometres wide. In recent years, the worst example of this was the Indian Ocean tsunami, which struck in 2004. It affected countries all around the Indian Ocean in the space of a few hours. By the time it was over, more than 200,000 people had died, and many more had lost their homes.

The DEADLIEST natural disaster EVER was the *Yellow River Flood* in 1931. At least 2 million PEOPLE DIED

Fortunately, disasters this big are rare, and your risk of getting caught up in any natural disaster is extremely small. But some disasters are so enormous that they leave no hiding place. They include collisions with giant objects from space – something that could happen in your lifetime, but almost certainly will not. They also include global warming, a slow-motion disaster that is happening right now. Unlike all the other disasters in this book, global warming is something we have helped to start. It's also something that we can all help to stop – before it is too late.

David Burnie



Volcanoes

No one knows how many volcanoes there are on Earth, because some of them are hidden far away on the deep seabed. However, on land there is no mistaking a volcano when it suddenly erupts. Millions of tonnes of ash and steam are blasted into the air, while rivers of lava often pour down a volcano's sides. From a distance, it's one of the most stunning sights in nature, but it can be terrifying when witnessed up close. Volcanoes sometimes give signs that they are about to explode, but often, an eruption literally comes out of the blue.

A truck speeds for safety before a huge cloud of ash, during the eruption of Mount Pinatubo in the Philippines in 1991. The ash fell like snow and reached as far as Singapore, over 2,000km away.

Time bombs

Volcanoes make dangerous neighbours, because it is impossible to know exactly what they will do next. Some are completely extinct. A few – like Stromboli off the coast of Italy – are active all the time. But the most deadly volcanoes are dormant ones. Like gigantic time bombs, they can stay silent for centuries or even thousands of years, before suddenly exploding back into life.

Sudden awakening

For hundreds of years, El Chichón in Mexico was thought to be extinct. However, the volcano was just dormant, and in 1982 its long sleep came to an end. Three colossal explosions, just days apart, shook the volcano, killing 2,000 people. The eruption left a crater 1km wide. At the bottom is a lake, which still bubbles with escaping gas.

Lava on the run

The world's biggest volcanoes produce runny lava, which pours downhill in red-hot rivers and streams. This kind of lava hardly ever makes volcanoes block up, but it's dangerous because it moves so fast. In 1977, lava surged down the slopes of Nyiragongo, an African volcano, at 60km/h.

Sticky situation

Covered in a heat-resistant suit, a scientist takes a sample of lava from an active volcano. It is dangerous work, particularly in a volcano like this, where the lava is thick and sticky. Instead of flowing away, this kind of lava can block a volcano's vent, making the internal pressure rise until the volcano blasts itself apart. In the explosion, lumps of hot lava – called lava bombs – can be flung 1km through the air.

Lopsided blast

Mount St Helens was one of North America's most scenic mountains, with a perfect cone-shaped peak. Then in March 1980, the mountain exploded, and its northern slope collapsed. The eruption left 57 people dead, and threw millions of tonnes of dust into the air.

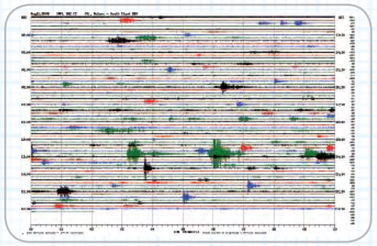
Peak before

During the blast

Peak after

Webicorders

Days before an eruption, the lava building up under the ground causes small earthquakes, or tremors. Scientists can predict when a volcano is about to explode by picking up these tremors. In the past, the tell-tale quakes were detected with seismograph machines, which showed the wobbling motion of the ground as a graph. Today, we use webicorders, which send out warning information by radio and around the world via the internet.



In harm's way

When volcanoes erupt, all kinds of deadly hazards are suddenly unleashed. Rivers of lava set forests and buildings on fire. Worse still, super-heated clouds of gas and rock can surge down the volcano's sides, smothering anything – and anyone – trying to escape. Meanwhile, volcanic dust reaches high into the atmosphere, where the wind spreads it far and wide.

Burn out

On the island of Hawaii, a stream of lava from the Kilauea volcano sets fire to a group of trees. This kind of lava has a temperature of up to 1,000°C – hot enough to set fire to trees and buildings without even touching them. Kilauea's lava often reaches as far as the sea, where it disappears in huge plumes of steam.

Spotlight on flying into trouble

On 15 December, 1989, a Boeing 747 flew into a cloud of ash produced by an erupting volcano in Alaska. All four engines shut off, and the plane plunged nearly 4,000m before the pilots managed to get them to restart.

Crushed by ash

During a big eruption, ash can build up on roads and roofs like a deep layer of snow. However, unlike snow, volcanic ash is heavy – particularly if rain makes it wet. Eventually, the weight can become so great that roofs collapse, killing or injuring people inside. This house was destroyed by ash during the eruption of Tungurahua, a volcano in South America that erupted in 2006.

Clearing up

After an eruption is over, the hard work of clearing up begins. These people are sweeping away dust in Quito, the capital of Ecuador, after an eruption 90km away. Volcanic ash is hard and gritty, and it can make car engines seize up. Its one good point is that it is full of minerals, so ash helps to make soil very fertile.

Well prepared

Ordinary dust can make you cough, but breathing volcanic ash can cause bronchitis and other serious diseases. That is because volcanic ash is made of tiny sharp-edged particles of rock and natural glass. It is bad enough if you are healthy, but for people that already have heart or lung problems, it can kill. These children live close to Mount Merapi, the most active volcano in Indonesia. They are well protected against the risks.

The big melt

Many of the world's highest volcanoes are covered with ice or snow. Around their summits, heat and cold create some of the strangest scenery in the world, including ice towers and steam-filled ice caves. When the volcano erupts, the ice can disappear in minutes as the heat makes it melt. The result is a volcanic flood – one that races downhill, sweeping up mud, ash, whole trees and even boulders the size of cars.

Ice tower

Over 3,500m up on Mount Erebus, a tower of ice looms against the bright blue sky. Mount Erebus is in Antarctica, and is the southernmost active volcano in the world. Near its summit, ice towers form where steam comes out of the rock, freezing as it meets the air. The towers grow up to 15m high before their own weight makes them collapse.

Glacier burst

This bridge was damaged during a huge flood that happened in Iceland in 1996. The flood was triggered by an eruption underneath Iceland's biggest glacier, the Vatnajokull. Water built up under the glacier until finally the ice gave way and a torrent of water was released. At its peak, the flood was 50km wide and up to 5m deep. Fortunately, no one was harmed, but some of Iceland's largest bridges were destroyed as the water poured downhill towards the sea.

Flooded by mud

In 2008, Chile's Chaitén volcano erupted after being silent for nearly 10,000 years. As well as pouring out millions of tonnes of ash, it triggered off volcanic mudflows, known as lahars. Lahars can be extremely dangerous, because they set like concrete when they come to a stop. In the Chaitén eruption, one lahar blocked a river, sending its water straight into a town.

Eruptions are often followed by mud-laden floods

Protect yourself

Ash and mudflows are the two biggest dangers in many volcanic eruptions. The best way to protect yourself against ash is to breathe through a piece of cloth. Volcanic floods can strike long after an eruption, so it is important to keep away from low ground.

Lingering damage

Before Mount Pinatubo erupted in 1991, powerful earthquakes warned that disaster was on its way. About 50,000 people were evacuated before the volcano finally exploded, an operation that saved huge numbers of lives. Since then, many people have moved back to rebuild their homes, but life next to Pinatubo is still not entirely safe. Every year, the rainy season loosens ash on the volcano's slopes, causing dangerous mudslides.

Blasts from the past

The Earth is scarred by huge eruptions that happened long ago. Some of them – like the explosion of Krakatoa or Vesuvius – buried ancient towns and cities, and claimed thousands of lives. Much further back in time, ancient eruptions affected prehistoric animals, wiping out entire species by killing off their food. One of the biggest prehistoric eruptions took place in India, more than 60 million years ago. It was so powerful that it may have helped to end the reign of the dinosaurs.

Krakatoa

The island of Krakatoa blew itself apart in 1883, in an explosion that could be heard over 3,000km away. Up to 30,000 people died in the eruption itself, and in the tsunami that it caused. In 1927, a new volcanic cone emerged from the sea where Krakatoa had once been. It is called Anak Krakatau, or "Child of Krakatoa".

Dark times

The Deccan Plateau, in India, was built up by some of the biggest eruptions the world has ever seen. The eruptions began about 68 million years ago, or 3 million years before the dinosaurs disappeared. Lava from the eruptions formed an immense sheet 2,000m deep, which covered half of the Indian subcontinent. In these hills near the plateau's edge (left), the layers of lava look like dark stripy bands.

The eruption of KRAKATOA literally *shook* the world

A year without a summer . . . spotlight on

The summer of 1816 was one of the coldest on record – in North America, rivers were still frozen in July. The culprit was Mount Tambora in south-east Asia. It erupted in 1815, producing so much ash that it blocked out the sun for months.

Ancient Atlantis?

About 3,600 years ago, the Mediterranean island of Santorini exploded, in one of the biggest eruptions of historical times. The centre of the island vanished, leaving a curve of jagged cliffs high over a deep blue bay. Santorini may have inspired the legend of Atlantis, an island civilization that disappeared beneath the waves.

Window on the past

In 79 AD, the eruption of Mount Vesuvius completely destroyed the Roman city of Pompeii. Blanketed by a deep layer of ash, the city then lay forgotten until it was accidentally rediscovered in 1748. Since then, the ruins of Pompeii have gradually been excavated. Thanks to the ash, they are amazingly well preserved, making Pompeii one of the most fascinating archaeological sites in the world.

Danger zone

With its scalding-hot springs and spectacular geysers, Yellowstone National Park has some of the most stunning scenery in North America. But something even more incredible lurks beneath the ground. It is a giant chamber of magma, or molten rock, covered by a lid of solid ground. If the lid melts or cracks – as it has done in the past – the magma will force its way to the surface, and produce an immense explosion. In the last two million years, Yellowstone's magma chamber has exploded three times. The last eruption was about 600,000 years ago, and the next could happen at any time.

Grand Prismatic Spring

Yellowstone's Grand Prismatic Spring is longer than a football pitch, and nearly 50m deep in the middle. The centre of the spring is too hot for living things, but the shallows near the edge teem with heat-resistant bacteria called thermophiles. These extra-tough microbes can survive temperatures of up to 60°C. They give the spring its extraordinary colours, which slowly change throughout the year.

Steaming landscape

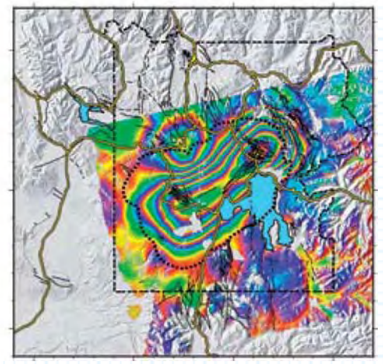
Yellowstone is famous for its wildlife, such as bison, and also for its geysers, which blast steam and boiling water high into the air. One of them, called the Steamboat Geyser, has two openings or vents, like the funnels on a ship. When it erupts, it throws water 100m into the air, making it the tallest geyser in the world. Yellowstone has about 200 active geysers – more than anywhere else on Earth.

Passing through

About 600,000 years ago, Yellowstone was a volcanic wasteland without any signs of life. Today the area is one of North America's busiest national parks, attracting more than two million visitors every year.

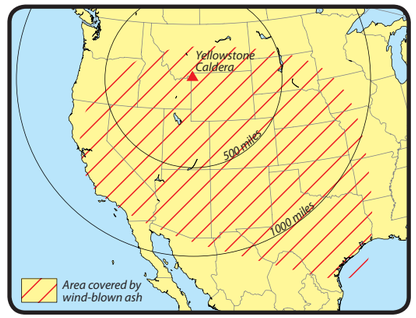
Eyes on the ground

Using satellites, scientists can map the ground level at Yellowstone, to see changes caused by volcanic activity. Each map is built up from pictures taken several months apart. The coloured rings show where the ground level has changed. Each complete set of colours marks a fall or rise of nearly 30mm.



Smothered by ash

The last time Yellowstone erupted, most of the western half of the United States was covered by volcanic ash. If the same thing happened today, hundreds of cities would be affected, and tens of millions of people will have to move to safety.



Life fights back

After an eruption is over, living things soon start to reclaim the devastated landscape. Insects and birds are often the first to arrive, followed by plants, whose seeds drift through the air. Within a few years, the lava and ash are covered with patches of greenery, as pockets of soil build up, and more plants take root. Decades later, a volcano's slopes are covered with thick forest again, as living things reclaim the ground that they had lost.

Growing on lava

This plant is sprouting on bare lava on Kilauea – a volcano in the Hawaiian Islands. Lava is hard and unwelcoming, but it does have one big plus: it is full of the minerals that plants need in order to grow. Ferns and shrubs set up home in cracks in the lava and sheltered gulleys. There, the roots are shaded from the sun, and they can collect water when it rains.

Volcanoes HELP life as well as harming it

Plant pioneers

After Mount St Helens erupted in 1980, fireweed, or willowherb (above), was one of the first plants to make a comeback. With its bright red flowers and airborne seeds, it quickly takes over ash-covered ground. The same plant is common in Britain. During World War II, it created a blaze of colour where bombs had scorched the ground.

Future forest

When Mount St Helens erupted, millions of trees were destroyed in minutes. The photograph above, taken 15 years later, shows that the forest soon started to grow back. Today, some of these trees are more than 10m high, and will soon be producing seeds themselves. As the forest grows back, it gradually changes, as the first trees to arrive are replaced by taller, slower-growing kinds.

Restless neighbour

These ponies are grazing on the slopes of Arenal, an active volcano in Costa Rica, Central America. Like many volcanoes, Arenal is surrounded by rich farmland, because volcanic ash makes for very fertile soil. Arenal was dormant for 400 years, until it came back to life in 1968. Fortunately, its eruptions are only small, so it is not quite as dangerous as it looks.

Spotlight on Surtsey

The island of Surtsey was born in 1963, when it blasted its way through the sea's surface off the coast of Iceland. Since then, scientists have found about 20 kinds of plants on it, together with several species of seabirds.

Earthquakes and landslides

On 17 January, 1995, the ground began to shake in the Japanese city of Kobe. In the next 20 seconds, houses collapsed, escaping gas caught fire, and elevated expressways cracked, crashing onto the ground below. It was the most expensive natural disaster on record, and 6,000 people died. Fortunately, earthquakes this big are rare, and many parts of the world never have earthquakes at all. However, like landslides, they can strike at almost any time. If they happen under the ocean floor, the result can be something even more deadly and far-reaching – a tsunami or tidal wave.

Despite being designed to withstand earthquakes, Kobe's roads and railways were badly damaged by the 1995 quake. Here, several pillars of an elevated expressway have given way.

Restless Earth

In some parts of the world, earthquakes are unknown. In others, the threat of a big quake is never far away. This difference is due to Earth's rocky shell, or crust, which is divided into huge plates that are slowly on the move. The centres of plates are seldom hit by quakes, but if you live near the edge of one, you may be an earthquake expert already. Neighbouring plates often collide or scrape past each other where they meet, triggering huge jolts that make the ground shake.

The next BIG quake, could hit at *any time.*

Jagged edge

The San Andreas Fault, in southern California, is one of the most famous earthquake zones in the world. Here, two parts of the Earth's crust are sliding in opposite directions, creating a visible gash 1,200km long. Instead of moving smoothly, the two plates often snag together, creating earthquakes when they separate.

Following clues

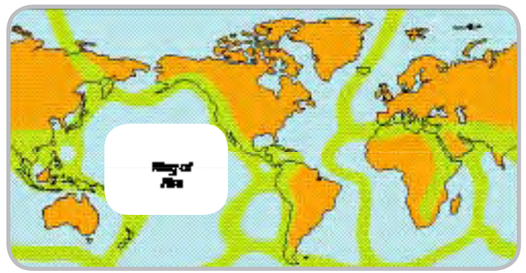
Scientists have discovered that the centre of a quake occurs further along the fault than the last one in the area. Over several decades, quakes travel along the whole fault and then start again at the other end. This is used to predict where and when the next big quake will hit.

Spotlight on ups and downs

During an earthquake, the ground can move up and down, as well as from side to side. Sometimes the sea shore is raised by several metres, leaving fish and coral reefs stranded out of the water.

Aftermath of a quake

After the Kobe earthquake hit Japan in 1995, fire burned through many houses in the city, causing as much damage as the earthquake itself. Earthquakes trigger fires by breaking gas pipes and petrol tanks, and by causing sparks. The water supply is often cut, which makes it difficult to put out the fire once it has taken hold.

Earthquake zones

Four-fifths of the biggest earthquakes happen in the "Ring of Fire" – a 40,000km-long zone that surrounds the Pacific Ocean. The Ring of Fire includes the San Andreas Fault, and also the whole of Japan. After this, the second most active earthquake zone runs from southern Europe, through the Himalayas, to Indonesia. In 2004, an earthquake here triggered the Indian Ocean tsunami – one of the deadliest natural disasters ever.