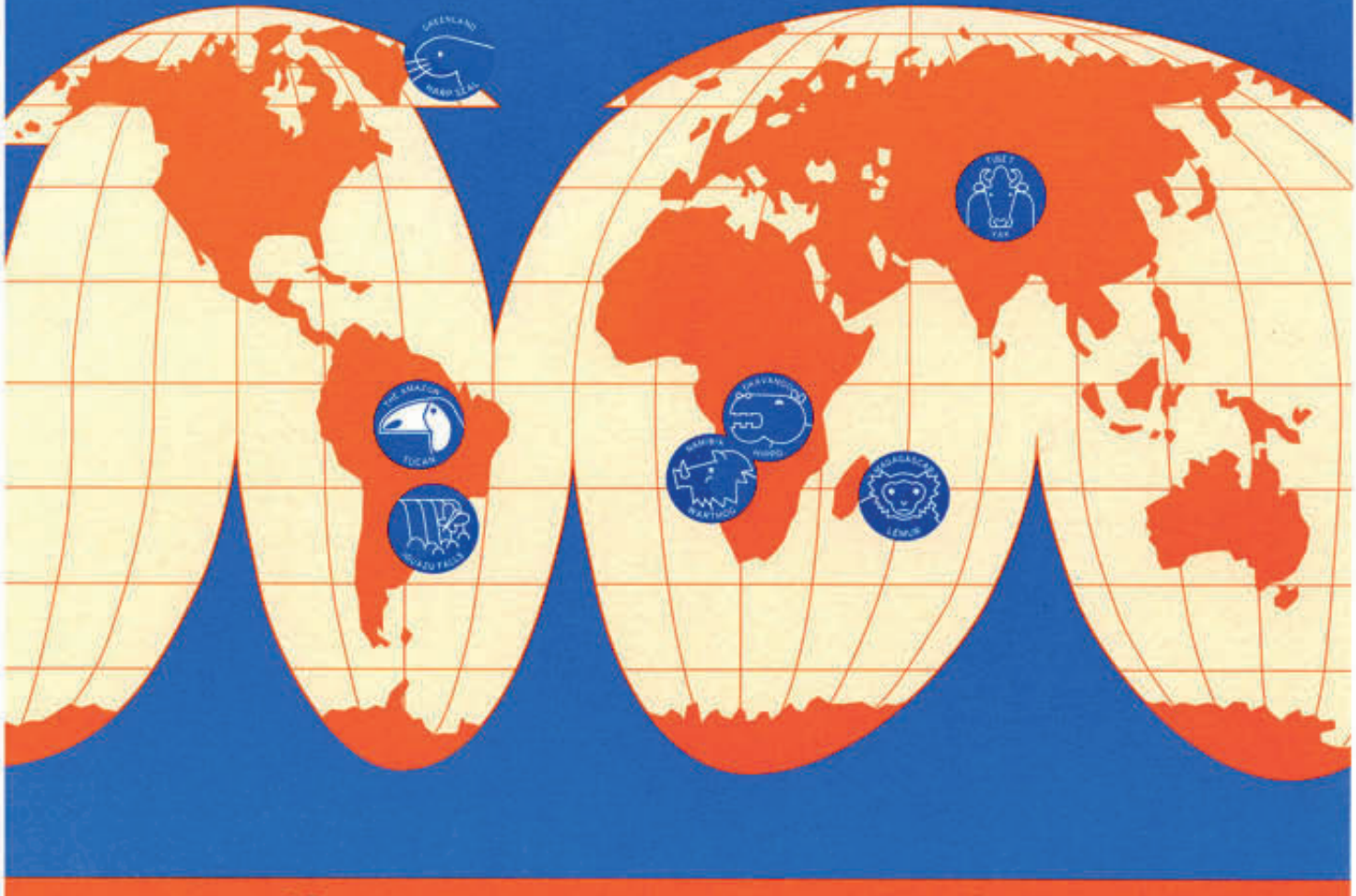
THE GREATEST PLACES

Teacher Activity Guide



http://www.greatestplaces.org/teachers

THE GREATEST PLACES

Acknowledgements

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James Heintzman, Packet Developer
Dr. Diane Stanitski-Martin, Science Advisor
Mike Day, Executive Producer and Omnitheater Director
Graphic Design by Black Dog Graphics
Lynne Kujawa, Copy Editor

To purchase copies of this or other teacher activity guides, write to: Educational Resources, Science Museum of Minnesota, 30 East Tenth Street, Saint Paul, MN 55101
OR call: 1-800-221-9444, extension 4543
OR visit our web site at http:www.smm.org

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THE GREATEST PLACES

Contents

Cover map: Goode's Equal Area Projection

MAKING OF *THE GREATEST PLACES* FILM

This large-format film is a journey to seven of the most geographically dynamic locations on earth. It features spectacular land forms, diverse wildlife, distinctive ecosystems, and the people and cultures indigenous to these places.

The story begins 250 million years ago with the breakup of the supercontinent Gondwanaland. Plate tectonic activity placed land masses in their present positions as it changed their structure and composition. Every place on earth is made from the same recipe: The key ingredients water, air, earth, light, and life are at different temperatures and in different proportions.

The Greatest Places shows some of the most spectacular combinations of these basic ingredients. Its aerial and remote cinematography along with computer animation highlights glaciers, islands, plateaus, waterfalls, rivers, deserts, and deltas in their most stunning examples in the following places:

Greenland
Madagascar
Tibet
Iguazu Falls of South America
The Amazon
The Namib Desert
The Okavango Delta

Introduction

Place: a portion of geographical space occupied by a person or thing. OR a center of felt value.

This activity guide has three basic features:

- place pages with maps
- background information
- core activities that demonstrate basic geography concepts (with illustrations and follow-up suggestions when appropriate). The activities and information are designed as starting points for further study.

For anyone who has ever dreamed of travel to faraway places and exotic cultures, geography is more than an interdisciplinary field of study. It is the ticket for fascinating journeys and memorable learning experiences.

This teacher activity guide was developed in conjunction with the large-format film, *The Greatest Places,* produced by the Science Museum of Minnesota. The film is a journey to seven of the most geographically dynamic locations on earth. A family guide, a web site, two international institutes featuring partnered classroom teachers and museum educators, and a new addition to the Museum Trunk™ program also were developed to complement the film.

Even though it was developed for the film, this guide is designed to stand alone as a resource for studying global geography. The same format and features given for the seven places in the film and in this guide can be used as models for studying any place on earth. Since it would be impossible to provide even a cursory introduction to all of the people and places in these few pages, the activities and background information in this guide deal primarily with physical geography. The resources given at the end of this activity guide and in the Trunk, as well as *The Greatest Places* web site (http://www.greatestplaces.org) can provide more specific information. All of the educational resources developed for *The Greatest Places* are designed in accordance with the National Geography Standards.

Cultural baggage

Greenland
Madagascar
Tibet
Iguazu Falls
The Amazon
The Namib Desert
The Okavango Delta

activity

Give each student a resealable bag to take home. Have them return it, filled with 10 real objects that represent something about their own place, including the environment, culture, climate. All objects or items must fit inside the bag. Places could be a neighborhood, a city, a state, on a country. If you have different seasons, you may want to design a bag for each one. Pictures can be cut from brochures and magazines and used along with real objects. Encourage creativity in the choice of objects; suggest selecting items that are not obvious.

Put all the bags on a table. Have each student pick one bag from the collection and then go around the classroom to ask questions about the contents in order to find out who made it. They can ask for help in figuring out what the objects are, and once the creator of the bag is discovered, the meaning behind the objects selected can be revealed.

TRY THIS, TOO:

After studying the Greatest Places, ask students to list what objects they would put in a bag to represent each place.

Culture in a box

activity

Pick out a place or a country that you would like to learn more about. As an introduction and as an explanation of your own culture and your place, design a culture box with a maximum of 25 items that would help people in that place or country understand what you and your place are like. Find a school in another place or country that would be willing to receive your culture box – and perhaps send one back to you as well.

Once you know where your culture box is going, brainstorm ideas in small groups of five or less and then share your ideas with the entire class. The entire class should brainstorm again after sharing group ideas. What things or pictures best tell the story of your place? What is unique to your place? (Three-dimensional objects are usually more interesting than pictures and words. In some countries videos, or CDs may not be practical.)

Check your final list of ideas for interest, safety, shipping ability, durability, and cost. Find the size and weight limit for your shipment. Weigh each item and determine the shipping cost. Some items may have to be changed. Come to a consensus on which things should be included.

Write up brief descriptions for each item selected. Include the reasons the item was selected for the culture box, background information, and any necessary explanations of its significance. (e.g., people living their whole life in the tropics may have difficulty appreciating a hockey puck unless they are familiar with the game of hockey which is played on large sheets of frozen water. You could tell them that people who enjoy winter above the 45th parallel are experiencing the equivalent of playing inside a freezer; this is something that they might relate to.)

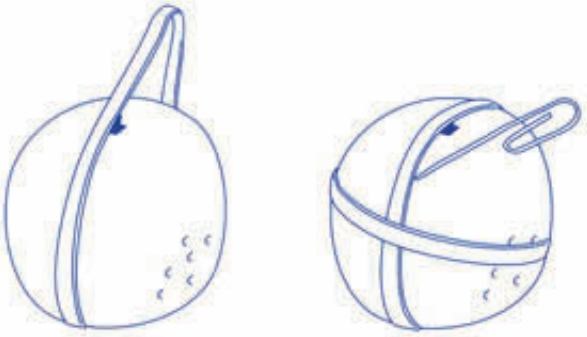
Prepare a list of questions about the other place or country that you would like answered by the students there. You may wish to draw pictures or write personal descriptions of your place. Design graphics and packaging for shipping and send your box to its destination. Be sure to let them know it is on the way. Remember some schools may not have computers or e-mail.

Global Orange

activity

Navel oranges work best for this activity.

Imagine an orange as a model of the earth. Wash it with soap and water to remove any waxy coating. Roll the orange on a table top with the flat of your hand to loosen the peel.



Take the orange and put a flat rubber band around the middle of it, covering the stem and the navel. Now the orange is divided into equal halves. Take another rubber band and put it around the middle of the orange the other way, halfway between the stem and the navel.

Mark or scratch along each line with a marker, a paper clip, or a fingernail. (Markers can be a little messy). Remove the rubber bands after you have traced both circles on the orange.

The first circle you traced is the prime meridian, which goes from the North Pole, throughEngland, through western Africa, to the South Pole.

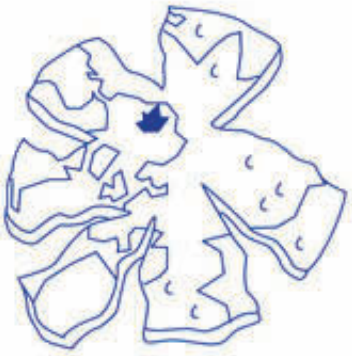
After the South Pole, this line becomes the 180th meridian; it runs east of the north island of New Zealand and through the Bering Peninsula in Siberia. The International Date Line is centered on the 180th meridian. The prime meridian is an imaginary line that is a base for the 360 degrees of longitude parallels that geographers use to mark the globe. The equator is marked by the second circle drawn. This is a base for the 180 degrees of latitude covering the globe.

Using a globe, find and mark (or scratch) the approximate centers for each of the continents on the orange, using the lines for reference. (e.g., What part of Africa is above the equator? About how far down the orange would it go? What parts of Africa are west of the prime meridian?) Find and mark the centers of other continents. (Where is South America in relation to Africa and the equator?) Working out from the center, scribble or scrape the

rough shape of all the continents on the surface of the orange. Don't worry about doing it perfectly and don't try to draw outlines; it's almost impossible to draw them accurately. Draw the shapes instead, using the globe as a guide. Concentrate on where places are in relation to each other.

When you are done, carefully cut with the knife through the line around the equator, without cutting

the orange underneath. Carefully slide your finger between the peel and the orange segments to completely separate them. Nowcarefully remove the two hemispheres of your orange without breaking any of the peel. (You may need help with this.)



Place the two intact peels, or the northern and southern hemispheres, on the table with the continents facing up. If you wanted to have flat maps like those in a book, the continents would have to be flat. What do you have to do to make the 3D contintents into flat, 2D maps?

Go ahead and flatten them. What happens?

Map makers have to use a variety of tricks to stretch 3D shapes into regular, flat maps. The gaps are filled in by stretching them mathematically. There are some examples on the next page.

OVERVIEW:

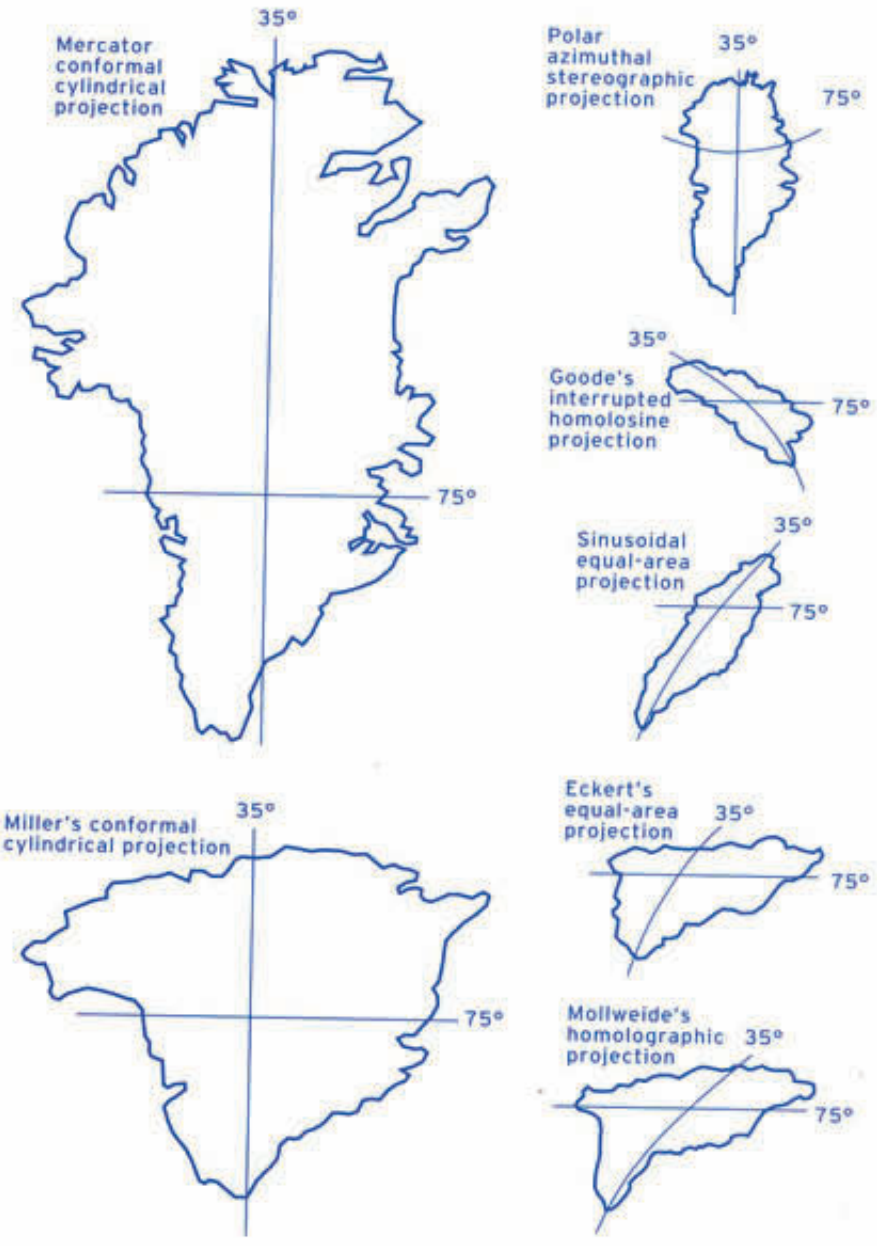
Students create model globes from oranges to demonstrate why flat maps are distorted pictures of the earth's surface.

MATERIALS:

for each student or team of students:

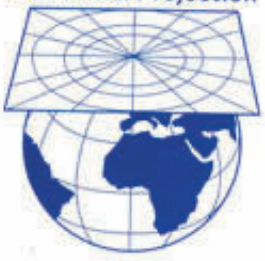
one navel orange, two wide rubber bands, paper clip/marker, reference globe, plastic knife with serrated edge.

The shape and size of Greenland according to seven different projections, all the same scale at the equator. The most accurate is the Polar Azimuthal projection at the upper right.



Map makers have to use a variety of tricks to stretch 3D shapes into regular, flat maps. The gaps are filled in by stretching them mathematically. Here are some examples:

Azimuthal Projection



Lambert Equal Area Projection

Cylindrical Projection

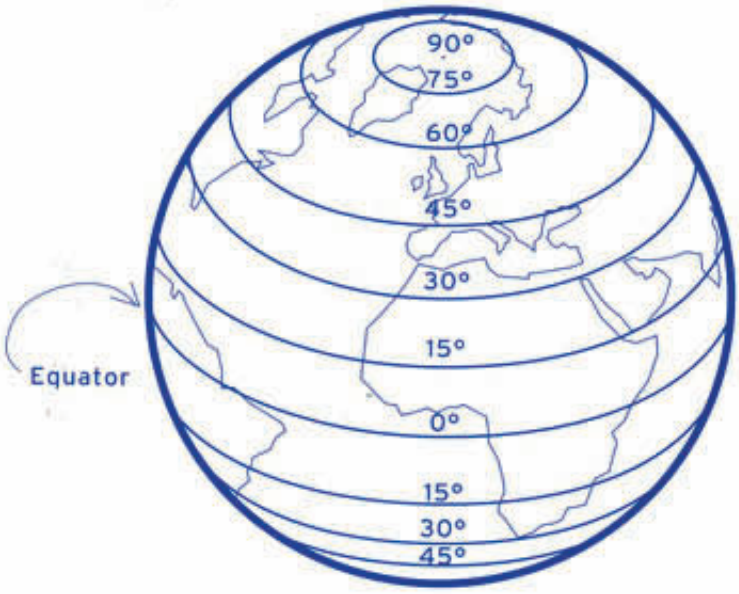
Mercator Projection

Mercator projection: Best for showing details of coastlines, navigation.

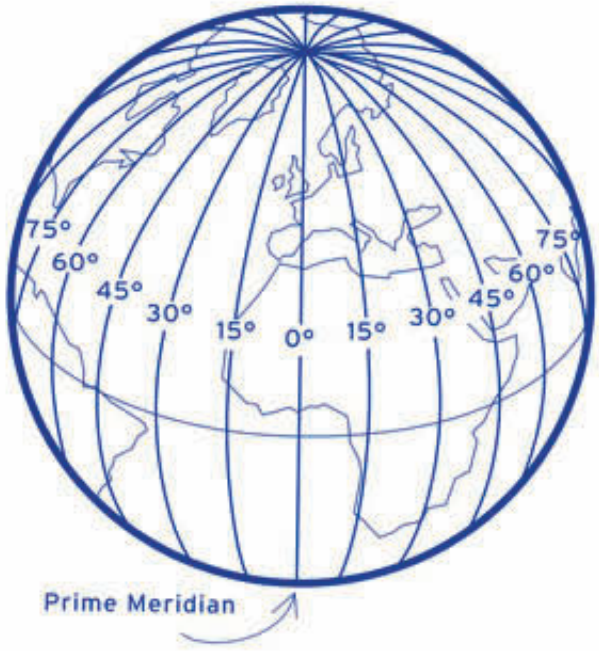
Goode's Interrupted Equal Area Projection

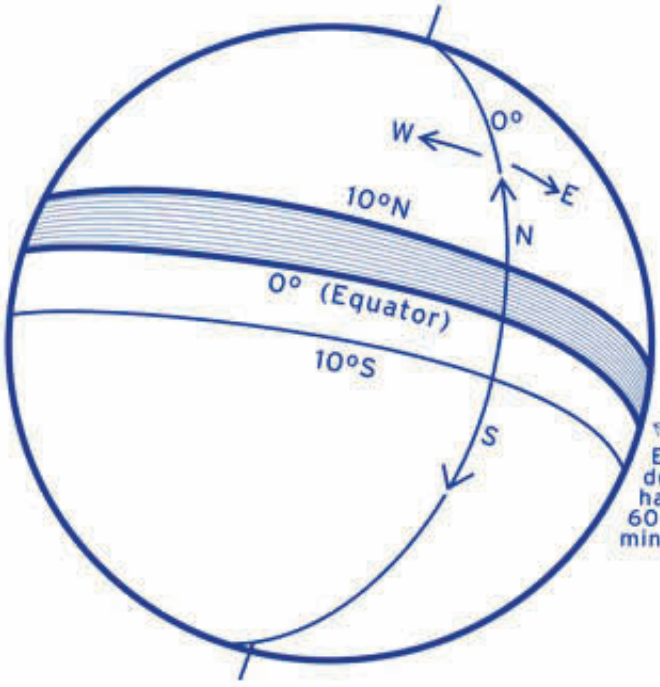
Goode's Interrupted Equal Area projection: Shows areas in proportion as the globe does. Does not make North and South America the focal point.

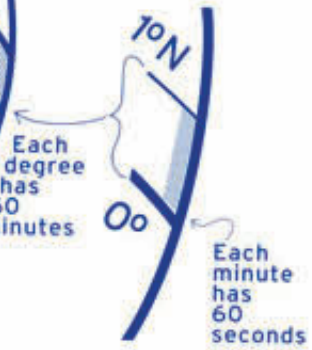
Latitude lines or Parallels



Longitude lines or Meridians







COORDINATES FOR CITIES:

64°11'N/51°4'W
18°55'S/47°31'E
3°08'S/60°01'W
20°S/23°25'E
22°43'S/14°34'E
29°40'N/91°09'E

KEY:

Cities in respective order:

Nuuk, Greenland
Antananarivo, Madagascar
Manaus, Brazil
Maun, Botswana
Swakopmund, Namibia
Lhasa, Tibet

THE GREATEST PLACES

Greenland

(Kalaallit Nunaat)

SNAPSHOT

2,175,600 sq.km./840,004 sq.mi. (three times the size of Texas with 25,000 miles of coastline.

Capital: Nuuk (formerly Godthab)

Population: 56,000 (nearly 100% urban, small towns)

Languages: West Greenlandic (an Inuit dialect), Danish

Biome: Tundra (a thin border near the surrounding ocean, around the central ice cap which occupies 85% of the island.

Economy: Fishing, tourism

99% literacy rate

LANGUAGE

Inugujoq, kutaa (in-nooq-oo-jok, koo-tah)/Haluu=hello

Ajunnginniarnat innulluarit (ah-jun-ghin-e-are-not in-nool-oo-arit)=goodbye (long-term)

Ajunnginniarnat takuss (tah-kooss)=goodbye (short-term)

Quajanaq/qujanarssuaq (kwa-jah-nahk/kwa-jah-nars-soo-ahk) =thank you /very much)

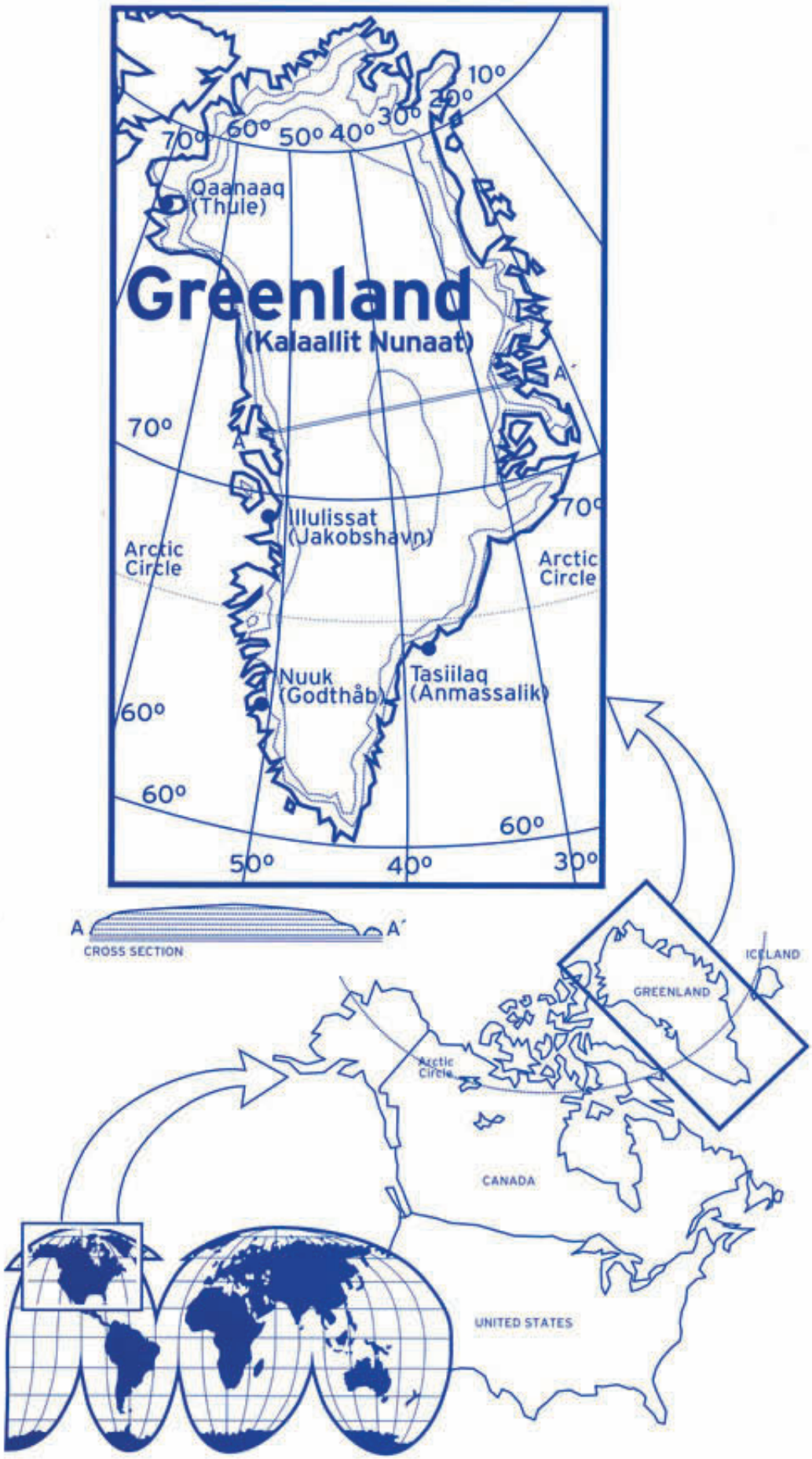
Imeq (ih-mek)=water

siku (sih-koo)=ice

If you fly into the airport at Nuuk, the capital of Greenland, you will land on a runway cut from rock more than 3 billion years old, some of the oldest rock on earth. More than 85 percent of this rocky island, an island more than two and one half times the size of New Guinea, is covered by a glacial ice cap that averages 2135 meters (7,000 feet) thick. At its thickest, the ice is 3,000 meters (9,842 feet) thick.

The immense weight of this mass of ice, 10 percent of the world's freshwater total, has actually pressed the center of the island below sea level. Snow falls every month of the year, and very little melts in the interior, where July temperatures average only -12 degrees Celsius (10 degrees Fahrenheit.) Thick fogs collect along portions of 40,000 kilometers (25,000 miles) of coast, a thin, rugged strip of land that features some of the most dramatic landscapes on earth with fjords, steep and rocky river valleys carved by glaciers and flooded by a rising sea, combined with massive icebergs just off-shore.

Ten thousand to 15,000 icebergs, some as long as a city block, break off from the glaciers every year. The surrounding ocean is barely above freezing and air temperatures can plummet to -50 degrees Celsius (-58°F), but it features an incredible abundance of life in its rich, cold coastal waters, from plankton to fish, from seals and walrus to whales.



LANDSCAPE

Tundra has no trees or only dwarfed trees and shrubs. During a short season of above-freezing temperatures, there are large expanses of surface water on top of permanently frozen soil, or permafrost.

Tundra is then filled with incredible numbers of insects and the migratory shorebirds and waterfowl that feed on them during the short breeding and nesting season. Tundra also can support large numbers of migratory grazing mammals, both large and small, like caribou and lemmings.

Tundra is found in high northern latitudes or on mountain tops. There are no equivalent large expanses of tundra in the southern hemisphere.

THE GREATEST PLACES

The Amazon

SNAPSHOT

BRAZIL

8,456,510 sq. km./3,265,059 sq. mi. (the Amazon basin covers about 2.5 million square miles)

Capital: Brasilia

Population: 164 million (80% urban)

Language: Portuguese

Biomes: Tropical rain forest, grasslands, deciduous forest

Average annual income: $1,200

Literacy rate: 83%

The Amazon Basin also extends into Peru, Equador, Colombia, Venezuela, and Bolivia

LANGUAGE

Portuguese is the national language of Brazil. Spanish is spoken in other countries of the Amazon.

oi=hello

tchau=goodbye

Muito obrigado/obrigada=thank you sir/madam

Com licenza=excuse me

Como vai voce/tudo bem=how are you?

Vou bem, obrigado/a=I'm fine

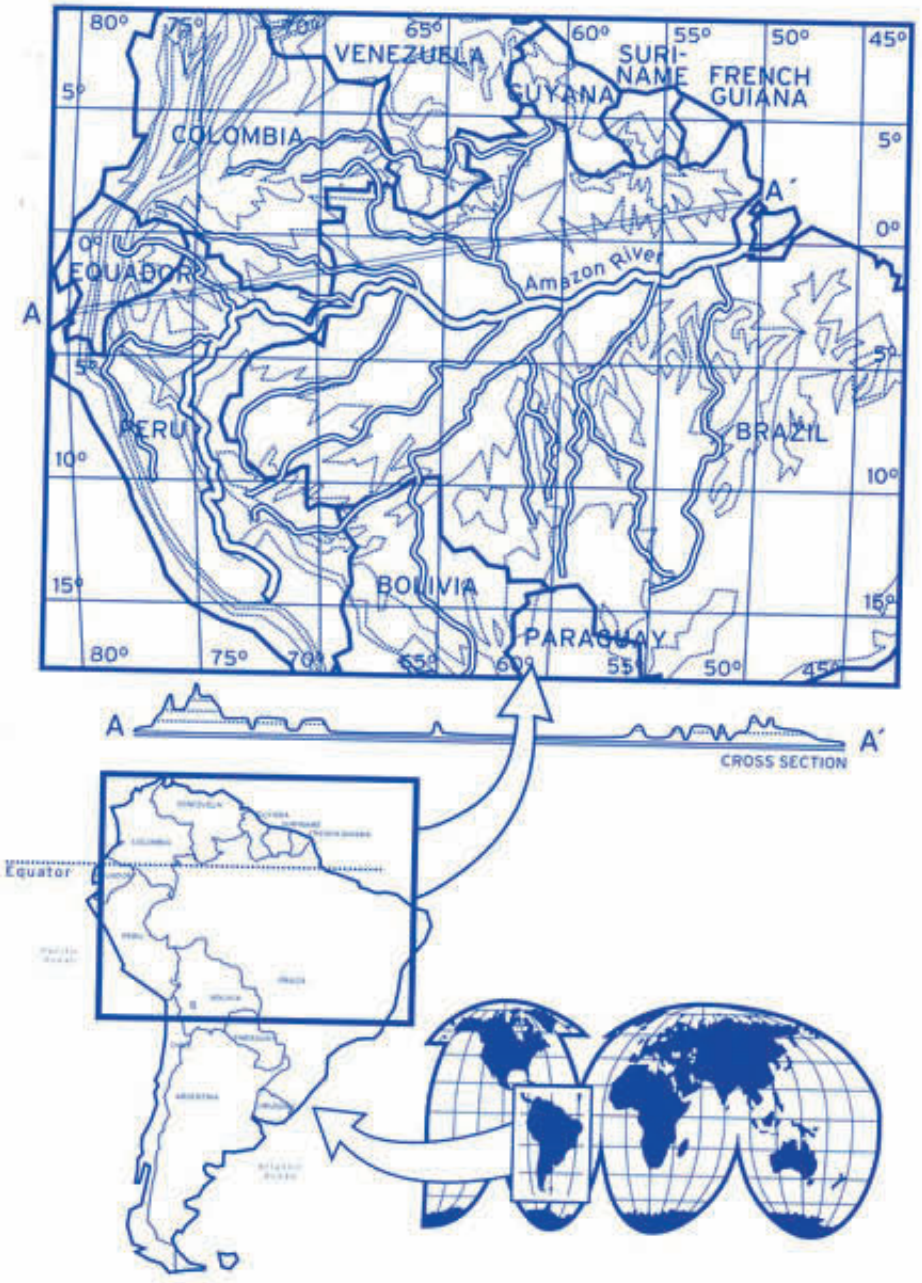
Pardo desculpe/tudo bem, obrigado/a=pardon me, sir or madam

At Manaus, just halfway on its 6,500 kilometers (4,000-mile) journey from the Andes Mountains to the Atlantic, the Amazon River is already so wide you cannot see across it. The largest river on earth carries so much water, with so much force, that it is still a distinct flow of fresh water more than 200 kilometers (124 miles) into the ocean. It drains a watershed of 4 million square kilometers (2.5 million square miles), a basin that covers nearly two-thirds of South America. It is a basin filled with the rich biological diversity of the tropical rain forest as well as the richness of the river itself. Seventeen of its tributaries are more than 1,600 kilometers (1,000 miles) long.

The reasons for so much rain, so much water, and so much biodiversity in the Amazon are complex, but they can be described in simple terms. The Amazon, like other rain forests, is located near the equator, where the energy of the sun striking the earth is at a maximum throughout the year. There is no winter and no summer, but there is a wet season and a dry season. Most of the 1,000 to 2,000 mm (39 to 78 inches) of rainfall in the basin comes between January and June. During this time of heavier rains, the river floods and spreads out up to 48 km (30 miles), covering a total area larger than England.

The constant sun and rain create conditions like those in a greenhouse: a constant temperature, high humidity, and plenty of light. Plants grow very well here, and many different kinds of animals can live in the three types of forest in the Amazon basin: *variza*, *igapu*, and *terra firme* (permanently flooded, seasonally flooded, and dry land.) The diverse nature of the Amazon basin features striking animals such as jaguars, sloths, peccaries, macaws, toucans, pink dolphins, spider monkeys and giant otters. It has more than 2,000 species of fish, including the *arapaima*, which can reach 15 feet and 400 pounds.

The Amazon Basin



LANDSCAPE

Tropical rain forests normally have a steady amount of solar energy and large amounts of precipitation (200–500+ centimeters per year) Temperatures are relatively constant, day and night, and warm year-round with constant high humidity. They are marked by lush plant growth.

The intense competition for light and space helps create a great amount of biodiversity in plants and with animals. There is no top-soil buildup as in temperate forests because there is a constant, rapid breakdown of organic materials by bacteria and fungi.

A seasonally flooding river, like the Amazon, with its cyclical constraints and disturbances, is a contributing element to biological diversity. Tropical rain forests are on or near the equator.

THE GREATEST PLACES

The Okavango Delta of Botswana

SNAPSHOT

BOTSWANA

566,730 sq.km./218,814 square miles (About the size of France)

Capital: Gabarone

Population: 1.5 million (75% rural)

Languages: Setswana, English

Biome: Savanna/desert

Economic: Diamonds, coal, minerals, tourism

Average annual income: $2,800 US

LANGUAGE

Setswana, English

Dumela Rra/Mma (doo-may-la rra/mma)=hello

O kae (oh-key)=How are you?

Ke teng (kay-tang)=I'm fine

Ke itumetse (kay ee-too-may-tsay=thank you

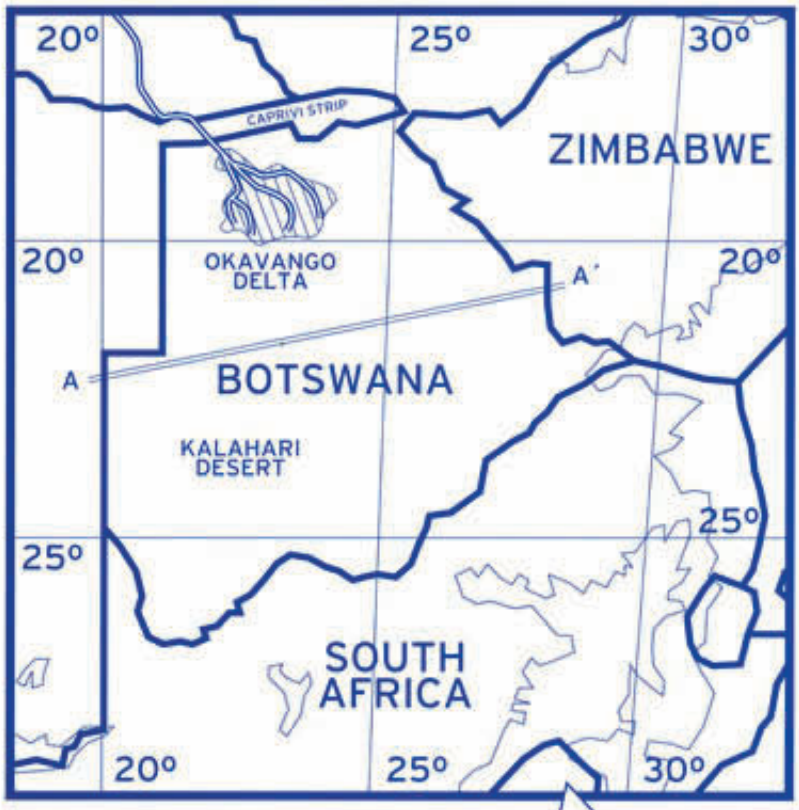
Tsamaya sentle (tsah-mah-yah)=goodbye (if staying)

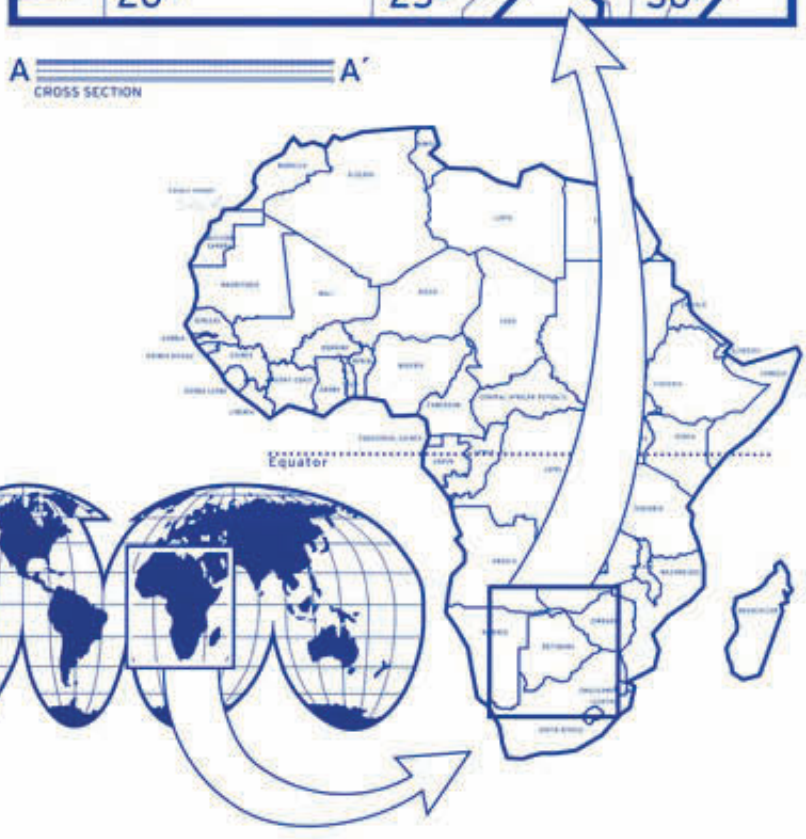
Sala sentle (sah-lah saynt-lay)=goodbye (if leaving)

metse=water

At the northern edge of the Kalahari in Africa, there is a lush, isolated oasis called the Okavango Delta. The delta is a rich botanical mix of forests, reeds, papyrus, and water lilies in the middle of dry savanna. Here there are herds of aquatic antelope, water buffalo, hippos, crocodiles, and multitudes of birds (flamingos, jacanas and cranes) and savanna wildlife (zebra, elephants, giraffes, and wildebeest).

"Africa's Last Eden" is there because a river flows out of the distant Angolan Highlands into a shallow basin of rock filled with sand. Its flow blocked, the river spreads out in this basin to form a broad inland delta, a maze of islands, lakes, and river channels that constantly change and reform with the pulse of the river. Then the river simply disappears into the sand and thin air of the Kalahari Desert.





LANDSCAPE

Grassland/savanna—Grasslands have more rain than deserts, but only 25–75 centimeters per year. Trees grow only along waterways, which may be either above or below the surface. Grasslands, which include many other flowering plants, support herbivorous animals—insect swarms, browsers, herds, flocks in tremendous numbers.

Plants and animals are adapted to marked cycles of rain and drought. Much of the plant growth and animal life is at the surface or below ground, where conditions are more stable. There are generally clear skies and steady, strong winds. Temperature extremes are the norm, especially in the interior of continents.

Savannas have a rainy season that supports tree growth beyond watercourses with a permanent source of water. They are usually found in the middle latitudes.

THE GREATEST PLACES

Madagascar

SNAPSHOT

581,540 sq.km./224,533 sq.mi. (About two times the size of Arizona)

Capital: Antananarivo

Population: 14.8 million (75% rural)

Languages: Malagasy, French

Biome: Subtropical savanna, temperate grasslands, shrub forests, deserts, tropical rain forest

Economy: coffee, vanilla, rice, cloves, tourism

Average annual income: $60 US

LANGUAGE

Malagasy is national language (Mal-ah-gash)

final vowels, including y, are not voiced

Manao ahoano, Tompoko (mano own, toom-pook)=hello, sir or madam (lack of honorific is considered impolite)

Veloma, Tompoko (vel-oom, toom-pook) =goodbye

Misaotra, Tompoko (mee-sowt, toom-pook)=thank you

Fahasalamanao, Tompoko (faha sahla mahn, toom-pook) =How is your health?

Aza fady, Tompoko (ahs fahd, toom-pook)=excuse me

Salam tsara aho (sah-lahm tsahr ah)=I'm well

Madagascar is an island continent that is just a little smaller than Texas; it has more diversity for its size than any other island on the planet. Stretching 1600 kilometers (1000 miles) through the tropics to the Tropic of Capricorn, it has rain forests, grasslands, deserts, scrublands, dry forests, savannas, deciduous forests, mountains, mangrove swamps, beaches, and coral reefs—all packed into an area the size of Great Britain. Some parts of this island receive more than 3500 millimeters (136.5 inches) of rain a year and others less than 400 millimeters (15.6 inches). It has more than 10,000 different species of plants, more than 900 different orchids, and two-thirds of the world's chameleon species. Instead of monkeys, it has lemurs—more than 20 different kinds—found nowhere else on earth.

Madagascar is an exercise in alternative evolution on a grand scale, an island whose timeline split off into a separate reality when it broke off from the continent of Africa 65 million years ago. It is, as biologist Allison Jolly puts it, "a world like our own," but a strikingly different one. A strip of steep highlands along the east coast wrings out the moisture of the prevailing tradewinds, leaving the rest of the island with varying amounts of water on varying kinds of rocks and elevations. The southern tip features a spiny forest of succulent plants that looks like a cactus garden grown wild. The far northern coast has lush tropical growth and coral reefs. The mountainous central ridge of the island can be covered with trees, grass, shrubs, or combinations of all of them.

Madagascar can be very wet or very dry, all of the time, none of the time, or anywhere in between. Scattered through all of this diversity is a menagerie of wild animals found nowhere else on earth.

LANDSCAPES

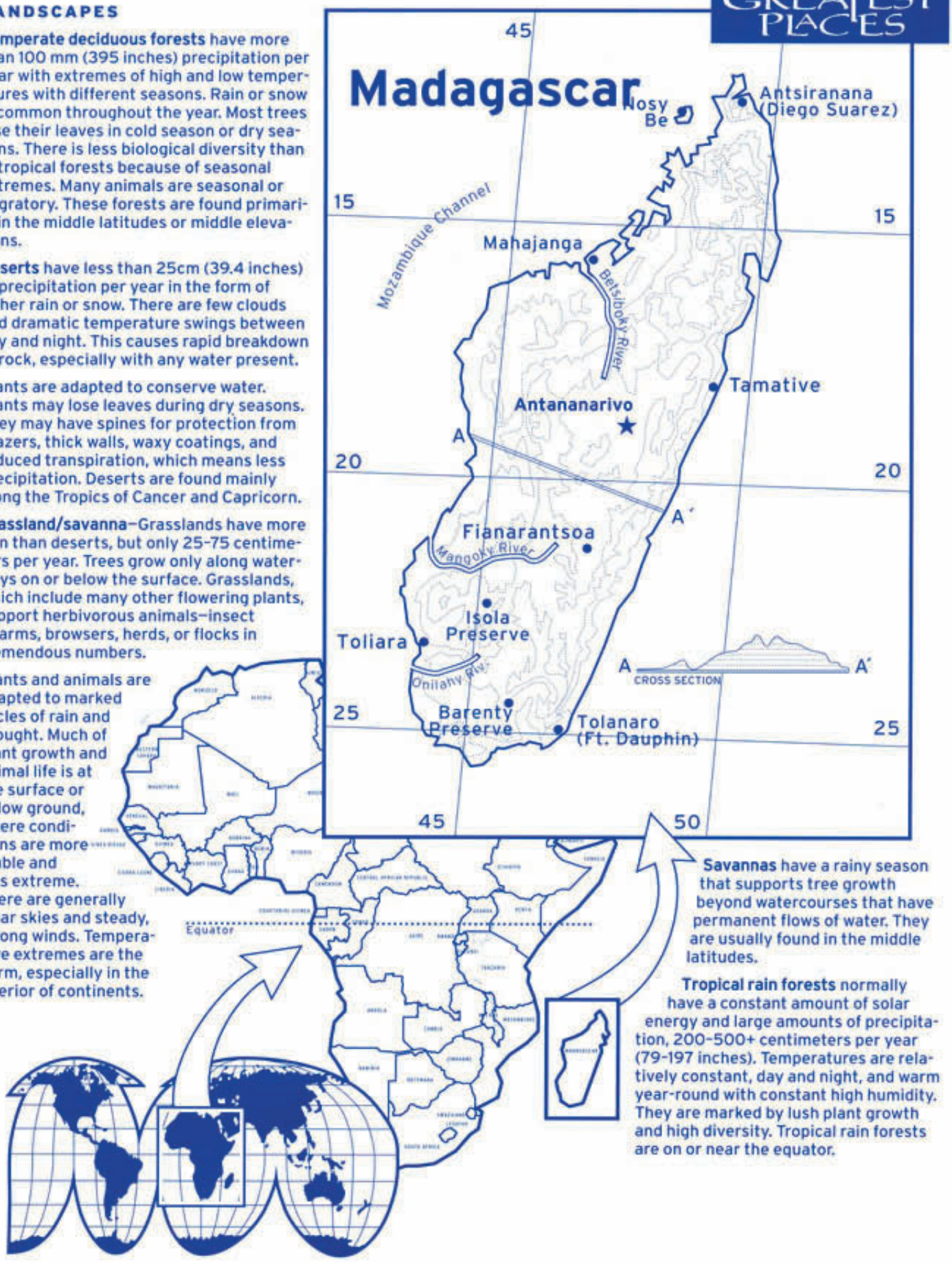
Temperate deciduous forests have more than 100 mm (395 inches) precipitation per year with extremes of high and low temperatures with different seasons. Rain or snow is common throughout the year. Most trees lose their leaves in cold season or dry seasons. There is less biological diversity than in tropical forests because of seasonal extremes. Many animals are seasonal or migratory. These forests are found primarily in the middle latitudes or middle elevations.

Deserts have less than 25cm (39.4 inches) of precipitation per year in the form of either rain or snow. There are few clouds and dramatic temperature swings between day and night. This causes rapid breakdown of rock, especially with any water present.

Plants are adapted to conserve water. Plants may lose leaves during dry seasons. They may have spines for protection from grazers, thick walls, waxy coatings, and reduced transpiration, which means less precipitation. Deserts are found mainly along the Tropics of Cancer and Capricorn.

Grassland/savanna—Grasslands have more rain than deserts, but only 25-75 centimeters per year. Trees grow only along waterways on or below the surface. Grasslands, which include many other flowering plants, support herbivorous animals—insect swarms, browsers, herds, or flocks in tremendous numbers.

Plants and animals are adapted to marked cycles of rain and drought. Much of plant growth and animal life is at the surface or below ground, where conditions are more stable and less extreme. There are generally clear skies and steady, strong winds. Temperature extremes are the norm, especially in the interior of continents.



Savannas have a rainy season that supports tree growth beyond watercourses that have permanent flows of water. They are usually found in the middle latitudes.

Tropical rain forests normally have a constant amount of solar energy and large amounts of precipitation, 200-500+ centimeters per year (79-197 inches). Temperatures are relatively constant, day and night, and warm year-round with constant high humidity. They are marked by lush plant growth and high diversity. Tropical rain forests are on or near the equator.

THE GREATEST PLACES

Namibia

SNAPSHOT

824,290 sq.km. (318,260 sq.mi.)

Capital: Windhoek

Population: 1.5 million (66% rural)

Languages: Many different people; Damara, Owambo, Herrero, German

Biome: Desert

Economy; Diamonds, minerals, fishing, tourism

LANGUAGES

There are many different languages in Namibia

Damara

matisa=how's it going?

#Leinchees ("click" line-cheese)=good day

#lein se haray ("click" line-say hah-ray)=goodbye (when you are leaving)

#lein se ("click" line say) #on re (awn-ray) =goodbye (when someone else is leaving)

moro=good morning

ayo'=thank you

Owambo

ongahe lipi=how's it going?

iyaloo= thank you

kalapo nawa=goodbye

nawa=good

oshiwa=beautiful

Hererro

perivi=how's it going?

okuhepa=thank you

karanawa=goodbye

nawa=good, fine

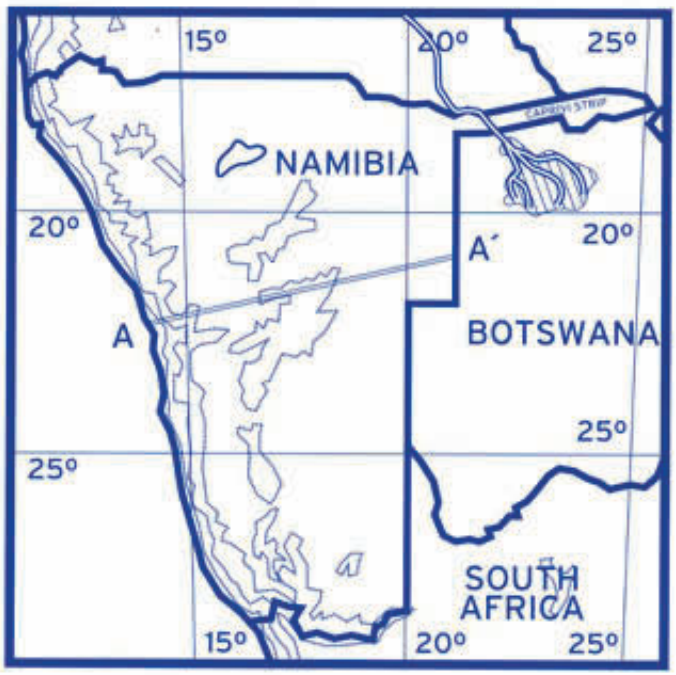
Less than 15 millimeters (0.5 inches) of rain falls each year on the Namib, a narrow strip of desert that stretches 2,000 kilometers (1,200 miles) along the southwest coast of Africa. Pink and red sand dunes tower 300 meters (984 feet) above a beach lined with penguins, seals, pink flamingos, and shipwrecks rusting in the breakers. The cold water of the Benguela Current that sweeps the isolated coast is not warm enough to evaporate into rain clouds; the temperatures along this coast allow only a brief period of heavy fog early in the day, which moves only to the mountains just beyond the dunes.

A few highly adapted animals use this meager supply of moisture and a variety of behaviors to survive temperatures that can reach more 70 degrees Celsius (158° Fahrenheit) on the surface of the sand dunes. Temperatures right next to the ocean may reach a high of only 30° Celsius (86° Fahrenheit).

The Namib is the home of brightly colored lichens and an odd plant called *Welwitschia* that appears to be more dead than alive but lives for thousands of years. The *narra* vine grows in and moves, with the shifting dunes, producing melons buried deep in the sand that are prized by hyenas and elephants, as well as people. Some lizards fight the heat by never having more than two feet at a time touching the burning sand. Other animals, like the golden mole or the skoogi lizard, spend most of their lives below the suface of the dunes, "swimming" through the sand.

Beetles perch on the dunes each morning in the fog, collecting moisture on their bodies that runs in channels to their mouth. The wheel spider rolls 44 times a second down the steep faces of the dunes to escape its primary enemy, a parasitic wasp. Desert-adapted elephants and ostriches move slowly along the dry river valleys to the ocean, foraging on plants that are able to survive in one of the oldest and driest deserts on earth.

Namibia



LANDSCAPE

Deserts have less than 25 centemeters of precipitation per year in the form of either rain or snow. There are few clouds and dramatic temperature swings between day and night. This causes rapid breakdown of rock, especially with any water present.

Plants are adapted to conserve water. Plants may lose leaves during dry seasons. They may have spines for protection from grazers, thick walls, waxy coatings, and reduced transpiration, which means less precipitation. Deserts are found mainly along the Tropics of Cancer and Capricorn.

The presence of cool ocean currents like the Benguela Current, offshore from Namibia, can assist in the creation of deserts. Moisture reaches the land only in the form of fog; the warm air over the desert holds the moisture and doesn't normally permit rainfall.

Similar systems are the Humboldt Current/Atacama Desert and the California Current/Sonoran and Baja Deserts.

THE GREATEST PLACES

Tibet

SNAPSHOT

Tibet (Xizang Province of China)

1,221,600 sq.km./471,660 sq.mi.

Capital: Lhasa

Population: 2,300,000

Biome: Grassland

Economy: Herding

LANGUAGE

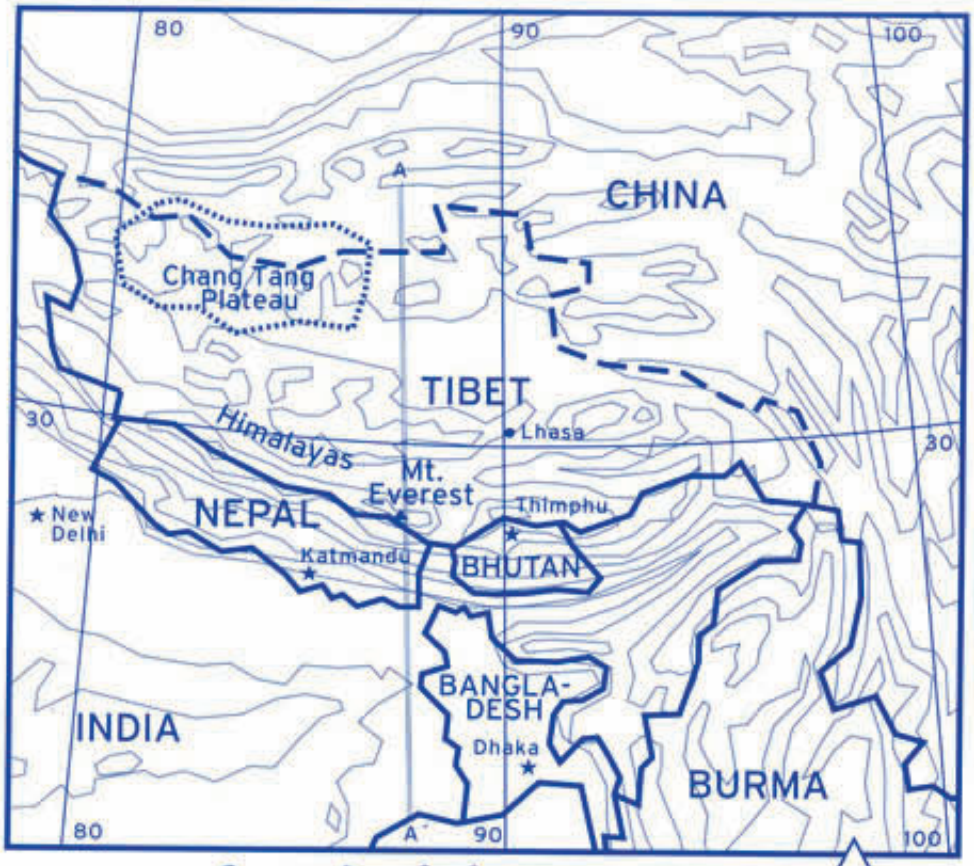
tasi dalek (tah-shee day-lek)=Hello

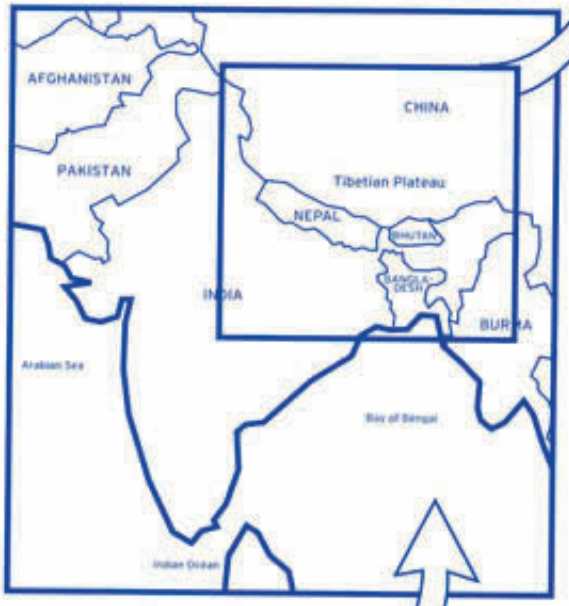
thuji cha (thoo-jih chay)=
Thank you

Tibet is part of the world's highest inhabited plateau, 2 million square kilometers (769,230,769 square miiles) surrounded by the tallest and youngest mountains on earth. More than 30 of the mountains are taller than 7,300 meters (24,000 feet) It has incredibly clear blue skies, thin air, and an abundance of intense light. Many of the great rivers of Asia—including the Mekong, the Brahmaputra, the Yangtse, and the Indus rivers—begin in the mountains in and around Tibet.

The Chang Tang plateau in northwestern Tibet is an isolated level plain of grass the size of Texas, averaging 5,000 meters (3 miles) above the sea. Like other grasslands, it can support large numbers of grazing animals, but only if the herds are constantly moving through the landscape. The people of Tibet were among the first nomadic herders, a way of life that began about 10,000 years ago, long after the rise of agriculture.

In the Chang Tang, speargrass is virtually the only plant that grows in the harsh, dry, and cool climate, where summer temperatures reach 21° Celsius (70° Fahrenheit) and winter temperatures as low as -10° Celsius (14° Fahrenheit). Yaks, antelope, and other grazing animals move across a vast, treeless, sun-drenched plain from one season to the next, in an age-old rhythym. For a large portion of the year, dried grass is their only source of food. The nomads of Tibet subsist entirely on what they can obtain directly from their land, in an atmosphere so thin that it is only half as dense as the air at sea level.





Tibet

Xizang Province of China

LANDSCAPE

Grasslands have more rain than deserts, but only 25–75 centimeters per year. Trees grow only along waterways above or below the surface. Grasslands, which include many other flowering plants, support herbivorous animals—insect swarms, browsers, herds, flocks in tremendous numbers.

Plants and animals are adapted to marked cycles of rain and drought. Much of plant growth and animal life is at the surface or below ground, where conditions are more stable. There are generally clear skies and steady, strong winds. Temperature extremes are the norm, especially in the interior of continents. Grasslands have rich soils because of breakdown of grasses' dense and extensive root systems.

Temperate deciduous forests have more than 100 centimeters precipitation per year. There are extremes of high and low temperatures with different seasons. Rain or snow is common throughout the year. Most trees lose their leaves in cold or dry seasons. There is less biological diversity than in tropical forests because of seasonal extremes.

Many animals are seasonal and migratory. Temperate forests are found primarily in the middle latitudes or middle elevations.

In Tibet, rich deciduous forests are located at lower elevations near the southern and eastern borders.

THE GREATEST PLACES

Iguazu Falls

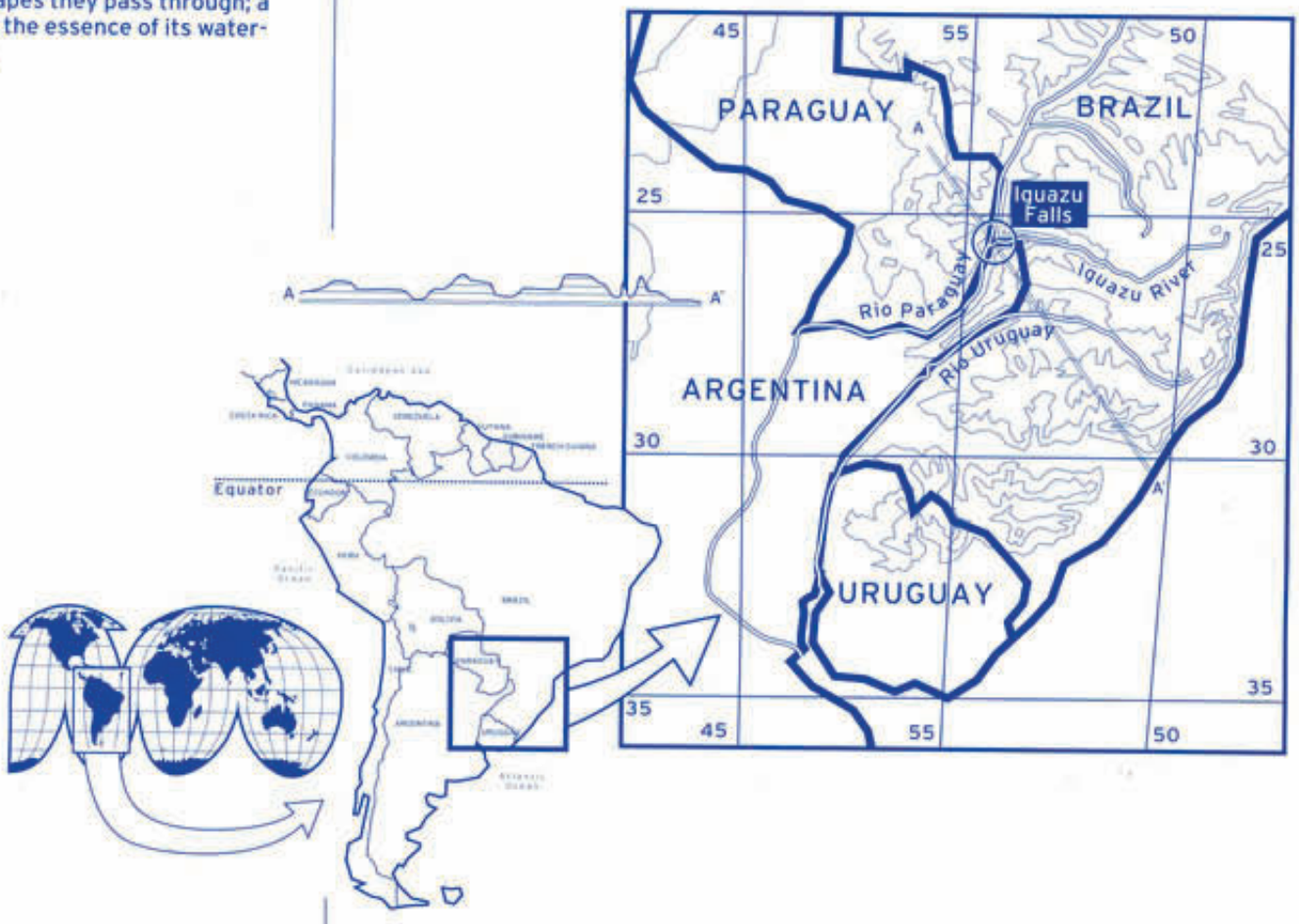
LANDSCAPE

Rivers are always moving. The energy input for food chains starts with detritus, fine pieces of disintegrated and dissolved organic matter, such as fallen leaves. A river's gradient and speed of current, water temperature, inflows from its watershed, water depth and volume, and number of tributaries, are all limiting factors for life.

Most rivers have distinct seasonal changes reflected in their water channels. Rivers are major connecting links between people and biomes. They carve and define the landscapes they pass through; a river is the essence of its watersheds.

Starting in the highlands near the Atlantic Ocean in Brazil, the Iguazu River flows west for more than 800 miles and tumbles over more than 70 waterfalls. Near the boundary of Argentina, Brazil, and Paraguay, in a series of 275 separate cascades, the river drops 250 feet over a crescent-shaped cliff more than 2.5 miles long.

One early visitor described the falls as "the awesome spectacle of an ocean pouring into an abyss." Surrounded by lush tropical forest filled with wild orchids, ferns, bamboo, begonias, and bromeliads and punctuated by colorful wildlife like macaws and parrots, Iguazu Falls has become one of the world's premier tourist destinations.



The reason for seasons

activity

Place four identical globes, equally spaced, around a bare light that shines in all directions (360 degrees). Make sure that the axis of all four globes are tilted 23.5 degrees toward the same wall or direction.

Greenland

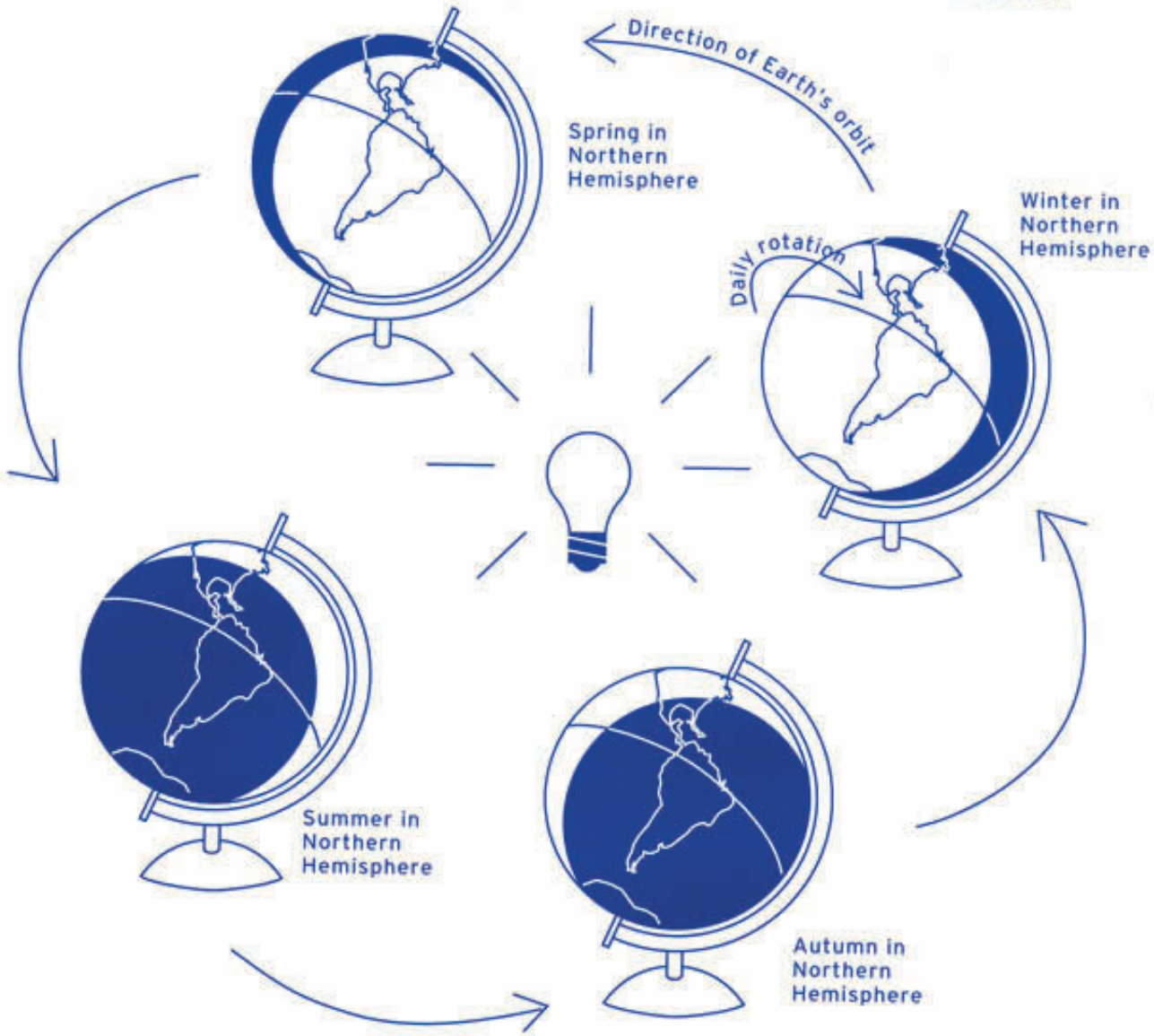
The Amazon

Turn on the bare light representing the sun and turn off the room lights. Note how the equator gets the same amount of light at any time of the year. Note how the northern portions of the globes, especially near the poles, have constant light in the summer and near constant darkness in the winter.

Slowly spin the globes toward the east, representing the earth's days and nights. Spin and observe the globe representing summer in the northern hemisphere and see why the term "Land of the Midnight Sun" is used. Also note that Antarctica gets very little direct sunlight at any time of the year.

OVERVIEW:

The reason the earth has distinct seasons is the constant 23.5 degree tilt of the earth's axis in relationship to the sun. The earth is actually closer to the sun during winter in the northern hemisphere, but as this activity demonstrates, the tilt of the earth and the amount of solar energy striking different parts of the globe, is responsible for the change of the seasons.



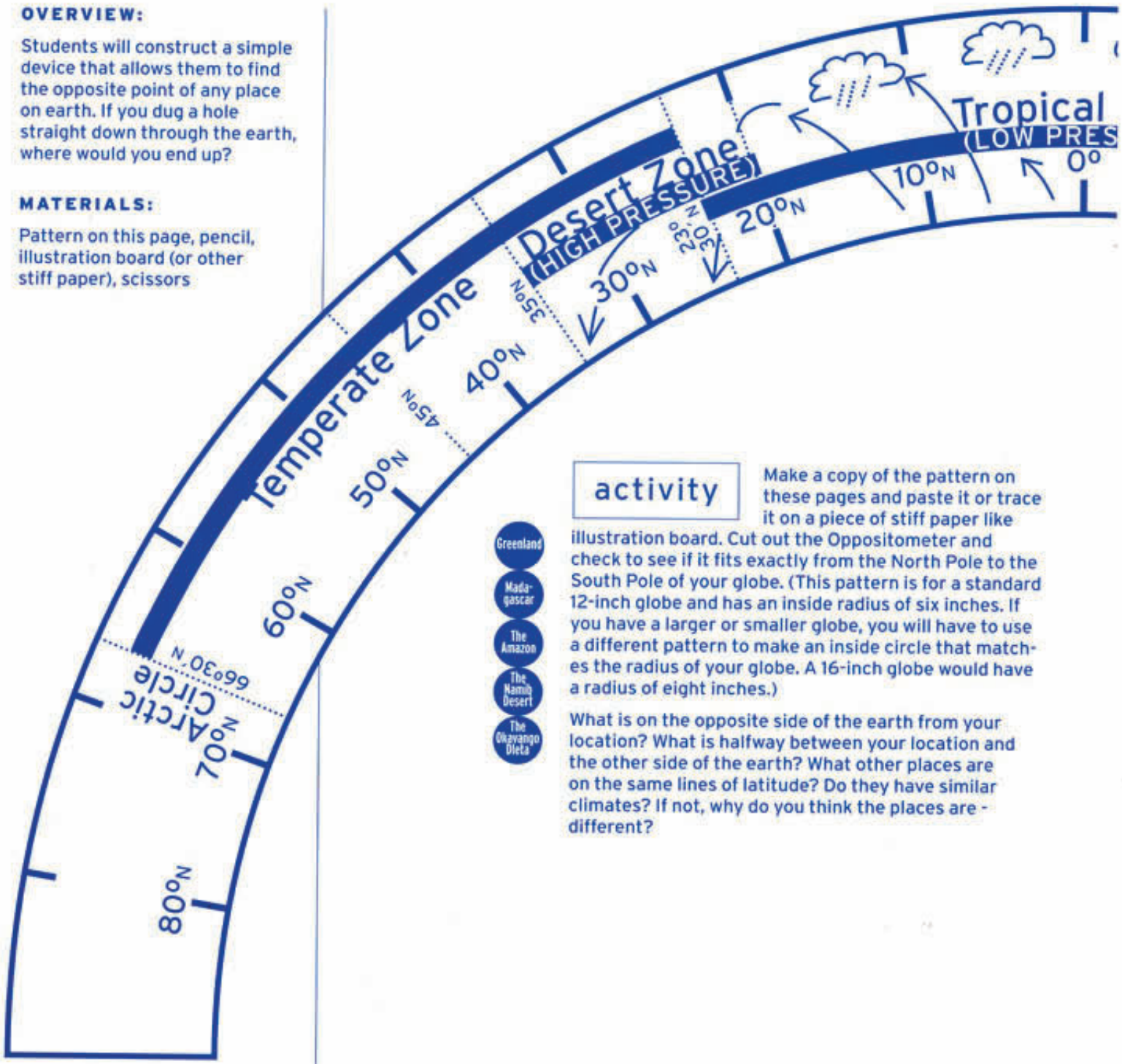
Make an Oppositometer

OVERVIEW:

Students will construct a simple device that allows them to find the opposite point of any place on earth. If you dug a hole straight down through the earth, where would you end up?

MATERIALS:

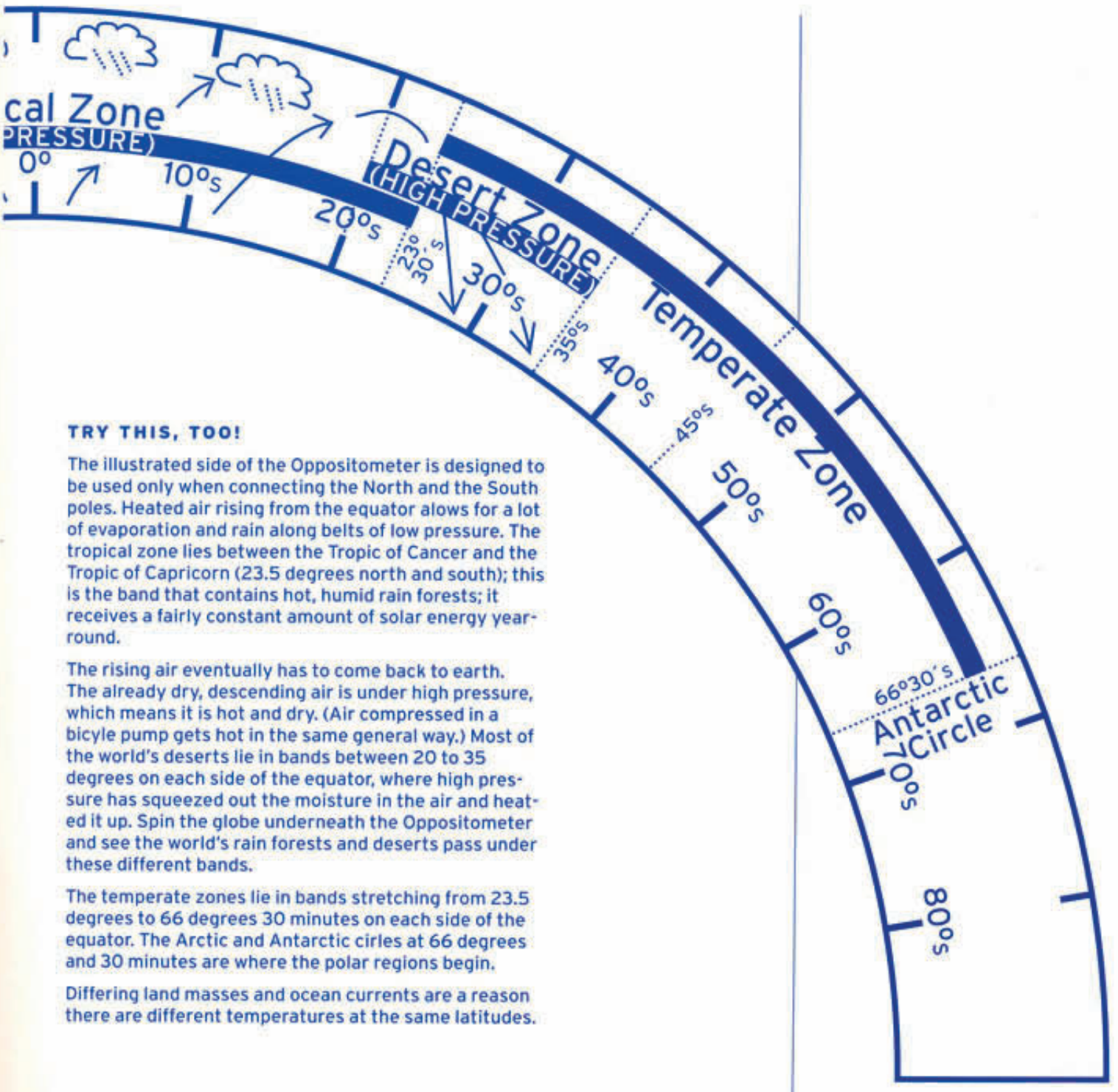
Pattern on this page, pencil, illustration board (or other stiff paper), scissors



activity

Make a copy of the pattern on these pages and paste it or trace it on a piece of stiff paper like illustration board. Cut out the Oppositometer and check to see if it fits exactly from the North Pole to the South Pole of your globe. (This pattern is for a standard 12-inch globe and has an inside radius of six inches. If you have a larger or smaller globe, you will have to use a different pattern to make an inside circle that matches the radius of your globe. A 16-inch globe would have a radius of eight inches.)

What is on the opposite side of the earth from your location? What is halfway between your location and the other side of the earth? What other places are on the same lines of latitude? Do they have similar climates? If not, why do you think the places are different?



TRY THIS, TOO!

The illustrated side of the Oppositometer is designed to be used only when connecting the North and the South poles. Heated air rising from the equator alows for a lot of evaporation and rain along belts of low pressure. The tropical zone lies between the Tropic of Cancer and the Tropic of Capricorn (23.5 degrees north and south); this is the band that contains hot, humid rain forests; it receives a fairly constant amount of solar energy year-round.

The rising air eventually has to come back to earth. The already dry, descending air is under high pressure, which means it is hot and dry. (Air compressed in a bicyle pump gets hot in the same general way.) Most of the world's deserts lie in bands between 20 to 35 degrees on each side of the equator, where high pressure has squeezed out the moisture in the air and heated it up. Spin the globe underneath the Oppositometer and see the world's rain forests and deserts pass under these different bands.

The temperate zones lie in bands stretching from 23.5 degrees to 66 degrees 30 minutes on each side of the equator. The Arctic and Antarctic cirles at 66 degrees and 30 minutes are where the polar regions begin.

Differing land masses and ocean currents are a reason there are different temperatures at the same latitudes.

On the level

OVERVIEW:

Students create a model landscape, then measure and trace the elevations at different water levels to make a contour map of the landscape.

MATERIALS:

Artist's plasticine clay or Sculpey® clay, tub, water, masking tape, clear pane of plastic or Plexiglas® slightly bigger than the top of the tub, clear transparency film, marker.

The Namib Desert

Madagascar

Tibet

activity

Make a small, mountainous landscape in a small, clear plastic box. (Use Artist's plasticine clay or Sculpey® clay instead of regular modeling clay. It is important to keep the water clear.) Be sure to make high hills and steep valleys.

Measure and mark one-inch lines on a piece of masking tape. Apply the tape vertically to one corner on the outside of the box.

Take a clear pane of plastic slightly bigger than the top of the box. Tape a piece of clear transparency film to the center of it, so it doesn't move. Use a marker to trace the outline of the container on the transparency film so it can be taken off and replaced in exactly the same place for each step.

Pour water to the first one-inch mark. Place the clear pane of plastic with the clear film over the box, on the marks.

Looking straight down, trace the exact shorelines (where the water and land meet) with a transparency marker. You should end up with an irregular circle or irregular circles. Food coloring added to the water will make the shorelines easier to see.

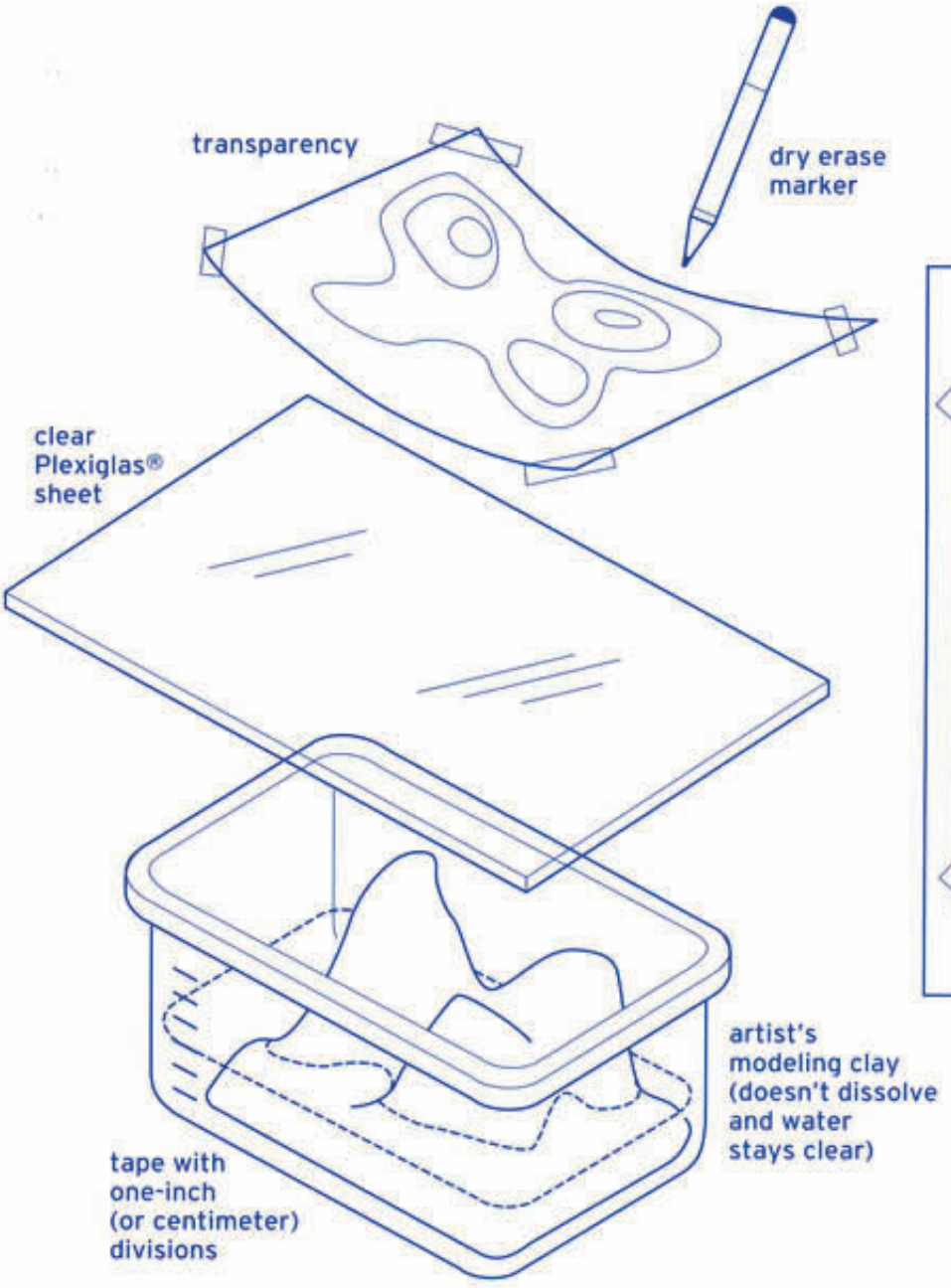
Remove the clear plastic pane and pour water to the next level. Trace the shorelines in the same way as you did before. (The new shorelines should be rough circles inside the previous ones.) Repeat at each level until you run out of land. You now have drawn a contour map of the landscape inside the box.

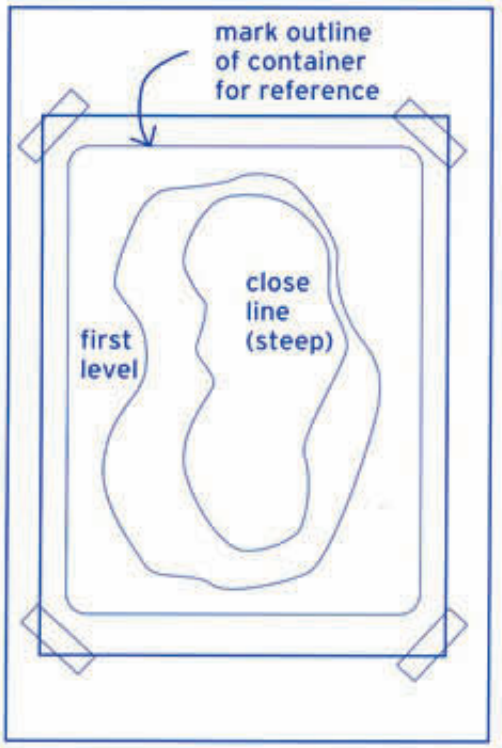
Notice that when the lines are closer together it shows the slopes are steeper, and when the lines are farther apart it shows the ground is flatter.

TRY THIS, TOO:

Use Playdoh® for a simple landscape in a large enough box with room to maneuver around it. Mark clay at each level of water with a paper clip. When finished, pour out the water and carefully remove the landscape without distorting it. Cut slices across each level with dental floss held at the proper distance. Trace the outline of each slice's outline on paper. Color in each level with standard elevation colors used on maps. If you reassemble the pieces and cut a vertical slice, you will get a cross-section profile with elevations marked.

Obtain a United States Geological Survey topographical map of your area that shows your location. (Check topographical maps in the Yellow Pages.) Note the contours and compare with the world outside your classroom walls.





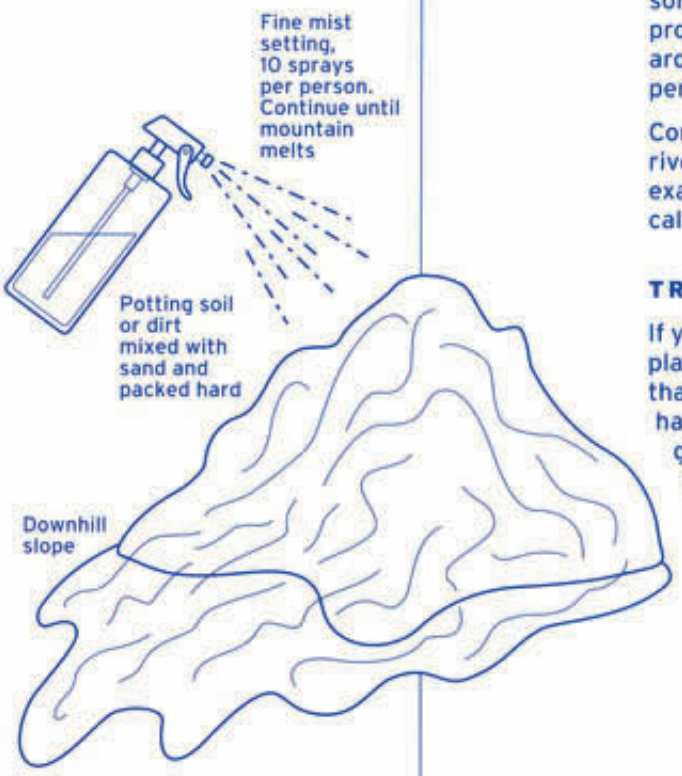
Melting mountain

OVERVIEW:

Students will create a model of a mountain that allows them to mimic geologic time frames.

MATERIALS:

Dirt, water, spray bottle



Tibet
Iguazu Falls
The Amazon
The Okavango Delta

activity

This activity is best done outdoors, especially where the earth is already dug up for constuction. It can be done in the classroom with potting soil packed on one side of a plastic tub. The larger the scale, the more dramatic the effect.

Make a mountain by packing earth or potting soil as hard as you can, so it's almost like a rock. (You may have to spray a little water on it as you go.) You can mix in some rocks, gravel, or sand in different places, if you like. Try to place your mountain on a gentle slope.

Once the mountain is made and packed tight, each person in the group gets 10 sprays at a time on a fine mist setting. Each spray of mist may represent 10,000 years of rain. (Sooner or later someone will switch the setting to a stream to accelerate the process, but that's acceptable.) Keep passing the spray bottle around the group and keep spraying until something starts happening.

Compare the resulting landscape to real mountains, canyons, and rivers—the Rockies and High Plains in the United States, for example. If you could watch mountains over the span of geological time, they would seem to melt and flow away, too.

TRY THIS, TOO:

If you have a sink with a leaky faucet that hasn't been fixed yet, place a bar of soap on the spot where the water drop hits. Be sure that the bar of soap is not bumped or moved and observe what happens over the course of a week or so. This type of erosion (or gnawing away) of the soap is similar to what happens to soft, fine-grained rocks like sandstone or limestone when water flows over and through them.

Shake, rattle and roll

activity

Find an old-fashioned red clay paver brick, one that you can break apart with a hammer.

Ask students to explain how a brick is made. (Clay is squeezed and heated under pressure to make something hard, like a rock.) While wearing safety goggles, break off a six or more pieces with a hammer, making each piece about a half-inch long. Let everyone feel the sharp broken edges of the freshly fractured brick. Put the pieces into a clear plastic juice or milk jug and add about an inch of water. Save one broken piece for later comparison.

Pass the bottle around a circle of students, letting each student shake the jug vigorously 10 times. This will represent a few thousand years of weathering and erosion of the rock. Let each student shake 10 times and continue until the fine particles from the eroded brick color the water. Pour the water into a clear container for visibility and carefully remove the remaining pieces. Feel the smoother, rounded surfaces. What would happen if you continued the process for a few million years? If these extremely fine particles settled as sediment, were covered with other sediments, and then squeezed under pressure and heat beneath the earth, what would you have?

(You would have another hard brick/rock. This is a simple model of the rock cycle, a central tenet of geology. It seems obvious now, but until it was recognized in the 1700s, no one had a good explanation for how such things as mountains, valleys, deserts, beaches, and river channels were created or how they were connected in a single cycle. Mountains rise, wear down, and are carried away by water and deposited in layers of sediment. These sediments are eventually buried, undergo heat and pressure beneath the crust of the earth, and may eventually rise up as mountains again.)

TRY THIS, TOO:

Add soil, sand, and fine gravel to a small jar. Fill with water, cover with a lid, and shake vigorously. Set down, allow to settle, and observe. Geologists can determine the distance sediments travel from their source by the size of particles in sedimentary rock.

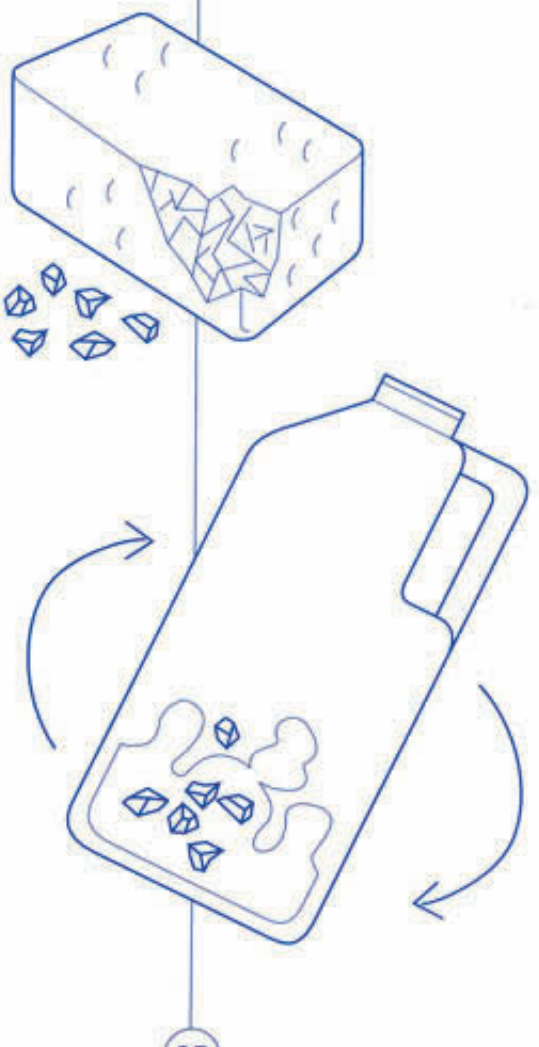
Iguazu Falls
The Namib Desert
The Amazon
Tibet

OVERVIEW:

Students will create and operate a model of the rock cycle.

MATERIALS:

Red clay paver, safety goggles, hammer, clear milk jug, water, also sand, soil and gravel



That sinking feeling

OVERVIEW:

Students will create a model of isostasy, the rebounding of the earth's crust when overlying mass is removed.

MATERIALS:

Clear plastic tray, water, clear resealable plastic bag, ice cubes

Greenland

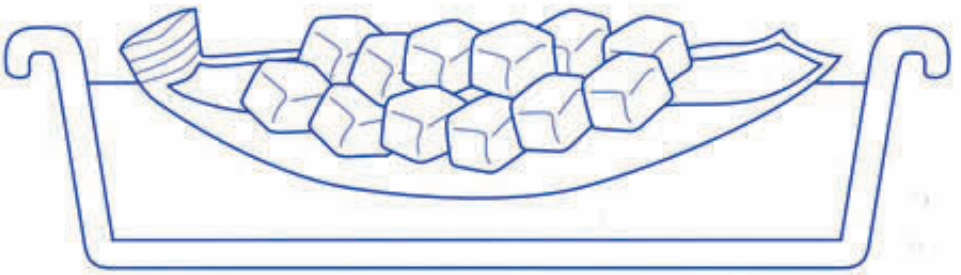
activity

Take a large, recloseable plastic bag (1 quart size or larger), fill it about half full of air, and seal. Float the bag in a clear plastic tray half filled with water. Note the level of the top of the bag. Slowly add ice cubes on top of the bag. What happens to the level of the top of the bag under the weight of the ice? Remove the ice cubes and observe. What do you think this has to do with Greenland?

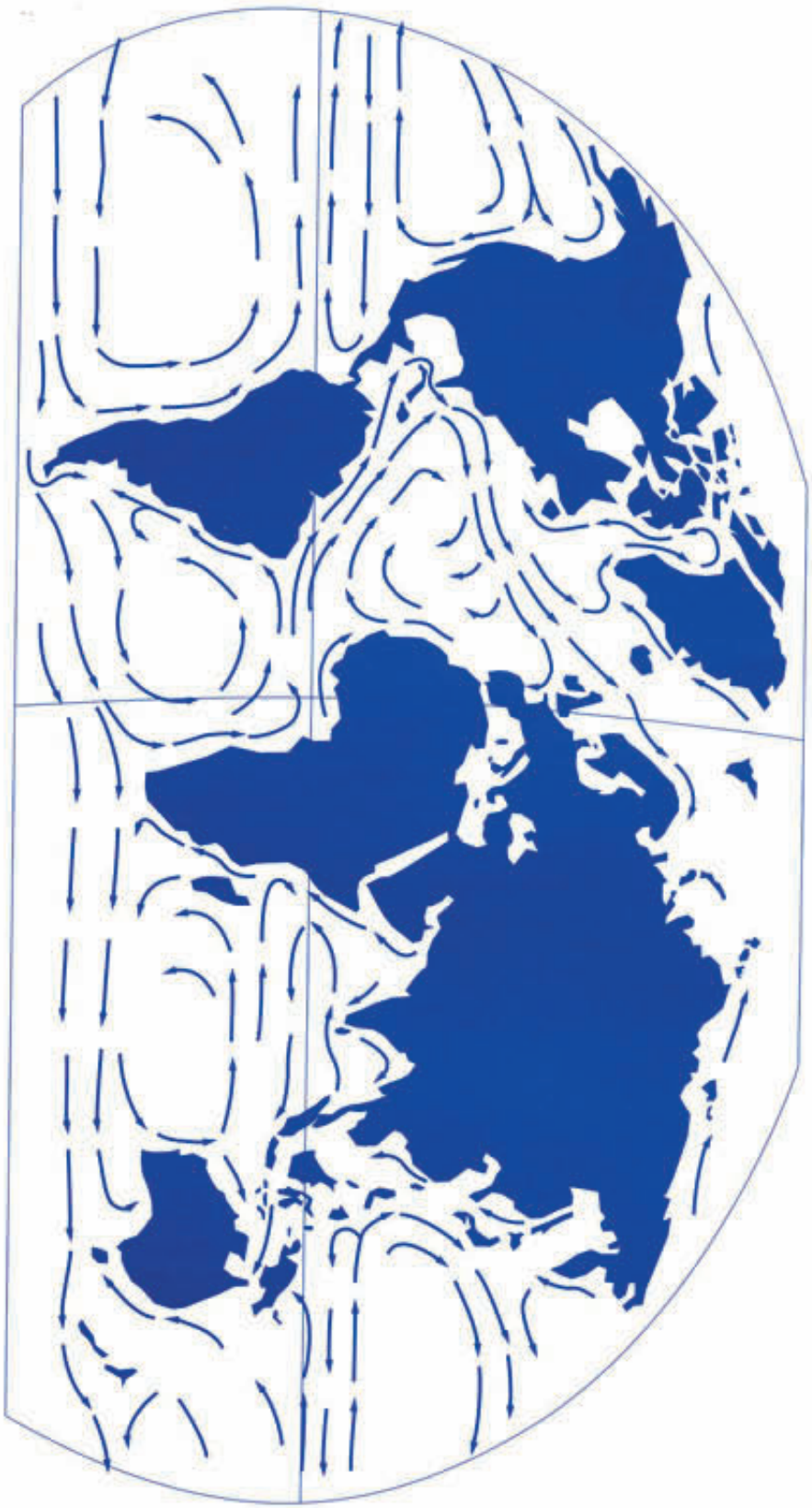
To make the connection a little clearer, cut out a rough map of Greenland that is a little smaller than the plastic bag from very thin foam or from paper and place it inside the bag before sealing

TRY THIS, TOO:

Mix different amounts of water with salt in clear plastic glasses. Float an ice cube in each one. Observe the different levels of the ice cubes in the glasses. (The greater the difference in the proportions, the greater the effect.) Icebergs have four-fifths of their mass below the surface. What percentage of salt do you need to accurately simulate an iceberg?



Major ocean currents



Off the shelf

OVERVIEW:

Students create a model that demonstrates how cold dense currents bring nutrients that have settled on the ocean floor to the surface.

The upwelling of these organic nutrients to the surface, where they mix with the sun and air along continental shelves, results in a rich concentration of plankton and an abundance of sea life. Rich fisheries and concentrations of marine life can be found in places like the coast of Namibia, Greenland, the Arctic and Antarctic, the coast of Peru, the Bering Sea, and along the west coast of North America.

The effect of the Benguela Current off the coast of Namibia is enhanced by prevailing winds from the southwest; as warmer surface layers are driven north and west, cooler layers rise to replace them, bringing nutrients like phosphates and nitrates along.

Greenland

The Namib Desert

activity

Take a wide, shallow clear plastic glass and place two wide rubber bands, about one inch apart, around the edge of the glass as shown in the illustration. (A shallow, rectangular, clear plastic tray also may be used.)

Pour about three to four inches of very warm water into the glass. You should be able to touch the bottom of the glass with a dropper without getting your fingers wet. (A larger, clear plastic container that is less likely to move or tip also can be used.)

In a separate glass, mix 10 or more drops of red food coloring in one-quarter cup of cold water. Use a dropper to carefully place about a half-inch of the cold red water at the very bottom of the first glass, making a distinct color layer under the clear water. (Don't try to squeeze all of the red water out each time; that will stir things up. A syringe or a funnel and rubber tubing also can be used to put down the layer.)

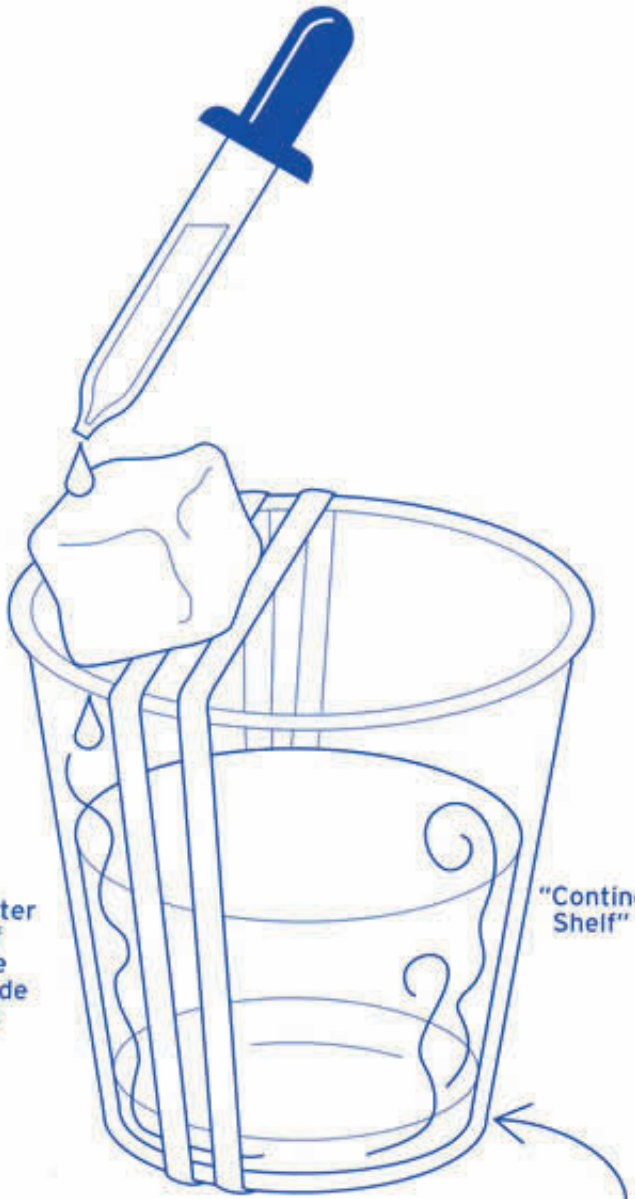
In another separate glass, mix 10 or more drops of blue food coloring in one-quarter cup of very cold water. Place an ice cube on the rubber bands so that it tilts toward the outside edge of the glass. Use a clean dropper to place a drop of the cold blue water on the ice cube every five seconds. Use only five drops. (If desired, skip this step and carefully place a large block of ice removed from a plastic margarine container on the surface.) Wait patiently and observe the following:

The cold dense water will sink down the side and push the layer on the bottom up the other side of the glass (the continental shelf).

FOR THE TEACHER:

You can do the activity first and then explain or elict explanations and connections. In temperate climates, lakes freeze from the top down. Spring melting causes a turnover of the stagnant water at the bottom when the colder, denser water from the melting ice sinks and displaces it.

This would probably work best as a demonstration for grades 1-3, and a small group activity for grades 4-7.



MATERIALS:

Clear plastic tumbler or container, two wide rubber bands, dropper, water, red and blue food coloring.

Bon voyage

Here are some basic questions to ask yourself when exploring any new landscape or any new place or experience, this could be a new job, a new game, a new group, a new piece of software, a new field of study, a new neighborhood, or a new country; any unknown place you are about to explore.

- What do you need to know before you get there?
- How do elements interact in the landscape? What is actually happening? What phases are occurring? How has the landscape changed? How is it changing? What is the history of the landscape?
- What are the unique characteristics of the place? What features can be found elsewhere?
- What outside forces affect the place, and how?
- What are the limits or constraints? What are the rules?
- How do living things reflect and adapt to the place?
- How do non-living things reflect the elements of the place?
- What cultural behaviors reflect the place? What things do you need to study in detail?
- What are the rhythms of the place? What kinds of cycles occur?
- How will you convey what you have learned to others?
- What single thing summarizes the place? What central image comes to mind?

activity

Plan a one- or two-week trip to your place for a new friend from another country (pick a real country). What makes your home special? How is it different from any other place on earth? What kinds of places and experiences would you show your friend? Do a budget with all of the expenses your friend will have (try to keep costs down as much as possible). What will they need to bring? What will you need to provide? What time of the year would you like them to visit? What do you want them to understand about you and your place? What are some must-do experiences?

TRY THIS, TOO:

Design a travel poster and tourist brochure for your place. What images will you need to tell people about it? You may want to check tourist materials from your state or city to see the highlights other people have selected.

Plan an adventure abroad. Find out as much as you can about one of the Greatest Places by checking as many resources as you can, such as guidebooks, the World Wide Web, and anything else that will help you plan a trip to that place. How much will it cost? What is the least amount of money you can spend and still have a great trip. What do you need to do or know before you go? What do you need to bring along? What are some must-see or must do experiences unique to that place? Do you need to learn the language?

Design a travel brochure and/or poster for that place.

Plan a trip to all of of the Greatest Places. What airlines would you have to use? What cities would you go through? How many frequent-flyer miles would you accumulate?

By the shape of it

activity

Take a large sheet of butcher paper. A three-by four-foot sheet will work well, but you can use a smaller or larger sheet.

Without drawing or marking on the paper and without looking at a map, work together to tear out the shape of your place, your state, or your province from the sheet of paper. (Concentrating on the shape, rather than the outline, makes it easier to be accurate.) Add geographic and physical features like cities, rivers, and mountains with a pencil or marker. (Rectangles or squares aren't as much fun to work with, but you can check what latitude and longitude lines they occupy and try to find out why those boundaries were chosen. What latitude or longitude lines were used in your place?)

What odd shapes or projections did you remember? What shapes or lines did you forget? What is the history behind each of those boundaries? Which ones are formed by natural features like rivers or mountain divides? At what latitude or longitude do the straight lines lie? When were those boundaries or areas established? Did the place always look the same? Were parts added or removed in the past? What is the story behind each part?

Try the same activity with one of the Greatest Places (or any other place you find interesting.) Find out why those places are shaped the way they are.

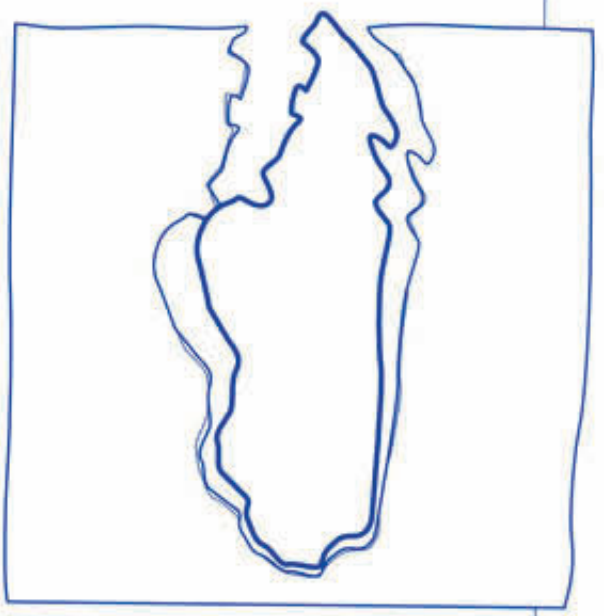
Greenland
Madagascar
Tibet
Iguazu Falls
The Amazon
The Namib Desert
The Okavango Delta

OVERVIEW:

Students create mental maps of selected places.

MATERIALS:

3 x 4 foot sheet of butcher paper



Resources

Check out *The Greatest Places* web site
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Maps; Getting From Here to There, Harvey Weiss, Houghton Mifflin Company, 1995. ISBN 0395720281.

National Geographic web site: http:www.nationalgeographic.com

THE GREATEST PLACES

The National Geography Standards

SIX ESSENTIAL ELEMENTS	World in Spatial Terms	Places and Regions	Physical Systems	Human Systems	Environment and Society	Uses of Geography
Cultural Bagage		✔		✔	✔	✔
Culture in a Box		✔		✔	✔	✔
Global Orange	✔	✔		✔		✔
Reasons for Seasons	✔		✔			
Make an Oppositometer	✔	✔	✔			✔
On the Level	✔			✔		✔
Melting Mountain			✔			
Shake, Rattle and Roll		✔	✔			
That Sinking Feeling		✔	✔			
Off the Shelf		✔	✔		✔	
Bon Voyage		✔		✔	✔	✔
By the Shape of It	✔	✔			✔	✔