Changing Climate, Greening Energy:
An Eagle's Eye View

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FORWARD

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people. We are both a leader and trusted partner in fish and wildlife conservation, known for our scientific excellence, stewardship of lands and natural resources, dedicated professionals and commitment to public service.

There is much talk now of a changing climate and a new focus on renewable sources of energy as fossil fuel supplies decline, or are more and more difficult to obtain. During the industrial revolution, natural sources of energy to fuel that revolution were tapped as never before – dams were built across tens of thousands of streams and rivers in America, acres of lands stripped for lumber and minerals, and habitat altered to allow for fossil fuel extraction activities. All this was done without an understanding of the impacts of these activities on the environment.

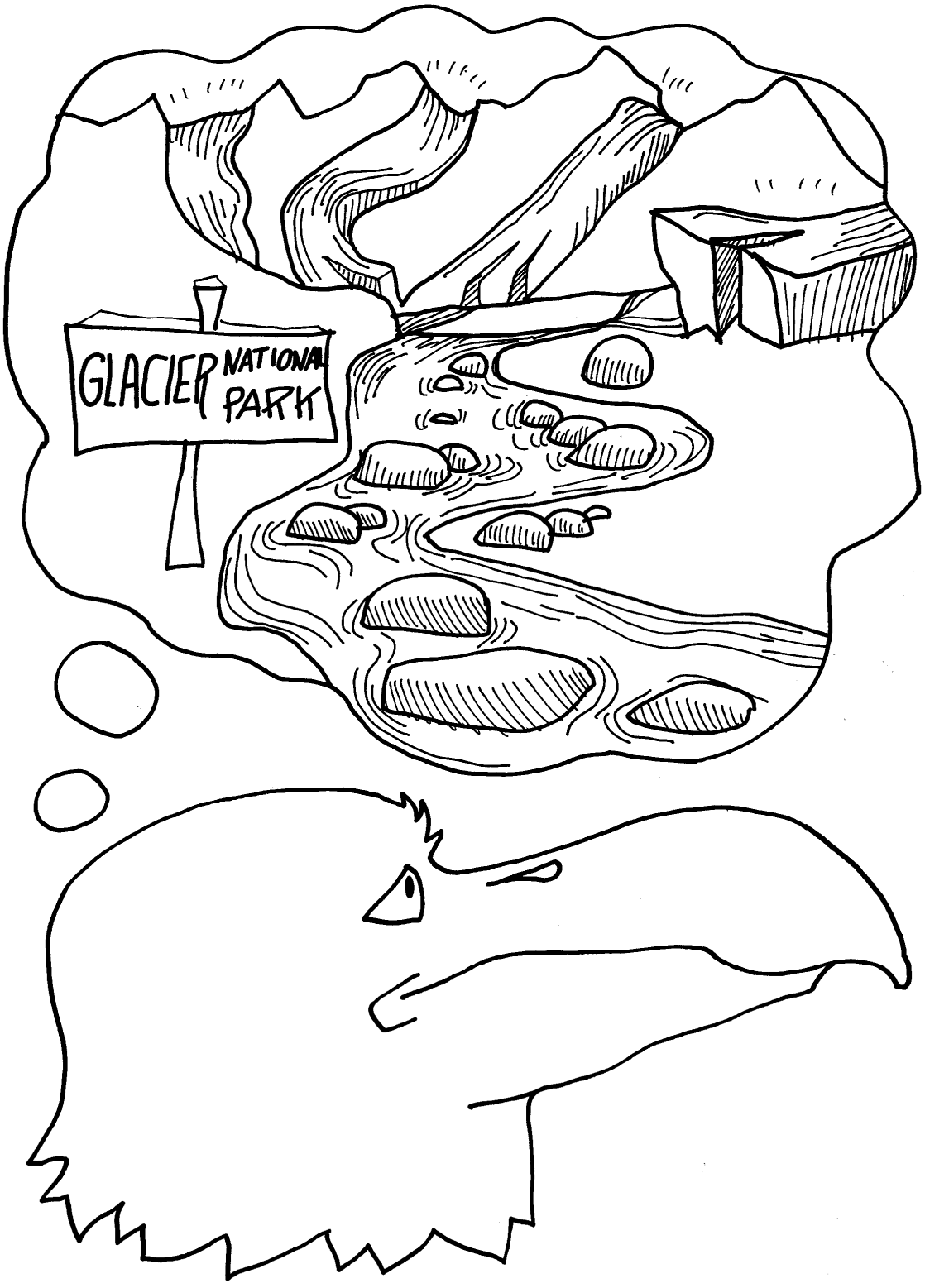
All that is "green" may not be entirely green; trade-offs between energy security, reducing greenhouse gas emissions, and restoring and conserving healthy populations of fish and wildlife may need to be made. As we march forward into this 21st Century, exploring new ways to minimize our "carbon footprints" on the landscape, as we seek domestic sources of energy, we hope that America will do so with our eyes open to potential impacts to the environment, including our precious fish and wildlife and their habitat.

Join Barry the Bald Eagle as he takes an Eagle's Eye View.

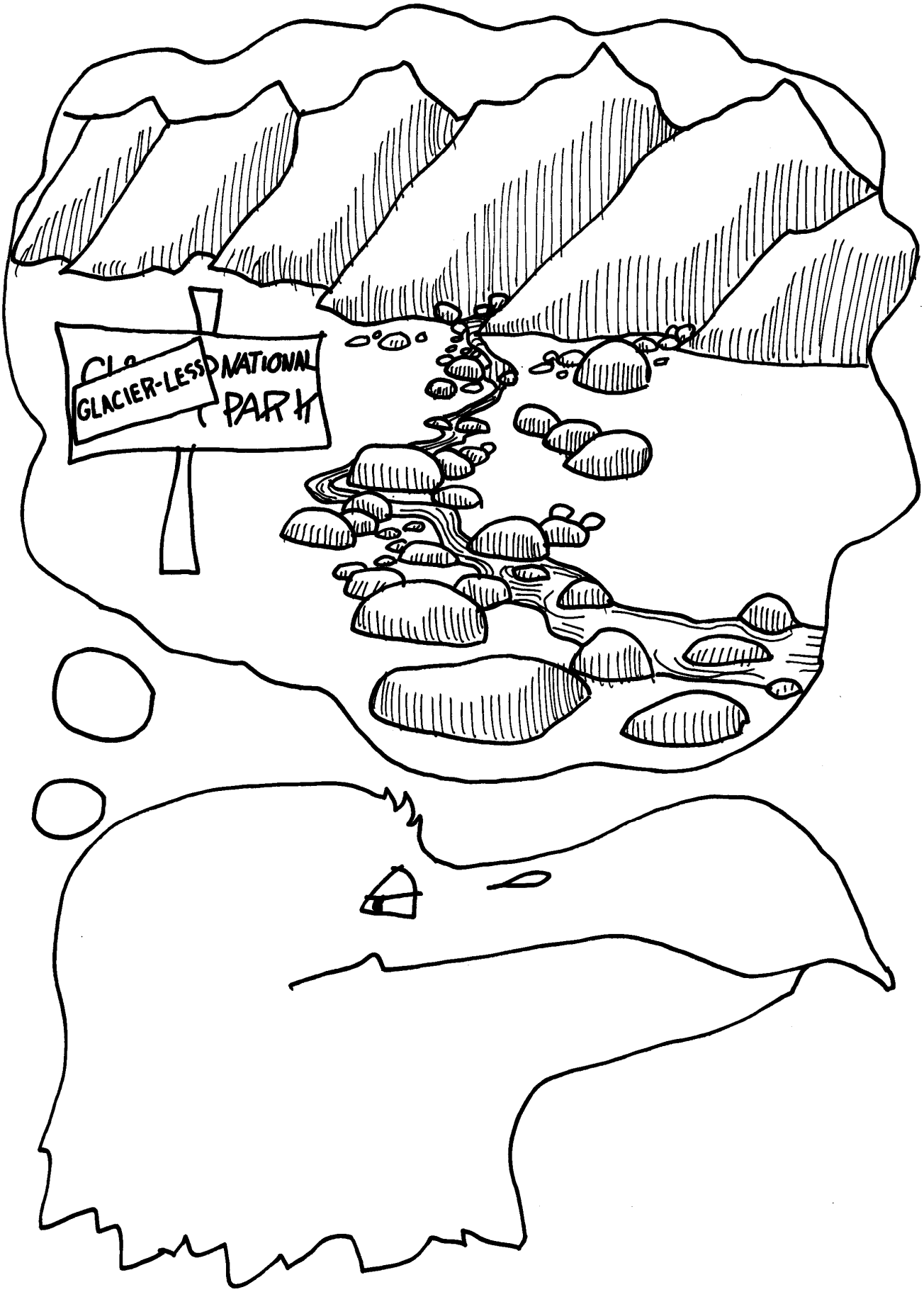
Meet Barry Whitehead*. He works for the U.S. Fish and Wildlife Service (USFWS).

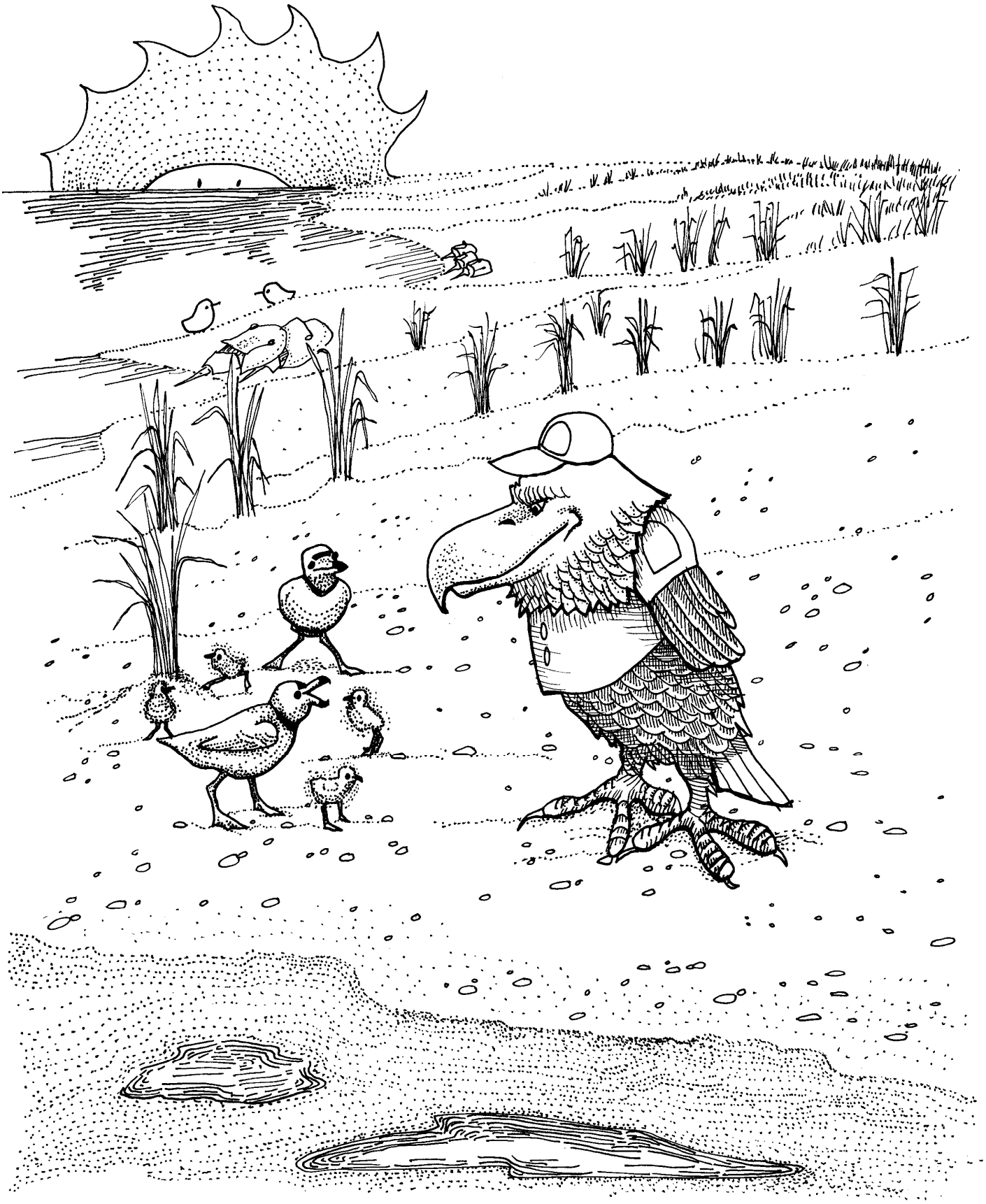
*The bald eagle's scientific name is *Haliaeetus leucocephalus.* Leucocephalus means "white head!"

USFWS has been thinking about climate change, renewable/green energy ideas and what it means to fish and wildlife.

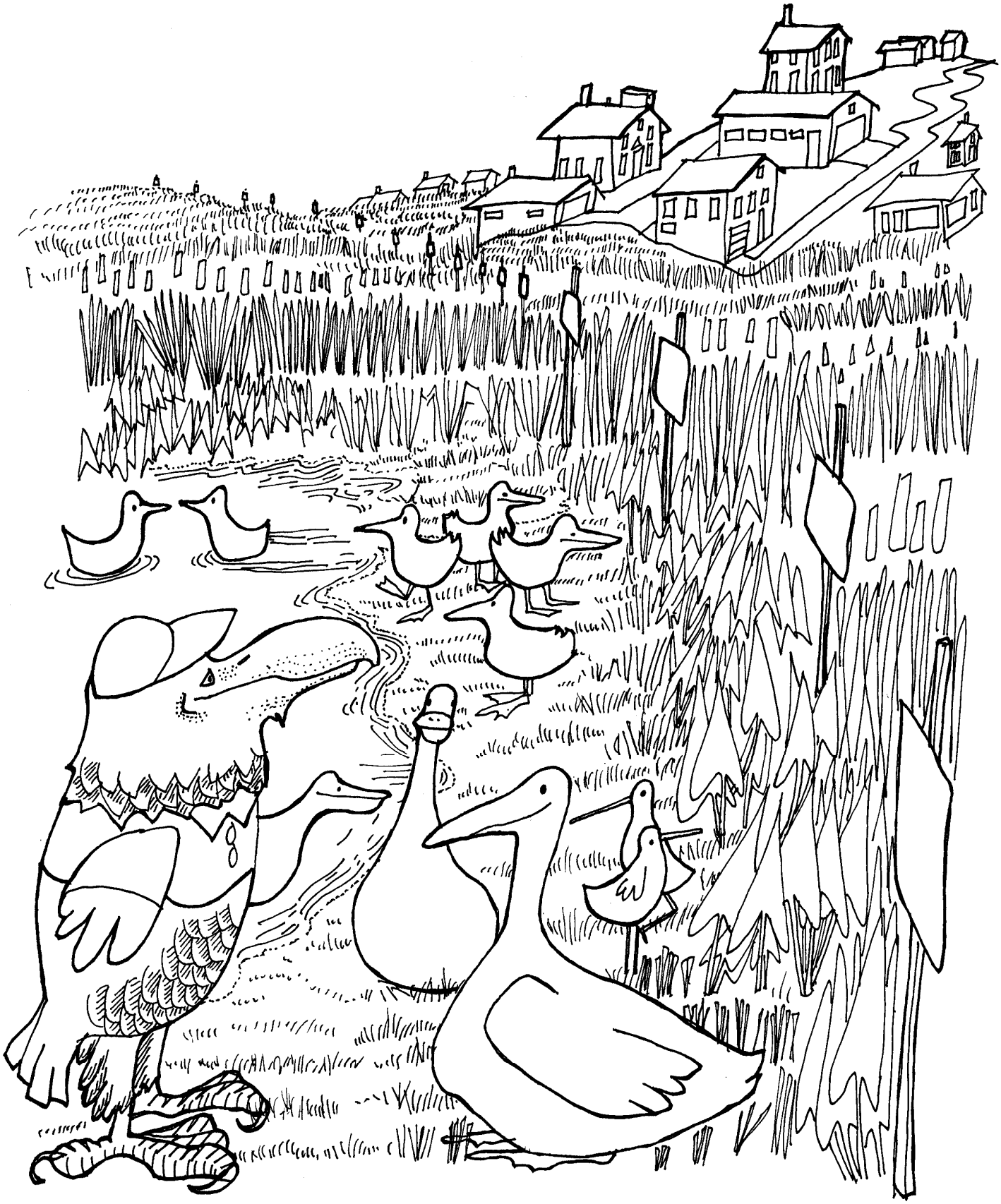


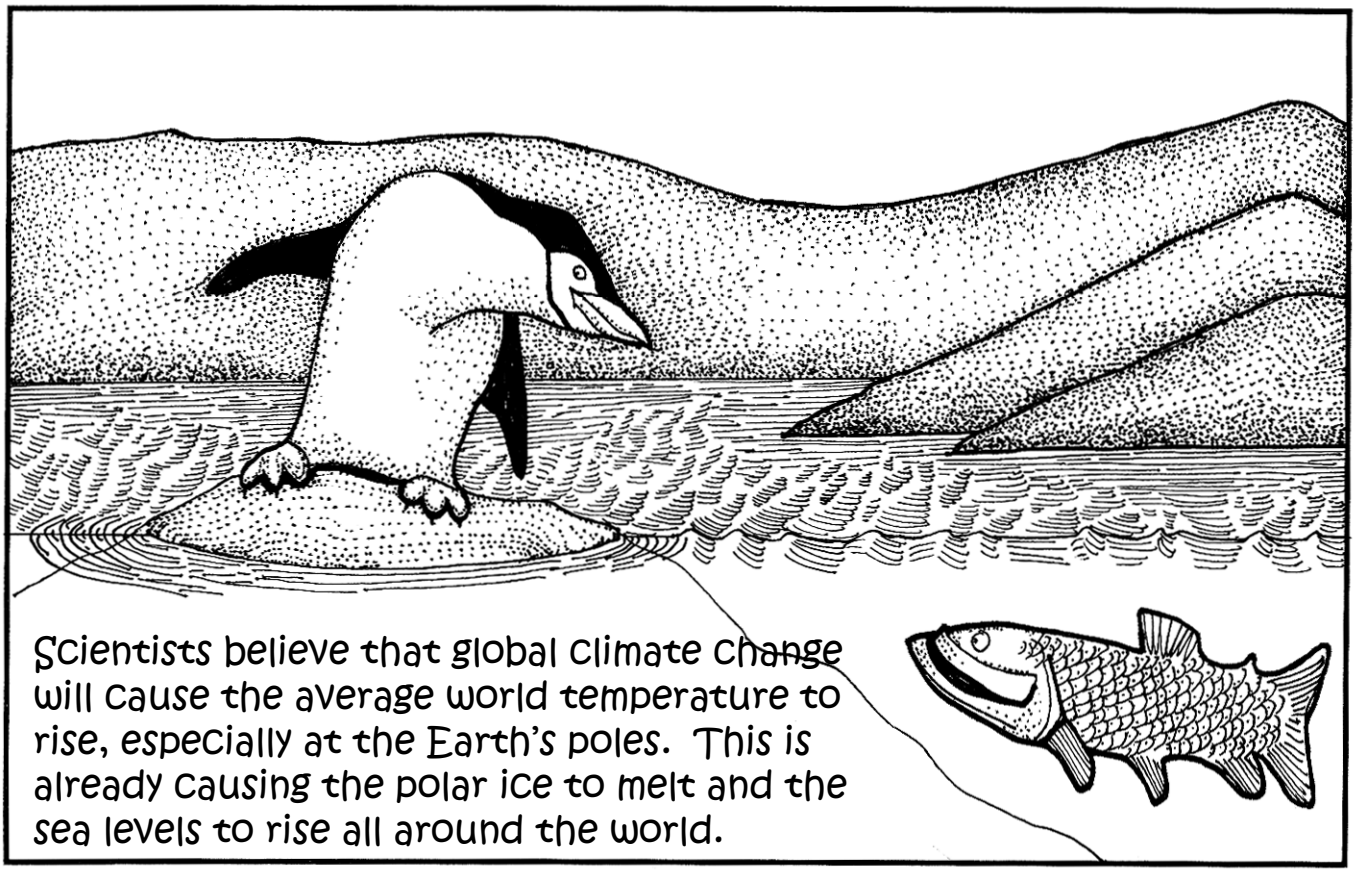
Scientists have documented that something is happening to our planet.


GLACIER-LESS
NATIONAL
PARK

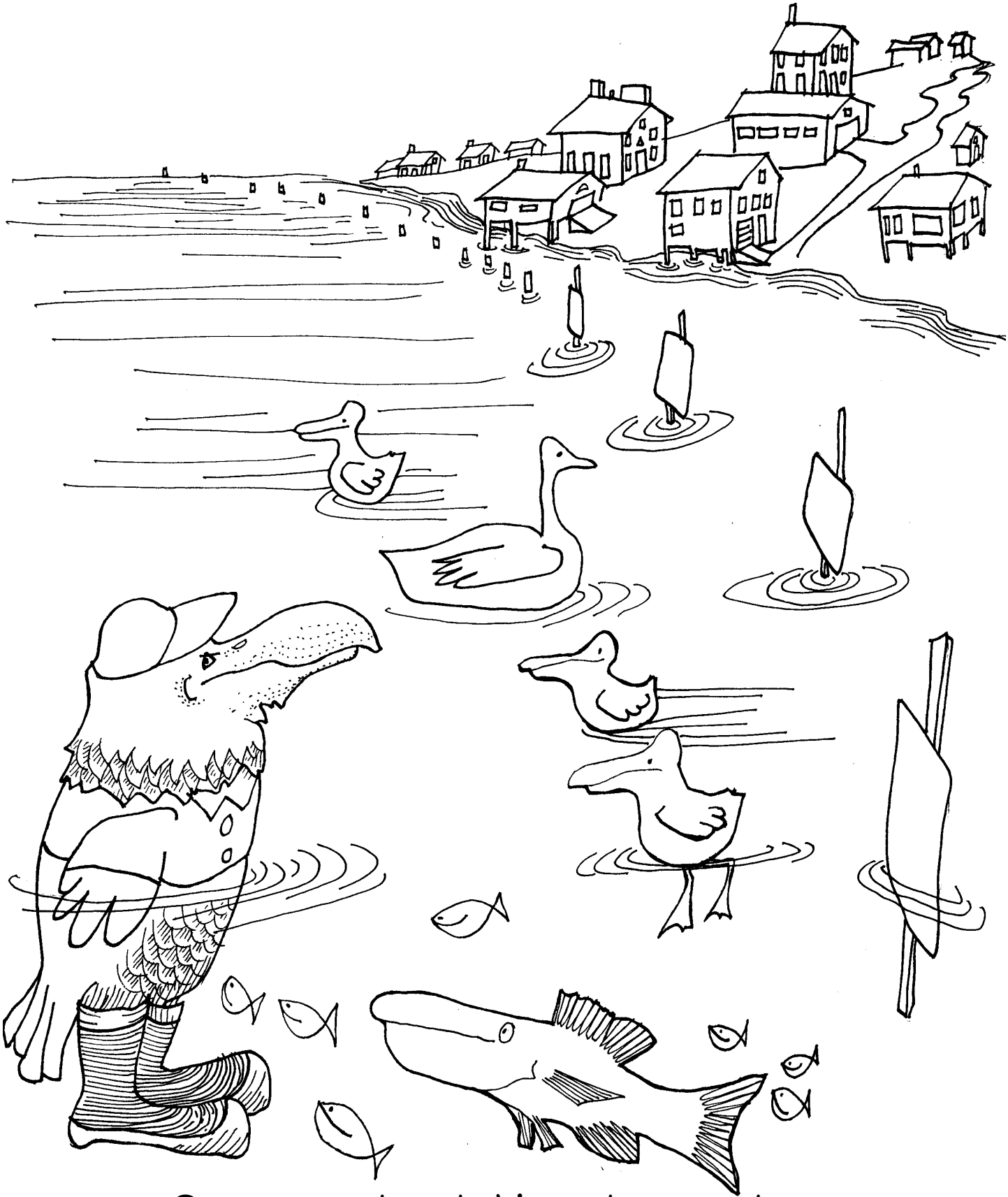



STATE HISTORICAL MARKER
UNTIL 21ST CENTURY
THIS SPOT WAS
PIPING PLOVER
HABITAT





Scientists believe that global climate change will cause the average world temperature to rise, especially at the Earth's poles. This is already causing the polar ice to melt and the sea levels to rise all around the world.



Can you see how habitat changes when the sea level rises?

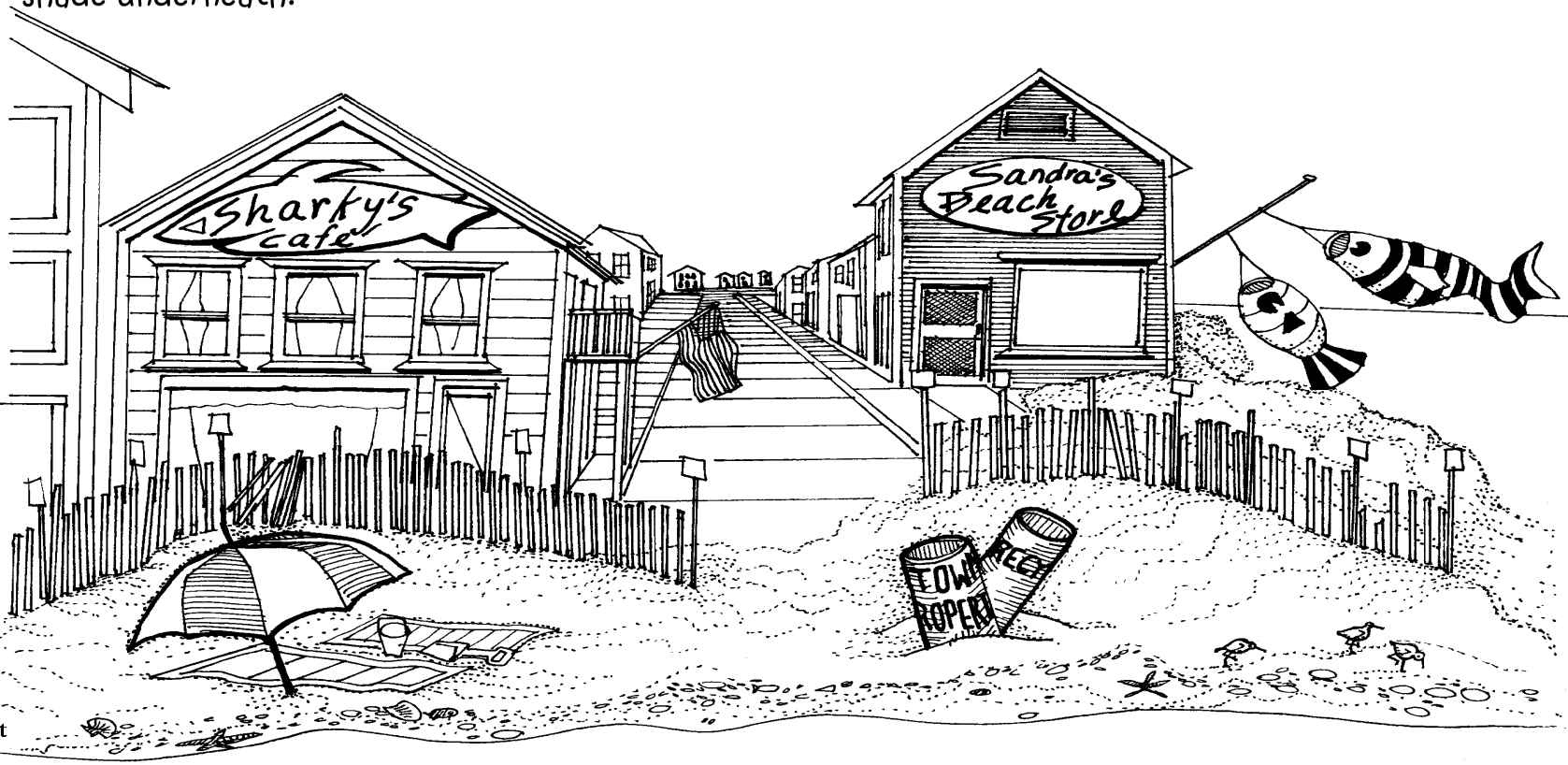
What would happen to this Town? If portions of ice caps in Greenland and the Antarctic Peninsula melt, the sea level is expected to rise by 2 feet in certain parts of the world. Draw a line between 2 and 2 and color below that for the new sea level.

FEET

60 58 56 54 52 50 48 46 44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2

Present

What if all the Greenland ice melts? The sea level might rise 24 more feet! Draw a line from 26 to 26 and shade underneath.



FEET

60 58 56 54 52 50 48 46 44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2

Present

Oh no! What if the West Antarctic ice sheet melts, too? That's 18 more feet of sea level rise! Draw a line from 44 to 44 and color underneath it. What changes do you see now?

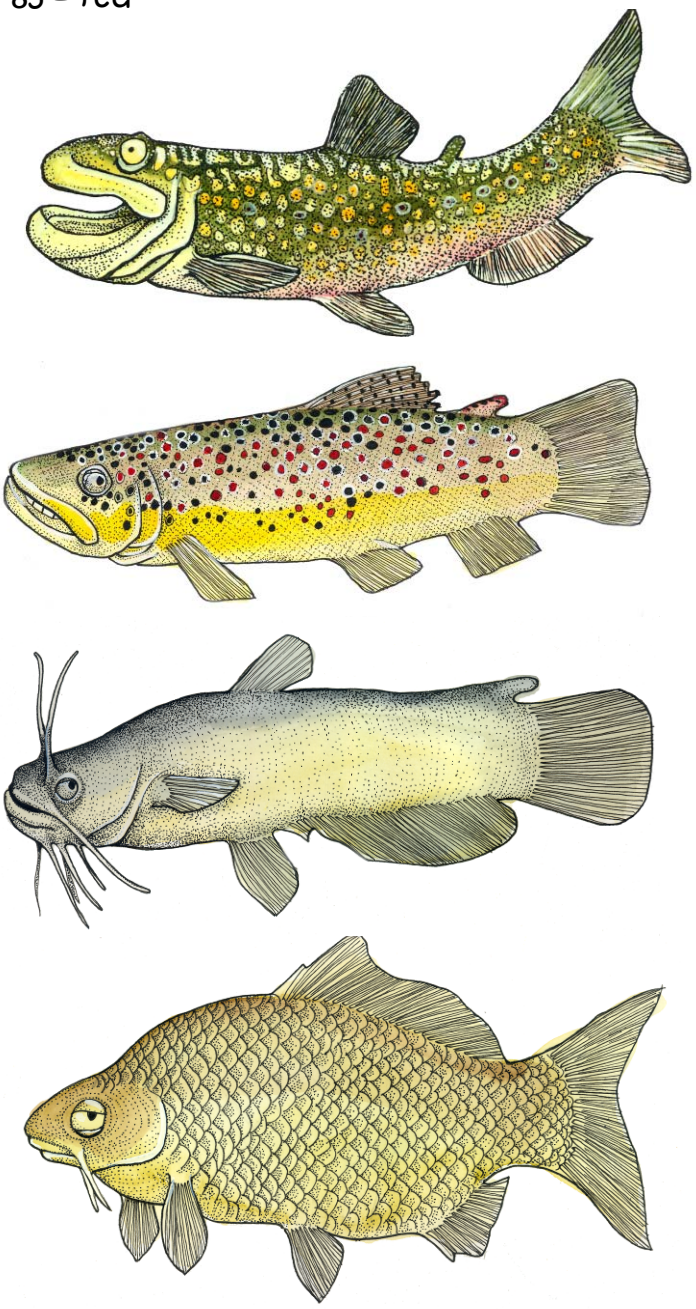
What would happen if the entire Antarctic ice sheet were to melt? The sea level could rise approximately 156 more feet!
Draw a line from the top of the page and shade underneath. We do not even have enough room on the page to show how high the sea level would be! What happened to this coastal town?

(http://www.grida.no/publications/other/ipcc_tar/?src=/climate/ipcc_tar/wg1/412.htm and http://www.ldeo.columbia.edu/~mstuding/wais.html)

But not only does climate change alter sea levels – it may change streams and rivers world wide. It doesn't take a huge temperature shift to cause certain fish to vanish – fish species that depend on colder water!

On the next page are four maps of the same watershed over a few decades of climate change. Barry's friend the brook trout needs cold water and prefers the water to be around 55 degrees F (blue), although they can survive in warmer water temps to about 65 degrees (green). As water temperatures warm (yellow, orange and red) the brook trout may be forced out of this watershed. Use the key to color by number to see what happens.

55 – blue
68 – green
74 – yellow
78 – orange
85 – red



Brook trout (*Salvelinus fontinalis*) In spite of their name, brook trout are often found in lakes and are also common in cold, clear headwater streams. Like most salmonid fishes, brook trout thrive in waters with low temperatures and high oxygen content.

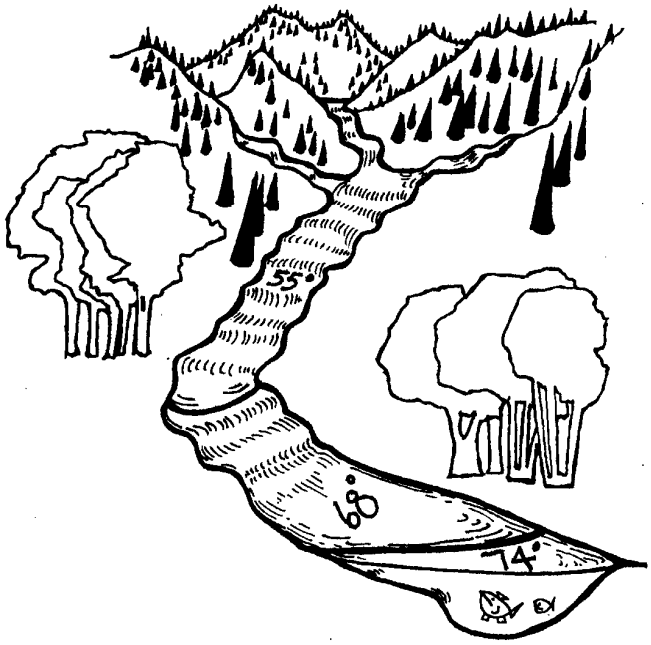
Brown trout (*Salmo trutta*) can tolerate higher temperatures than other salmon and trout.

Yellow bullhead (*Ameiurus natalis*) live in pools and backwaters of sluggish streams, ponds and lakes.

Carp (*Cyprinius carpio*) can inhabit turbid or clear water over mud and silt and are more common in warm water, even up to 100 degrees F.

SO a stream that historically supported brook trout could someday only support carp!

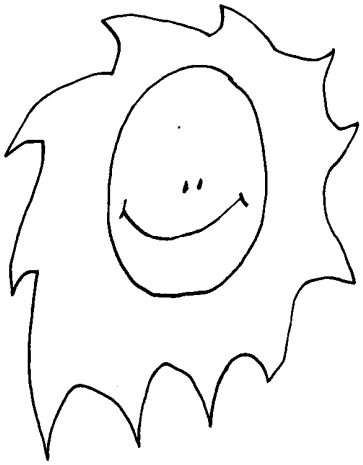
1. This is the stream today – several different habitats represented by different water temps.



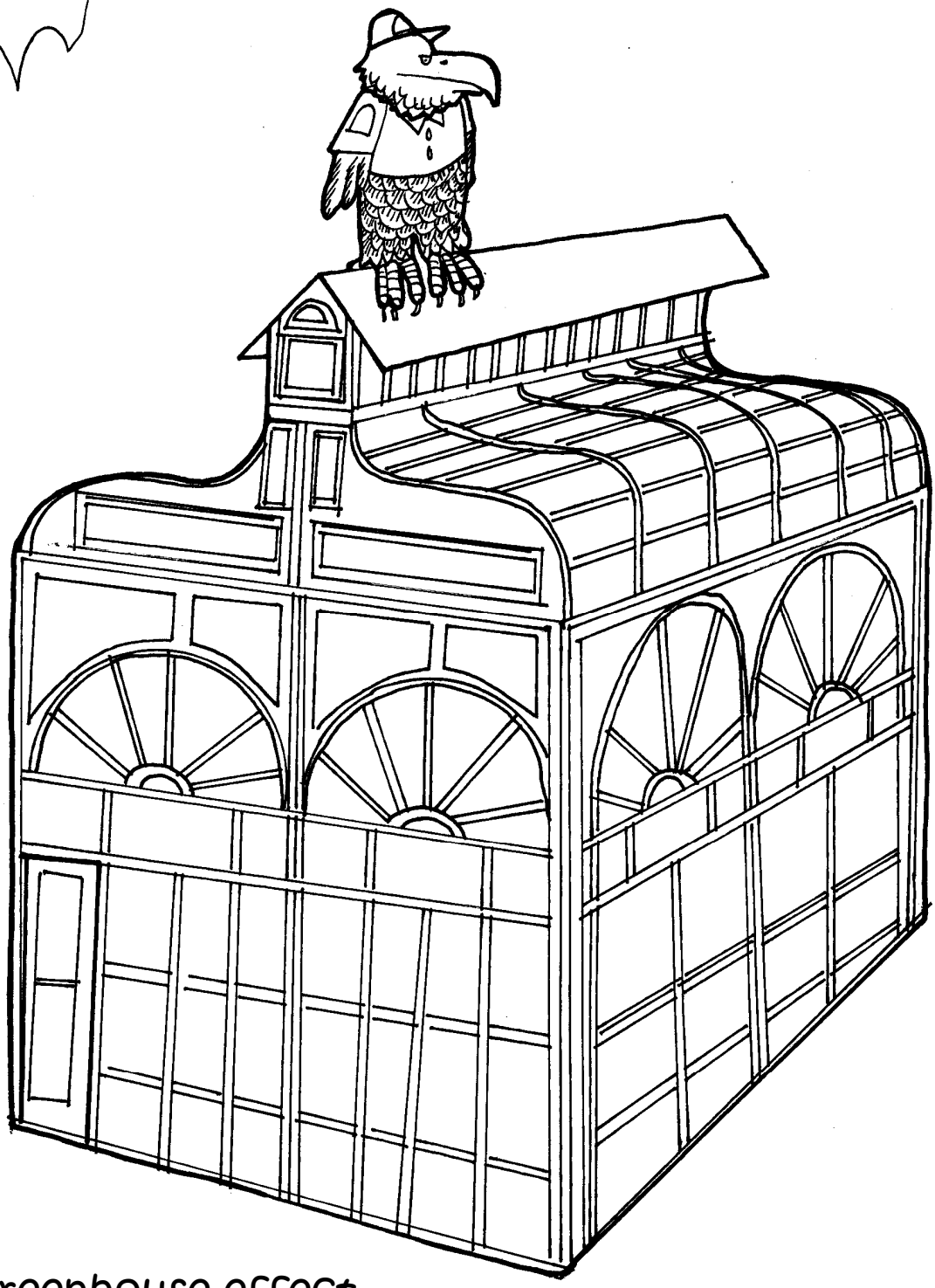
2. Now advance into the future with a warming planet. Now there is less cool-water habitat and new, warm-water habitat.

3. The planet continues to warm and now the cool-water habitat is gone and more of the habitat is very warm water.

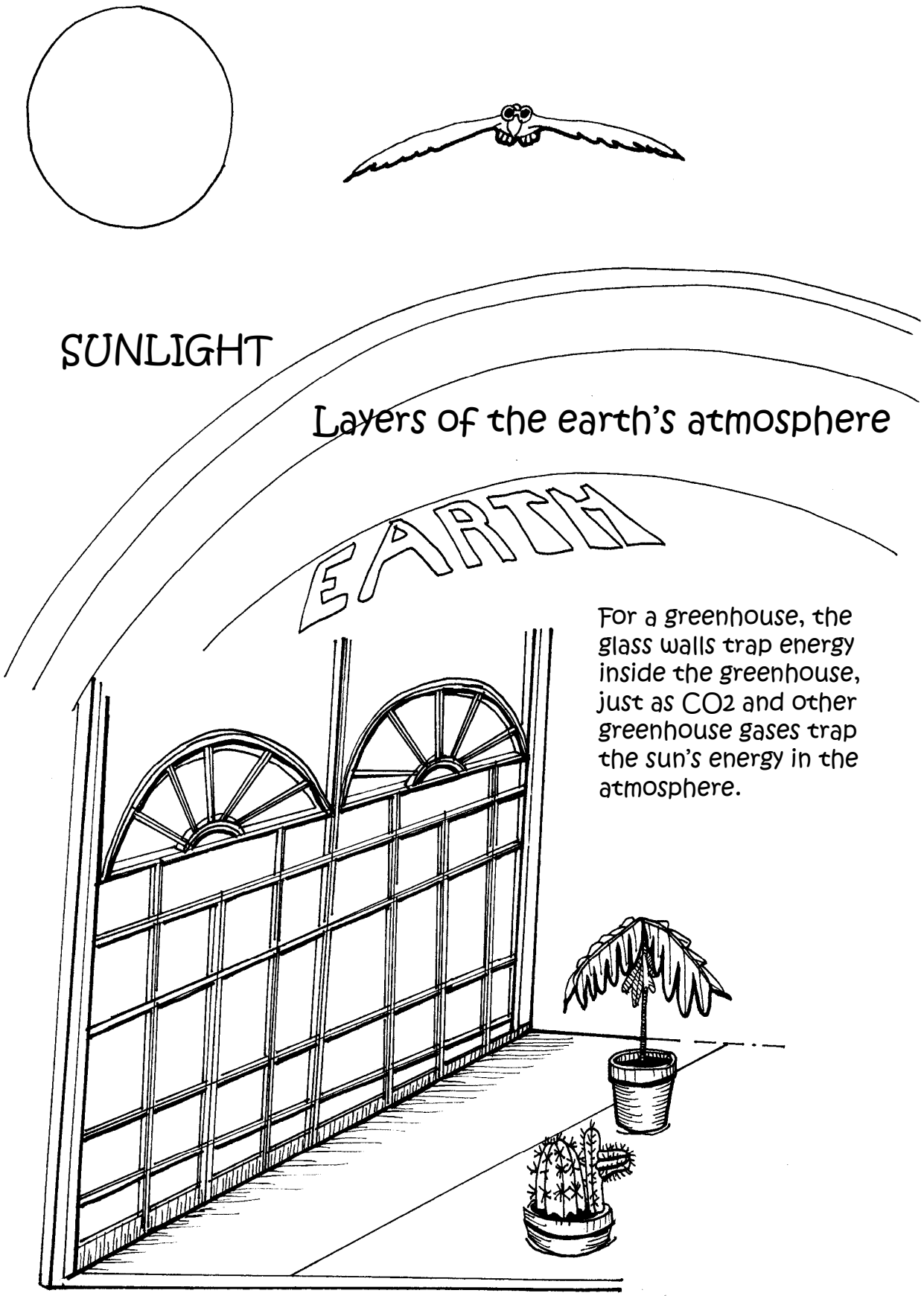
4. Finally, the entire stream is now a warm water stream, with likely little diversity in fish species as few can tolerate such warm water and low levels of oxygen.



So, what is causing the earth's atmosphere to warm up?



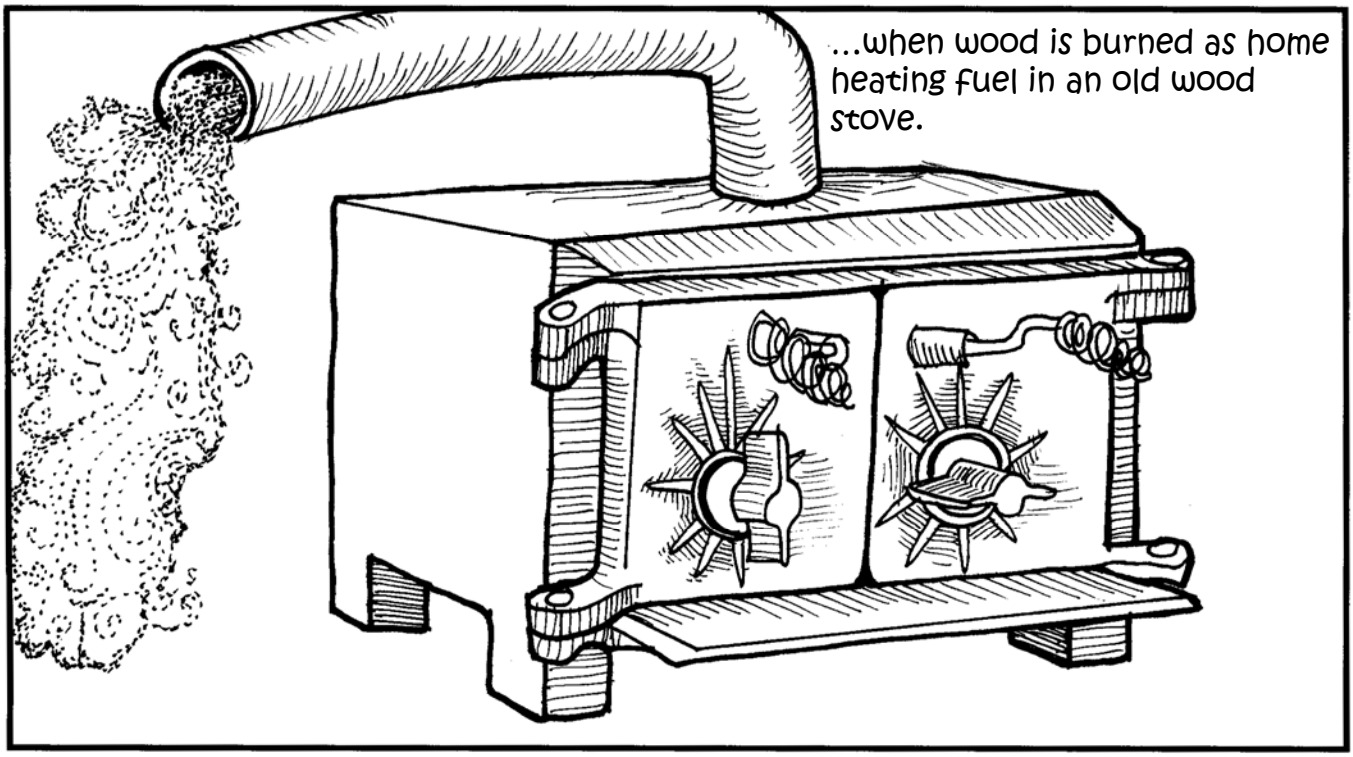
The greenhouse effect.



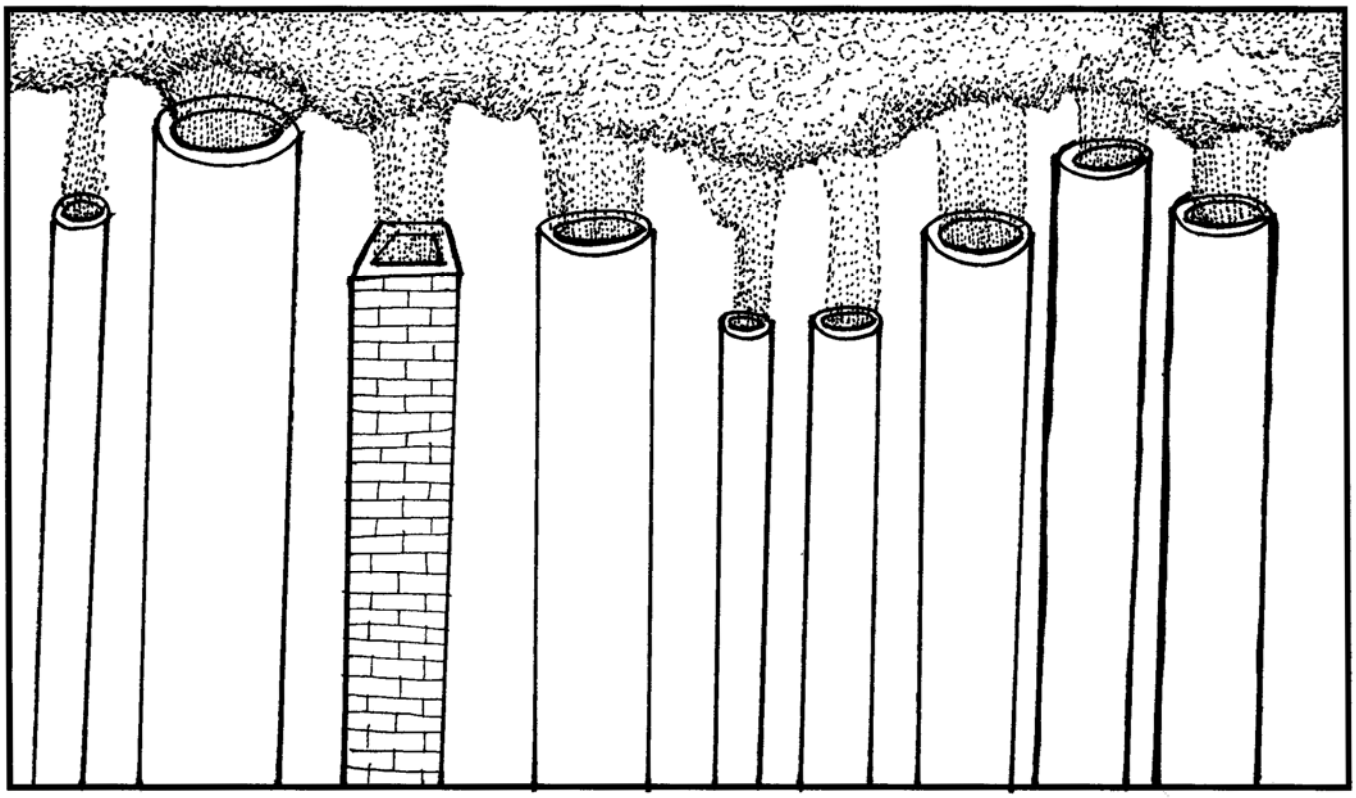
For a greenhouse, the glass walls trap energy inside the greenhouse, just as CO_2 and other greenhouse gases trap the sun's energy in the atmosphere.

Heat is trapped in the atmosphere by increasing amounts of greenhouse gases and infrared radiation is resent towards earth, like in a greenhouse or auto sitting with the windows shut in the sun. For more information, visit EPA's kid's page at: www.epa.gov/climatechange/kids/greenhouse.html.

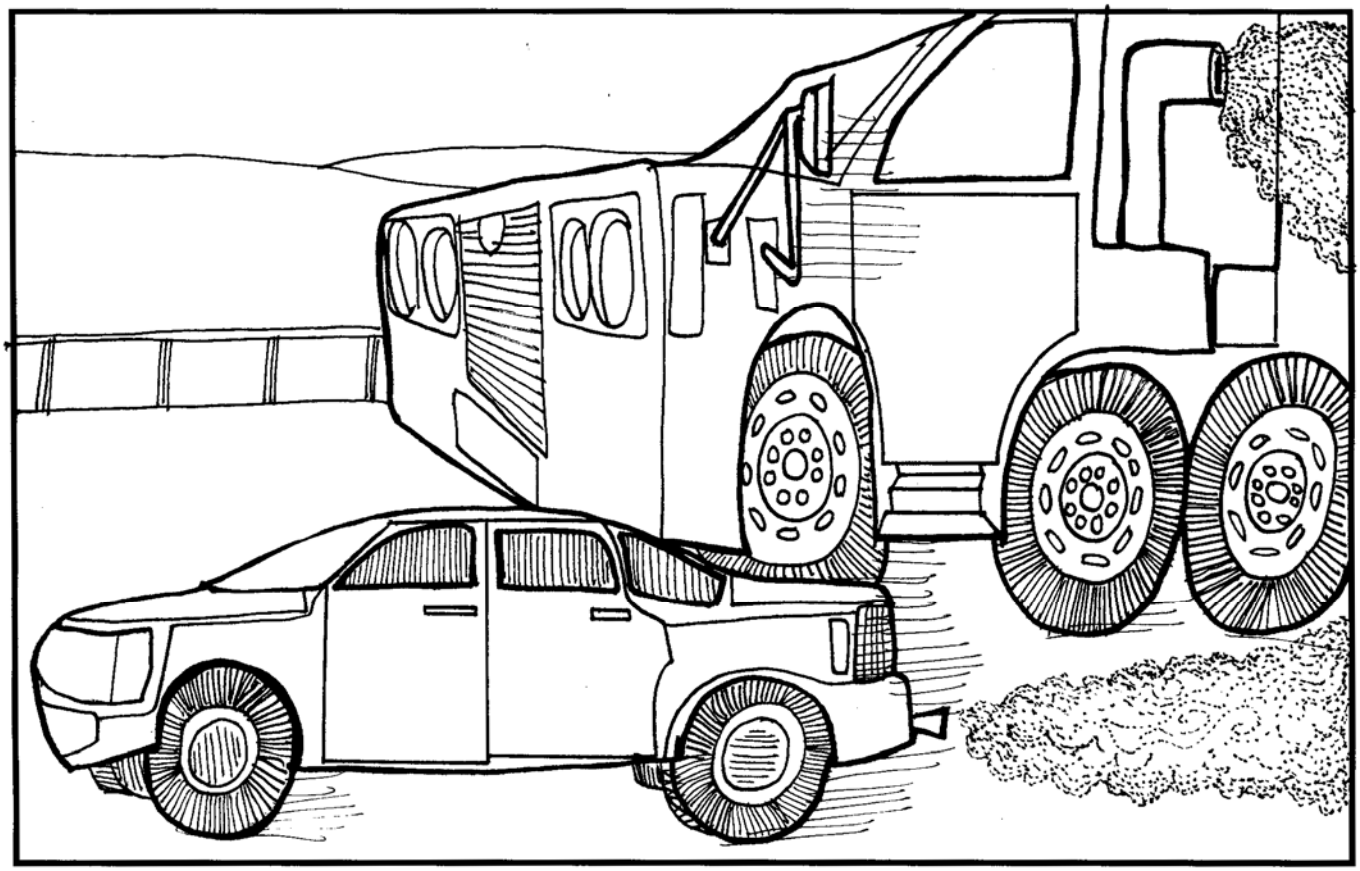
CO_2 released into the air in forest fires, and clear cuts.....



Where do greenhouse gases come from?



CO_2 is produced by industries which are dependent on carbon-based fuels.....



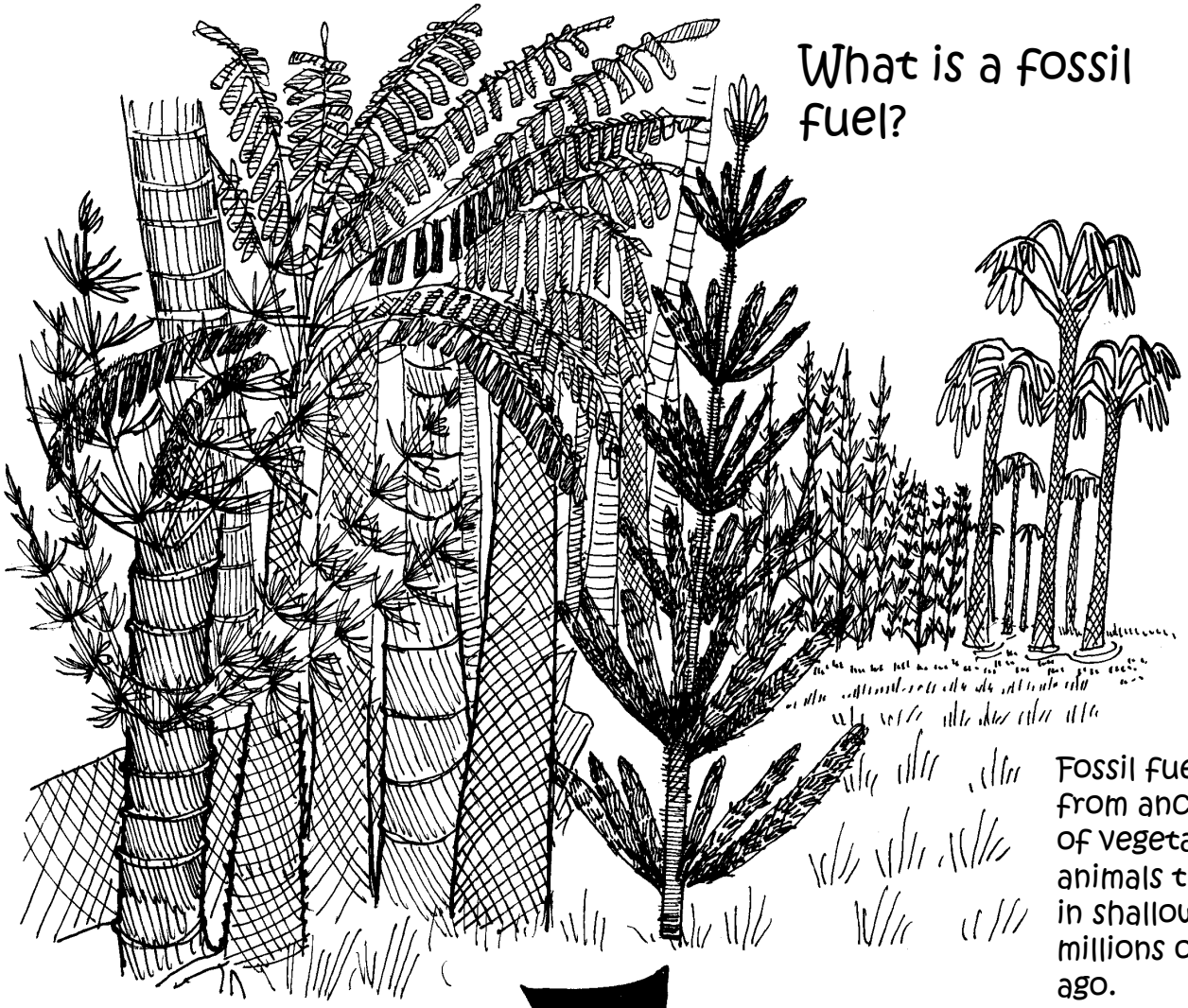
And by our transportation system which is based on fossil fuels....

Here a large truck burns diesel fuel and a big car, gasoline.

Why do we need so much energy?

Eagles get their energy from eating fish and scavenging what they can find; people need sources of energy to power tractors, cars, ships, trains, trucks, factories, and to make electricity, among other needs.

What is a fossil fuel?

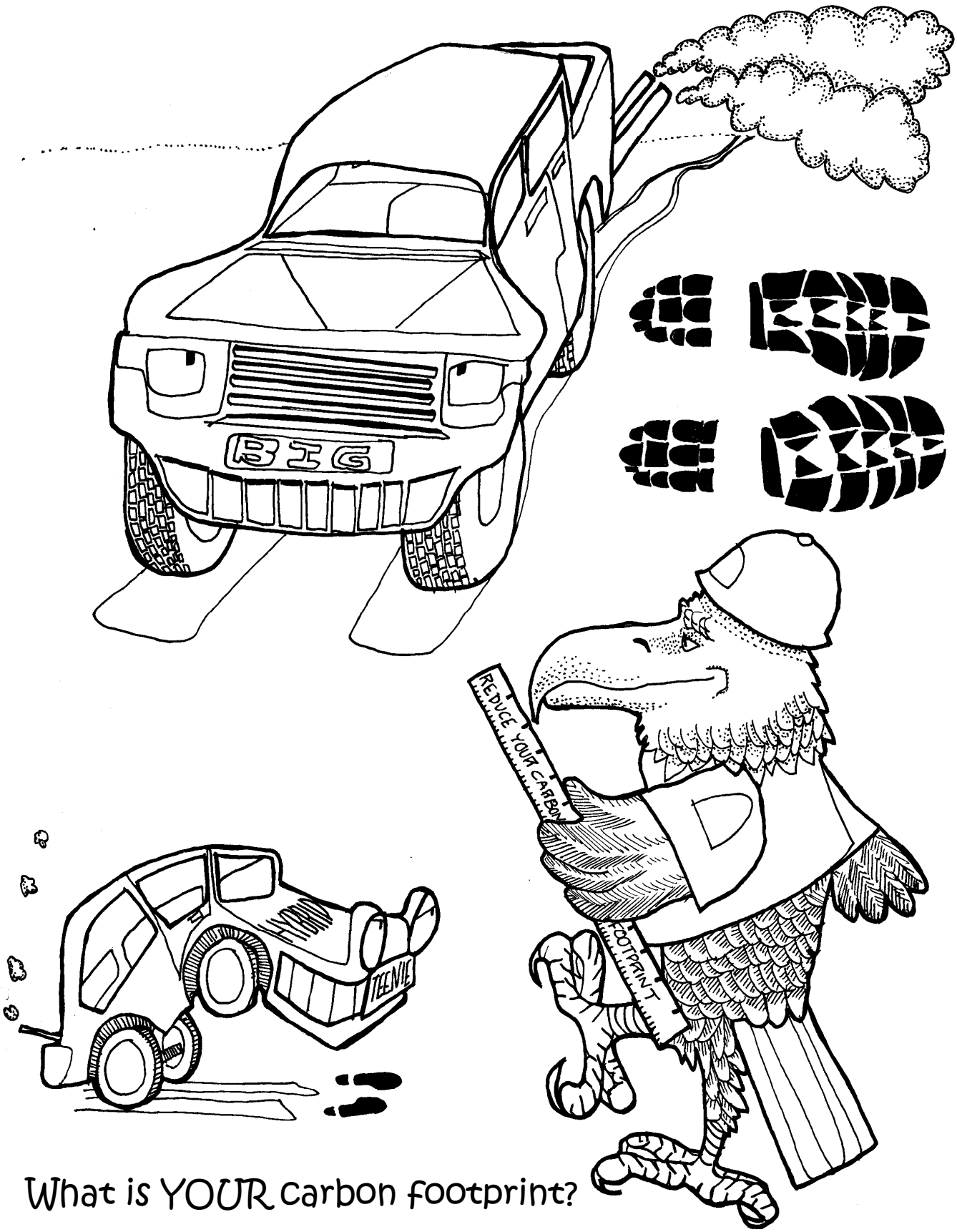


Fossil fuels come from ancient beds of vegetation and animals that lived in shallow seas, millions of years ago.

(This is how coal forms.)

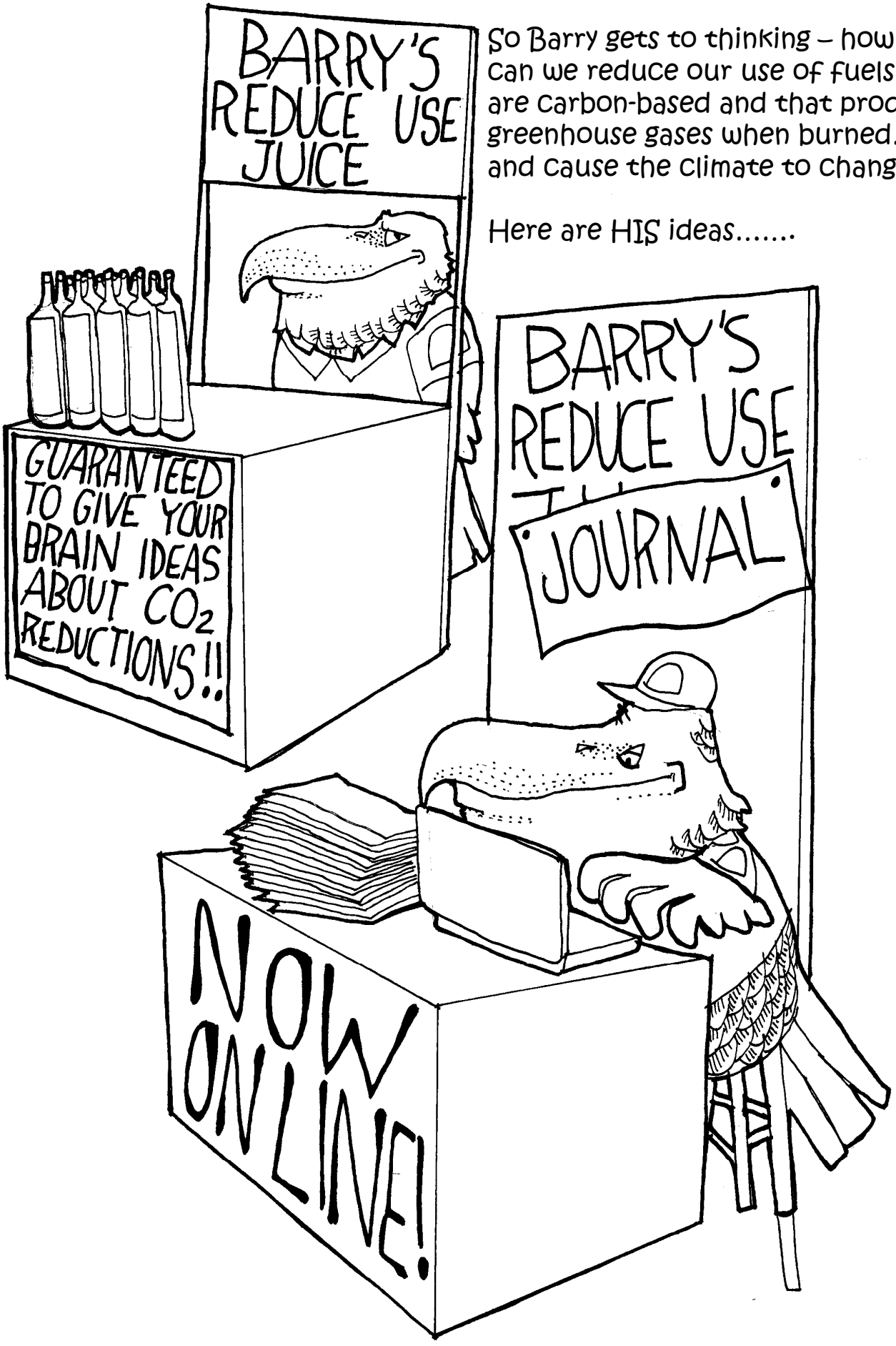
The bodies of these living things were buried by sediment and compressed by layers and layers of soil.....

.....and rock into the concentrated carbon-based fuels we can drill or mine today. They are not renewable – once burned up, the supply will be used up!



What is YOUR carbon footprint?

Your carbon footprint is the "mark" you leave behind each time you do something that causes greenhouse gases to be released into the environment.



So Barry gets to thinking – how can we reduce our use of fuels that are carbon-based and that produce greenhouse gases when burned... and cause the climate to change?

Here are HIS ideas.....

Barry's Reduce Use Journal

"All the Reduce Use News that's Out There" Upstate Edition

VOL. I No. 1

WHAT TO DO?

Energy-Efficient Options for Home Use!

-Use energy star rated appliances
-Shut off lights when not in use
-Unplug televisions and computers to reduce "vampire energy" drain

Make Like a Polar Bear and Insulate Yourself!

Are you cold? Do you feel a draft? Wait! Don't turn up the thermostat…put on a sweater and save energy! Cozy up in a nice blanket and throw on some slippers.

$Create Financial Incentives for Conservation$

There are economic incentives for conservation! Look up conservation easements and renewable energy tax credits.

Waste Not, Want Not

This old adage will get you further than grandma's house! Why throw out that old head of lettuce when you can compost it and those coffee cans make great containers! If it needs to go, recycle it!

Rail Companies Boast of Off the Chart Fuel Efficiencies!

Those trains are very efficient! Some trains are said to be able to transport one ton of cargo using only one gallon of fuel! (http://www.foxbusiness.com/story/markets/industries/transportation/genset-trains-reduce-emissions/?test=rai)

Choose Smaller Vehicles!

Why use that gas guzzling SUV to go down to the local farmers market to buy a few groceries when you can take a small vehicle for errands and use less fuel?

Keep your Car Tires Inflated!

Did you know that by simply making sure the proper amount of air in each of your vehicle's tires can increase the miles per gallon you get? It's true!

Public Outrage Fuels Biofuel Plant Construction!

The public is sick and tired of being subjected to dirty air, polluted water and fluctuating fossil fuel prices! They demand an alternative, and switch grass or algae biofuels might be the answer!

Department of Energy Explores Alternative Sources of Energy

Time and money is being spent on researching "green" energy and local energy efficiency improvements. Bring on the hydrogen, solar, wind, tidal, biofuels, biomass, geothermal and hydro energy!

Tidal Power Can Move You!

Everywhere and every day on the coast the tides go in and out. Imagine harnessing that energy to power our cities! It is clean (no emissions) and renewable!

Gravity can be Your Friend

There is energy in gravity! Engineers and scientists are trying to figure out ways to harness the energy in gravity.

Buy Local! Farmer's Markets Flourish Upstate!

More people want fresh, local produce, cheese, eggs and products! It cuts down on the "mileage" imported foods have, as well as supports local businesses and agriculture!

All that Looks Green May Not Be

Not all that is called "green" is! Often you will be coaxed to buy or replace something due to its "greenness." Sometimes it is just better to hang on to what you have and replace it when necessary!

Goats and Sheep Restore Endangered Species Habitat!

Goats and sheep will eat just about anything! Allow them to graze on some land overtaken by invasive plants, and soon you'll have no more invasive weeds! The land is then ready to be planted with native plants and grasses that can be important habitat for wildlife!

Row, Row, Row Your Boat

Who needs that noisy outboard motor when you can row that boat and quietly glide through the waters and listen to birds, wildlife and the peaceful sound of the wind through the trees?

Use Public Transportation!

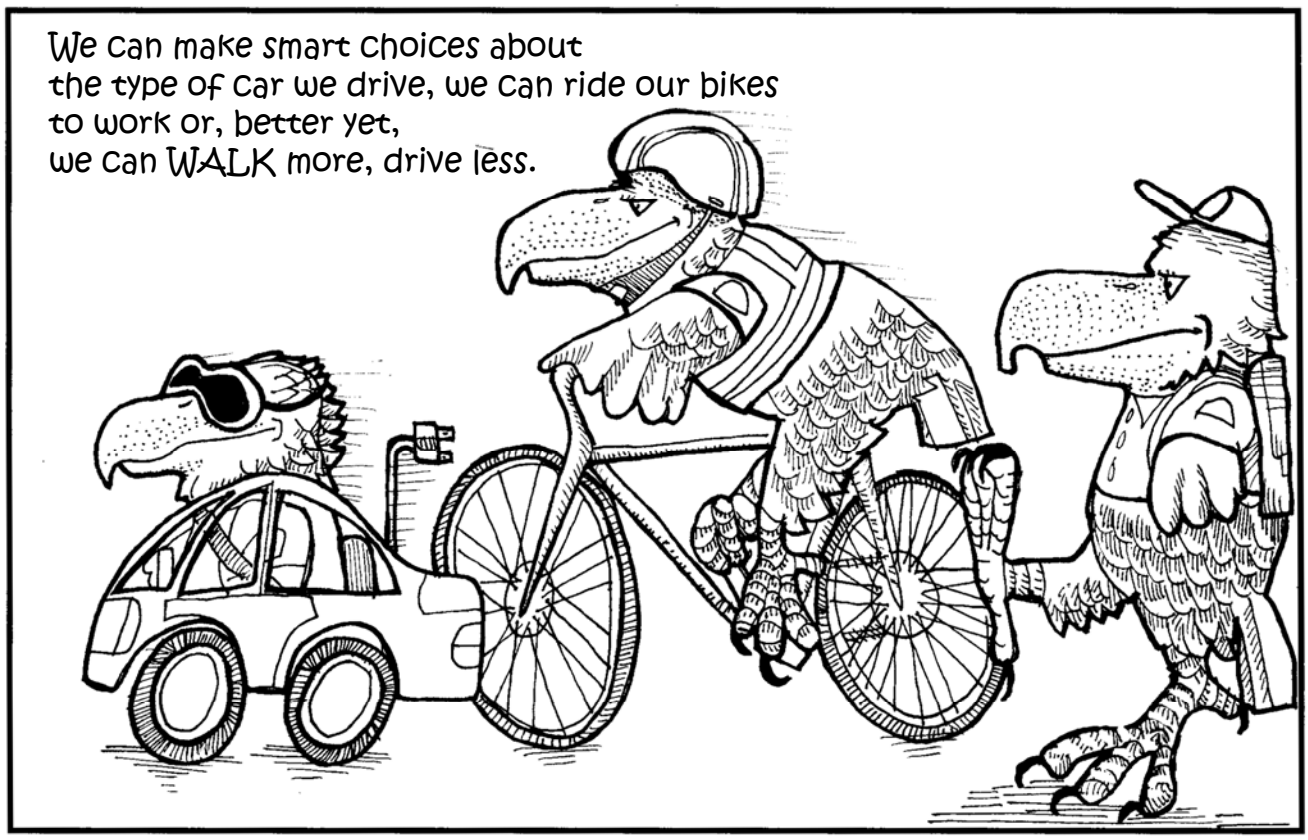
Use the bus or train instead of taking your car downtown! See the sights, do homework or read a book instead of being behind the wheel and reduce pollution and carbon!

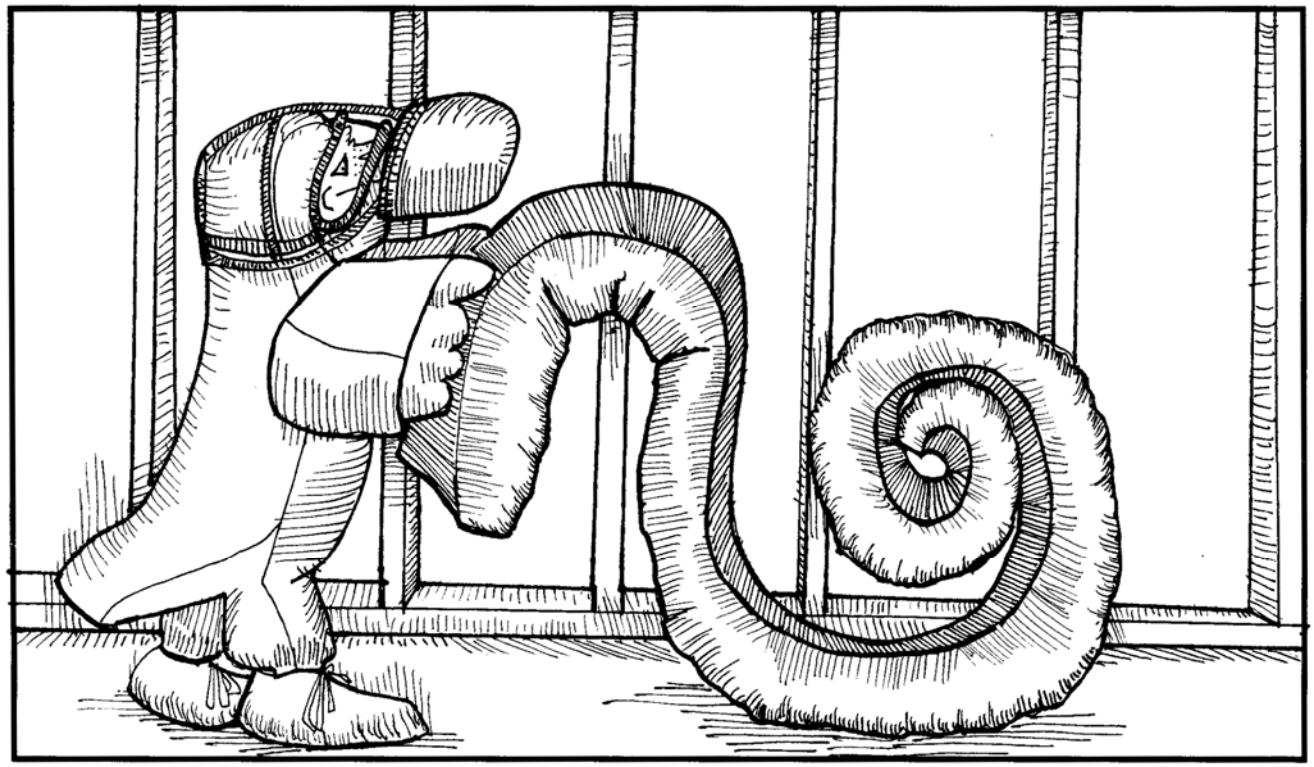
Dive into a Carpool!

Do you know someone who goes to the same place you do? Carpool! It is easier on the environment, and you get to have someone to chat with!

Cap 'N Trade

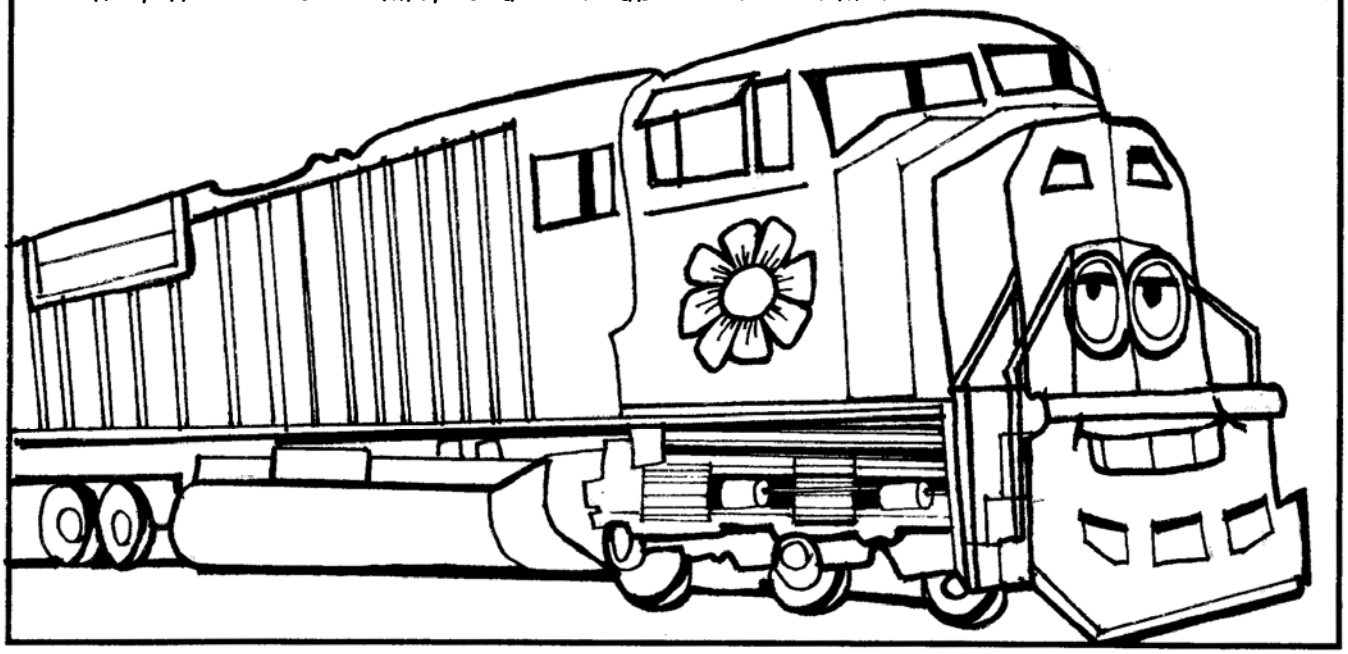
Cap and trade is a system where companies are given pollution credits. These credits can be sold amongst companies giving a

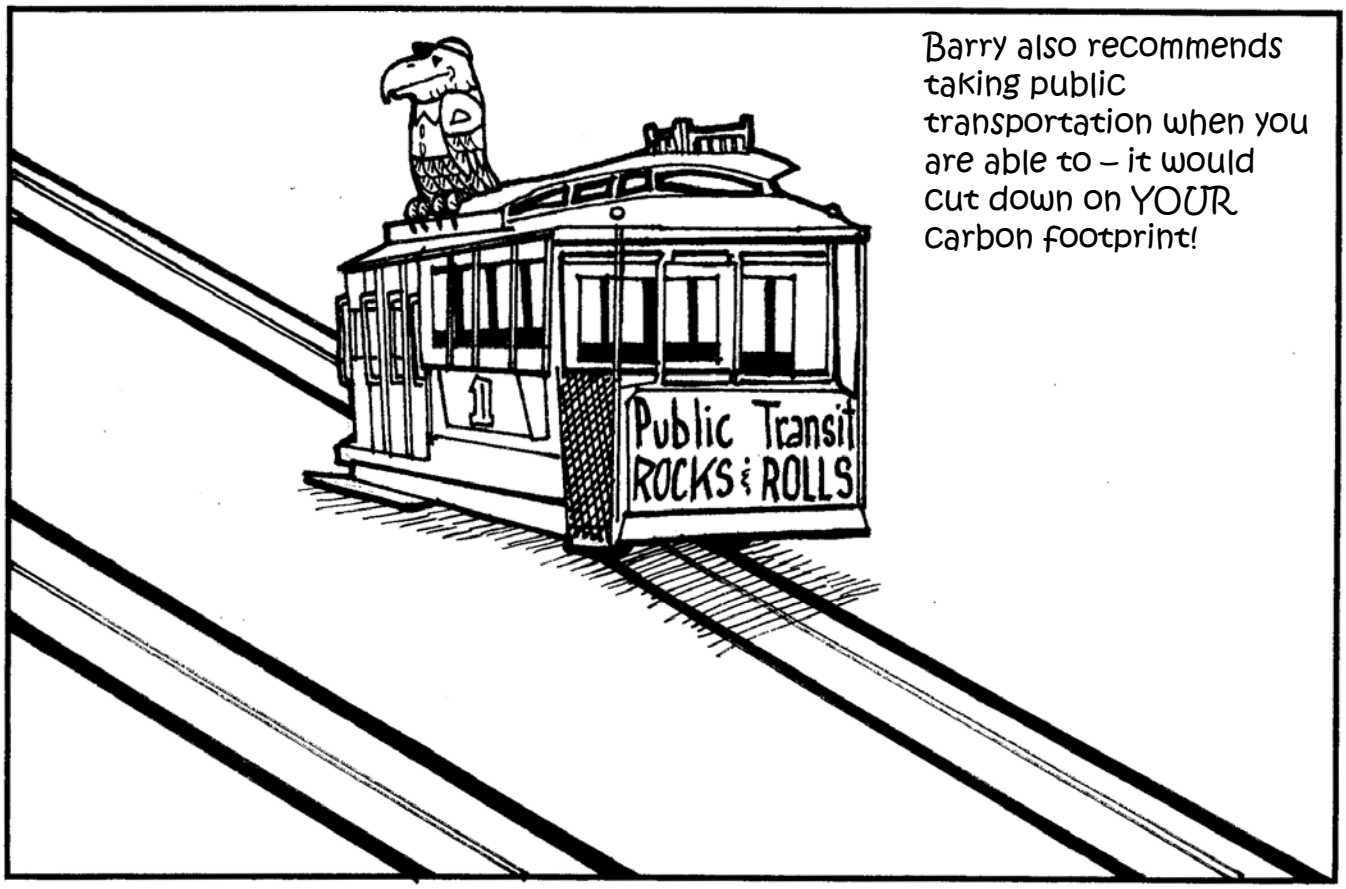




Installation of insulation ensures that energy used to heat our homes isn't wasted. Here Barry is installing a thick blanket of insulation in a house.

New data provided by one rail company, CSX ,tell us that things can be transported cross country by rail using less energy than by transporting it by trucks. CSX can haul a ton of freight 436 miles on one gallon of fuel. http://www.csx.com/?fuseaction=about.environment





Barry also recommends taking public transportation when you are able to – it would cut down on YOUR carbon footprint!

Planting some tree and crop species can help capture CO_2.

A scientist at the Forest Service Northeast Research Station in Syracuse, NY found 31 tree species that could be grown in that city to help decrease CO_2 levels. The best trees for this are those which are good at absorbing CO_2 and are low maintenance.

Some of them are: the horse chestnut; black walnut; American sweet gum; red and white pine; Douglas fir; London plane tree (cousin to sycamores); and scarlet, red and Virginia live oaks.

Where does the tree store CO_2, and is it stored "forever?"

START HERE

1. TAKE A CARD!

2. CHOICES! TAKE A CARD OR LOSE A CARBON

3. OH NO YOU'RE IDLING IN TRAFFIC

4. CARBON & SKIP A TURN

5. TAKE A CARD!

GO BACK 3 DETOUR SPACES

6. TAKE A CARD!

7. TRADE! TAKE 2 CARBONS FROM ANY PLAYER

8. STAY AT HOME & DO NOTHING

9. DO NOT TAKE A CARD

10. TAKE A CARD!

11. CHOICES! TAKE A CARD OR GAIN 2 CARBONS

12. WHAT A BUSY DAY! TAKE 2 CARDS

13. HURRAY! DO NOT TAKE A CARD. ROLL AGAIN.

14. TAKE A CARD!

15. TAKE A CARD.

16. CHOICES! TAKE A CARD... OR LOSE 3 CARBONS!

17. OOPS! FORGOT SOMETHING ROLL THE DIE AND GO BACK THAT MANY SPACES

18. TAKE A CARD.

19. TAKE A CARD

20. JOGGING TO WORK I LOSE IT. CARBON? TAKE A CARD

21. DETOUR! ROLL THE DIE AND GO BACK THAT MANY SPACES!

22. TAKE A CARD AND GIVE ANY PLAYER 2 CARBONS

23. WHEW! YOU ARE TIRED! DO NOT TAKE A CARD!

24. TAKE A CARD

25. TAKE A CARD

26. DETOUR! ROLL THE DIE AND GO BACK THAT MANY SPACES

27. TAKE A CARD

28. CHOICES! TAKE A CARD OR LOSE 2 CARBONS

29. TAKE A CARD!

30. THE END! WHO HAS THE MOST CARBON LEFT? WHO HAS THE LEAST? WHAT CAN YOU DO TO REDUCE CARBON EMISSIONS?

CARDS

CARBON TOKENS HERE

See Instructions on last page!

PLANT A PLANT

Plants like trees provide cool shade to animals and us humans alike, cutting down on air conditioning (which needs a lot of energy to be run).

Plants take in CO_2 and remove the "greenhouse gas" from the atmosphere (until you cut them down and release the CO_2).

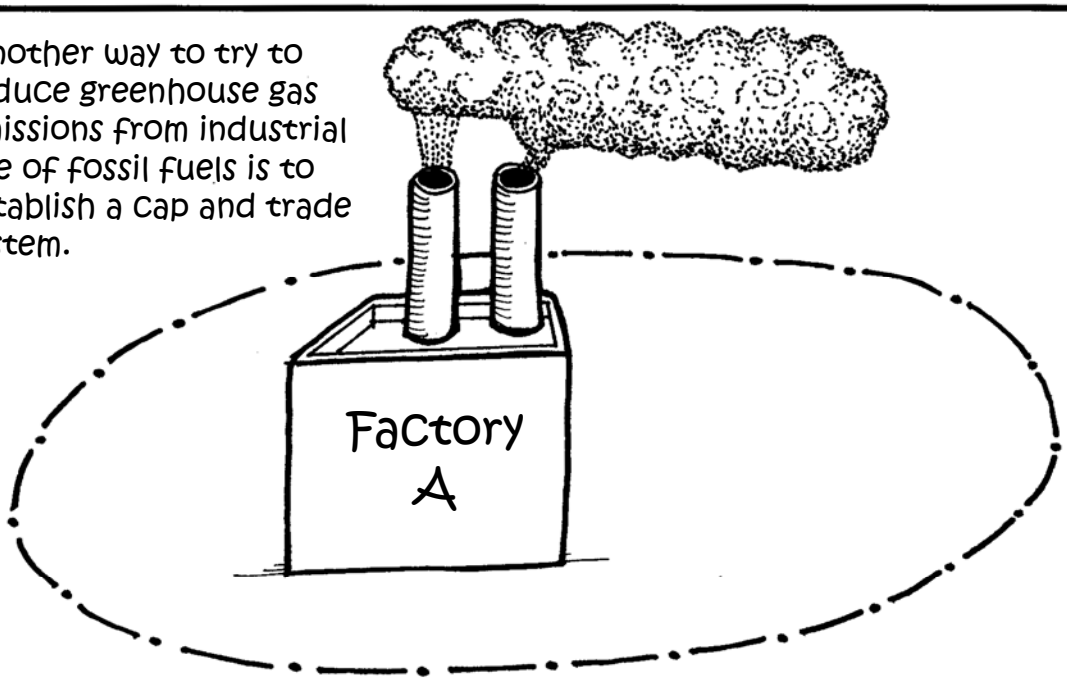
Plants like trees, shrubs, etc., provide wildlife habitat.

Some plants can be grown to provide a renewable source of energy that is more fuel efficient than fossil fuels.

If you plant a garden at your house, you can save on the fossil fuels used to drive back and forth from the grocery to buy fresh fruit and vegetables.

Started a compost heap! Lose two carbons!	Began recycling all paper and plastic! Lose three carbons!	Lowered the thermostat in the winter! Lose two carbons!	Bought local produce! Lose three carbons!	Went shopping with re-useable grocery bags! Lose one carbon!
Installed solar panels on your house! Lose four carbons!	Chose to purchase renewable energy from electric company! Lose two carbons!	Planted a tree! Lose one carbon!	Planted a garden with vegetables and fruits! Lose two carbons!	Designed a passive solar house! Lose four carbons!
Bought a high efficiency television! Lose two carbons!	Used cloth diapers instead of disposable! Lose two carbons!	Bought a plug-in hybrid vehicle! Lose four carbons!	Trade! Give four carbons to any player!	Trade! Take four carbons from any player!
Traded in the small car for a big truck! Gain four carbons!	Built a big house that needs a lot of energy to heat! Gain four carbons!	Bought imported foods! Gain three carbons!	Threw away recyclable paper and plastic! Gain three carbons!	Left air conditioner on when no one was home! Gain two carbons!
Took the car instead of using the bicycle! Gain two carbons!	Bought something with a lot of plastic packaging! Gain one carbon!	Bought an inefficient refrigerator! Gain two carbons!	Bought a lot of stuff, even though you didn't really need it! Gain three carbons!	Cut down a tree! Gain one carbon!
Used paper towels instead of re-useable ones! Gain two carbons!	Television kept on when no one was watching! Gain two carbons!	Still using incandescent light bulbs! Gain two carbons!	Trade! Give two carbons to any player!	Trade! Take two carbons from any player!

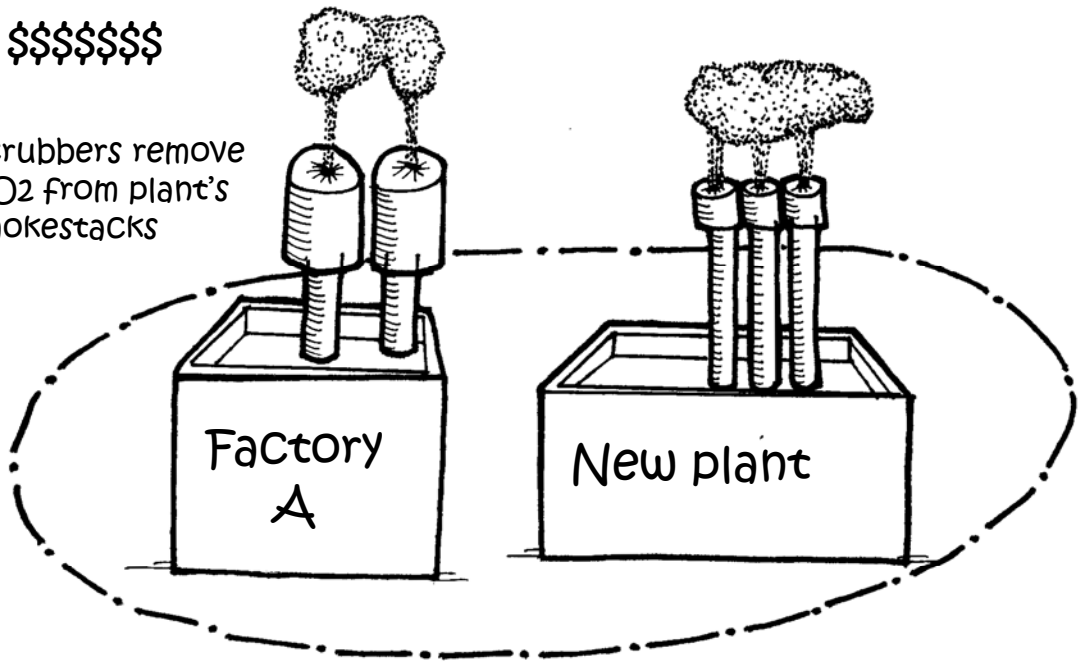
Another way to try to reduce greenhouse gas emissions from industrial use of fossil fuels is to establish a cap and trade system.



This works when the government sets a limit on CO_2 emissions for an area. Here Factory A has an allowance of CO_2 allowed.

$$$$$$$

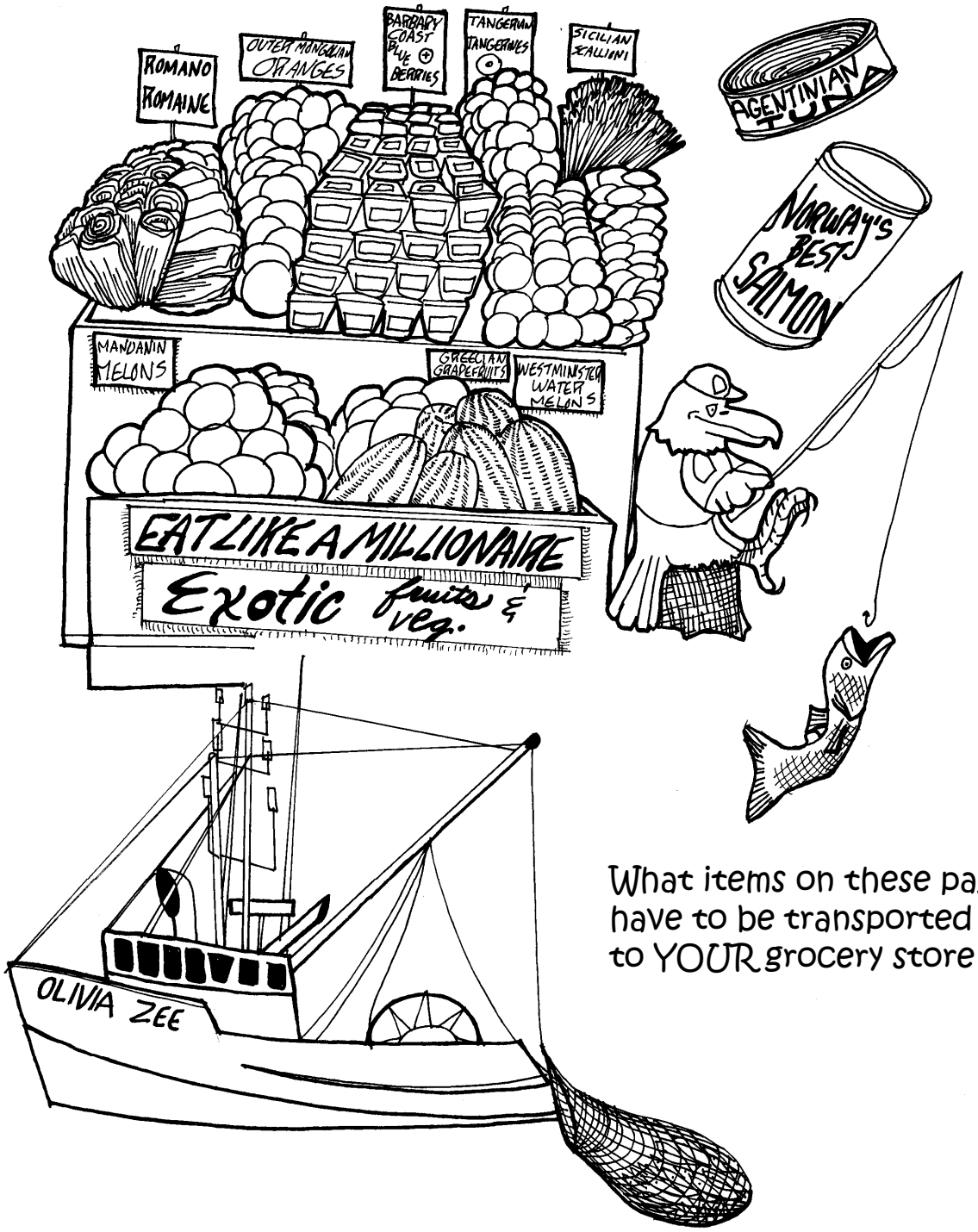
Scrubbers remove CO_2 from plant's smokestacks



In this case, Factory A decided to put in scrubbers and reduced its emissions – it can then sell credits to a new plant and now there can be two plants as long as their total emissions are below that cap for that area!!!

Draw lines connecting the local foods with your grocery basket .

Your grocery basket.

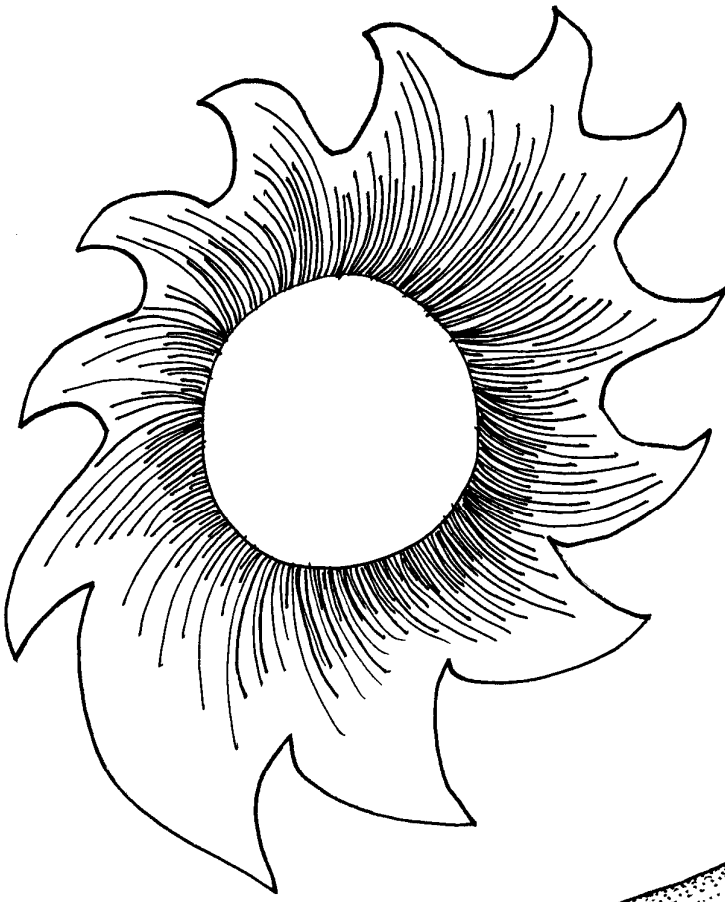


What items on these pages would have to be transported many miles to YOUR grocery store shelves?

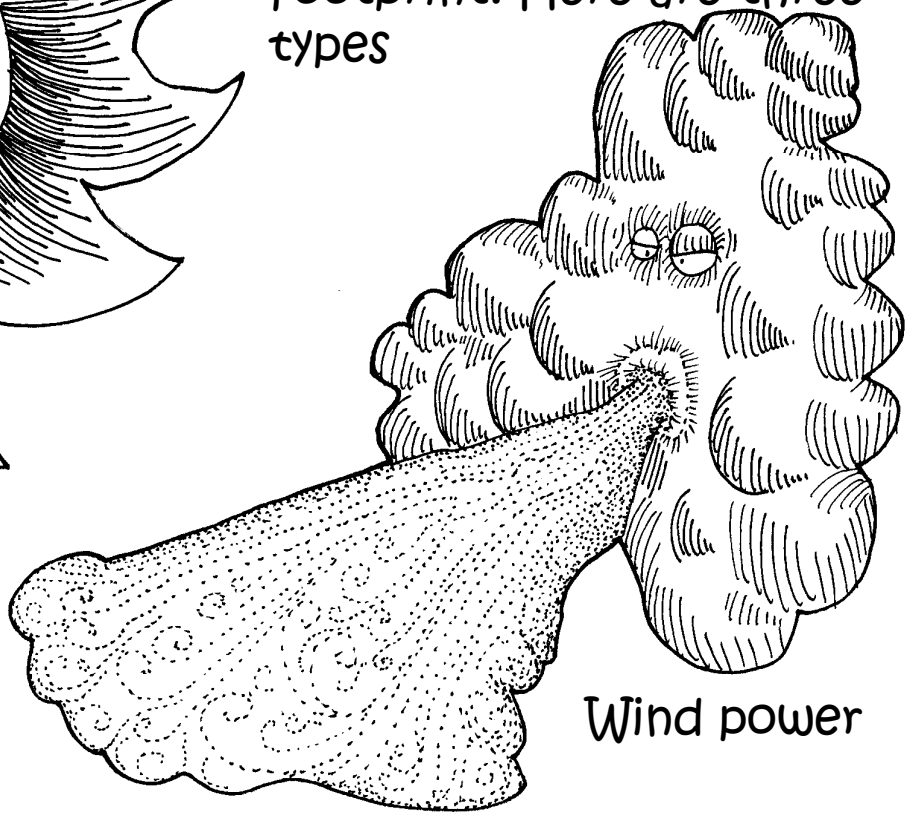
You can support local businesses ***and*** reduce your carbon footprint when food doesn't have to be hauled thousands of miles to your grocery store.


KINGFISHER & SONS
FRESH
FISH

Finally, people can try to make a switch to renewable, non-carbon based sources of energy to reduce their carbon footprint. Here are three types



Solar (sun) power

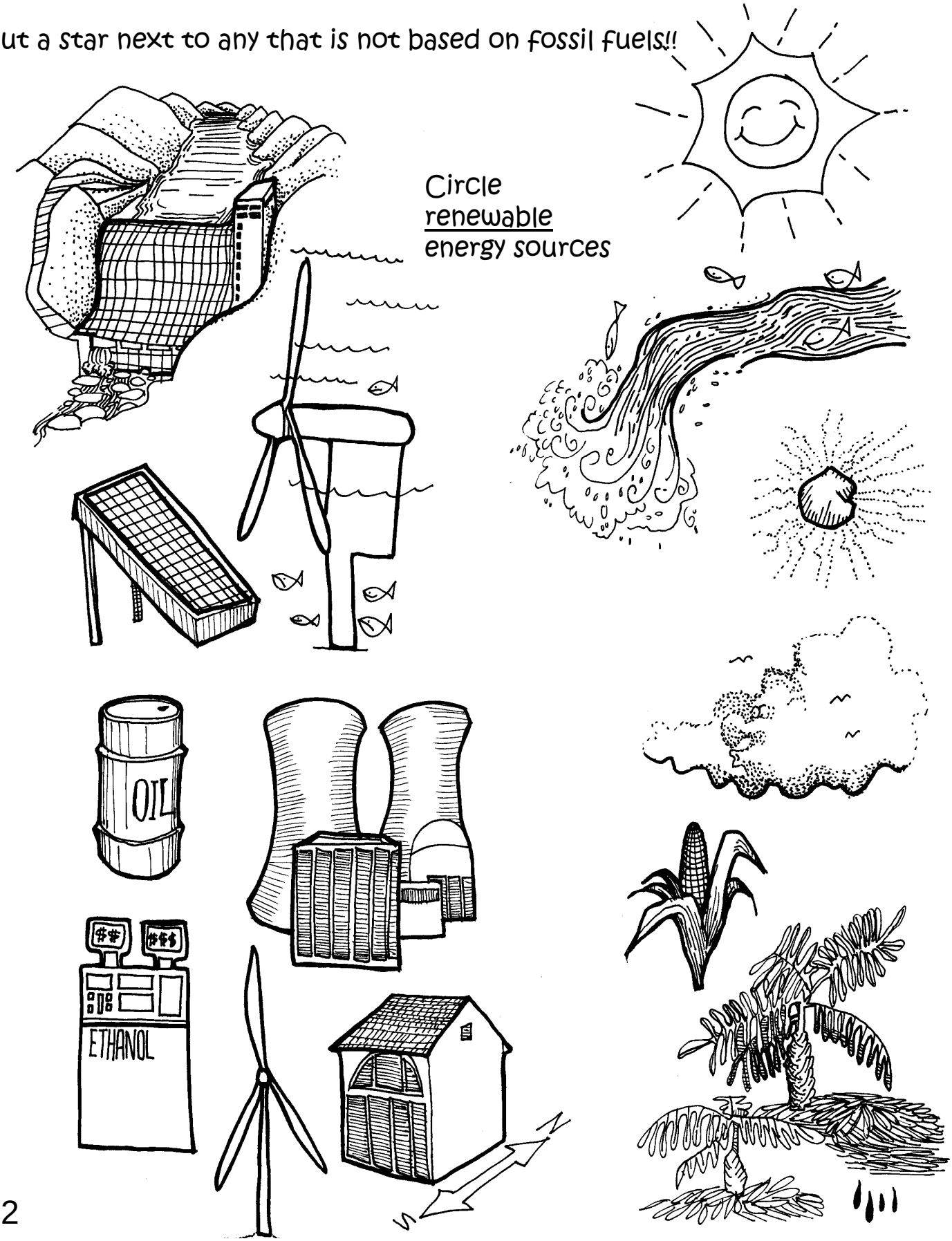


Wind power

Hydro or water power – harnessing the power of water, as it is moved by the force of gravity or the tides

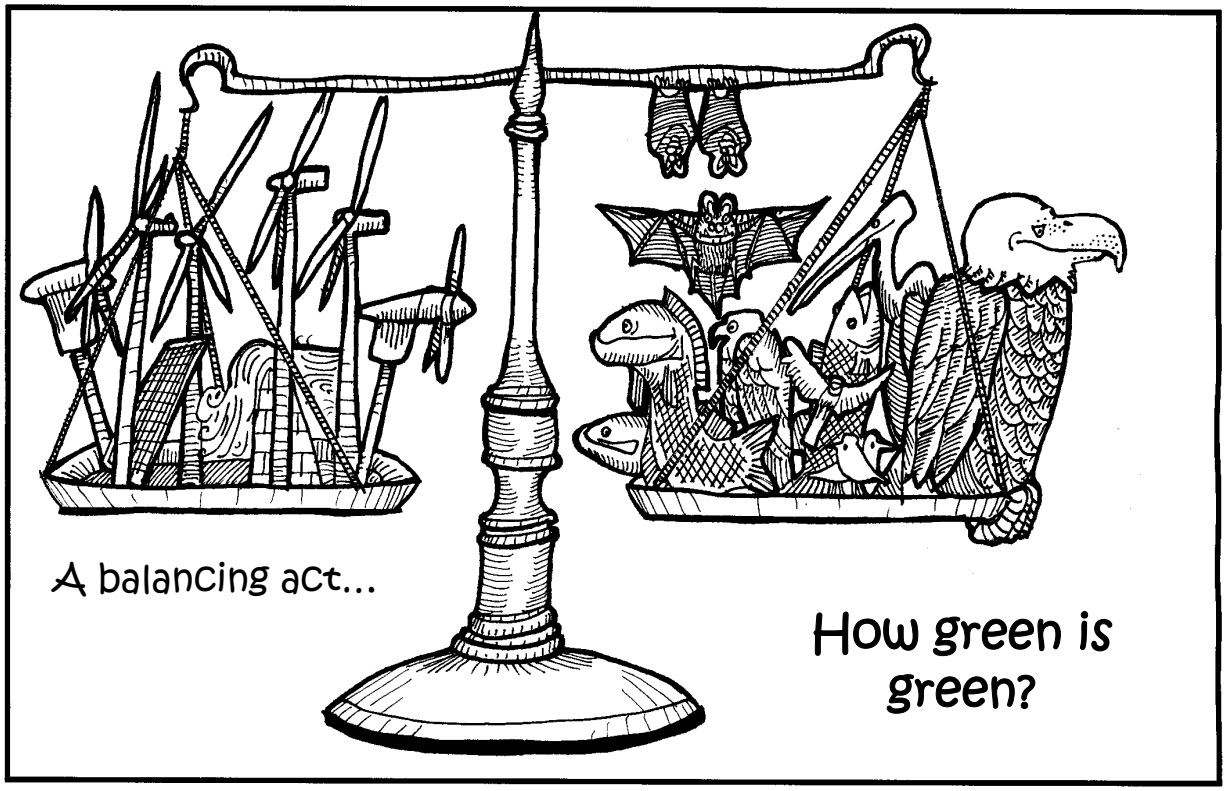
Match the source of energy to ways we capture or harness that energy.

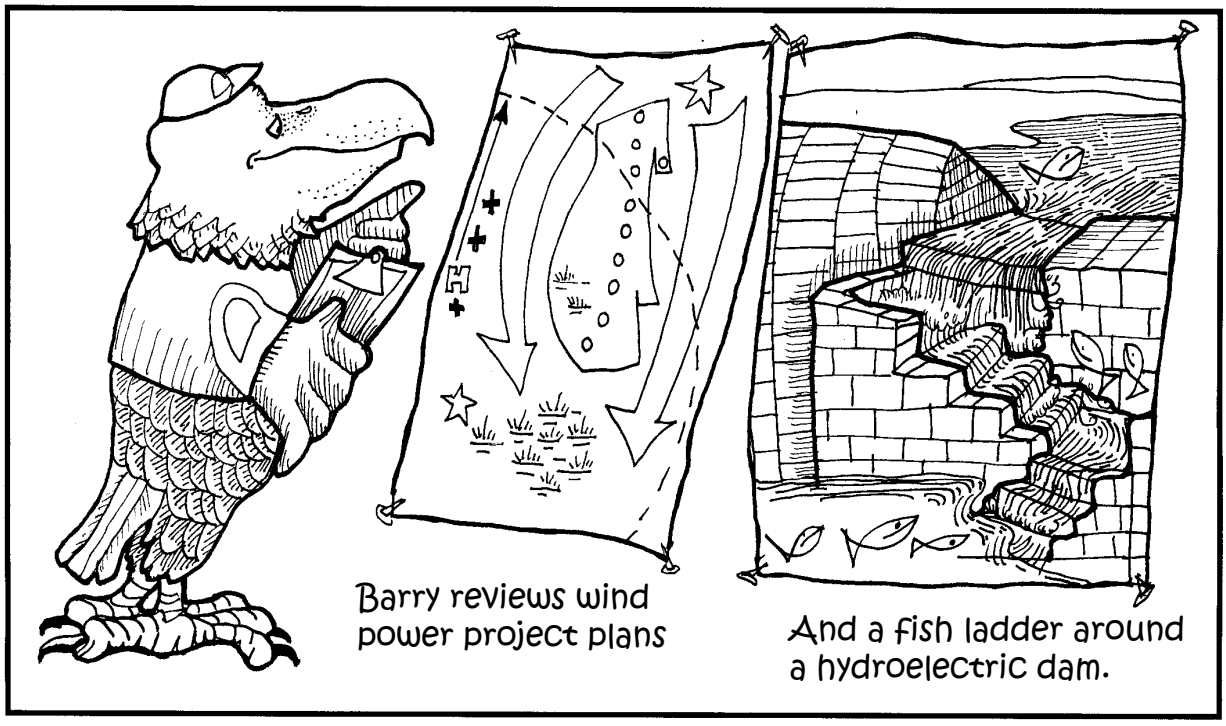
Put a star next to any that is not based on fossil fuels!!



Circle
renewable
energy sources

What about....energy production & wildlife?





Barry helps people weigh the benefits of building and relying on renewable/green energy projects against the projects' potential impacts to fish and wildlife.

Barry's Reduce Use Journal

"All the Reduce Use News that's Out There"

Special Edition

Cautious Greening and Fun Facts!

VOL. I No. 2

Ethanol: a renewable source of energy, however...

Six units of energy go into the process of making ethanol to produce one unit of energy (http://www.energybulletin.net/node/5062).

Some plants that are expected to be used for ethanol production: switchgrass, corn, soy, sugarcane, sugarbeet, barley, hemp, cotton, wheat, straw, etc. Some methods will use the cellulose and "waste" product from these plants to ferment into ethanol.

If farm fields are used to grow crops for ethanol production, they are no longer being used to grow crops for livestock food and/or human consumption. Is there enough space to grow food and crops for ethanol production?

Algenol is a type of algae that can produce ethanol without needing to be fermented. The ethanol can be harvested without killing the algae and can yield 6000 gallons of ethanol per acre versus 400 per acre with corn ethanol.

Solar panels harness the power of the sun directly, however...

Solar panels are often made in countries where there are fewer environmental controls on production. Some companies were found to be dumping the toxic byproduct of solar panel production, silicon tetrachloride (http://earth2tech.com/2008/03/10/the-dark-side-of-solar/).

Some greenhouse gases such as sulfur hexafluoride are created in the manufacturing of solar panels (http://venturebeat.com/2009/01/14/solar-panels-pose-an-environmental-hazard-claims-report/).

It takes 8-11 years of solar panel use to offset the amount of energy that went into the manufacturing of the solar panel. The new thin film solar panels have less silicone in them, and that time is reduced to 2 years (http://www.urbanecology.org.au/topics/solarpanels.html

A coal plant will never offset the energy costs of its construction and operation, as it will always need a steady supply of non-renewable carbon-based resources to run it (same citation as above).

New low emission cars...

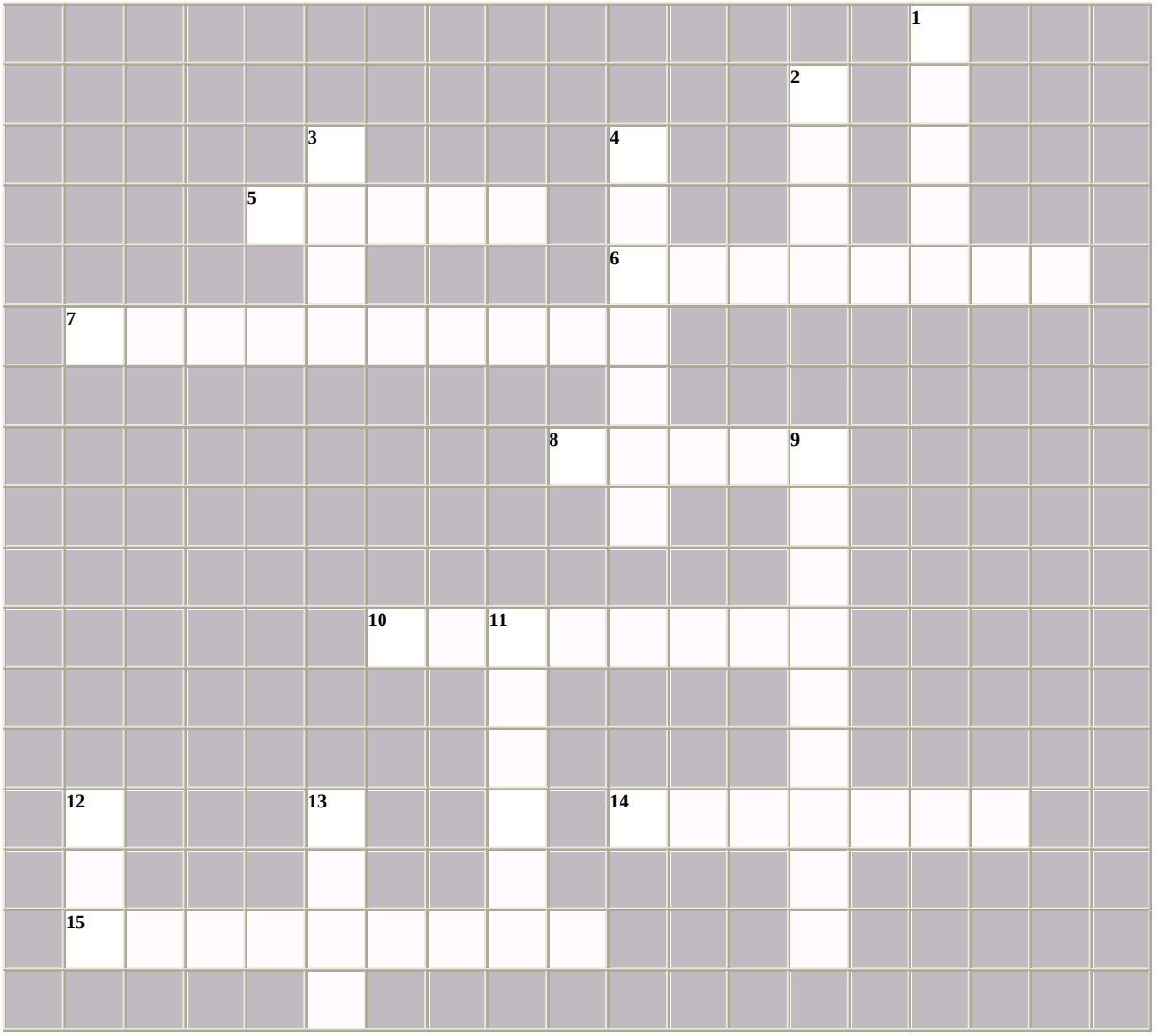
Although hybrid vehicles DO get better gas mileage, they also require special batteries which require replacement more often than regular vehicle batteries. Rather than send these batteries to the landfill, we need to make sure we recycle and recondition the used batteries. (http://www.motorists.org/ma/1100027274.html)!

Production of a new car is environmentally expensive! The materials used to make it must be mined and transported, the machinery used to put it together needs to be powered and maintained, and the vehicle needs to be transported to the showroom floor. There is some debate whether it is more environmentally responsible to buy a new hybrid, or keep your older car. The short answer? It depends. Would you be trading in a ***gas guzzler?*** If so, it might be a good idea to get the hybrid. If your current vehicle gets decent mileage per gallon, it might be best to hang onto it. If you need to buy a new car anyway, consider a hybrid. Better yet, consider buying a plug-in hybrid, which can be charged from an electrical outlet and run for 40-60 miles on the electric charge alone! No emissions, better mpg, and it can even be charged from a residential wind turbine or solar panel! (http://www.ecogeek.org/content/view/1699/)

BEWARE OF VAMPIRES

Vampire (or "standby") energy is the electricity used by your appliances, TVs, cell phone chargers, DVD players and other gadgets when they are turned off! These electronics still use electricity even when they have been shut down. Wasted energy from "standby" sources accounts for more than 65 billion kilowatts per hour in one year in America! This equals 87 billion more pounds of carbon in the atmosphere each year. How to combat this energy theft? Unplug you stuff! Better yet, plug your gadgets into a power strip and then turn off the entire strip when you are finished (http://www.ucsusa.org/publications/greentips/energy-vampires.html).

Renewable energy, wildlife and you!



Down

1. This type of renewable resource uses the power of the sun's radiation.
2. Nocturnal flying mammals that can get hurt in wind turbines.
3. These aquatic animals cannot make it past a dam to go upstream.
4. This type of electricity generation uses tiny atoms and fission.
9. A resource that is not diminished permanently when used.
11. An eel _____ is used to transport eels past a dam.
12. A large structure used to hold back water.
13. This non-renewable resource destroys ecosystems to mine it.

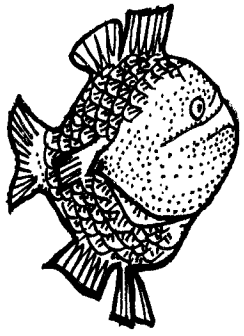
Across

5. This type of renewable resource uses the movement of tidal waters to generate electricity.
6. We need to use less energy; we need to _____!
7. Energy from deep under the ground is called _____.
8. Hydroelectric power uses the movement of _____ to convert it into electricity
10. The welfare of _____ must be considered, even for renewable energy.
14. Wind spins the _____ to generate electricity.
15. Wind turbines may block the path of _____ birds.

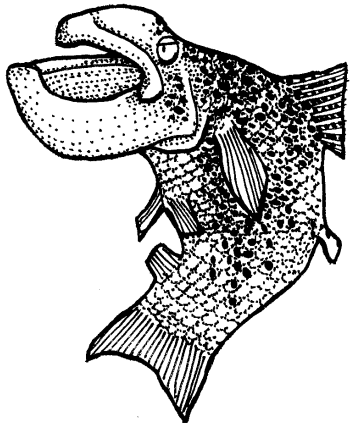
Barry's Energy Word Hunt

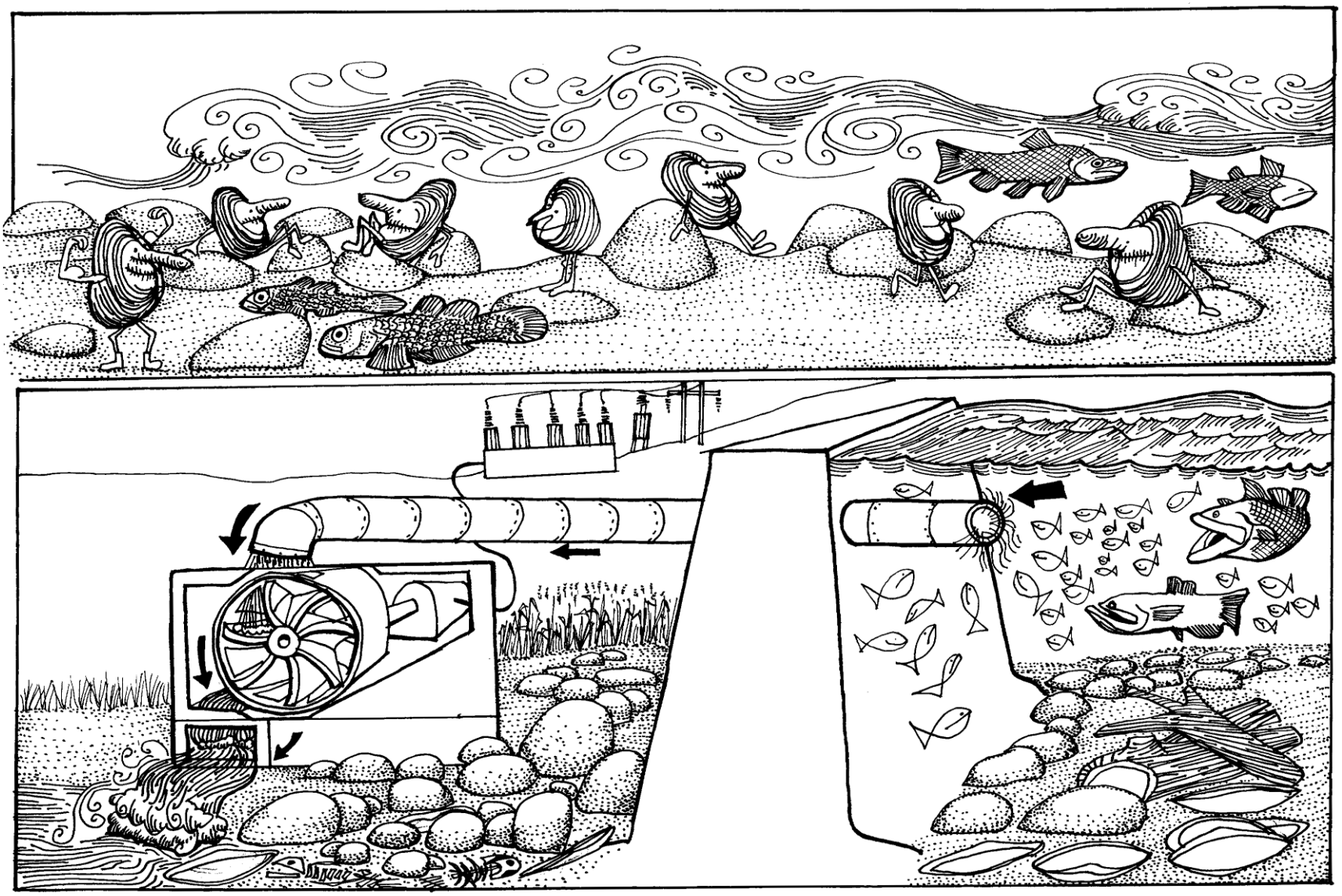
F O F M A L G B B U S L T V H H S T N N
H M H N U S P C V P J H K D Z I B M A I
I H J U J X X N R Z O E C B V P O G C N
Z D W V W D L Z G W O N V T I D A L D H
K G T J B F T H P L M I G R A T O R Y L
J W G E P X H Y D R O E L E C T R I C Y
J G G S P J N Z F K N C A Z L J M O G I
Q E G U J C H W Z N T T Y U T W Z R L N
T O I I E M D I I Q R U G P Y G F R C U
B T B E Z W F U O J H I O F O R O Y N C
S H U L P W P Y B G L M B I U N S G D O
N E Y K R G L S I N S S J E J X S Q V N
I R S Q F Z S Q O O R B M Z B S I A L S
J M E N E R G Y M B J B W I L D L I F E
W A S R V J R P A Q M A F S C N F P B R
Z L H A R H S Y S T U R B I N E U Y V V
N B B S Z E B Y S D S Q I D C F E I I E
I L R E N E W A B L E Y O P N I L X S X
E L E C T R I C I T Y G C V D S R C D H
E C O S Y S T E M Y K W C T U H T H F J

Can you find?

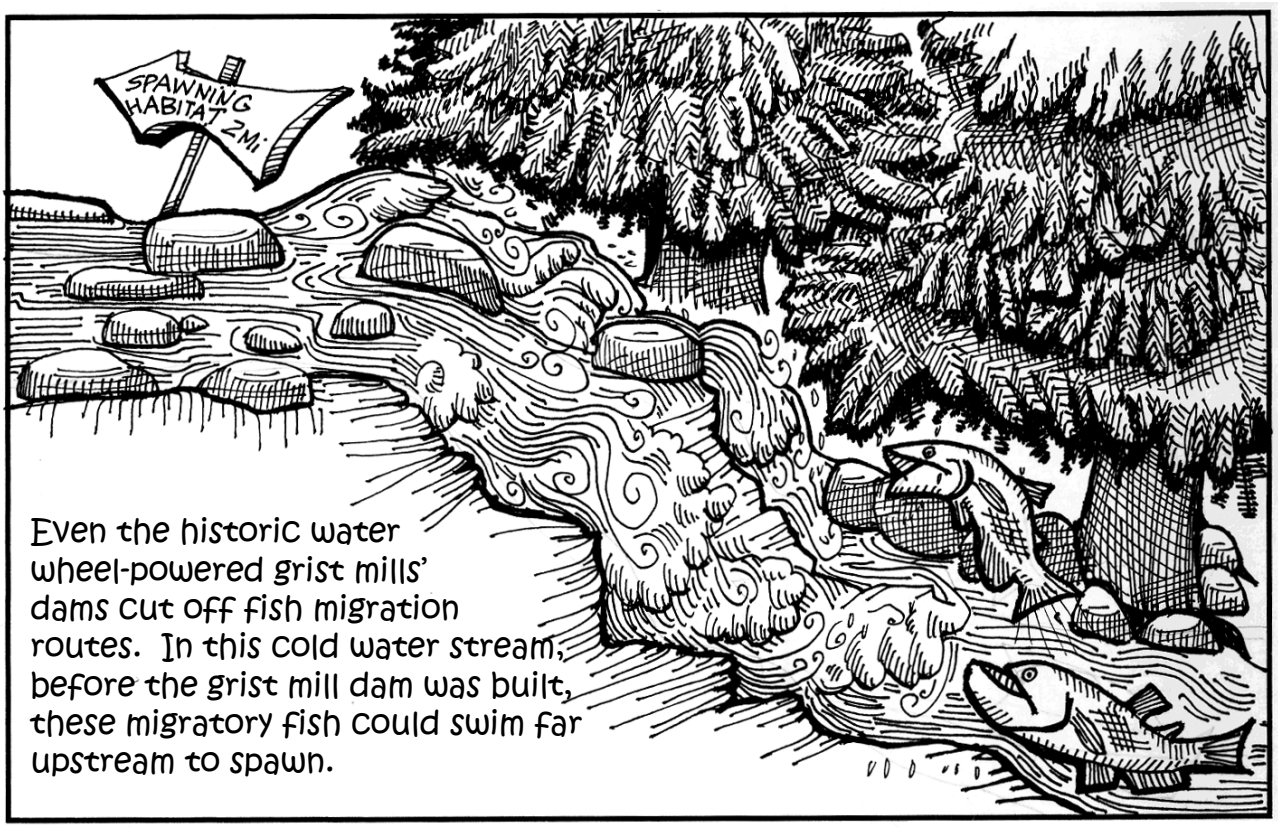


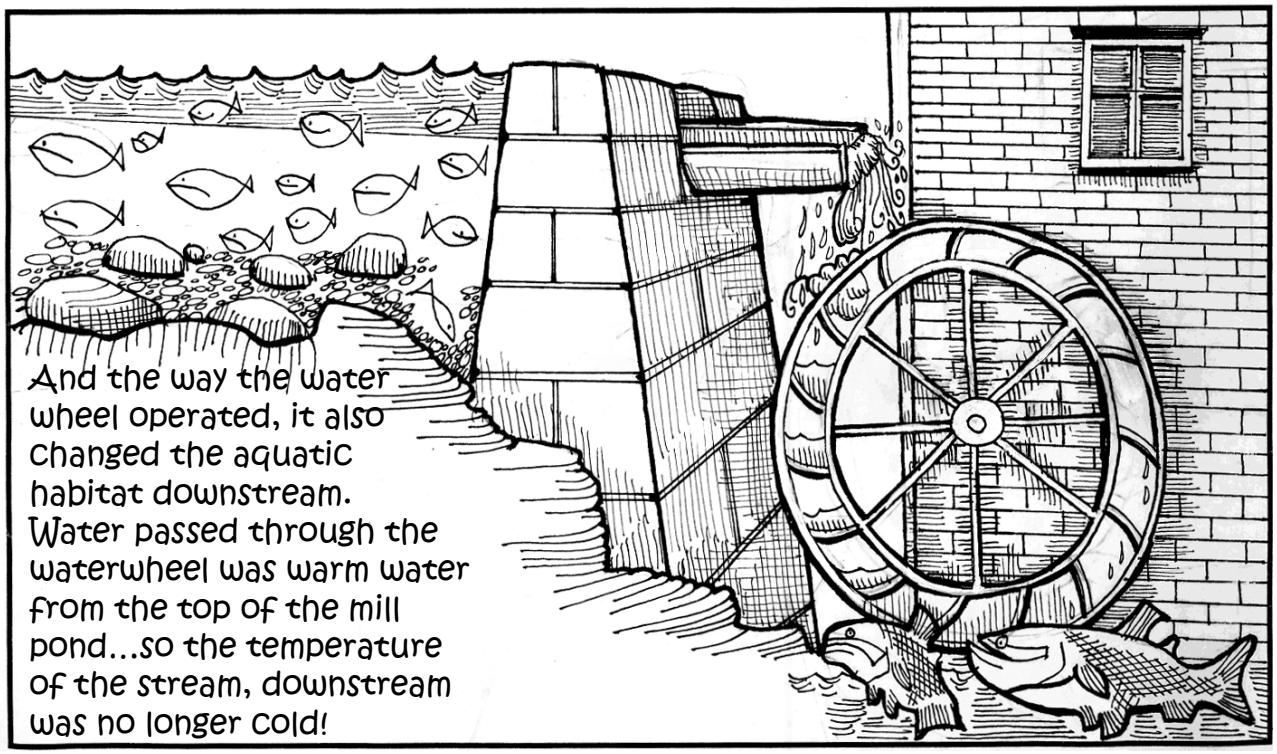
Fossil Fuel	Ecosystem
Biomass	Energy
Tidal	Renewable
Fish	Conserve
Migratory	Wildlife
Hydroelectric	Turbine
Geothermal	Electricity

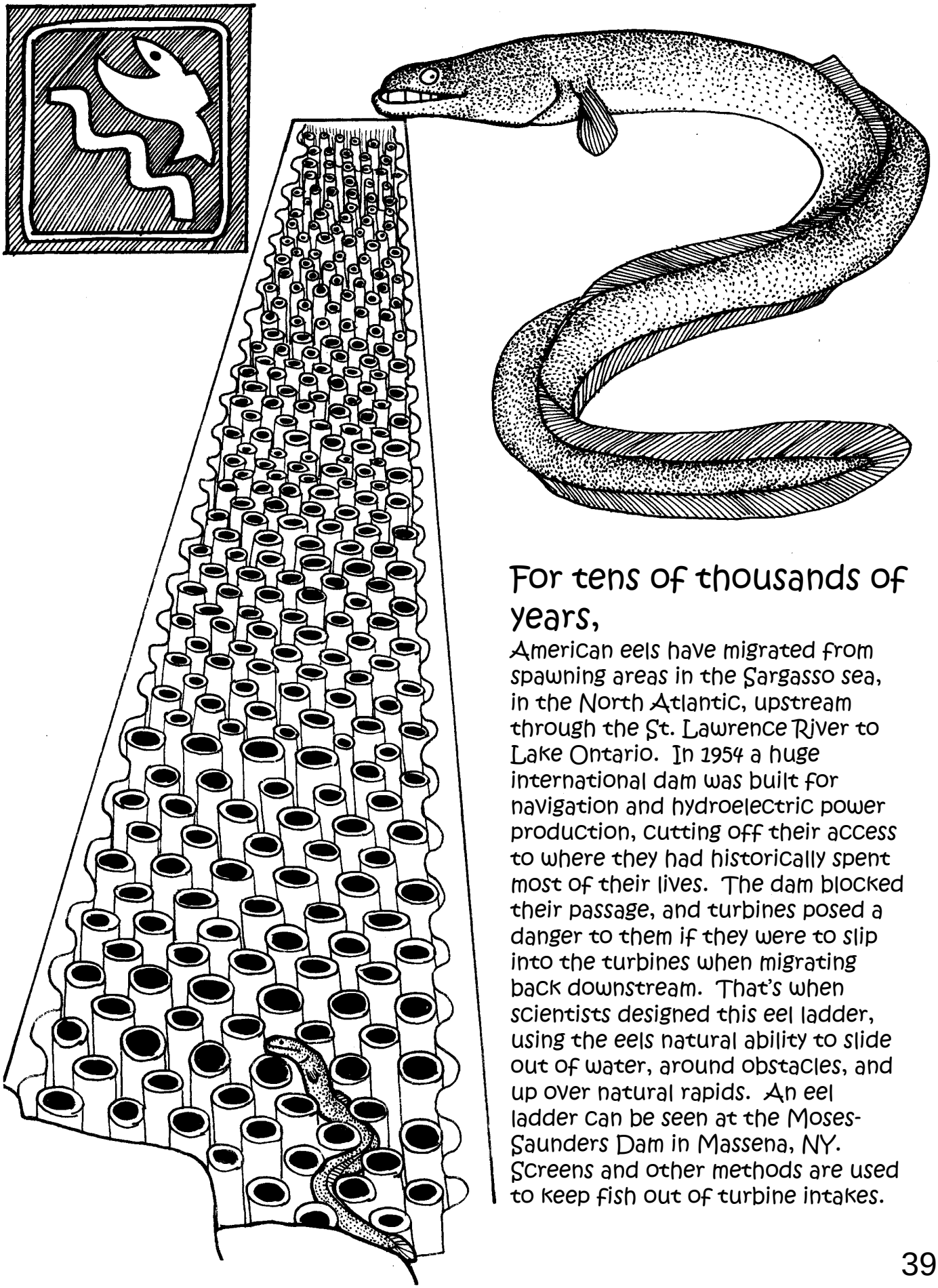




Hydroelectric power is clean, non-carbon based energy, but when dams are built on clear, high gradient streams, the aquatic habitat is partially destroyed by the dam, drowned by a deep water lake (where oxygen levels may plummet at the bottom of the lake), and temperatures rise, and a section of the stream, the bypass reach, may be dewatered completely. Fish may also be caught and killed in power generation turbines.

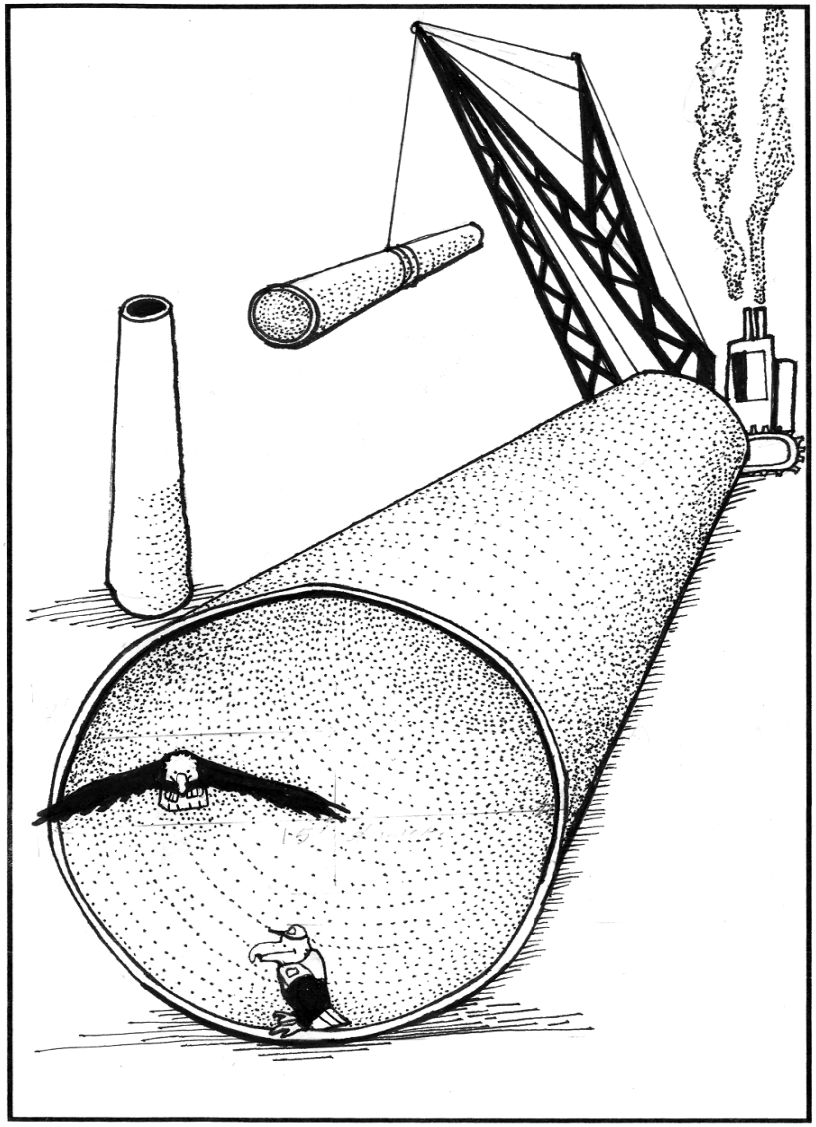

SPAWNING HABITAT 2Mi.
Even the historic water wheel-powered grist mills' dams cut off fish migration routes. In this cold water stream, before the grist mill dam was built, these migratory fish could swim far upstream to spawn.


And the way the water wheel operated, it also changed the aquatic habitat downstream. Water passed through the waterwheel was warm water from the top of the mill pond...so the temperature of the stream, downstream was no longer cold!



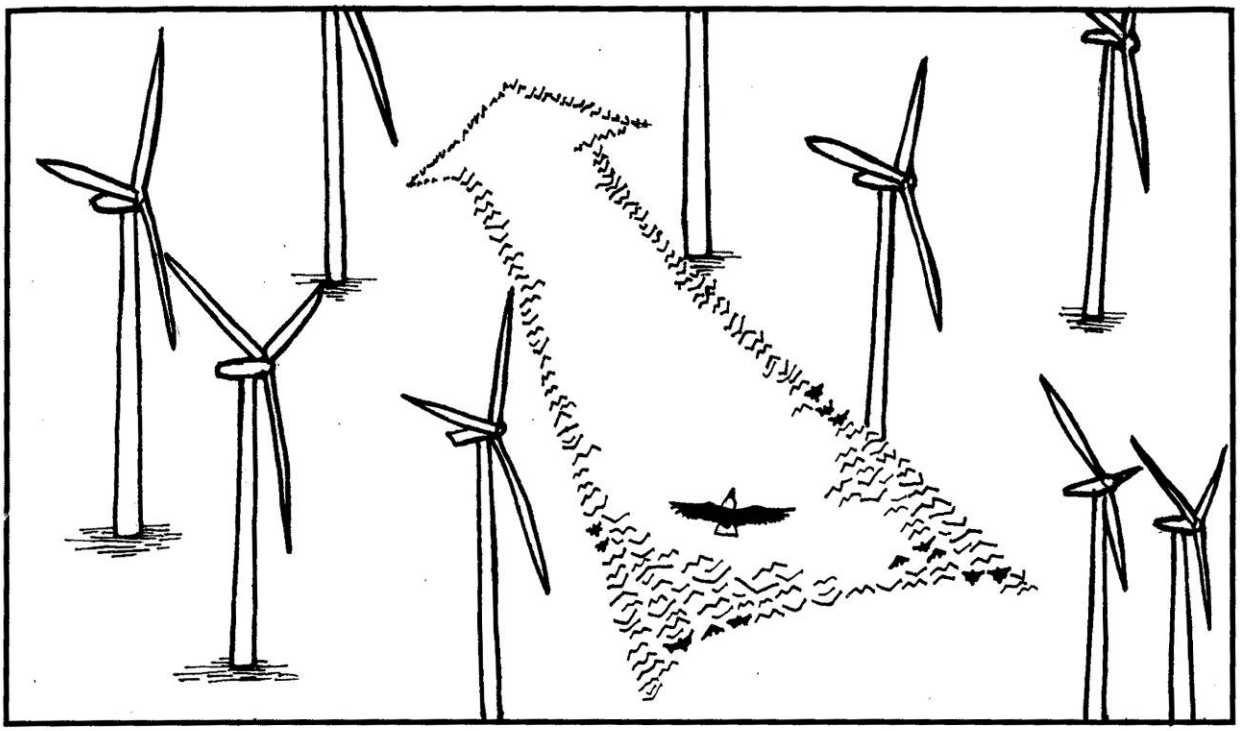
For tens of thousands of years,

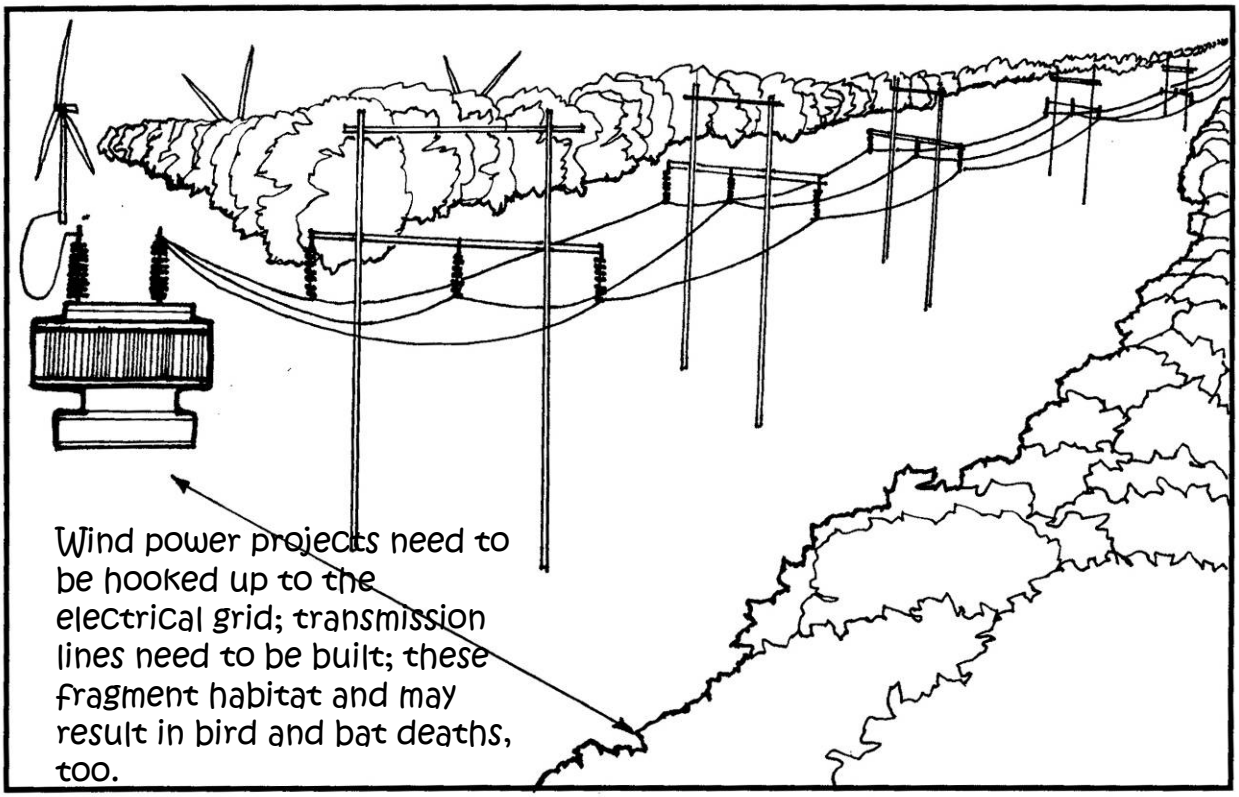
American eels have migrated from spawning areas in the Sargasso sea, in the North Atlantic, upstream through the St. Lawrence River to Lake Ontario. In 1954 a huge international dam was built for navigation and hydroelectric power production, cutting off their access to where they had historically spent most of their lives. The dam blocked their passage, and turbines posed a danger to them if they were to slip into the turbines when migrating back downstream. That's when scientists designed this eel ladder, using the eels natural ability to slide out of water, around obstacles, and up over natural rapids. An eel ladder can be seen at the Moses-Saunders Dam in Massena, NY. Screens and other methods are used to keep fish out of turbine intakes.



Monopole-design wind turbines are huge; the diameter of the tower is about 15 feet, twice the width of Barry's wingspan. If a wind turbine were constructed next to the Statue of Liberty, this is how it would overshadow Lady Liberty. BIG!!!

Wind turbines harness the wind and produce clean non-carbon based energy, but migratory and resident species of birds and bats may hit the turbines while they are operating. Air pressure changes around turbines also may kill birds and bats.





Barry's Bird Bonanza!

Directions: Hey kids! Time for you to be a wildlife biologist and decide where the best place to put the wind turbines are! Shade in the boxes for migratory bird paths given in the coordinates section. Then put a dot in the center of each box for the wind turbine section. Circle the turbines that you think are in a good place, and do not circle the ones you think are in the wrong place!

	A	B	C	D	E	F	G	H	I	J
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Migratory Bird Paths

10,F 5,D
2,A 3,G
5,E 9,I
10,J 4,J
3,H 8,H
6,C
1,C
4,F
7.A
9,G
3,I
7,B
2,B

Proposed Wind Turbines

2,B 8,H 1,F 4,J 5,I
8,E 9,B 4,C 4,F 7,B


Connect the numbers and then see what migrating birds and bats might have to fly through if each of these numbers were a wind power turbine, or a huge wind power project with many turbines.
SUMMER HABITAT
WINTER HABITAT
FALL
SPRING
FALL
SPRING
FALL
SPRING
FALL
SPRING
1
2
3
4
5
6
7
8
9
10
11
12
13
14
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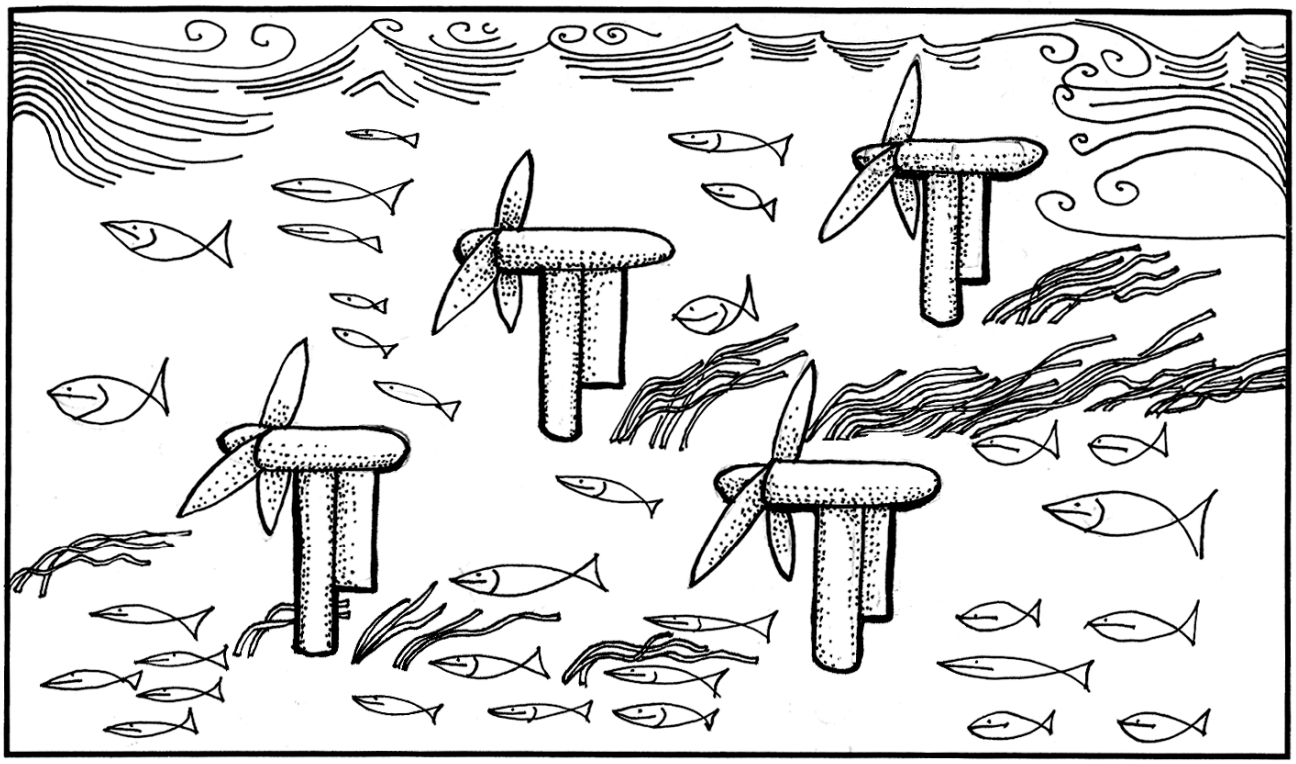
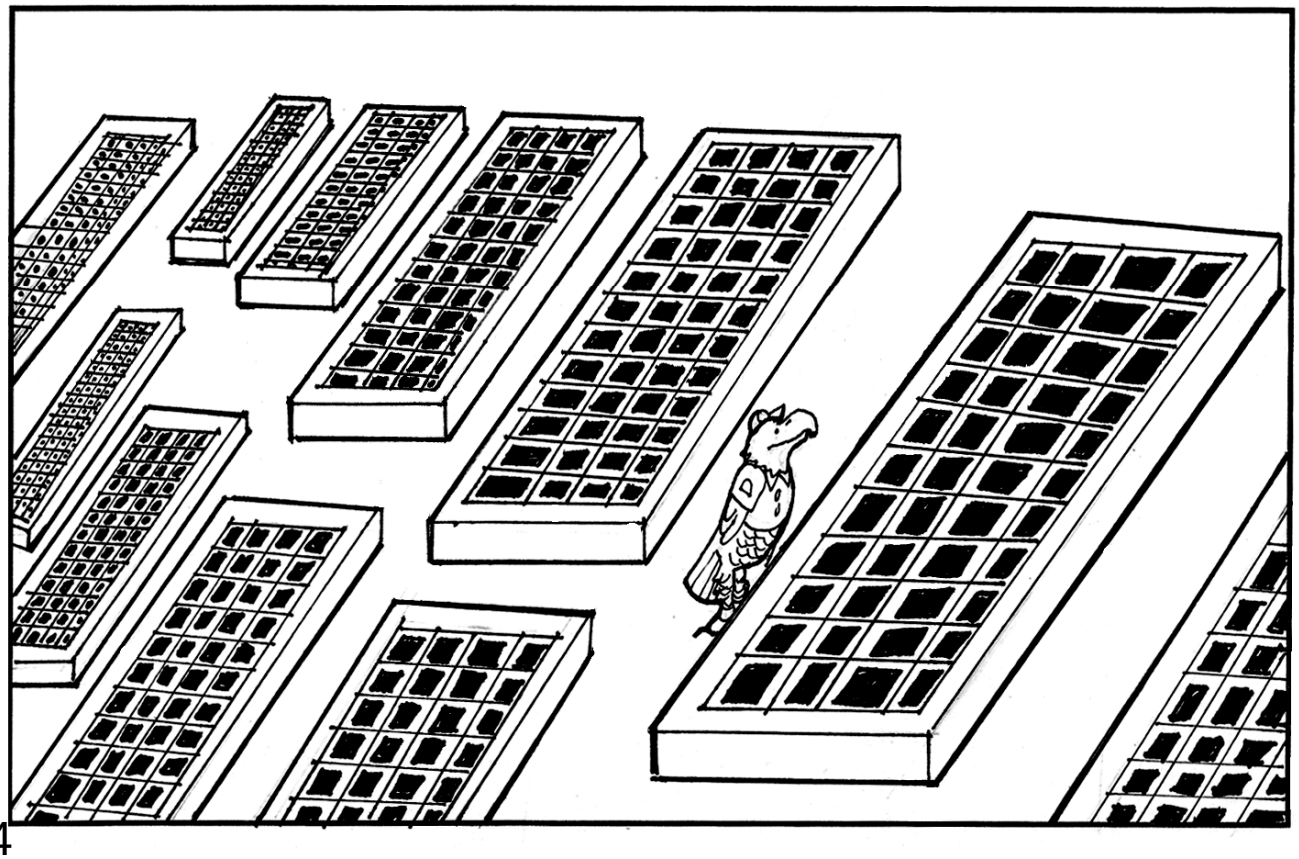
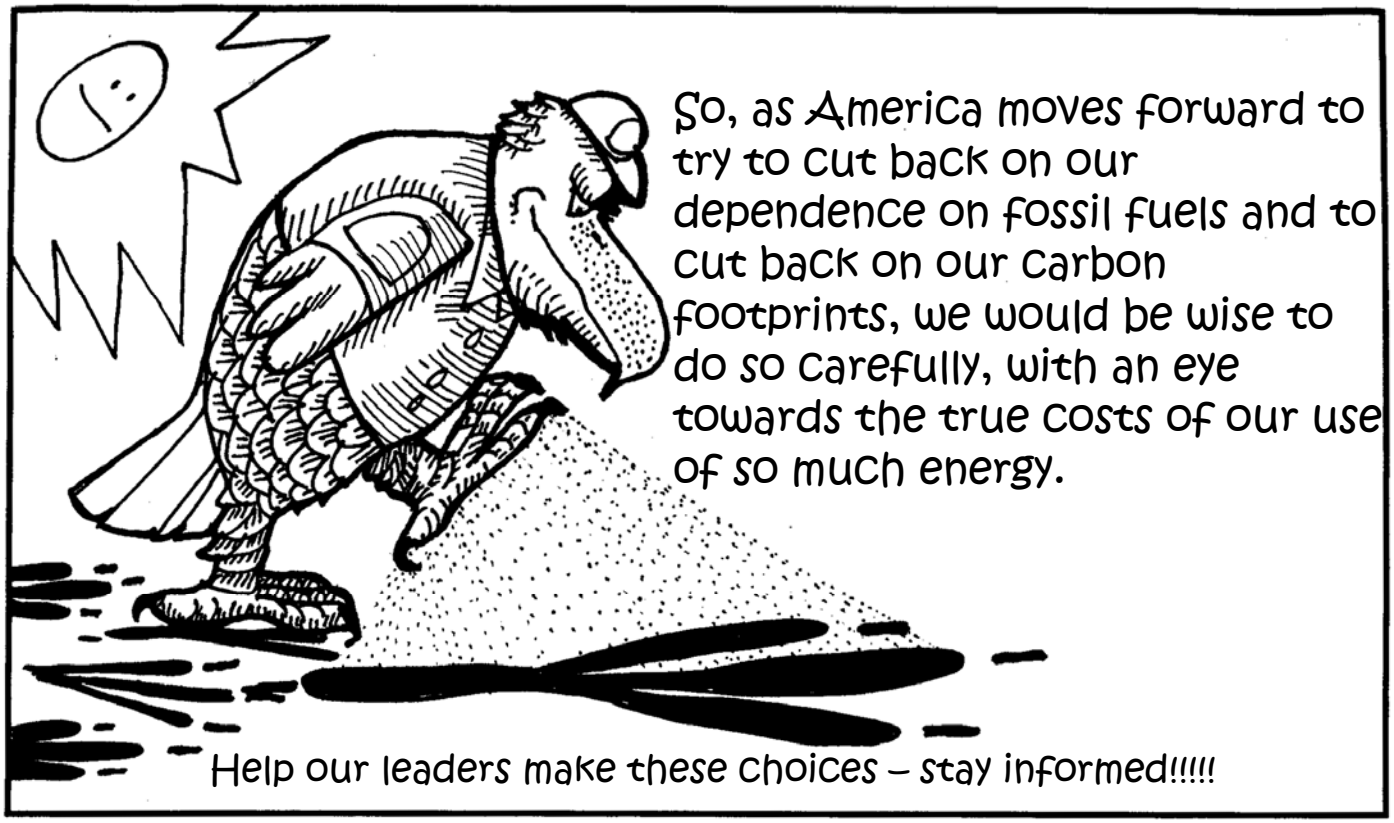
26

Studies are still underway to figure out if there are impacts to fish from tidal energy arrays. These produce electricity using the power of tidal currents – underwater.



Huge solar panel farms might eat up a lot of habitat, too.




So, as America moves forward to try to cut back on our dependence on fossil fuels and to cut back on our carbon footprints, we would be wise to do so carefully, with an eye towards the true costs of our use of so much energy.
Help our leaders make these choices – stay informed!!!!!


And now Barry telecommutes to work!

Glossary

Cap and trade is a system where there is an economic incentive to reduce or trade emissions of certain chemicals.

Carbon is an element which is found in all living things. It is the sixth element on the periodic table.

Carbon dioxide is an atom of carbon which is bonded to two atoms of oxygen. Carbon dioxide is created and stored by plants. Millions of years ago, these plants died and were compressed into "fossil fuels." When we burn the resulting fossil fuel, we are releasing the stored carbon in the form of carbon dioxide.

Carbon footprint is a measure of how much carbon dioxide a person, group or company produces within a certain time frame.

Compost heap is a pile of organic material such as old vegetables, paper towels, wood chips, and some other kitchen wastes that can be turned into rich, nutritious soil for a garden.

Climate change is the long term change of the average world temperature. We often refer to climate change in terms of human induced climate change, which is caused by an overabundance of carbon dioxide in the atmosphere from burning of fossil fuels.

Electrical grid is the network of power lines used to transport and deliver electricity.

Emissions are substances that are released into the air, water and/or soil from cars, factories, machinery, etc.

Energy is the capacity to do work. People eat food for energy to carry on metabolic processes, while an engine burns gasoline in order to push a car forwards.

Energy efficiency is a term used to describe a series of strategies used to conserve energy and therefore reduce carbon footprint.

Energy generation is the process by which electricity is produced. Some examples of this include hydroelectric, coal burning, wind turbines, solar power, nuclear power, etc.

Environment (biological) includes all components of the earth including air, water, sediment, soil, wildlife, plants and people.

Fish ladders are structures which allow fish and/or eels to swim over river obstructions such as dams.

Fish passages are channels cut into river obstructions such as dams to allow fish to swim up- or downstream.

Fossil fuels are carbon rich substances that are a non-renewable resource extracted from the earth and used to generate energy via combustion. These fuels are derived from plant and animal matter from millions of years ago that have been exposed to prolonged heat and compression.

Fuels are materials which are burned in order to create energy or do work.

Fuel efficiency is a measure of how much work can be done using a certain amount of fuel. For example, a big truck uses more gas than a small car. Therefore, the truck has lower fuel efficiency than the small car.

Global warming is the process by which the average world temperature increases due to increased levels of

greenhouse gases (methane, carbon dioxide) in the atmosphere.

Green energy is a name for energy that is renewable and has a low carbon footprint.

Green house gases are the gases which cause global climate change.

Green house is a glass or plastic building, generally used to cultivate plants, where sunlight is trapped inside creating a warmer environment.

Habitat is the specific environment and environmental conditions that wildlife relies on and lives in.

Habitat fragmentation is the breakup of a cohesive habitat into smaller, unconnected patches of wilderness.

Hybrid vehicle is a type of car that uses some electricity and some gasoline. This type of vehicle has higher fuel efficiency than regular gasoline engines.

Hydro power is electricity generated by the movement of water.

Incandescent light bulbs are the old style bulbs with a filament. These bulbs produce more heat and use more electricity and do not last as long as new bulbs (compact fluorescent or LED).

Migratory birds are birds that fly north in the summer to breeding grounds and south in the winter where there is an abundance of food.

Passive solar energy is a technique where a building is situated and constructed in such a way as to maximize solar exposure in the winter and minimize it in the summer. This can greatly reduce heating and cooling costs and thus reduce carbon footprint!

Plug-in hybrid vehicles are cars that have a hybrid electric/gasoline motor that can also be plugged into a wall outlet or a solar panel and charged so that even less gasoline is used.

Power is the supply of force. For example, there is electric power and physical power (such as horse power).

Renewable energy is a type of energy that does not rely on using resources that cannot be replaced.

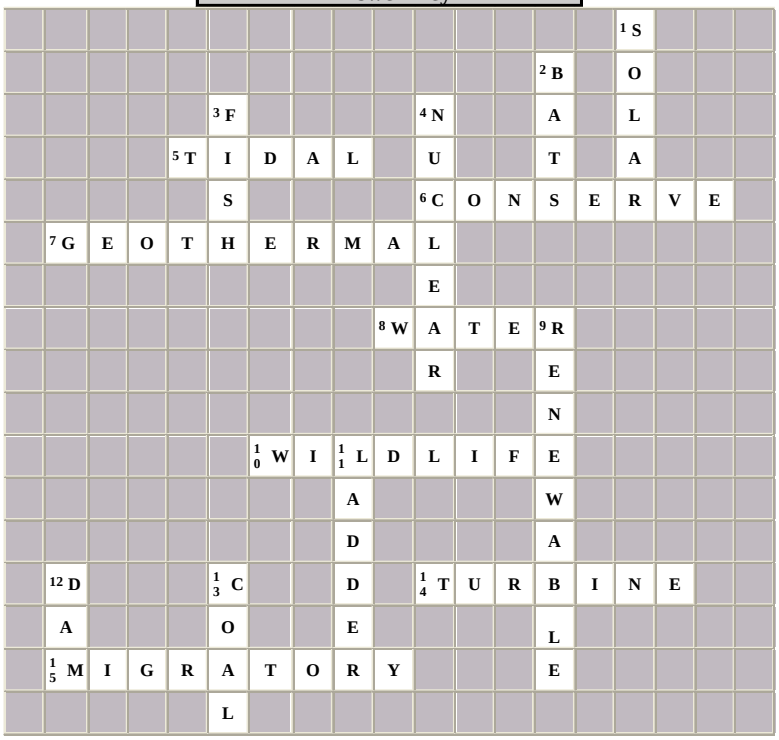
Solar energy is a renewable resource which creates electricity from the power of the sun.

Solar panels are devices which can turn the energy of the sun into direct current electricity. It is a renewable resource and can be used wherever sunlight is in abundance.

Tidal energy is a renewable energy which is harvested from the movement of the tides.

Tidal or tides describe the surge of ocean and tributary waters in response to the pull of the moon.

Answer Key



Fun and helpful links for more information!

EPA kids page: http://www.epa.gov/kids/
EPA global climate change kid's site: http://epa.gov/climatechange/kids/
NOAA student's page: http://www.education.noaa.gov/students.html
NRCS Conservation Education: http://www.nrcs.usda.gov/feature/education/
NYS DEC Conservationist for Kids: http://www.dec.ny.gov/education/40248.html
US Department of Energy: http://www.energy.gov/

Instructions for Center fold Carbon Trade game

Spread the centerfold on a flat surface, game side up. This is the "Carbon Trade" game, where you will have to take or lose carbons based on your actions. Sometimes you will be given a choice, sometimes you will go forward, and sometimes you won't do anything! Each player will start out with three carbons (use pennies, rocks, beads, beans, anything!) and roll a six-sided die. Count the spaces and do the action on the space you land on. If the space instructs you to go backwards, do not do the action on the new space! The game is over when the first person reaches the end, but the winner is the one with the fewest carbons!

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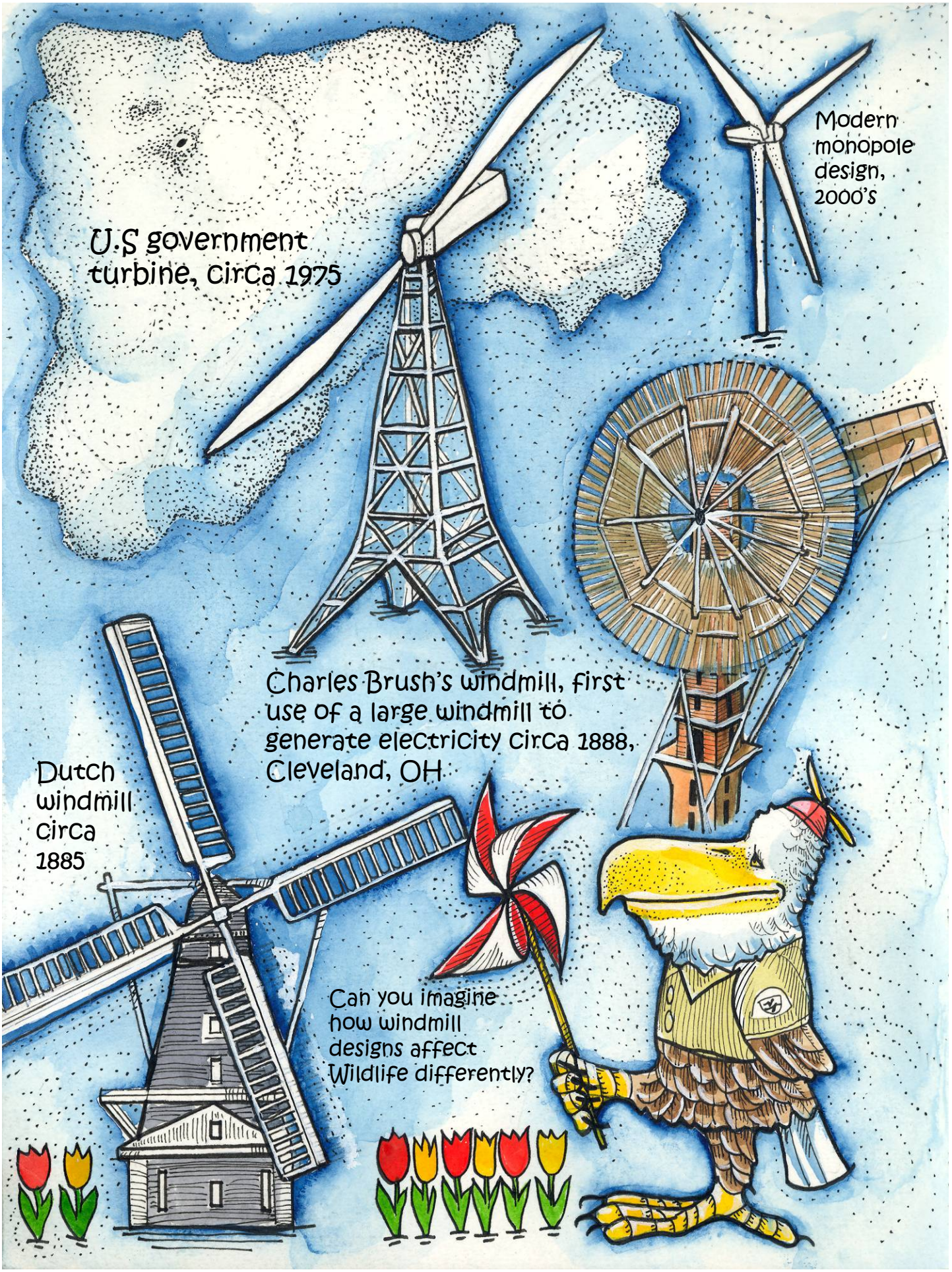
Illustrated by Laury Zicari, NYFO
Graphics/layout & IT support: Andy Lowell, NYFO
Special thanks to: Sandie Doran, Tim Sullivan & Megan Patch, NYFO
and Katherine Whittemore, Northeast Regional Office, USFWS

Notes


U.S government turbine, circa 1975
Modern monopole design, 2000's
Charles Brush's windmill, first use of a large windmill to generate electricity circa 1888, Cleveland, OH
Dutch windmill circa 1885
Can you imagine how windmill designs affect Wildlife differently?