DOCUMENT RESUME

ED 402 151 SE 058 781

AUTHOR Braus, Judy, Ed.; And Others
TITLE WOW! Windows on the Wild: A Biodiversity Primer.
INSTITUTION World Wildlife Fund, Washington, DC.
SPONS AGENCY Eastman Kodak Co., Rochester, N.Y.
REPORT NO ISBN-0-89164-142-4
PUB DATE 94
NOTE 69p.; Photographs may not reproduce clearly.
AVAILABLE FROM World Wildlife Fund, Environmental Education Department, 1250 24th Street NW, Washington, DC 20037.
PUB TYPE Information Analyses (070) -- Journal Articles (080)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Animals; *Conservation (Environment); Elementary Secondary Education; Endangered Species; *Environmental Education; Habitats; Interviews; Natural Disasters; Plants (Botany); Population Growth; Wildlife
IDENTIFIERS *Biological Diversity; Environmental Action; *Environmental Awareness

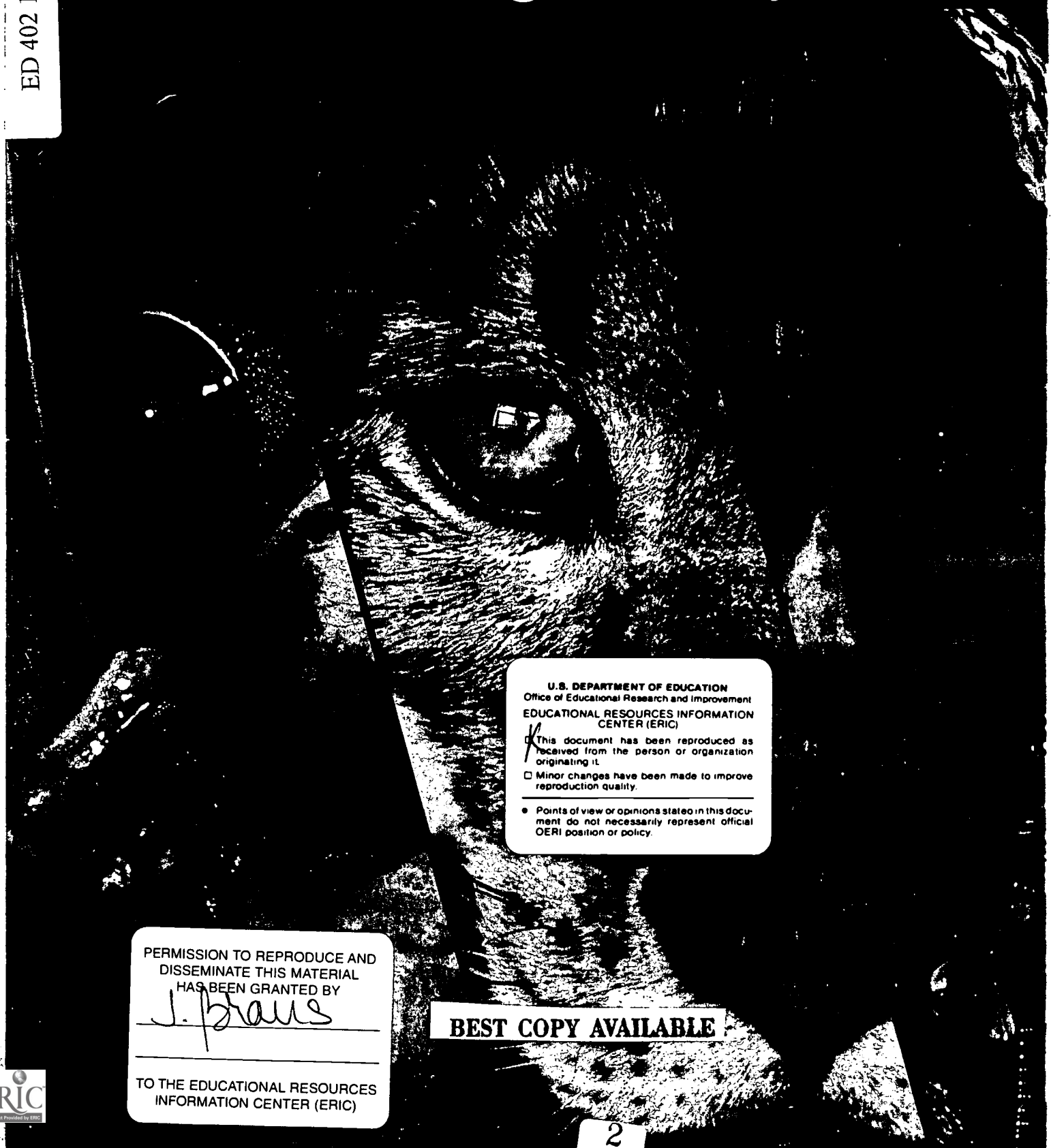
ABSTRACT

Windows on the Wild is an environmental education program of the World Wildlife Fund. This issue of WOW! focuses on biodiversity. Topics include: an interview with one of the world's leading experts on biodiversity; the lighter side of biodiversity through comics and cartoons; a species-scape that compares the number of species on the planet; natural disasters; a tabloid look at the wild world of nature; habitat loss, population growth, and the loss of diversity; bears; wildlife photography; facts and figures on biodiversity; pink potatoes and other wild plants; how spending habits affect the earth; the Maya civilization; and student action to slow the loss of biodiversity. (JRH)

Windows on the Wild℠

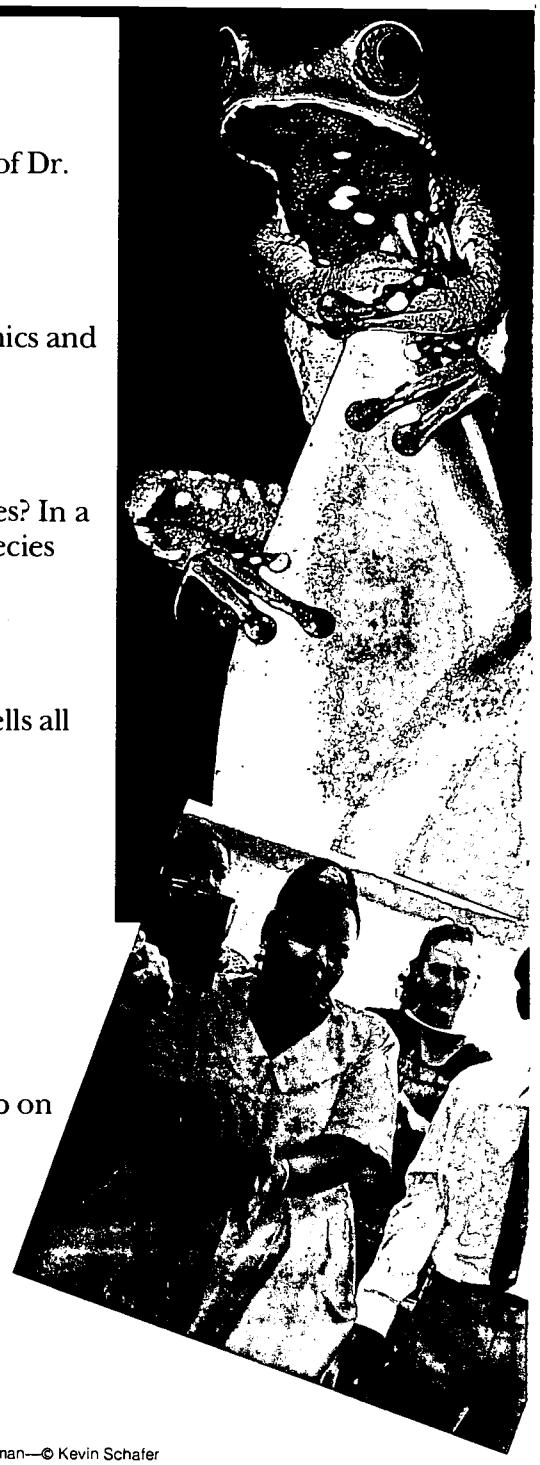
WOW!

A Biodiversity Primer
World Wildlife Fund



Contents

WOW! — A Biodiversity Primer



(Front Cover): red-eyed tree frog—© Gail Shumway; snow leopard—© Galen Rowell/Mountain Light; young Kuna Indian woman—© Kevin Schafer
(Back Cover): long-horned grasshopper—© Gerald Bishop; short-eared owl—© Dwight R. Kuhn; *Cissus cactiformis*—© 1990 J. Cancalosi/DRK PHOTO.
(Page 2): top—Lisa Pomerantz; middle—© Michael and Patricia Fogden; bottom—© Brian Hallett; **(Page 3):** left—© Gerry Ellis Nature Photography; right—© Kevin Schafer

Editorial and Design Staff
Judy Braus, *Editor*
Luise Woelflein, *Managing Editor*
Karen Keagle, *Program Assistant*
Diane O'Reilly, *Research Assistant*
Kimberly Kerin, *Art Director*

Scientific and Editorial Reviewers
Gerald Bishop, Editor, *Ranger Rick* Magazine, National Wildlife Federation; Maria Bober, Corporate Health Safety, and Environment, Eastman Kodak Company; Carol Dana, Environmental Consultant; Gary Hartshorn, Vice President, Research and Development, WWF; Leonard P. Hirsch, International Liaison Officer, Smithsonian Institution; Jody Marshall, Environmental Consultant; David Olson, Conservation Scientist, WWF; Mark Rovner, Vice President, Public Affairs, WWF; Amelia Salzman, Senior Program Officer, WWF; John Shores, Senior Biodiversity Specialist, U.S. Peace Corps; Caroline Taylor, Director Publications, WWF; Betsy Blizard Whitman, Environmental Writer; Laurence Wiseman, President, American Forest Foundation.

Special thanks to the many teachers and students who reviewed articles, photos, and art, and who helped shape this issue.

Windows on the Wild is an environmental education program of World Wildlife Fund (WWF) with support from Eastman Kodak Company and the National Environmental Education and Training Foundation.

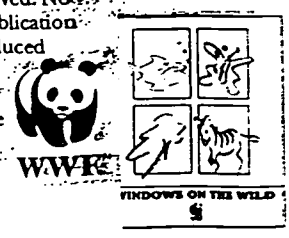
For more information about *Windows on the Wild* or how to order single issues or multiple sets of "WOW!," please write to Environmental Education, WWF, 1250 24th Street, NW, Washington, DC 20037. For more information about WWF, please write to the Membership Department at the address above.

WWF is a nonprofit conservation organization dedicated to protecting the world's biological diversity.

Printed on recycled paper containing 10 percent post-consumer waste, using soy-based inks.

Printed by Quad/Graphics, Pewaukee, Wisconsin.

ISBN # 0-89164-142-4



Ask Dr. B!

He's studied ants from Amazonia to the South Pacific. He's tromped through rain forests, deserts, bogs, and brush in more than 20 countries, on every continent in the world except Antarctica. He's explored islands that most of us have never even heard of. And he's discovered hundreds of new species. This globe-trotting scientist is Dr. Edward Wilson (right), one of the world's leading experts on insects ... and biodiversity. Our *Windows on the Wild* (WOW) editor, Diane O'Reilly, caught up with Dr. Wilson, or Dr. "B" as she likes to call him, in his office at Harvard University to ask him more about biodiversity. (By the way, the "B" is for biodiversity, of course.)

Joe Wrinn/Harvard News Office

WOW: First of all, Dr. B, just what is biodiversity?

Dr. B: Well, to put it simply, it's all life on Earth—everything from the tiny parasites that live in your gut to the 150-ton whales that swim in the seas. You can think about it like this: "Bio" means life, and "diversity" means variety. So biodiversity means the variety of life.

WOW: So biodiversity includes all the different organisms on Earth?

Dr. B: That's right. But it's more than just species. Biodiversity also includes the amazing variety of ecosystems—like rain forests, deserts, wetlands, and coral reefs. And it also includes the variety *within* species, which we measure by looking at genes.

WOW: I'm not sure I get the connection between biodiversity and genes.

Dr. B: Our genes are what make us who we are. You have black hair, I have brown hair. You have wavy hair, I have straight hair. It's our genes that carry the messages about how we look, who we are, and what we do. And it's this genetic diversity that makes each living thing unique.

WOW: OK. But how do genes actually make us different?

Dr. B: Try looking at it like this. Each species is like an encyclopedia of genetic information, containing billions of genetic letters that give it a unique "code of life." This code allows each species to adapt to the conditions of the ecosystem in which it lives. For example, over hundreds of thousands of years, some plants have developed certain chemicals that make them taste bad, which keeps insects from devouring them. Some animals have developed sharp claws, thick fur, keen eyesight, and other adaptations that help them survive. All of these traits are the result of coded messages in our genes that get passed from one generation to the next. And when a species goes extinct, all that valuable information is lost.

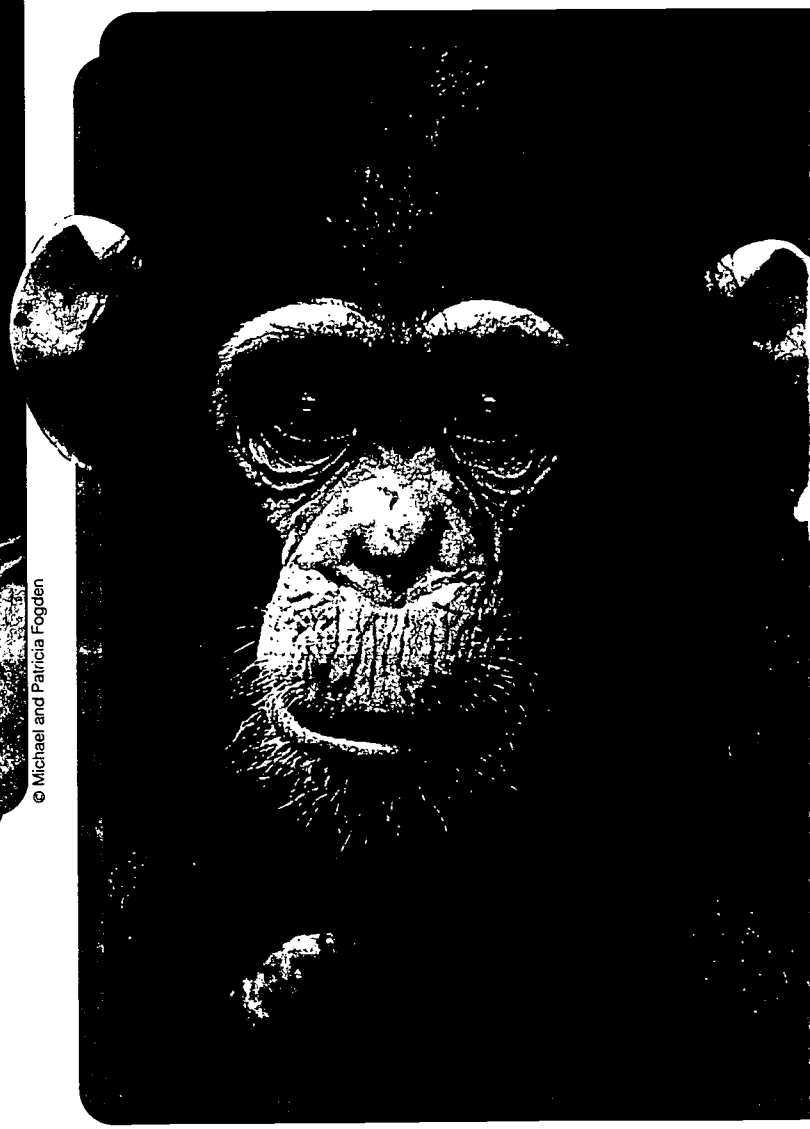
Here's another way to think about it. Take french

© Michael and Patricia Fogden

Grasping a colorful heliconia plant, this tiny leaf frog represents just one of the millions of creatures that live in tropical rain forests. More than half the world's species make their home in these hot, humid forests.

fries. They're made from potatoes, right? Well, it's the genes in potatoes that make them white or pink, bumpy or smooth, tasty or bitter. It's important that there's diversity in the kinds of genes potatoes have because this diversity allows us to mix and match different combinations of potato genes to make our crops grow better and to make sure they have the genes they need to fight off diseases.

Like many birds and mammals, this young chimpanzee needs large areas of forest habitat to survive. But in many parts of the world, natural areas are being lost to roads, houses, shopping malls, farms, and other types of human development.



Kennan Ward © 1994

WOW: So genes help protect our food supplies, right?

Dr. B: That's definitely part of it. But the most important reason to protect genetic diversity is that it's our safeguard against future problems—whether it's a new disease, a natural disaster, or something we can't even predict. It's our genes that help us adapt.

WOW: Does every species on Earth have hundreds of different genes?

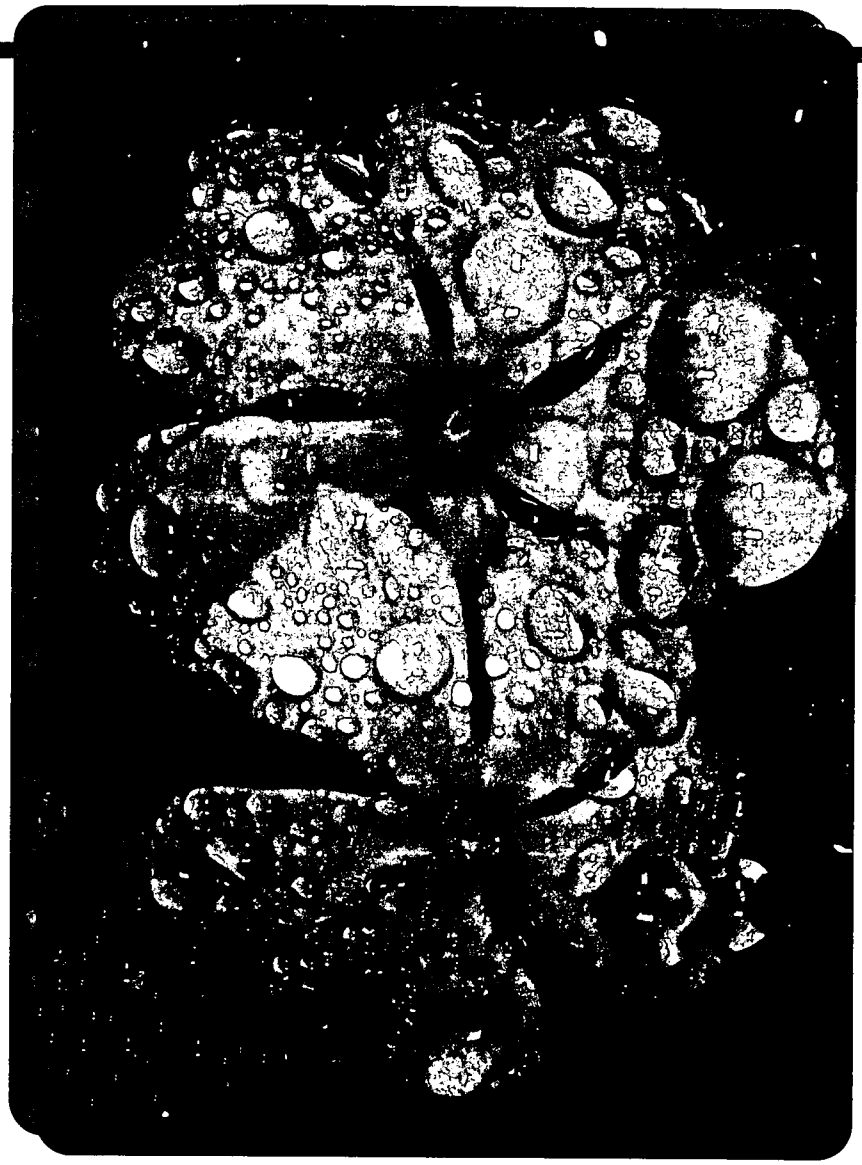
Dr. B: Well, the number varies from less than a hundred to more than a hundred thousand, depending on the size and complexity of the species.

WOW: Speaking of species, how many different species live on the planet?

Dr. B: Would you believe that no one knows for sure? So far, we have identified about 1.4 million species. That might sound like a lot, but it just scratches the surface of what's really out there. I estimate that the total number of species on Earth is somewhere between 10 and 100 million. And no one can give you a better estimate right now. That's why I say, when it comes to biodiversity, we live on a mysterious and unexplored planet. (For more about the number of species, see pages 12-13.)

WOW: Gee, between 10 and 100 million? That's pretty amazing. Where do all these species live?

Dr. B: All over the world. But some places have more kinds of species than others. For example, tropical rain forests are teeming with biodiversity, from the tip-tops of the canopy to the moist soil beneath the forest floor. In fact, half the species on Earth live in tropical rain forests. Did you know that a single tree in the tropics can have more than 1000 different kinds of insects living on it at one time? Now that's diversity!



This dew-dropped rosy periwinkle from Madagascar is not only beautiful—it's a lifesaver. It produces chemicals that help cure a variety of deadly diseases such as certain types of cancer.

But rain forests aren't the only places that you find a lot of species. Coral reefs are also incredibly diverse. And some scientists estimate that the deep ocean floor could be home to 10 million undiscovered species. Deserts, temperate forests, and other ecosystems throughout the world are also loaded with species—but just not as many as are found in tropical rain forests.

WOW: So are you and other scientists spending most of your time studying the tropics?

Dr. B: Well, a lot of scientists *are* working in the tropics. But a lot of others are working to sort out how other ecosystems work. You see, all ecosystems are important, not only because they're home to many species, but also because they perform a number of important services. They help purify our water, clean our air, generate oxygen that we breathe, recycle nutrients, and even regulate our climate. Even areas that don't have a lot of different species are still very critical to the health of the planet. For example, many wetland areas, which aren't as diverse as coral reefs or tropical rain forests, serve as nurseries for young lobsters, shrimp, fish, and other species. They also act as flood controls, help filter out water pollutants, and minimize storm damage. And that's just the start. We still have a lot to learn about how complicated these natural systems are and how they work together to keep the planet healthy.

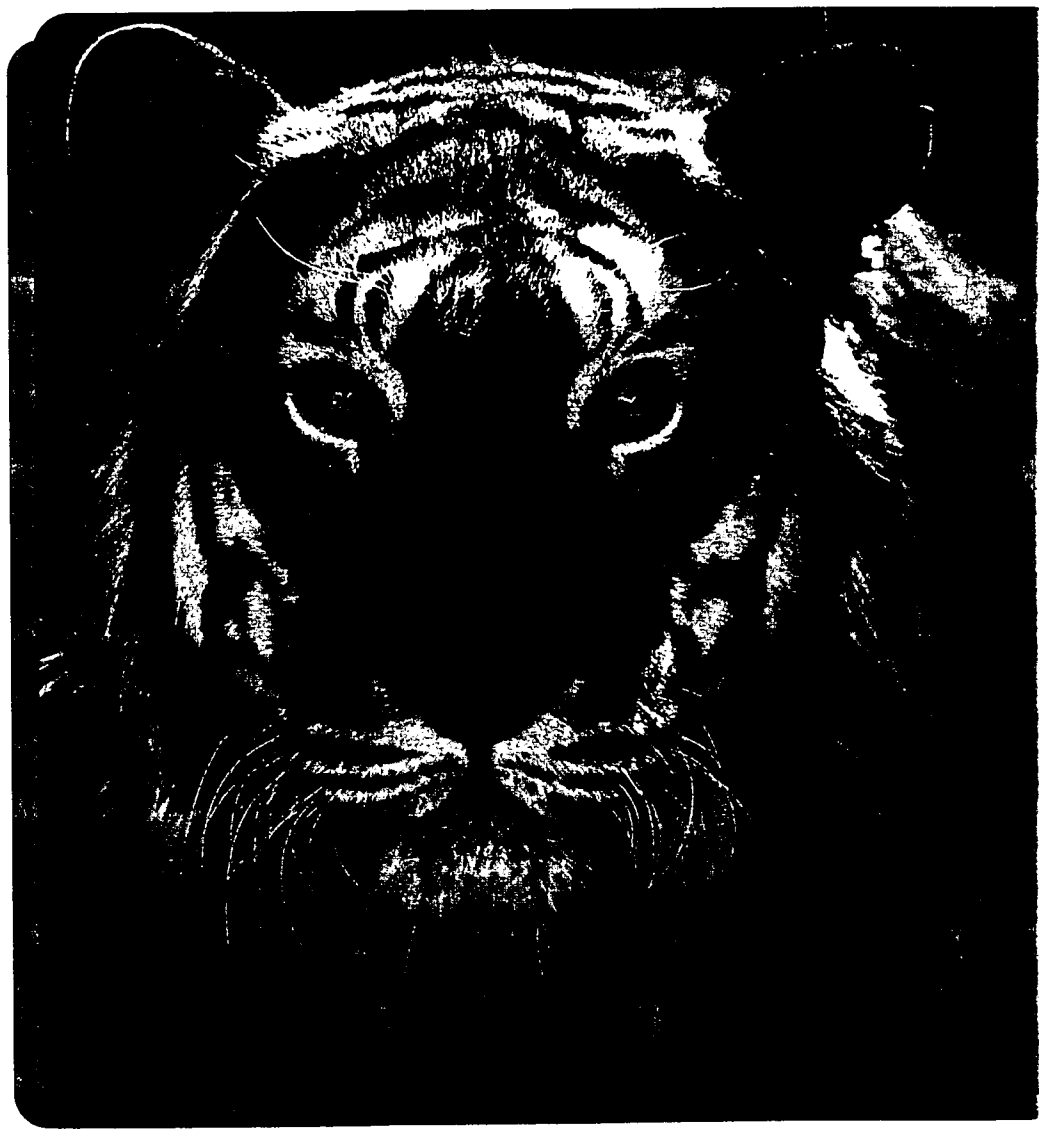
WOW: How do people fit into all of this?

Dr. B: I'm glad you asked that. People are a huge part of the biodiversity picture. For one thing, we are a very diverse species ourselves. We speak many languages, live in many different parts of the world, and celebrate a variety of cultural traditions. And although many of us don't stop to think about it, we are also a part of nature. Just like beetles and barracudas and bats, we have evolved over time, along with millions of other species. And just like the rest of life on Earth, we depend on biodiversity for our survival. Unfortunately, we are also the reason biodiversity is in trouble.

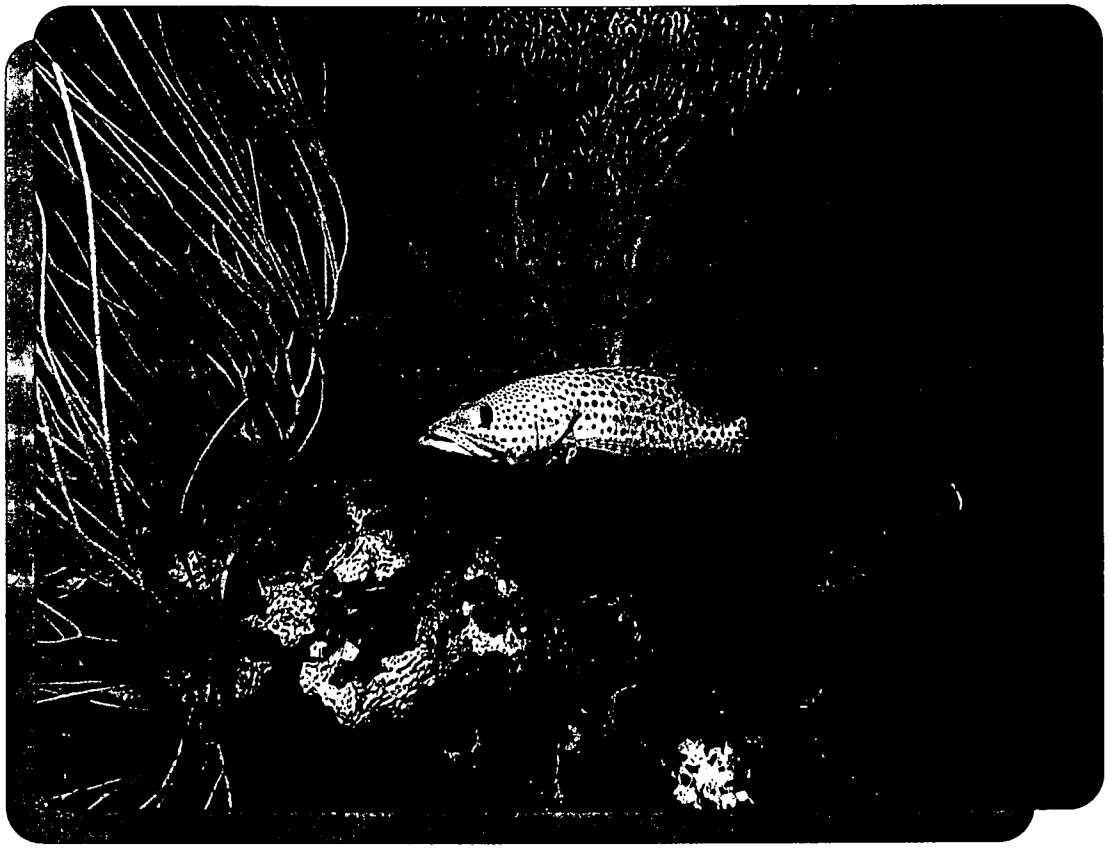
WOW: What do you mean?

Dr. B: Well, it's part of what some people call the HIPPO Dilemma.

WOW: Hippo? As in the hippos that live in Africa? What are we doing to hippos?



Bengal tigers once roamed widely across India and Southeast Asia. Now they're in trouble because of habitat loss and people killing them illegally for their bones, which are used to make traditional Asian medicines.



Coral reefs are home to thousands of animal species like this colorful grouper and these brilliant red sea whips in Papua New Guinea.

Dr. B: Actually, pygmy hippos in West Africa are endangered, but that's not exactly what I meant. You see, HIPPO stands for Habitat loss, Introduced species, Pollution, Population growth, and Overconsumption (using resources faster than they can be replaced naturally). These are the top threats to biodiversity in the world. The most serious problem by far is habitat loss, but all of them are causing species to become extinct. For example, take introduced species. These are plants and animals that people have brought, either by accident or on purpose, to places where they don't naturally occur. When this happens, the new species often spread quickly, pushing out native species. Just look at Hawaii. One introduced tree species has now wiped out more than 30,000 acres (12,000 ha) of native forest! (For more about the HIPPO Dilemma, see pages 23-29.)

WOW: I think it's sad that we're losing species, but I thought that extinction was a natural part of life. What about the dinosaurs?

Dr. B: Well, it's true that extinction is a natural process that occurs over time. After all, more than 99 percent of all species that have ever lived on Earth are now extinct! What I'm worried about is not the process of extinction itself, but how fast it's occurring. I've estimated that right now we are losing at least three species every hour. That's more than 70 each day! And the worst part about the extinctions happening now is that we may not be able to recover our losses for millions of years.

WOW: But why are you so worried about losing species? Is every single species of plant and animal really that important?

Dr. B: In my opinion, every bit of biological diversity that disappears is a priceless product of millions of years of evolution, and it should be cherished and protected for its own sake. But biodiversity should be saved for other reasons, too. As I mentioned earlier, we need the genetic diversity of wild plants to make our crops grow better and to provide new foods for

From the far reaches of Asia to the wilds of Africa and Latin America, human cultures are as varied as the landscapes and wildlife they depend on.

the future. We also need biodiversity to develop new medicines. When I go exploring, I wonder if a newly discovered insect or plant might hold the cure for cancer or AIDS.

The more species we lose, the less able we will be to sustain life. In many parts of the world, people are already struggling to survive because their natural resources have been depleted. You can think of biodiversity as a safety net that keeps ecosystems functioning and maintaining life on Earth as we know it. No one knows if, or when, that safety net will break. And no one knows what will happen if it does.

WOW: Do most people feel that loss of biodiversity is a serious problem?

Dr. B: Unfortunately, I don't think enough people know about the issue, and I hope that changes. But even those people who have studied the problem don't always agree on how fast we're losing species, how serious the problem is, or what we should do to help slow the loss of biodiversity. Many of the most respected scientists around the world do feel that loss of biodiversity—especially the loss of habitat worldwide—is the most serious problem facing the planet.

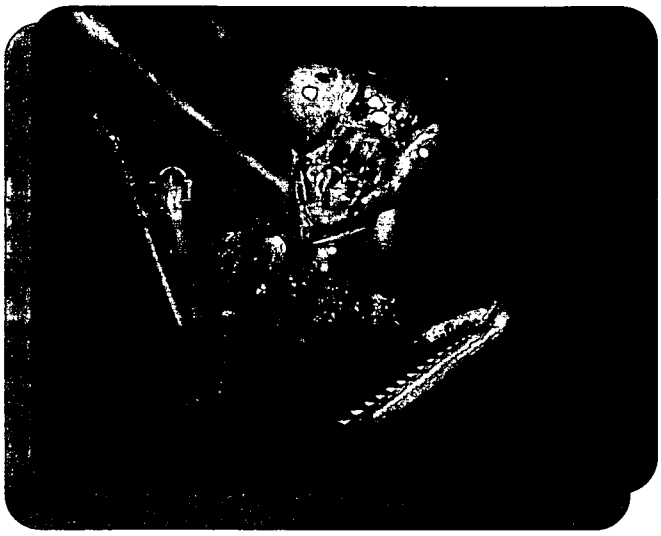
WOW: Are there any lessons that we've learned from the past that can help us solve this problem?

Dr. B: Good question. Unfortunately, we seem to keep making the same mistakes over and over again. Some scientists think, for example, that environmental catastrophes like soil erosion and toxic waste might have caused ancient civilizations, like those of the Mayas and Romans, to collapse. Just in the past two centuries, overhunting has caused the extinction of moas, dodos, passenger pigeons, and more than a hundred other bird species. And those are just the ones we know about. We've also learned some important lessons about contaminating the environment with dangerous chemicals. Bald eagles and other birds of prey almost went extinct in the lower 48 states because of pesticide poisoning from DDT. Once DDT was banned in this country, these animals began to recover. But DDT is still manufactured and sold in other countries—so it's still a problem in some parts of the world.

WOW: So do you think we can turn things around now and help slow the loss of biodiversity?

Dr. B: Although the issues are very serious, I think we can make important changes that will help protect biodiversity. Already many countries are working together to conduct biological inventories so that we can find out more about the diversity of life throughout the world. We're also working to understand the connections among living things so

that we can better understand what we need to protect. But protecting biodiversity will involve all of us, not just scientists. Political leaders, teachers, journalists, religious leaders, farmers, attorneys, and students need to get involved. And many of our everyday actions can help—from turning down the thermostat to choosing organic fruits and vegetables. You should never underestimate what you can do. Be creative. Solutions will come from all of us!



© Gerry Ellis Nature Photography

Mantids, with their bulging, compound eyes and grasping front legs, are expert predators and members of the most abundant group of organisms on Earth—the insects. There are more kinds of insects than all other kinds of living things combined.

Career Profile

Carmel Ervin: Educating Educators

When Carmel Ervin was young, she often ventured out to her grandfather's South Carolina farm and spent the day catching fish and insects with nets and tin cans. "I never caught many fish, but I did develop a love for nature that I'll never lose," Ervin says from her office at the Smithsonian Institution in Washington, D.C. These days, Ervin is busy making sure other kids get the same kind of firsthand thrill of science that she had.

Karen F. Elliott

As a science education specialist at the Smithsonian, Ervin helps teachers learn how to spice up their school science programs. "Science is doing!" she insists.

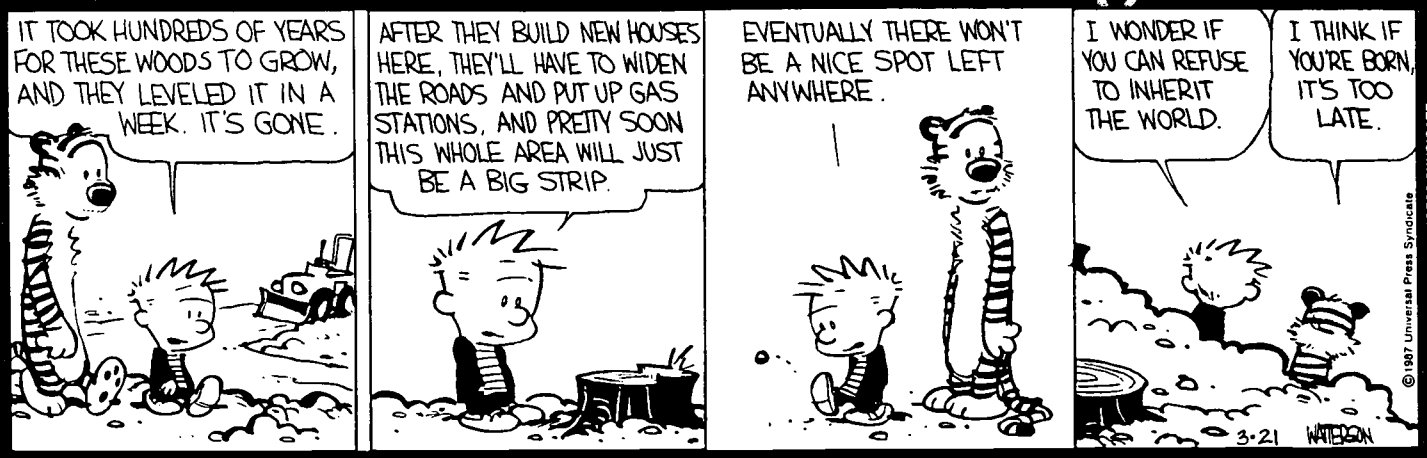
So, on a typical day at a teacher-training workshop, you might find Ervin leading a group of teachers along the shores of the Chesapeake Bay. You might see them crawling on all fours as they search for beach plants or digging madly in the sand for crabs.

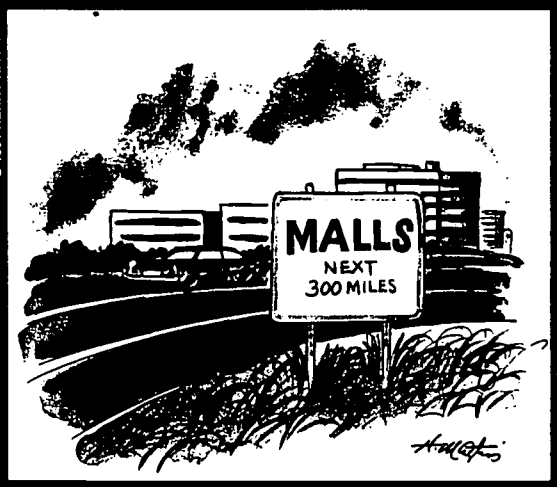
Ervin knows that few kids these days get to spend time on a place like a farm. That's why one of her main goals is to make science come alive for kids in the city. Instead of having kids read about blood circulation in a book, for example, she has them watch blood cells move through the veins of a live goldfish. Or, to teach about the adaptations of teeth, she might have students examine animal skulls ranging in size from a rat to an alligator.

Carmel Ervin doesn't expect to turn every student into a scientist, but she does hope to help people learn more about the life that's around them. "The more people know about the world," she says, "the more they'll appreciate and love the planet we all share."

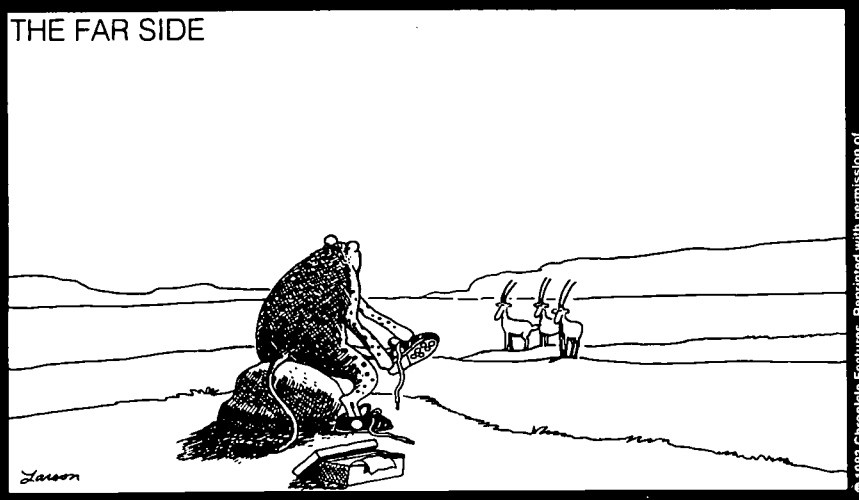
COMIC Relief

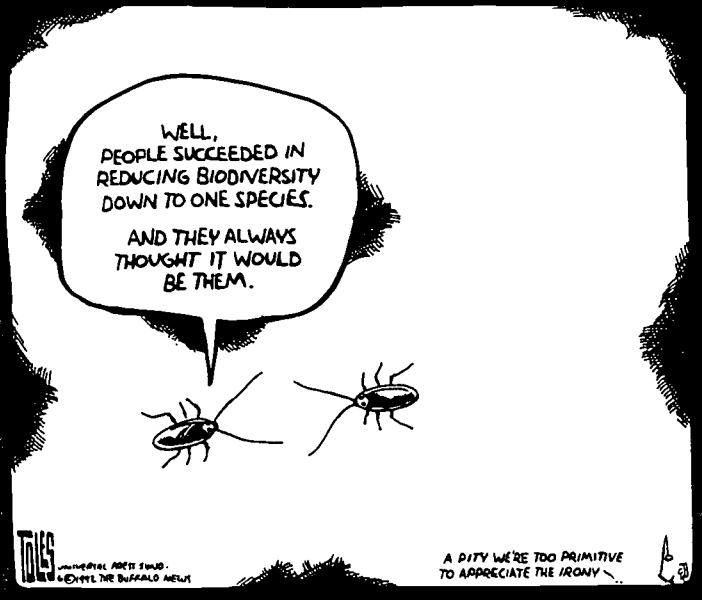
CALVIN AND HOBBES





THE FAR SIDE



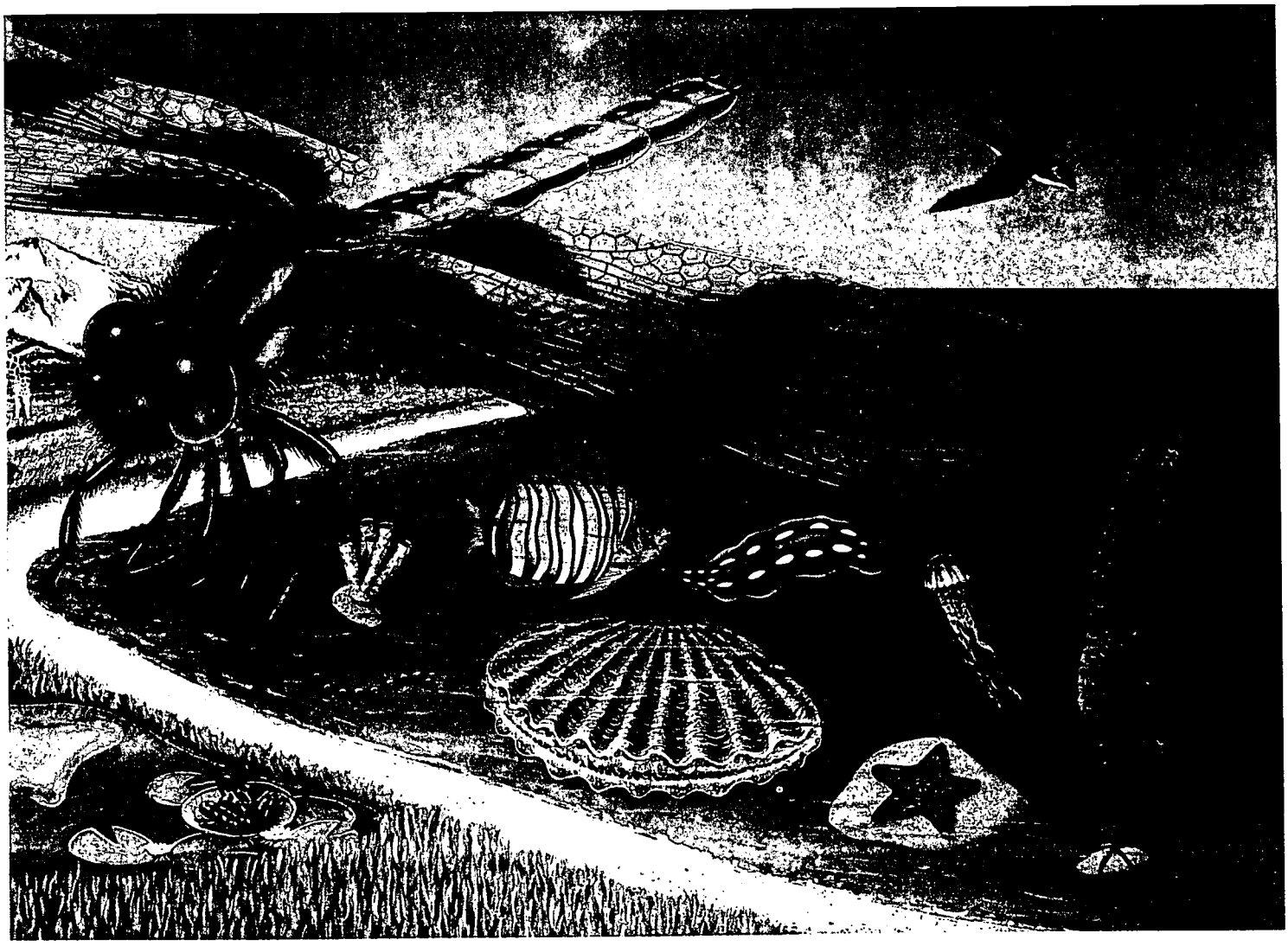


Sizing Up S P

Is this a scene from "Invasion of the Killer Dragonflies"? No. It's what's called a *species-scape*—a landscape of different species that symbolize life on Earth. Each of the organisms pictured represents a different group of living things, and the size of each picture indicates the known number of species that are in that group, compared with the known numbers in other groups. For example, the dragonfly represents all the insect species in the world, and the mushrooms represent all known species of fungi. (If you look at the key, you'll see that there are more than 750,000 known species of insects, but only 69,000 of fungi.) And people are represented by the giraffe, which symbolizes all the bats, bears, cats, mice, and other mammals that live on the planet.

Scientists have identified approximately 1.4 million species so far. But they predict that there are millions of other species that haven't been identified or described yet—especially "small stuff" like flies, beetles, bacteria, and fungi. And many of them are probably in places that scientists haven't really had a chance to study yet, like rain forest soils and the deep ocean floor. Who knows, in the next century we might find millions of new species—right beneath our feet!

E C I E S



KEY

1. Bacteria (4800); 2. Scarlet waxy cap mushrooms (Fungi—69,000); 3. Sea colander (Algae—26,900); 4. Trees, shrubs, and other higher plants (248,400); 5. Amoeba (Protozoa—30,800); 6. Yellow tube sponge (Sponges—5000); 7. Compass jellyfish (Corals, jellyfish, and relatives—9000); 8. Leopard flatworm (Flatworms—12,200); 9. Roundworms (12,000); 10. Earthworm (Earthworms and relatives—12,000); 11. Scallop (Clams, squids, and other mollusks—50,000); 12. African seastar (Seastars and relatives—6100); 13. Dragonfly (Insects—751,000); 14. Jumping spider (Spiders, crustaceans, and other non-insect arthropods—123,400); 15. Regal angelfish (Fishes, tunicates, and lancelets—18,800); 16. Leopard frog (Amphibians—4200); 17. Scarlet king snake (Reptiles—6300); 18. Tree swallow (Birds—9000); 19. Giraffe (Mammals—4000).

Illustration by Patrick Gnan

Statistics from *The Diversity of Life* by E.O. Wilson (Harvard University Press, 1992)

Mission IMPOS

SIBLE

by Caroline Taylor

It was a tough job, but somebody had to do it. Anyway, that's what they told me when I got the assignment. "We've had enough of these natural disasters," they said—"the volcanoes and the hurricanes and the forest fires and now the floods. So go interview Mother Nature to find out what's going on. Then try to get her to lay off."

Right. Like you can just walk right up and tap her on the shoulder and say, "Excuse me?"

I won't tell you how I found her (can't reveal sources and methods, after all), but I can say it wasn't easy. And when I finally did find her, we got right down to business.

"Let's start with volcanoes. Your Mount St. Helens and your Mount Pinatubo? And that one that keeps erupting in Hawaii—"

"What's the problem?" she broke in.

"The problem," I said, trying not to sound annoyed, "is that you keep doing these destructive things. The eruption of Mount St. Helens in 1980 devastated 200 square miles (520 km^2) of forest and dammed streams and lakes with lava and ash, killing 11 million fish and tons of other aquatic life. That was in addition to all of the mammals, birds, reptiles, and other animals that were wiped out."

"You know what they say," she replied. "'Mother Nature works in mysterious ways.'"

"But why did you do it?"

"I suppose if you were Mother Nature, you'd try to stop volcanoes from erupting?"

"Well, sure—"

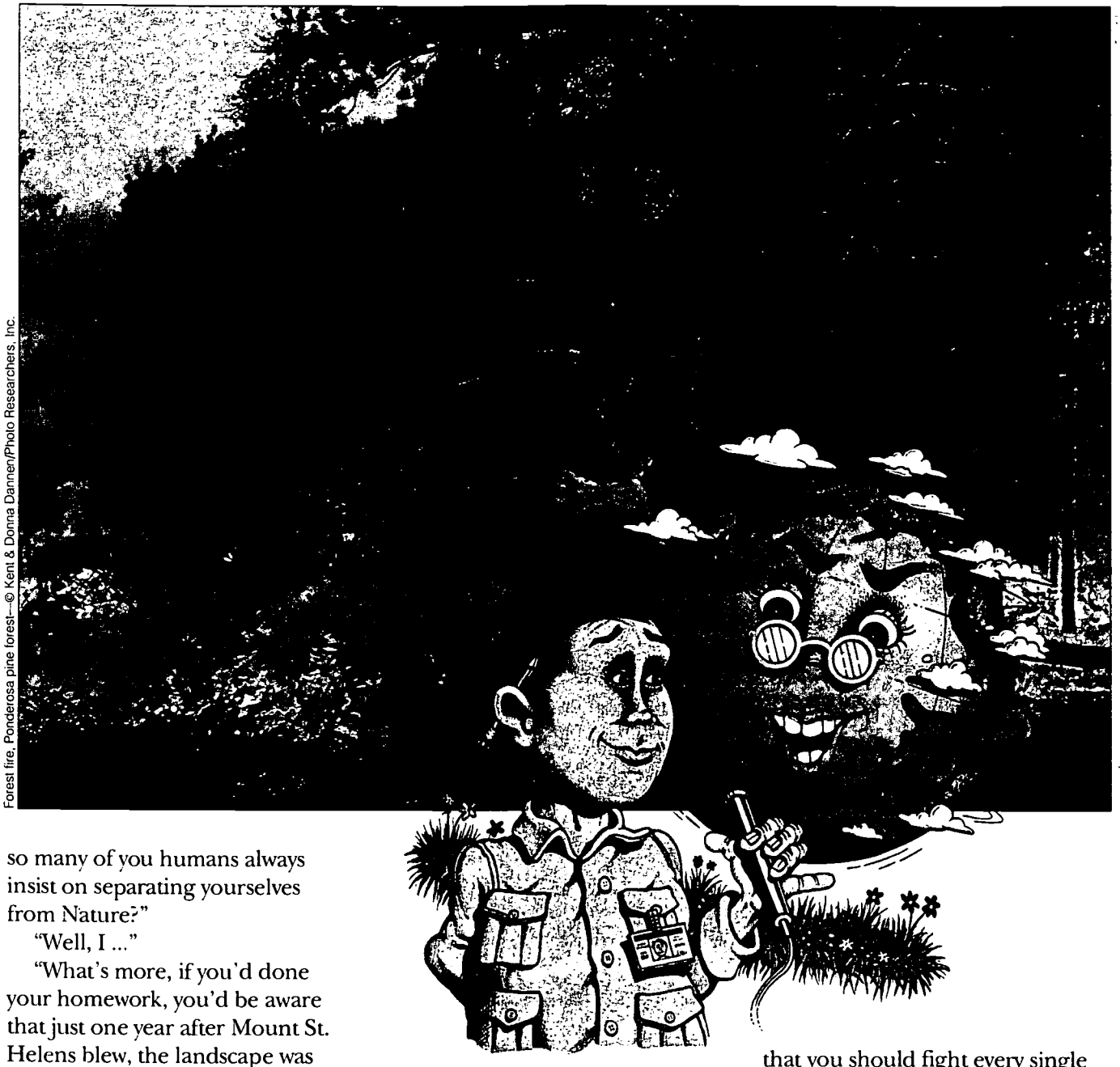
"Sorry, kid, but that's just not the way I operate. You can't *stop* Nature. I know I can be very unpredictable, and maybe I don't always make sense to you. The truth is, Nature just happens. Sometimes it's good for people and wildlife, and sometimes it's not."

"But don't you feel bad about all the mammals and birds and fish—and people, too—that get hurt when one of those mountains decides to vent?"

"This may come as a shock to you, but Nature doesn't have 'feelings' like you do. I'm Mother Nature, not a person. And by the way, people *are* mammals. Why do

Illustrations by Scott Ross

Kilauea volcano eruption, Hawaii—© Soames Summerhays/Photo Researchers, Inc.



Forest fire, Ponderosa pine forest—© Kent & Donna Dannen/Photo Researchers, Inc.

so many of you humans always insist on separating yourselves from Nature?"

"Well, I ..."

"What's more, if you'd done your homework, you'd be aware that just one year after Mount St. Helens blew, the landscape was dotted with blackberries, avalanche lilies, lupine, bracken ferns, and other plants. And you'd know that killdeer, ground squirrels, gophers, and even mountain bluebirds moved back pretty quickly. One day the forests, deer, and elk will probably be back too. Sure, disasters are a part of Nature. But *regeneration*—the return of life after these events—is a part of Nature too."

Maybe she had a point. But I could not forget my mission—to get her to lay off the disasters. So I did the only thing I could think of. I switched subjects.

"I suppose you're going to tell me it was OK that forest fires raged through 1.4 million acres (560,000 ha) of Yellowstone Park in 1988?"

"Let's just say that they were a necessary part of Nature."

"You can't mean that!" I was losing it, I know, but she didn't seem the least bit sorry about all the life she had destroyed.

"It was way overdue," she said, shaking her head. "From the 1880s to the 1970s, you humans thought that you should fight every single forest fire. But fire can be important for maintaining healthy ecosystems. In Yellowstone, the park had more than 90 years' worth of deadfall—old trees and kindling—that had to be swept out. You might say that the forest fires there acted like Nature's brooms."

I had her there. "So you just swept the poor animals out with the underbrush, huh?"

"Not for long, kiddo. I hate to keep criticizing your preparation for this interview, but have you

been there recently? Less than five years after those fires, Yellowstone was back in the swing of things. Life was popping up everywhere. In fact, scientists predict that there will be a tenfold *increase* in plant species over the next 20 years, not to mention an increase in animal life—from insects all the way up the food chain to birds and mammals. That's what I mean by regeneration."

"But what does this 'regeneration' business have to do with anything?"

"You're so stuck on those natural events that you're missing a very important point—namely that the rich biodiversity of this planet helps it to recover from events like volcanoes and hurricanes. Biodiversity allows Nature to bounce back when these big things happen—and that is one reason why it's so important to keep ecosystems healthy and to protect biodiversity. See, healthy ecosystems can weather these disturbances better than ecosystems that are unhealthy and fragmented. And believe it or not, some disturbances—like occasional forest fires—are actually needed to keep ecosystems healthy."

"Are you saying that forest fires can actually help *promote* biodiversity?"

"Sometimes—and in some ways. Many animals and plants are adapted to—and even need—small-scale disturbances like fires or floods or wind. "

"Look, Mother Nature." I was getting confused, and my head was starting to hurt. "I came here to ask you to lay off, and instead you keep telling me that all of these natural disasters are—well, natural."

"Except I wouldn't call them disasters," she replied coolly. "That's a human term, and it doesn't apply to the rest of Nature. You humans crave order. You want Nature to be something beautiful and pleasant and safe—like a landscaped rose garden." Mother Nature sighed. "But I'm not good ... or bad. I just am."

I opened my mouth to protest, but she interrupted again.

"I'll tell you something else. The impact of these disasters, as you call them, is often much worse because of people's activities. In

Career Profile

Diane Jukofsky & Chris Wille: Writing For Conservation

This time, the jeep is seriously stuck. Diane Jukofsky and Chris Wille climb out of the vehicle and sink to their knees in the sticky red mud of the Honduran rain forest. Armed with cameras and notebooks, they are looking for the loggers who made this illegal road. And now they're stuck, more than a day's drive from the nearest town.

Kathleen Cabble

Getting stuck or lost is just part of a day's work for Wille and Jukofsky, a husband-and-wife team of environmental journalists employed by an international conservation group, the Rainforest Alliance. The two writers travel throughout Central America covering stories for media throughout the world.

"Most people do not understand why the rain forest is being destroyed or what's being done to save it," Jukofsky explains. "That's why we decided to establish an environmental news agency. We're out here on the front lines of rain forest conservation to get the real story."

"The diversity of wildlife and the diversity of conservation efforts make Central America perfect for a couple of environmental journalists," Wille adds. "There's lots of news here, both good and bad."

Jukofsky was trained as a writer and then learned about conservation biology while working. Wille studied biology in school and learned journalism later, on the job.

Their constant travel into remote regions presents plenty of challenges for the wandering writers, but they know that what they're doing is critical to saving the rain forest.

As Jukofsky explains, "The best way to generate support is through the media. The media can help convert scientific information into political action. The media can turn citizens into activists. And that's what we need."

What about the jeep that was stuck deep in the mud? Chris and Diane got it out by stuffing sticks under the wheels. Then, covered with mud, they went to find out about the loggers.

many places you've whittled away wild areas with your homes and shopping centers and roads until there are only small pockets of natural habitat left. That means that when a large fire or other disturbance occurs, it can wipe out some species because there's no place for the animals to go, and there aren't always enough of them left to reproduce. You may not realize it, but many people think that the parks and protected areas left in the world are too few, too small, and too isolated from one another to bounce back after major disasters."

She had an answer for everything, and it usually circled back to people. But I wasn't done yet. And even though I could see it coming, I had to ask her about the summer floods along the Mississippi River in 1993. I wanted to see her wiggle her way out of this one.

She took a long, hard look at me over the top of her glasses. "Just where did you think all that water was going to go?"

"Well, uh, why not the Gulf of Mexico?"

"That would have been the case hundreds of years ago, but it just couldn't happen that way in '93 because of the way you people had rigged things. Over the years, people filled in low-lying areas to create cropland. They destroyed more than 19 million acres (7.6 million ha) of wetlands in the Mississippi River and Missouri River basins north of St. Louis. Those wetlands used to help control flooding naturally by absorbing and 'holding' water during seasons of high rainfall and releasing it during drier months. With no wetlands, there was nothing to soak up the water. And that doesn't even take into account all the other changes you've made—the thousands of miles of paved roads and hundreds of shopping centers."

"Wait a minute!" I cried. "The levees broke, millions of animals died, and people lost their homes and farms. People will probably be digging out of all that muck and slime for years. And you're saying it's our fault?"

That was the last straw. How could she just ignore the damage she'd caused? As I shut my notebook and got ready to leave, she just looked at me and shook her head slowly.

"You just don't get it, do you?" she said sadly. "You know, I feel like that comedian who always says, 'I just don't get no respect.' But maybe someday that will change. Remember, Nature just happens. And like it or not, you're part of Nature too. Whatever happens, happens to all of us. Got it? Ta, ta."

All of a sudden she was gone. And I was left with a splitting headache and a notebook filled with scribbles about fires and brooms and the "natural" way. So much for this assignment. The next time they ask me to interview Mother Nature, I'm going to say, "No way." I've learned my lesson: Don't mess with Mother Nature.

Change Is Natural

What may seem like a disaster to us is often an important part of the planet's life-building processes. Whether we like it or not, storms, fires, floods, and other disturbances are all part of how nature "works." And many organisms have evolved over time to cope with these sorts of upsets. For example, many animals rely on periods of heavy rains and floods to mate and find food. And some trees need the heat of a fire for their cones to open and release their seeds.

Sometimes natural disturbances happen on a huge scale—like volcanic eruptions and hurricanes and floods the size of those in 1993. Fortunately, these big disasters don't happen that often. But when they do, they can affect biodiversity by wiping out plants and animals—and occasionally even entire species. Part of the reason why it's so important to protect biodiversity and maintain healthy ecosystems is to enable life to bounce back after such disasters. And in the past, nature has been able to recover on its own.

Disturbances—and the changes they bring—are natural. And both small and medium disturbances "build" biodiversity because new species rush in to fill empty spaces. Problems occur when people get in the way of natural processes. By bringing new species to certain areas, damming rivers, filling in wetlands, and reducing the overall amount of space for wildlife, we often put so much stress on ecosystems that even Mother Nature can't handle the pressure. That's when natural disturbances become real disasters.

EXCLUSIVE

Attention Readers!!!

by Jody Marshall

The following special section contains information that will surprise, amaze, and possibly even shock you. Read on to discover a world where strange events, fantastic feats, bizarre relationships, and weird discoveries happen every day. "Where is this world?" you ask. The answer's easy: You're living in it. Each account presented on these pages describes a phenomenon that occurs right here on Earth—a planet with an infinite supply of natural wonders. As you read, you might find yourself agreeing that truth *is* stranger than fiction.

THE NATURAL INQUIRER

BIZARRE SEX CHANGE OCCURS UNDERWATER

Atlantic City, NJ—Oceans all over the world are the scene of an incredible sex-change phenomenon. According to researchers studying the strange change, many kinds of fish and other sea creatures undergo a sex switch during their lives—changing from either male to female or female to male, depending on the type of animal. For example, some male clownfish become females when their female mate dies. Then they find a new male mate.

Stoplight parrotfish swap sexes too: The bright red females eventually turn into greenish-blue males. And certain male shrimp become females when there's a shortage of mates.

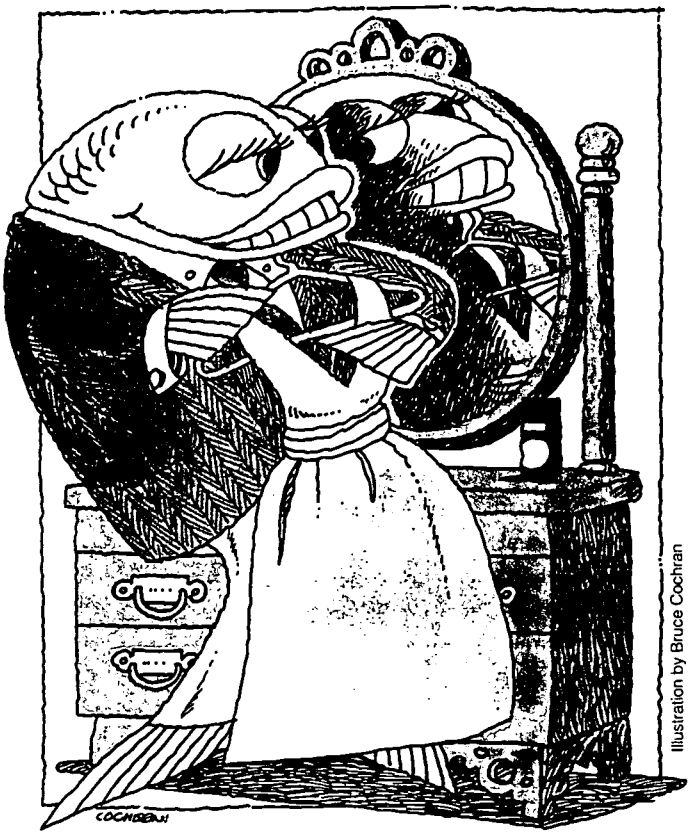


Illustration by Bruce Cochran

ALIENS
HAVE COLONIZED THE PLANET!

Worldwide—Aliens are everywhere on Earth—and have been for years! That's the word from scores of scientists investigating alien colonization around the world.

"They've populated the planet," claims researcher E.T. Hunter. "People come into contact with them every day—without even knowing it!"

Hunter is quick to point out, though, that these particular aliens aren't from outer space. "They're from right here on Earth," she says, explaining that scientists use the term *alien* to refer to plants and animals that have been introduced into areas where they weren't previously found.

Some of these alien introductions have been accidental. City rats, for example, came to the United States as stowaways on ships carrying European explorers to the Americas. But in some cases people have introduced animals and plants on purpose. The European birds called starlings are an infamous example. In 1890 they were released into New York City's Central Park by people who thought it would be a good idea to stock the United States with all the different birds mentioned in Shakespeare's plays. Now millions of starlings are all over the United States, and they're competing with native birds for food and nest sites.

Illustration by Robert Burger

Other aliens, whether they're birds, insects, plants, or other species, create similar problems for native species around the world. "We've got to be very careful to avoid introducing animals and plants into areas where they aren't naturally found," says Hunter. "We've learned the hard way that aliens can destroy native life forms."

Killer Has NO BRAIN, NO HEART

Illustration by Leif Peng

Atlantic Ocean—It drifts through the sea devouring unsuspecting small fish and other creatures. But a Portuguese man-of-war jellyfish is not just another carnivorous animal. In fact, it's not *an* animal at all—it's a whole colony of specialized animals. Tiny terrors form the mouths: Each one has long tentacles lined with stinging cells that capture prey and defend the jellyfish. Other animals in the colony do nothing but make a gas that fills the man-of-war's "balloon" and keeps it afloat. And still others take care of reproduction. These mindless meat-eaters manage to do all this without a brain or a heart. Without those body parts, you couldn't even flick the TV remote!

I N Q U I R E R

Illustration by Leif Peng

EXOTIC MALE DANCERS DAZZLE OPPOSITE SEX

Papua New Guinea—In a flashy display designed to impress females, male birds-of-paradise perform radical dance routines in the jungles of Papua New Guinea. The acrobatic birds shake, shimmy, and sometimes even hang upside down from tree branches to show off their bright colors and long feathers. The dull-colored females usually pick the flashiest dancers to be their mates.

O O Z E

IN THE NEWS

Calaveras, CA—Have you taken your frog slime today? Probably not, since it isn't on the market yet. But before too long miraculous medicines, made from the slimy substance that oozes from frog skin, may be available at your local pharmacy.

Frogs "use" their ooze to keep their skin from drying out—and in the case of certain species, to repel predators. In a news statement released recently, frog fancier Polly Wogg said that the slime some frogs produce is poisonous enough to kill a human.

Poison aside, medical researchers think frog-skin secretions could be as useful for humans as they are for frogs, although in different ways. For example, certain substances in these secretions are proving to be effective in treating infections, mental disorders, and other ailments. The sticky slime might also be used to create a kind of glue that replaces stitches. And there may be other uses as well. When used as directed, frog slime might be able to keep all kinds of sick people from—well, croaking!

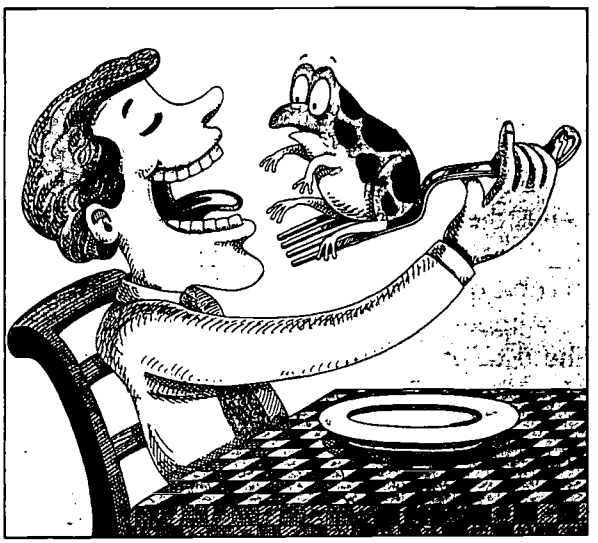


Illustration by Robin Hotchkiss

NATURAL INQUIRER

SHOCKING EVIDENCE REVEALS:

WE OWE OUR LIVES TO SEA SCUM

World's Oceans—They sure don't look like much. In fact, most of the time they don't look like anything at all. That's because they're too small to see without a microscope—except when they multiply to the point where they form masses of foamy scum on the ocean's surface. But some scientists think these tiny foam formers perform a mighty job, one that affects the health of the whole planet.

What are these wee wonders? Certain types of ocean algae. The algae release sulfur compounds that drift up into the atmosphere, where they stimulate cloud formation. And clouds help to regulate Earth's climate.

"Clouds are like a two-way atmospheric blanket," observes meteorologist Storm Front. "They keep Earth warm by holding in some of the heat reflected from Earth's surface. And at the same time they screen out some of the sun's rays. The net result is that the overall climate of the Earth stays within a certain range capable of supporting life."

Without the sulfur compounds the algae produce, not as many clouds would form. And a cloud "shortage" could change the Earth's climate for the worse.

"The algae-cloud-climate thing is a very complicated process that we're just beginning to understand," states Front. But he points out that at least one thing is clear: A species doesn't have to be big to have a big impact on the entire planet.

VAMPIRES COULD SAVE YOUR LIFE!

Illustration by Steven Nau

Costa Rica—According to a statement issued recently by medical researchers, vampires could save hundreds of lives each year.

"Vampires have a lot to offer modern medicine," says researcher Dr. Drake Ula. "For one thing, they're very smooth 'operators,'" he adds, referring to the creatures' habit of biting unsuspecting victims and "drinking" their blood.

Unlike the vampires depicted in horror movies, real vampires are tropical bats that feed mostly on the blood of large mammals, such as cattle. The bats cut a small slit in their prey with their teeth. A special compound in the bats' saliva keeps the prey animal's blood from clotting, allowing the bats to lap up a blood meal. In most cases the prey animals aren't harmed by the act, and often they seem unaware that they've even been attacked.

Dr. Ula explains that it was the bats' ability to keep blood from clotting that intrigued investigators. "We wondered, 'Could the anti-clotting agent in vampire bat saliva be used to dissolve human blood clots?' We figured that if it could, it might be useful in dissolving the clots that cause heart attacks."

Research has confirmed these ideas. In fact, it has shown that vampire bat saliva works twice as fast in opening clogged arteries as the medicines currently being used.

Medical research on vampire bats parallels similar research being done on other species, such as leeches and venomous pit viper snakes. "A lot of people get the creeps when they think about these guys," observes Ula. "But you just never know," he adds. "Some day you could find yourself in a hospital, and a vampire bat or pit viper could save your life!"

From Costa Rica to Cameroon, from North Dakota to Nepal— biodiversity is slipping away because of

The HIPPO Dilemma

by Luise Woelflein

The HIPPO Dilemma is not about real, live hippopotamuses. Instead, HIPPO stands for the five major problems threatening the Earth's biodiversity: abitat loss, ntroduced species, ollution, opulation growth, and ver-consumption. Many of these problems are interrelated. Pollution, for example, can harm ecosystems and the creatures that live in them. And too many people using too many resources can lead to pollution problems and habitat loss. On the following pages you'll find out more about these problems and how they're threatening biodiversity.

Hippos, like this chubby adult, are often hunted for their meat. So far, their numbers are OK, but their relatives, the pygmy hippos of West Africa, are endangered because of habitat loss.

The HIPPO Dilemma

Habitat Loss

All across the planet, biodiversity is disappearing—mostly because of one problem: habitat loss. Habitats are the places animals and plants live and get the food, water, sunlight, living space, and other essentials they need to survive. Over time, species have adapted to specific physical conditions in the areas where they live. They've also evolved complex interrelationships that help them survive. For example, many plants depend on particular animals to pollinate their flowers and disperse their seeds, and animals depend on specific plants for food.

When people clear woods for houses, fill in wetlands for farmland, or pave over meadows for a shopping mall, they alter habitat—killing or forcing out the animals and plants that once lived in it, upsetting ecological relationships, and reducing the ecosystem's ability to perform services like flood control, water purification, and nutrient recycling.

Bits and Pieces

It's easy to understand that when people build a huge shopping mall, plants and animals lose their homes. But people can also degrade habitats by chopping the habitat into smaller isolated pieces. This fragmentation can change conditions in the habitat so much that many original residents can no longer survive. Cutting a road through a forest, for example, brings drier air and more sunlight to areas along the road. And those changes can affect which species are able to live there. In addition,

Eco-Lingo

An *ecosystem* is a community of plants, animals, and other organisms that interact with each other and the physical environment and are linked by energy and nutrient flows. The soil beneath a fallen log, a salt marsh in an estuary, and the Brazilian rain forest are all examples of different-sized ecosystems. A *habitat* is where an individual organism or a species lives.

No Place to Go

Since 1980, summer tanager populations in the United States have dropped more than 17 percent. Wood thrush populations have dropped 23 percent. And sightings of rose-breasted grosbeaks have dropped by 33 percent. Experts believe the reason for these declines—and the reason many other songbird populations are declining—is habitat related.

rose-breasted grosbeak—© B. Schorre/VIREO

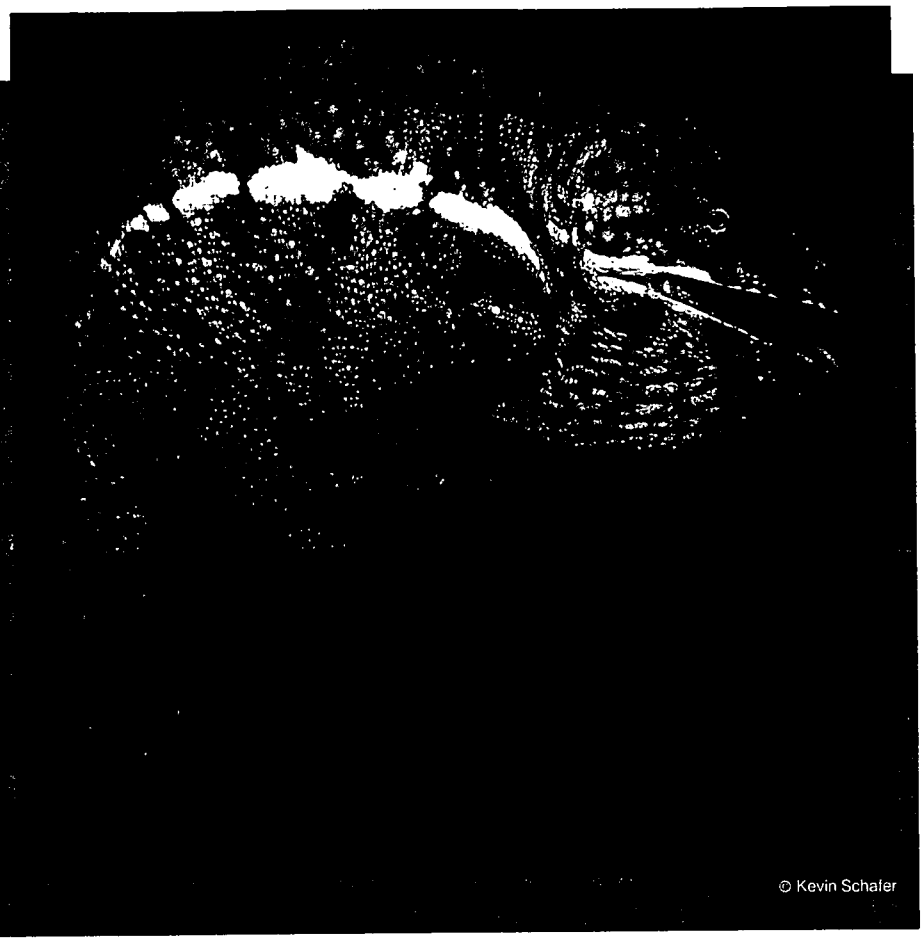
People are destroying and fragmenting both the birds' winter forest homes in Central and South America and their summer nesting habitats in the United States.

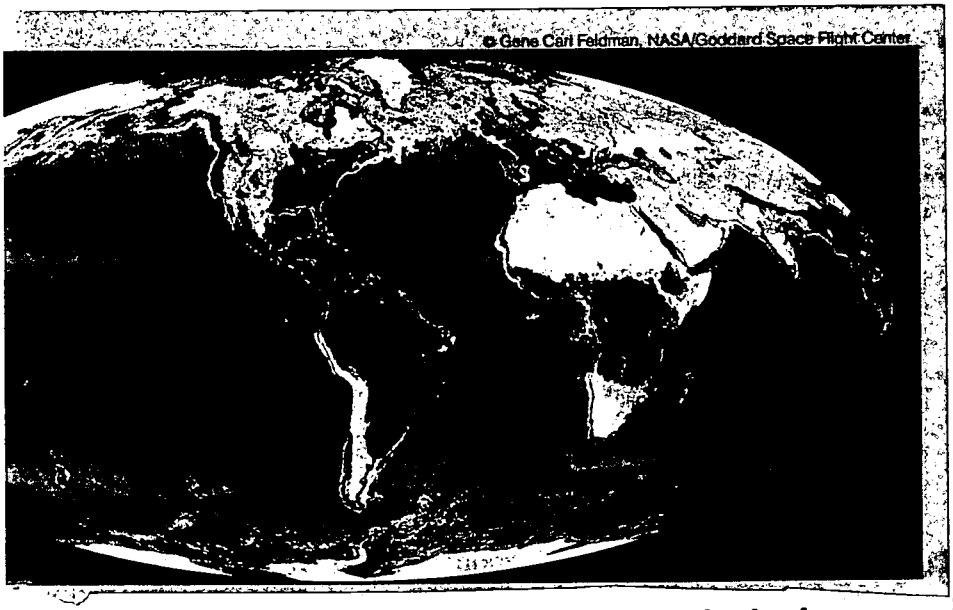
Eyes on the World

To help chart habitat change on the planet's surface, scientists often use equipment usually associated with space exploration. Satellites, circling high above the Earth, take pictures and relay them back to scientists on the ground. The satellites also collect other highly detailed information, such as the amount of moisture in a forest or the level of photosynthetic activity in the ocean.

Special Species

For some species, only one island, one mountain valley, or one stream is home—the species lives nowhere else on Earth. Animals and plants that live in only one area are called endemics (en-DEM-icks). If anything happens to the areas where they live, endemic animals and plants can be wiped out forever. Of the plants on Madagascar, 80 percent are endemic, and half the world's chameleon species live only on this island. Panther chameleons (right) are endemic to Madagascar.





This satellite image shows the Earth's biological productivity and is made up of several years of data. Rain forests and other highly productive land areas are green; less productive areas, such as deserts, are yellow. In oceans, the most productive areas are red and the least productive are pink. Using images like this, scientists can monitor planet-level change.

the road may provide easier access to once-isolated parts of the forest for introduced species, people, and other "invaders." And new animals that move in may compete with resident animals for resources or prey on them for food.

Roads, housing tracts, and other developments may also separate a population of animals into two smaller groups or cut animals off from important breeding or feeding areas. Some forest birds, butterflies, and other animals will not cross open space—even a narrow road.

In the United States, we've lost more than half of our original wetlands and prairies.

Introduced Species

Before 1985, there were no zebra mussels in North America. Now, these small clamlike animals live throughout the Great Lakes and have made their way to other bodies of fresh water—including all the way down the Mississippi River to New Orleans. Scientists think these European invaders most likely arrived here in the ballast tanks of freighters. Ships filled their ballast tanks with water in Europe and took on tiny, free-swimming zebra mussel larvae as well. When the ships arrived in the Great Lakes, they emptied their tanks to take on cargo, flushing the young zebra mussels out into a new world. Now the mussels are causing big problems, including killing native clams by growing on top of them and sinking buoys that help ships navigate.

New Kids on the Block

When species like the zebra mussel end up in areas where they don't occur naturally, people refer to them as introduced, alien, or exotic species. And like the zebra mussel, many introduced species end up causing big problems in their new homes. That's because they usually arrive without the predators, diseases, or parasites that keep their populations in check in their natural habitats.

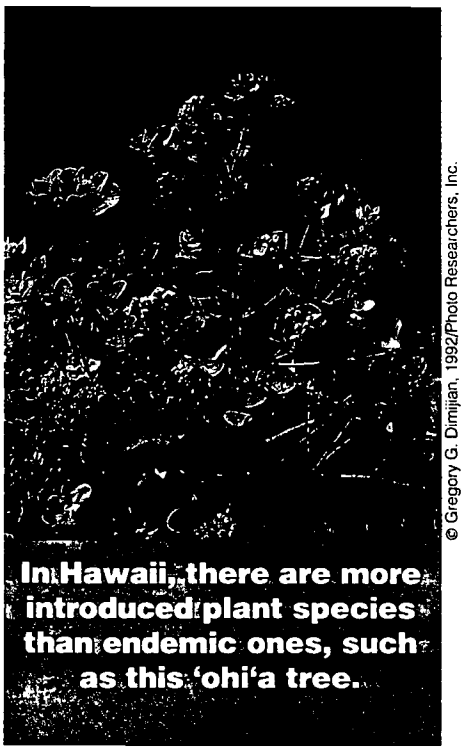
In addition, the new species can often survive better than native species in areas that have been disturbed by people. And native species often have no defenses against introduced species—or the diseases they carry.

The Accidental Tourists

Zebra mussels were brought to North America by accident. Many other introduced species were brought to their new homes on purpose by people who thought they were doing a good thing. For example, kudzu is a fast-growing vine that's native to Asia. In the 1930s, people started planting kudzu in the southern United States to help control soil erosion and to provide food for cattle. Today the plant is a real nuisance—it has spread over millions of acres, growing over anything in its path including trees and even houses!

© Robert Rattner, 1993

Zebra mussels, like these covering a clump of freshwater clams, are causing big problems in U.S. lakes and rivers.



© Gregory G. Dimijian, 1992/Photo Researchers, Inc.

In Hawaii, there are more introduced plant species than endemic ones, such as this 'ohi'a tree.

Pollution

In general, pollution is any human-caused change in the environment, such as pesticides in soil or water, that creates a harmful effect on living things. Sometimes pollution problems are easy to see, such as an oil spill, an overflowing landfill, or a turtle strangled by plastic trash. But many pollution problems are not so obvious. You can't see the acid in acid rain, for example, but lakes, forests, and other areas in many parts of the world are dying from its effects. Similarly, sediment that washes off construction or logging sites may end up clogging waterways or smothering offshore coral reefs. And pesticides spread on lawns, golf courses, and agricultural land often wash into waterways where

they can accumulate in the bodies of fish and other organisms. The levels of toxins may get so high that the organisms die, cannot reproduce, or become poisonous to eat.

Pollution Solutions

In 1969, the Cuyahoga River in Ohio became so polluted it caught on fire! Today, the river has bounced back. In fact, in the past 20 years or so, Americans have really made progress on some pollution problems. By switching to less-harmful products, increasing energy efficiency, and developing less-polluting technologies, we can continue to reduce pollution.

Energy-efficiency policies at the IBM company are saving as much energy each year as is used by 40,000 U.S. homes. They're also saving the company 22 million dollars a year!

Change in the Air?

Scientists know that carbon dioxide and other "greenhouse gases" perform an important function in Earth's upper atmosphere: Like the walls and ceiling of a greenhouse, they trap heat that radiates up from the surface of the planet. And this helps maintain temperatures that make life on Earth possible. Scientists also know that the concentrations of these gases are increasing, mostly because of people's activities, such as burning oil, gasoline, and other fossil fuels and burning forests for agricultural land.

Scientists don't know for sure what effects these growing levels of greenhouse gases will have. Many believe that an increased greenhouse effect could change the climate on a global scale. Temperatures could change so quickly in some areas that plants and animals wouldn't be able to survive the drastic climate change or adapt quickly enough. Areas might become too hot or too cold, too wet or too dry, for them to survive. And the organisms would have no other place to go because so much space is already taken up by people.

Beluga whales in the St. Lawrence River have such high levels of toxic chemicals in their bodies that they qualify as toxic waste under Canadian law.

Population Growth

In 1993 there were approximately 5.5 billion people on the planet. That's more than twice as many as there were in 1950. Every day we add about 250,000 more people to the planet—or more than 90 million each year. How many people is too many? A growing number of scientists and policymakers feel the planet already has more people than it can handle. And although many experts expect world population to stabilize sometime after 2100, they aren't sure at what level stabilization will occur. The low projection is a little more than 8 billion; the high puts the human total at more than 11 billion!

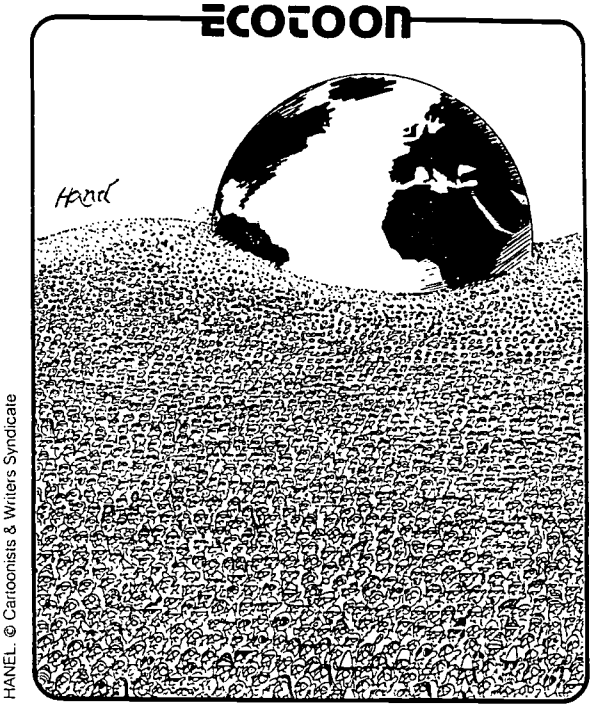
The Human Impact

Supporting such huge numbers of people is sure to put a lot of pressure on natural resources. All those people will need food, clothing, shelter, fuel for cooking, and other necessities. And in some areas, existing populations are already struggling to survive. For example, one-third of the people on Earth can't find enough fuelwood to meet their basic needs. As ecosystems are degraded, we lose the resources and the services they provide, such as water purification and flood control.

Easing the Squeezing

Finding ways to reduce popula-

The HIPPO Dilemma



HANEL. © Cartoonists & Writers Syndicate

tion growth is not easy. For example, studies have shown that providing educational opportunties for women can reduce birthrates. So can making health services, including family planning services, available to people. But biases and customs in many cultures around the world can make these steps difficult.

Over-consumption

Rapid increases in the sheer number of people on the planet are causing big problems. But there's another, equally serious, people problem: over-consumption. Increased demand for some products and more efficient ways to take resources have led people to consume fossil fuels, forests, minerals, water, and other resources at a much higher rate than those resources can be replaced. (Some resources, like fossil fuels, take millions of years to form and can never be replaced.) In addition, most of those resources are being used by people in industrialized countries, like the United States, to support a

Career Profile

Nalini Nadkarni: Treetop Explorer

© Mark Moffett/Minden Pictures

How would you like to be a professional tree climber? That's more or less how Nalini Nadkarni (nah-LEE-nee nad-CAR-nee) describes herself. Nadkarni is a botanist at Evergreen State College in Washington. She spends much of her time climbing high into the canopy of tropical rain forests in Costa Rica.

"I was constantly climbing trees as a kid," says Nadkarni. These days, she uses a special climbing harness, ropes, and clamps to climb 100 feet (30 m) or more above the ground. Most of her research focuses on epiphytes—plants like orchids and ferns that grow along the trunks and branches of the trees. Literally going out on a limb, Nadkarni collects samples of the plants and studies the roles they play in the forest, as well as how sensitive they may be to environmental disturbances such as acid rain.

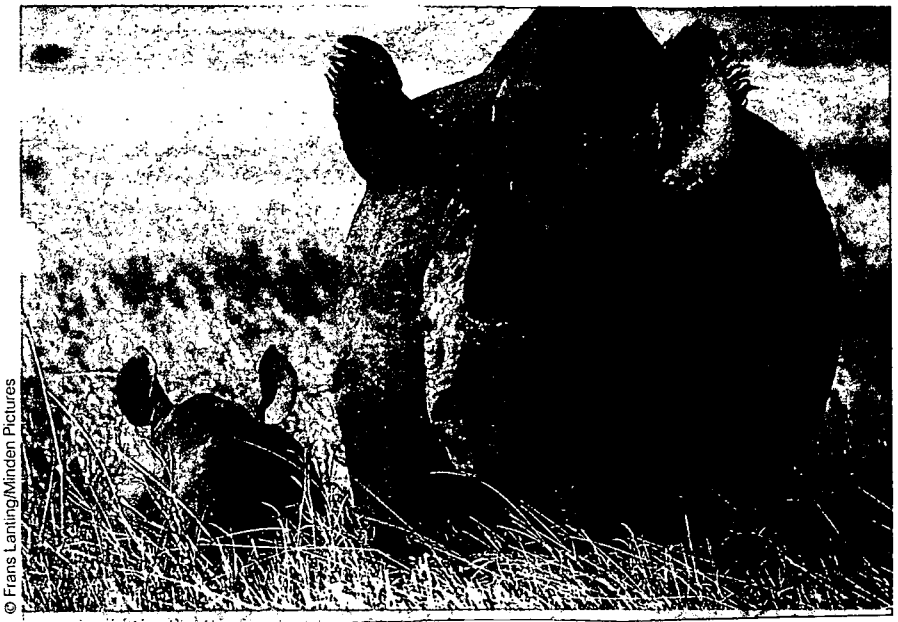
As interested as she is in how this information can contribute to forest conservation, Nadkarni admits there's another reason she likes to climb to rain forest canopies. "It's just so neat to be up there," she smiles.

Perched high in the treetops, Nadkarni sees butterflies, lizards, frogs, colorful birds, and other animals that are impossible to see from the ground. She's so wild about this magical world that she occasionally puts her young son, Gus, in a child pack and takes him along too.

Nadkarni has discovered new species of plants on her tropical tree climbs, and notes that the real excitement of her work is "exploring new ground." Then she adds with a laugh, "Or maybe I should say 'non-ground.'"

standard of living that many experts believe is not sustainable. (For more about sustainability, see "Lessons from Jungle Tombs" on pages 51-56.)

People in industrialized countries make up only a quarter of Earth's population—but they use three-quarters of its resources. People in the United States make up only 5 percent of Earth's population but generate at least a third of the planet's pollution.

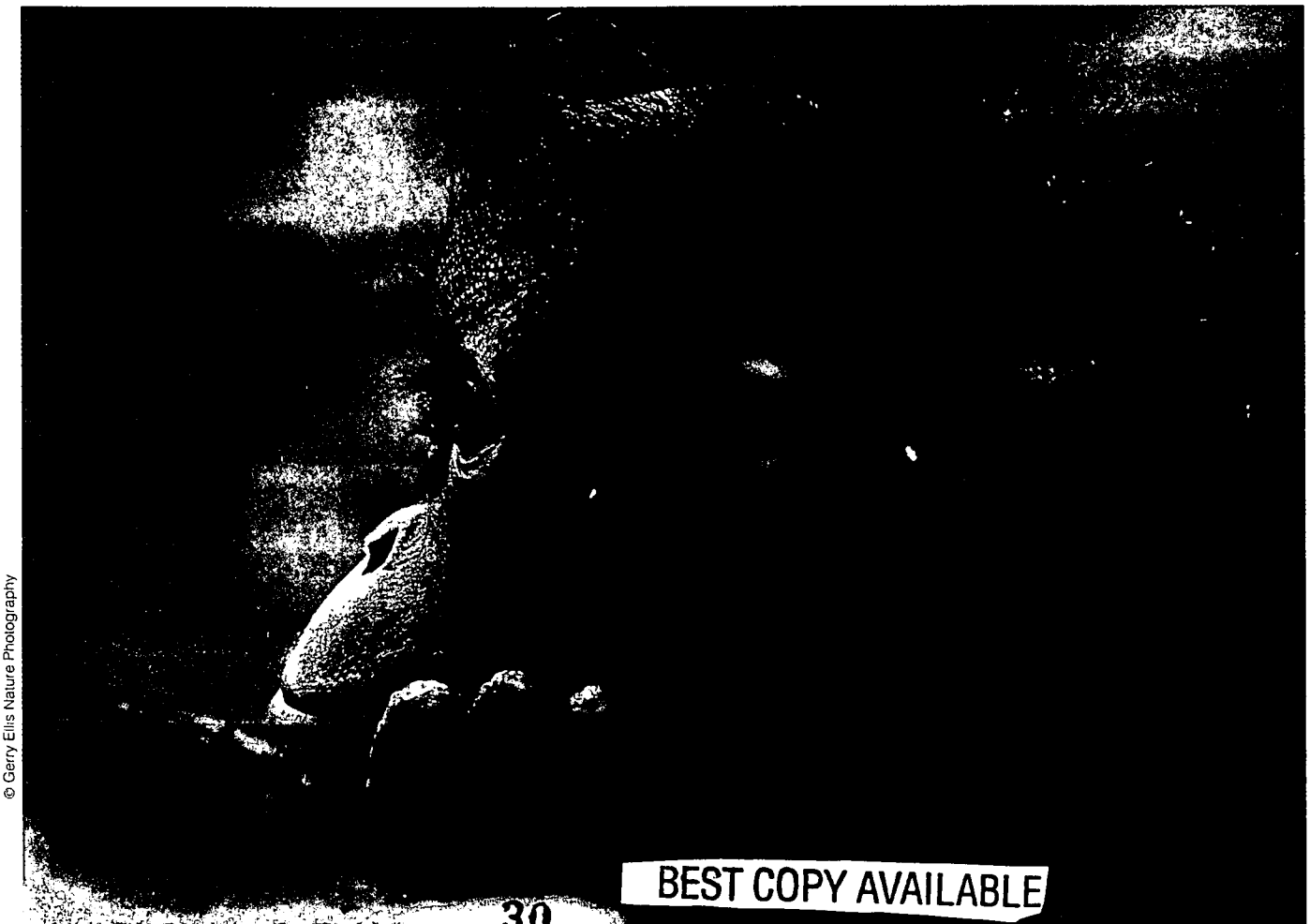


© Frans Lanting/Minden Pictures

Worldwide, trade in wildlife species—and products made from them—is worth at least five to eight billion dollars each year. This wildlife trade is pushing rhinos (above), tigers, and many other species to extinction.

The Big Picture

As if contemplating its future, this young orangutan (below) looks out on a forest home threatened by expanding human populations, logging, and other problems. To ensure the survival of species like orangutans and of the ecosystems where they live, we'll need to tackle all parts of the HIPPO Dilemma before it's too late.



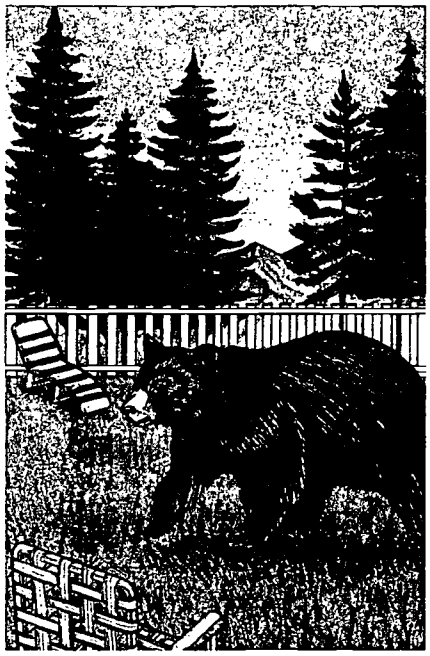
© Gerry Ellis Nature Photography

Bear in Mind

by Antonio B. Arroyo

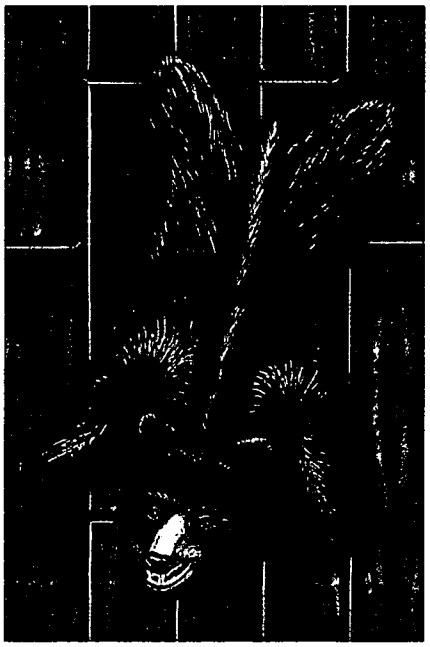
Suppose a black bear wandered through the backyards of a suburban neighborhood. Would everyone have the same response to this surprise visitor? Definitely not! According to Dr. Stephen Kellert, professor of social ecology, people respond to wild things and wild places in enormously different ways. Even two nature lovers can have very different reasons for wanting to protect the world around them.

Here are some of the ways people might react if they did see a bear through their window:



Wilderness Bearers

"Hey, look at that! There's a bear in our backyard! Do you realize how cool this is? It's like we're living in the wilderness now. This is better than watching a National Geographic special!"

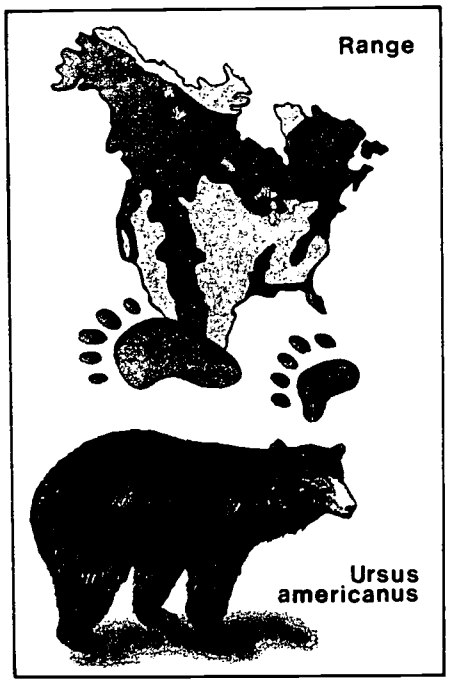


Bear Necessities

"Well, isn't that a tasty looking hunk of meat. That baby would feed the family for the whole winter. How I'd like to put that furry hide on my back when temperatures start dropping!"

Teddy Bear

"Look at that adorable little bear. Isn't he just the sweetest thing?! He reminds me of cousin Mike—I think I'd like to go out there and give him a great big bear hug!"



The Bear Bones

"There's a young *Ursus americanus* in the backyard. Isn't it wonderful? Note the shape of its face, the color of its fur, and its overall size. Hand me the binoculars—I'd like to observe it close up."

Beary Pretty

"My, what a beautiful creature is gracing our backyard! Its fur is so sleek. Its paws are so massive. We ought to get a photograph of it for the living room."

Unbearable

"Yikes!!! There's a vicious bear in the backyard! Quick! Hide the children! Get the dog in the house! Call the police!"

Bears aren't the only things that elicit such a range of responses from people. Think about a bee, for example. What would pop into *your* head if you saw one flying toward you? "There's my favorite honey-maker!" or "What a great buzz that little guy makes!" or maybe "Get that stinging thing out of here!"?

Even landscapes—such as a city block or a stretch of rain forest—affect different people in different ways. One person might find a city dynamic and exciting; another might find it noisy and stressful. One person might find delight in the lush life of the rain forest; another might find it strange and scary.

In short, attitudes toward living things reflect the incredible range of values and interests among people. As we consider the problem of biodiversity loss, it's important to remember that all of us see the issues from different perspectives. The challenge is to bring these different perspectives together and develop creative, workable solutions.

Illustrations by Mark Wickart

where the WILD

photos and text by Gerry Ellis

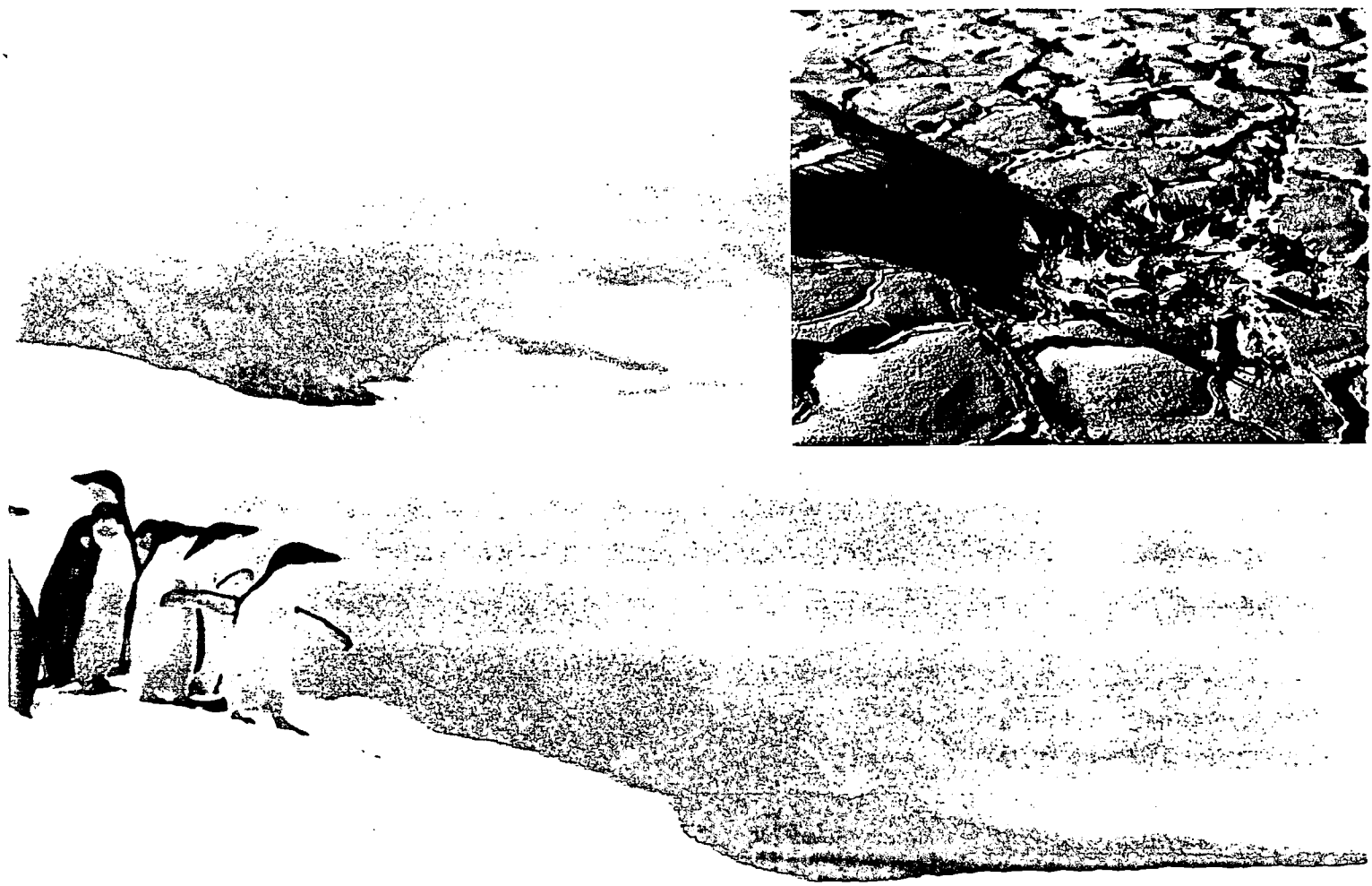
Snapping a perfect penguin portrait in the frigid reaches of Antarctica ... catching the first hint of sunlight as it streaks across a parched desert valley in Australia ... zooming in on the soulful eye of a mountain gorilla in Africa. As a wildlife photographer, I use my camera to capture the wonder and diversity of life—the beauty, the colors, the textures, the relationships. All species are tied together and to their physical environment in a thousand different ways, forming ecosystems as diverse as your imagination.

The images in this article are some of my favorites. As you look at each one, imagine what it would feel like to be there—to take in the wildness, to feel the breezes and hear the calls of wild creatures, to sense the rhythms of nature. And consider how lucky you are to be living on a planet so lush and alive.

© Harald Peeters

Photographer Gerry Ellis has been snapping pictures of wild places and faces—like this mountain gorilla in Rwanda—for more than 15 years. He hopes his pictures develop in people a deeper sense of appreciation for the tremendous diversity of life on Earth—and motivates them to take action to help preserve it.

things are



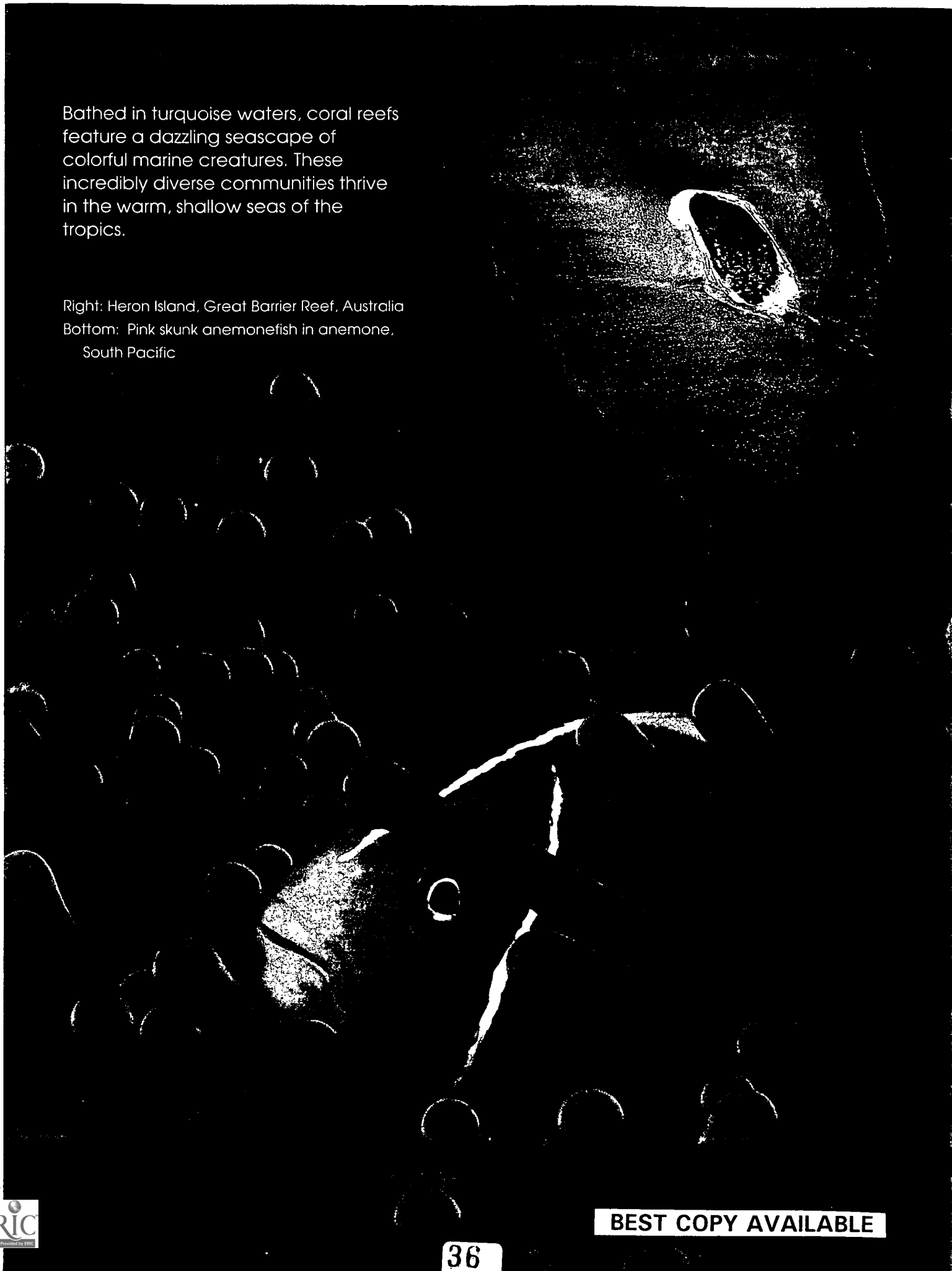
Full photo: Adelie penguins, Antarctica
Inset: Thorny devil, Australia

The African plains resound with the thundering hoofbeats of zebras, wildebeests, and other animals as they gallop across the dry land in search of water and grass. As the seasons change, many savannah creatures migrate vast distances in search of fresh food and water.

Top: African elephants, Africa
Left: Burchell's zebra, Africa
Inset: Kenyan sunset

Bathed in turquoise waters, coral reefs feature a dazzling seascape of colorful marine creatures. These incredibly diverse communities thrive in the warm, shallow seas of the tropics.

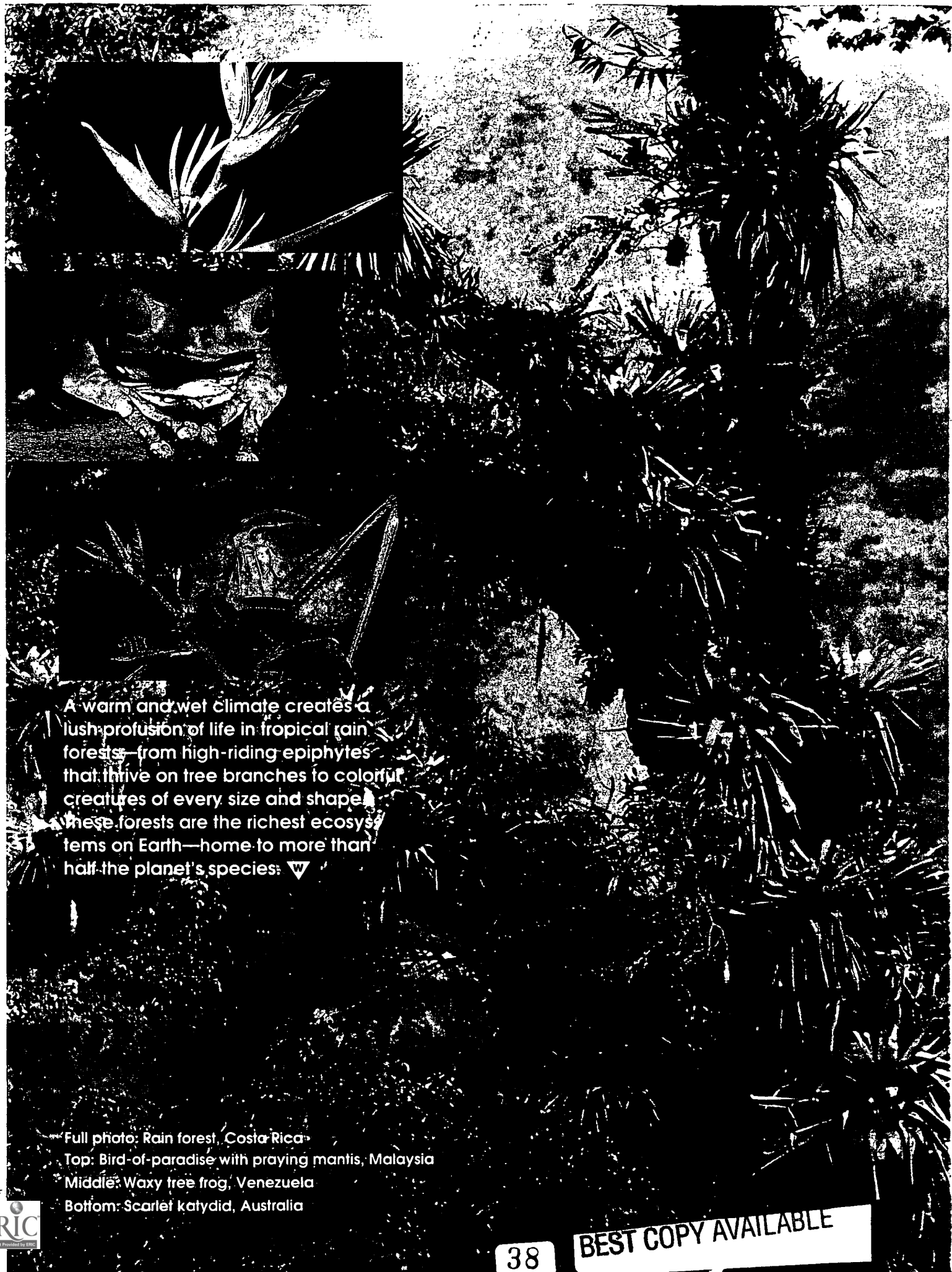
Right: Heron Island, Great Barrier Reef, Australia
Bottom: Pink skunk anemonefish in anemone, South Pacific



Along an island coast, this red mangrove tree looks as if it just walked into the water. Adapted to growing in salt-water, it can thrive where other trees can't. Egrets, fish, crabs, oysters, and many other creatures depend on these trees for food and shelter.

Acre for acre, there can be more life in a healthy wetland than in almost any other kind of habitat. Wetlands provide a variety of ecosystem services including flood control, water purification, and food and shelter for aquatic creatures.

Top: Red mangrove, U.S. Virgin Islands
Left: Great egret, United States
Inset: Skunk cabbage, United States



A warm and wet climate creates a lush profusion of life in tropical rain forests—from high-riding epiphytes that thrive on tree branches to colorful creatures of every size and shape. These forests are the richest ecosystems on Earth—home to more than half the planet's species.

Full photo: Rain forest, Costa Rica
Top: Bird-of-paradise with praying mantis, Malaysia
Middle: Waxy tree frog, Venezuela
Bottom: Scarlet katydid, Australia

CRUNCH

For every 100 pounds (45 kg) of people, there are 1000 pounds (450 kg) of termites.

The average American's energy use is roughly equivalent to that of 2 Japanese, 6 Mexicans, 12 Chinese, 33 Indians, 147 Bangladeshis, 281 Tanzanians, or 422 Ethiopians.

More than half the Earth's species are believed to live in the tropical rain forest. Fewer than 1500 scientists worldwide are trained to identify tropical organisms.

Over the past 50 years, the amount of pesticides used on crops in the United States has increased by 900%. Only 0.003% of all pesticides actually reach their target insects each year.

In just a pinch of soil, you might find 5000 different kinds of bacteria. And chances are many of them are unknown to science, because not even 5000 bacteria species have been identified and described worldwide!

Illustration by Stephen Bauer

Giant bluefin tuna, which are almost extinct from overfishing, can sell for as much as $60,000 per fish. A Porsche 968 coupe sells for approximately $40,000.

To survive, a single harpy eagle requires nearly 39 square miles (100 km^2) of rain forest. An eyelash mite spends its entire life in a person's eyelashes.

A single tree in a rain forest can be home to more than 1000 species of insects. Some scientists estimate an area of rain forest the size of a football field is cut down or burned every second.

There are about 650 species of birds in all of North America. There are about 850 species of birds in Costa Rica—a Central American country that's half the size of Tennessee.

Many experts think that human-caused damage to natural habitats results in a loss of between 10 and 1000 species every day.

Less than 5% of Earth's land surface is protected in national parks.

If you weighed all the animals in an acre (0.4 ha) of Brazilian rain forest, over 90% of the total weight would be invertebrates, and one-third of that would be termites and ants.

Scientists estimate that at one time oysters in the Chesapeake Bay could filter an amount of water equal to the total amount in the bay in just a few days. Today, with oyster populations at only 1% of their historic levels because of pollution and overfishing, it takes the oysters nearly a year to filter the same amount of water.

A coral reef can support close to 3000 species of fish and other marine life. Each year, poachers remove 1500 tons (1350 t) of coral to make jewelry and trinkets—that's more than the weight of 250 African elephants!

One-fourth of all prescription drugs used today were originally derived from plants. Only 5% of all plants have been studied for medicinal use.

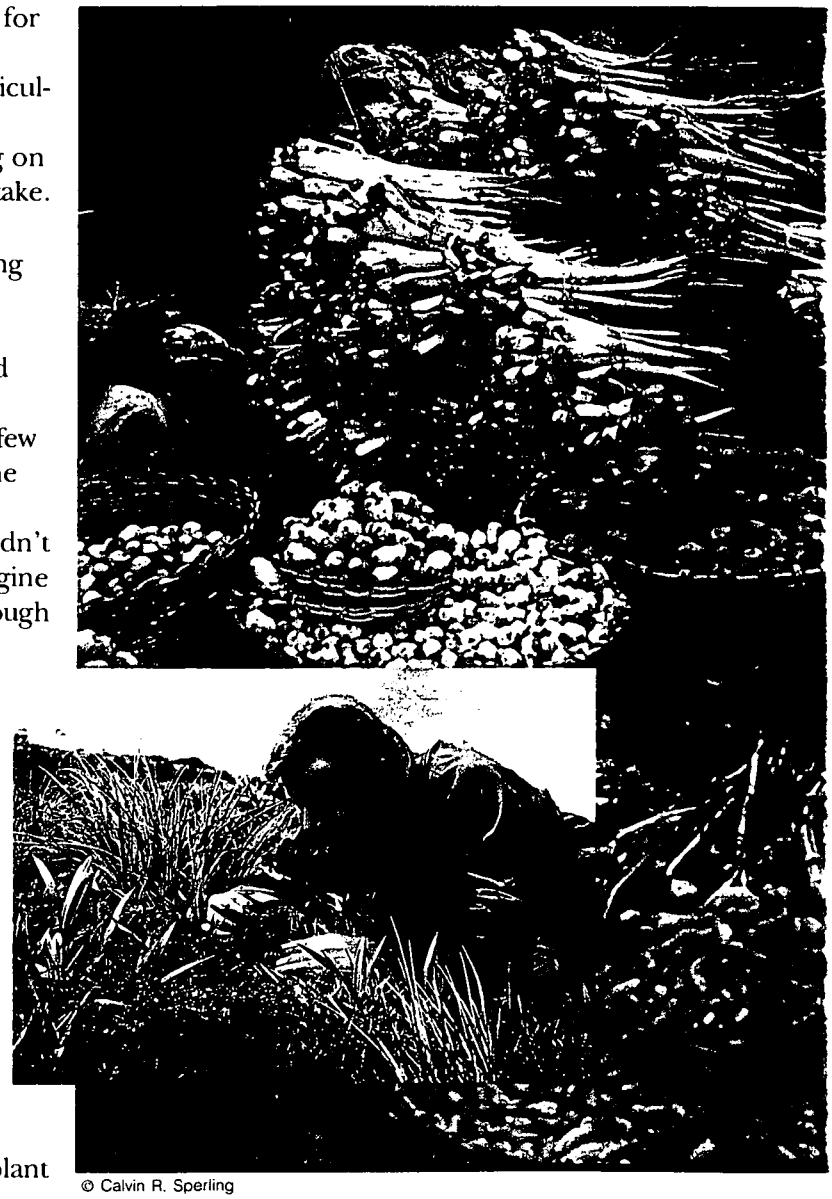
Raiders of the LOST

by Susan Milius

Calvin Sperling—a botanist for the U.S. Department of Agriculture's (USDA) Agricultural Research Service—wondered whether getting on the plane had been a mistake. His flight was supposed to be a quick hop over Ecuador's lowlands, but it had become something very different.

Thirty-two passengers plus luggage were crammed into an airplane built for 16. They had flown directly into a huge thunderstorm. Rain pounded the plane and lightning flashed every few seconds, followed by a huge clap of thunder. The pilot, blinded by dense clouds, couldn't see the ground, much less a landing strip. Sperling couldn't even see clouds because oil leaking from the engine had splattered his window. Water seeped in through cracks around the window and drizzled down the cabin walls. Passengers screamed as the craft dropped sharply and then jerked upward again. Every so often the copilot groped his way down the aisle, wringing out soggy rags he had stuffed into cracks to try to stop the leaks.

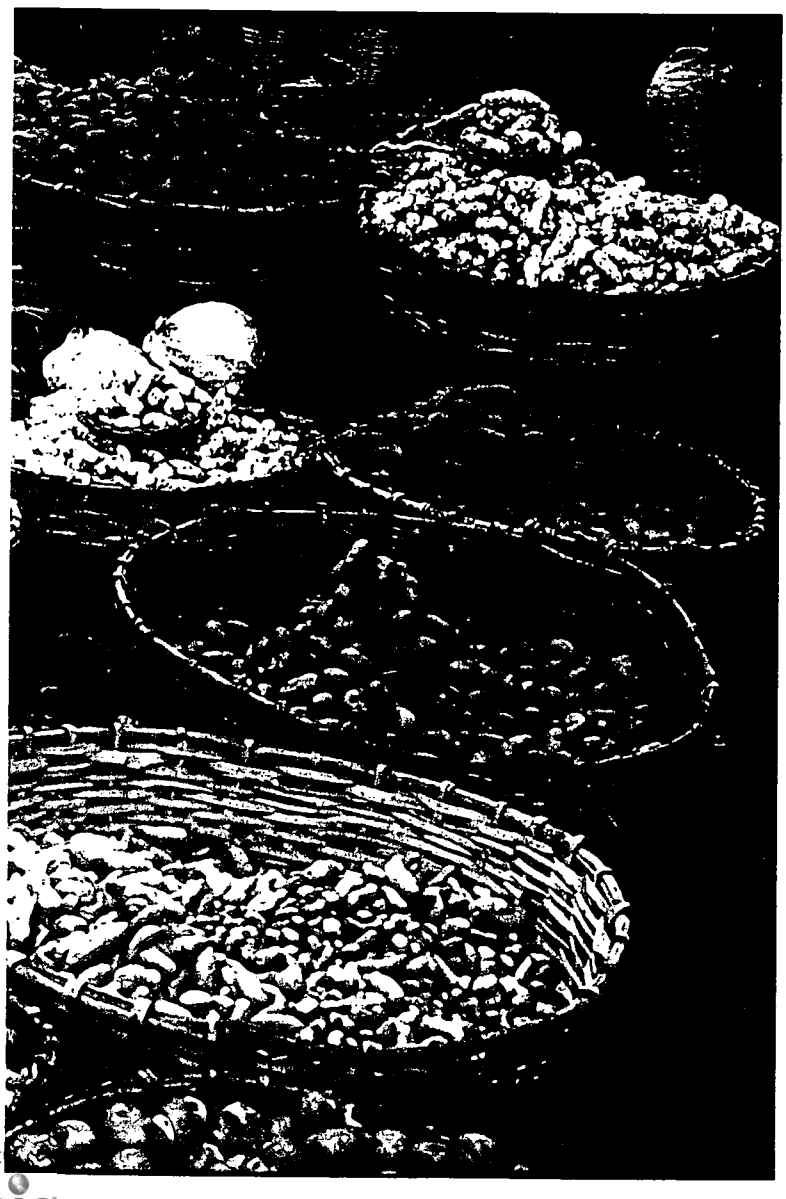
Finally a hole opened in the clouds, and the pilot caught a glimpse of the airport. A few minutes later the plane was safely on the runway. Sperling sighed with relief. He couldn't believe they'd made it.



© Calvin R. Sperling

Globetrotting Botanists

Dangerous air travel is just one of the hazards that botanists like Sperling face in their jobs. He is part of a small band of professional plant



hunters who search the globe for seeds and other plant samples that will end up in special collections called "gene banks." (See "Banking Plant Genes" on page 42.) Gene banks are treasure chests of biodiversity, where seeds and other plant parts are stored and then sent out to be tested for their potential to improve crops. Plant hunters are racing to save what remains of the planet's genetic heritage before growing human populations and other factors wipe it out.

Some people say Sperling is the Indiana Jones of the plant world—hacking through jungles on his quest for rare plants and maybe wrestling a poisonous snake or two along the way. But Sperling doesn't think of himself that way. He agrees that he and other plant hunters have brought back amazing treasures that would make Indiana Jones proud. For example, plant hunters on one trip in the Andes found a green-and-white streaked tomato that ended up being worth more than $8 million to commercial tomato paste makers. On another trip, they found the seeds for a type of wheat that's

In a colorful market in Colombia, Calvin Sperling (inset) found dozens of different kinds of potatoes and other crops. He and other botanists collect and study plants and seeds from around the world, making sure to gather only what they need and to leave behind enough plants to replace what they take.

worth an estimated $14 billion! But Sperling thinks he's like a lot of other people: just doing a job that needs to get done. Still, his job is anything but typical.

The Best Laid Plans

When scientists like Sperling want to collect plants, they can't just get up and go. Instead, they have to plan very carefully. They have to predict not only where the plants they want will be growing, but also when the plants will have ripe seeds.

Sometimes, no matter how careful scientists are, things don't work out the way they had planned. For example, on one trip Sperling managed to find a rare chickpea whose seeds he wanted. Unfortunately the plant was in flower and wouldn't go to seed for two months. Sperling couldn't very well camp beside the plant to wait, so he decided to look for seeds left over from the previous season. For several hours he carefully sifted through soil. Finally, he found one seed.

Safeguarding Food

Why go to such effort—and take so many risks—to collect and preserve odd plants like pink potatoes, white sunflowers, purple-skinned peanuts, and weedy things that only a botanist can identify? Simple. Those plants could provide us with new foods or other products. They might also have characteristics that scientists could transfer to existing crops, such as the ability to grow with less water, resistance to a disease, or the ability to grow faster.

Where the Genes Are

When Sperling and other U.S. botanists visit other countries to collect plants, their trips are arranged and carried out with the cooperation of the host country. All the material they collect is shared between the host country and the United States. And the material that's brought back to the United States ends up in gene banks. There it can be screened for beneficial traits and scientists can

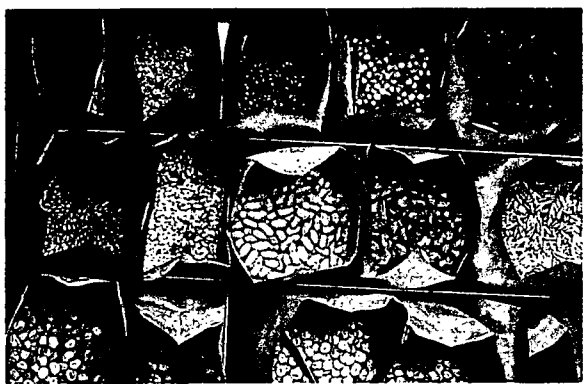
BANKING PLANT GENES

Step inside a USDA gene bank and you've stepped inside a "Fort Knox" of the plant world. These banks don't store money or gold—but they do store something equally precious: seeds and other plant parts. These plant parts contain the plants' genes—the codes that determine the plants' characteristics. Here's how scientists deal with their special treasure.

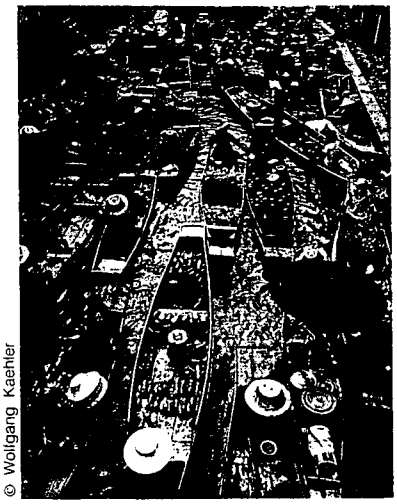
Seeds: To store seeds successfully for long periods of time, each gene bank has to keep the seeds alive, or viable. For most seeds that's easy to do: Scientists first dry them out, then store them in sealed packages in a cold room. The seeds "think" it's winter! Seeds can also be stored for much longer periods of time in the "deep freeze": Scientists store the seeds in liquid nitrogen at –321° F (–196° C)!

Whether put in cold storage or the deep freeze, seeds can't stay viable forever—eventually they have to be taken out and planted. Then scientists collect fresh seeds to put back into storage.

Protected by a face shield and thick gloves, this technician gets ready to preserve seeds in a vat of liquid nitrogen (left). Other seeds (below) are stored in separate bags in a room that stays between 41° F (5° C) and –4° F (–20° C).



Photographs: *Agricultural Research* magazine, USDA



© Wolfgang Kaehler

In this bustling market in Thailand, people and produce travel by boat.

try to breed those traits into crops. If plant researchers or breeders in the United States or in other countries need genetic material in the collections, the USDA sends it to them free of charge. And if a disaster strikes—like the corn disease described in the box on the right—scientists have plenty of material on hand to work with when searching for a solution.

The Whole Plant: Not all plants can be stored successfully as seeds. That's because some seeds, such as those from wild rice and many tropical crops, cannot survive cold storage. Other plants, including many fruit and nut trees, don't "breed true"—their seeds produce plants that are very different from the parent plant. To preserve these plants scientists save the whole plant. Then they use parts of these plants, such as cuttings or tubers, to clone new plants. The USDA has collections of whole plants at ten special centers across the country. One center in New York state, for example, grows 2,500 types of apples.

Bits and Pieces: All the information that's needed to create a particular plant is stored in each of the plant's cells. That means that scientists should be able to grow plants even if all they have is a leaf, a few grains of pollen, or even just a few cells from a plant. Growing a plant this way, though, is often very difficult. But scientists are trying to perfect ways of doing so. And they're developing ways to store these little bits of plants in gene banks.

NEAR DISASTER CHANGES CORN

In 1970 a plant pathologist in Florida found that a previously minor disease was ruining corn. This was as strange as if people started dying from the common cold. By the end of the year, this new deadly form of the disease had spread all the way to Texas and Minnesota and had destroyed a billion dollars worth of corn—about 15 percent of the total crop. Scientists discovered that one gene made plants prone to the disease and that 80 percent of the corn in the United States carried this gene. Within two or three years, a crash program had supplied farmers with seed without the gene. And the near disaster reemphasized the need for genetic diversity.

Down on the Farm

As scientists scour the world for plant material for gene banks, they aren't just looking for wild plants. They're also interested in collecting and saving plant varieties that people have cultivated for a long time. For example, people in Asia have traditionally grown thousands of different varieties of rice and farmers in Peru have grown dozens of kinds of potatoes. Saving "old" crop varieties is important for the same reasons as saving wild species: They usually have a lot of genetic diversity that people may be able to transfer to modern varieties.

But protecting those traditional varieties can be as difficult as preserving wild plants. That's because farmers often give up using traditional plant varieties when offered modern varieties that are more disease resistant or can produce higher yields. In Ecuador, for example, dozens of traditional food crops disappeared in one generation when farmers switched to new varieties.

Potatoes Aplenty

In many parts of the world, farmers still grow traditional crops. One such place is Peru. Stephen Brush, an anthropologist from the University of California at Davis, has found two valleys in Peru where the average family grows 12 kinds of potatoes. In those valleys, people grow purple-skinned potatoes with solid purple flesh, red-and-white potatoes, and potatoes covered with little knobs.

Brush found that about 50 percent of the potato

DOING MORE

Gene banks are important in the battle to save genetic diversity. But many people argue that the best way to preserve diversity is to save plants in their habitats. That's because no collection can save all the world's plants, and saving habitat also saves other species the plants depend on, such as pollinating insects and seed-dispersing birds.

Calvin Sperling agrees that protecting plants in their native habitats is important. He points out that setting up reserves can also be a more economical way to preserve plants. But he cautions that these reserves can only complement storing plants in gene banks—not completely replace them.

fields in one of those valleys were planted with modern white potatoes. But he also discovered that the farmers were still growing as many varieties of native potatoes as farmers in the other valley—they just had less acreage planted with native potatoes than the other farmers. This suggests that, in addition to scientists who collect and preserve traditional varieties of crops in gene banks, farmers can preserve traditional varieties right on the farm.

The Quest Continues

Although people are preserving crop diversity in some parts of the world, many "old" varieties and wild plants are disappearing fast. Will we have the material we need to make the crop improvements we want? Will we be able to head off the next plant disaster? No one knows for sure. But scientists like Sperling are rushing to collect and preserve seeds as fast as they can.

Career Profile

Dr. Eloy Rodriguez: Medicine Man

When chimp researcher Richard Wrangham saw a young chimpanzee eat the leaves of an *Aspilia* plant and then throw up a short time later, he wondered if the leaves might have made the animal sick. But when he saw that the chimp had thrown up a lot of parasites, he wondered if it had eaten the leaves to get rid of the parasites. He decided to contact someone who he knew could help solve the mystery: Dr. Eloy Rodriguez.

As a medicinal plant chemist, Rodriguez tracks down plants that can cure sickness and disease. The job requires quite a bit of detective work—from observing the behavior of wild animals to interviewing people in communities that have traditionally used natural medicines. Because rain forests boast so many diverse plant and animal species, Rodriguez spends several months a year in these areas hunting for medicinal knowledge.

Rodriguez collects samples of promising plants, then returns to his laboratory at the University of California at Irvine to analyze how the plants' chemicals affect various diseases. In the case of the *Aspilia,* he had Wrangham send him some samples and discovered that Wrangham's hunch was right: The chimp probably had eaten the *Aspilia* as a kind of medicine. In fact, Rodriguez found that the plant has the potential to attack viral infections as well as certain kinds of cancerous tumors.

© Dr. Eloy Rodriguez

By discovering the rain forest's hidden medicines, Rodriguez isn't just helping to save human lives. He's also helping to save the rain forest. "As people hear about new discoveries in the rain forest, I hope it will encourage them to work harder to protect these ecosystems," he says.

This article was adapted with permission from "Raiders of the Lost Potato" by Susan Milius, *International Wildlife,* March/April 1991, © National Wildlife Federation.

Miguel and Carmen would be there any minute. Simone hurried to put on her makeup and pull on her faded jeans just in time to run out the door and catch her ride to the mall. A bunch of her friends were meeting for pizza and a movie, and Simone's neighbors, Miguel and Carmen, were going to drop her off before their basketball game....

Wait a minute. What does this have to do with biodiversity? Everything! From makeup to basketballs to gasoline, the products we use every day link us in hundreds of ways to nature's incredible diversity.

What's more, whether you prefer jeans or stretch pants, basketball or soccer, lots of makeup or none at all, you have the power to make more than a fashion statement through the things you buy. By choosing certain products over others and deciding not to buy something, you can show your support for recycling, habitat protection, energy conservation, and other issues that affect all of us. And the more you know about the products you buy—such as where they come from, how they're made, and how they affect the environment—the more power you'll have as a consumer.

MALLING IT OVER

illustrations by Lisa Pomerantz

Banana Split

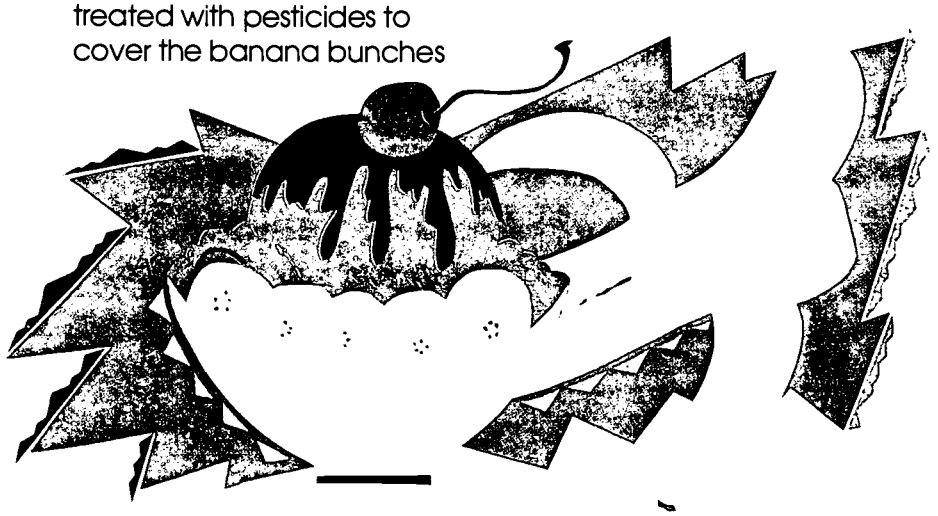
Every year the average American consumes more than 25 pounds (11 kg) of bananas! That's good for our health. But most bananas that make it to our supermarkets come with a hefty environmental cost. Bananas grow only in tropical countries—countries that are also home to threatened rain forests. Each year, people cut down more rain forests to make room for banana plantations. In addition, banana growers often use a lot of pesticides to fight the many pests that attack banana trees. And because people who buy bananas want "perfect" looking fruit, some growers end up throwing away bananas that are too small or too large or have tiny spots.

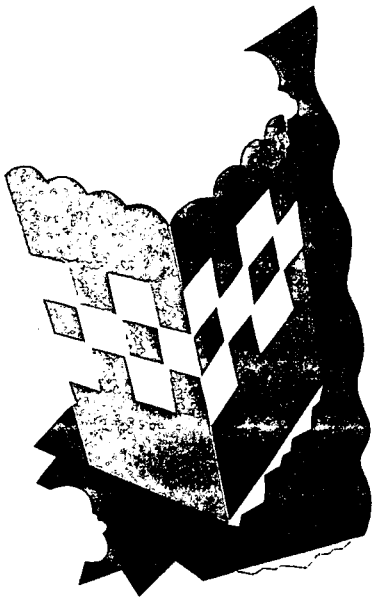
There's also another problem—plastic. Banana growers use plastic bags treated with pesticides to cover the banana bunches as they grow. During harvesting, the plastic is tossed away, ending up as trash that can pollute soils and streams.

Recently, though, some banana growers have turned to "eco-friendly" ways of producing bananas. They have stopped cutting down more rain forest, have reduced their use of pesticides, and are starting to recycle the plastic bags. And they are looking for ways to use the "small, large, and spotty" bananas for baby food and banana chips.

ECO-O.K.
Rainforest Alliance
APPROVED

Some banana growers have become so "green" that they've earned the "ECO-O.K." seal of approval from the Rainforest Alliance. ECO-O.K. bananas meet strict standards set by this environmental group and sport the bright sticker shown above. So far, only a few farms have earned the sticker, but the Alliance hopes the number will keep growing.





Pass the Popcorn

A movie just wouldn't be the same without popcorn. And life in general wouldn't be the same without corn. Corn not only gives us obvious corn products like popcorn and cornmeal, but also sweetens toothpaste, soda, and peanut butter. It thickens pies, binds magazines, and fries food. And its byproducts are ingredients in many other products such as glue, fireworks, ink, batteries, and paint. Besides the corn we grow in the United States, many varieties of wild corn grow throughout the world. Scientists are constantly searching for ways to improve our crops by incorporating genes from these wild populations into domestic corn. Preserving wild corn and the places where it grows may help preserve our own food supply.

Sweet Tooth

Believe it or not, the chocolate you eat is made from the seeds of cacao (ka-KOW) trees that grow in the tropics. The beans are roasted, ground up, and mixed with sugar and milk to make candy. Unlike many crops, cacao trees grow well under the shade of taller trees.

That's good news for rain forests. Instead of cutting forests to plant cacao, farmers can grow the trees under the shade of the rain forest canopy or commercial trees such as rubber or Brazil nut. Another plus for cacao is that farmers can grow a healthy crop without using as many pesticides or fertilizers as they do with other crops. And fewer chemicals help protect tropical soils. By the way, if you think you like chocolate, listen to this: The Aztec Indians valued their cacao beans so much that they used them as money!

Birds of a Feather

It's a long way from the rain forest to your local pet store. But thousands of wild parrots make the trip every year—illegally!

The wild pet trade is a serious problem for parrots and other threatened and endangered species. Although some parrots are bred in captivity, many wild-caught birds are still smuggled into the United States every year. And many of the captured birds don't survive the long trip from rain forest to pet store. Unless you can be absolutely sure that a parrot or other potential pet was raised in captivity, it's best to say "no" to wild pets.

Drug Store Diversity

From cancer drugs to antibiotics, we can thank biodiversity for many of the medicines that save our lives. In fact, 25 percent of all prescription medicines in the United States have active ingredients that were originally derived from plants. Other organisms also contribute to our national medicine chest. For example, some medicines used to reduce blood pressure come from the venom of snakes called pit vipers. Right now, scientists and local experts are literally racing against the chain saws to test plants in the rain forests for their potential in fighting diseases.

How Much Is Enough?

OK, you just had to buy that hot, new pair of shoes. But how many pairs of shoes do you need? How many CDs? How many clothes? How many videos? Americans buy more "stuff" than anyone else in the world. And all this stuff takes energy and resources to create. Do we need it all? How much is enough? What do you think?

Costly Karats

It glitters. It shines. And it can really mess up the environment... big time. It's gold—that shiny, yellow metal that you wear around your neck and dangle from your ears. Unfortunately, when people buy gold products, the price tag may not always include the environmental costs that come from mining.

Gold is mined using a variety of processes to remove impurities and help separate the gold from the surrounding rock. Cyanide is often used to extract the gold, and sulfuric acid is sometimes produced when the sulfur in the ore is exposed to air and water. Both of these substances can cause serious pollution problems, from contaminating the soil to poisoning fish. Although U.S. mining operations are regulated by government, some people believe the regulations are not strong enough and, in some cases, may not be adequately enforced.

Even more deadly are small-scale mining operations in some countries in Latin America, which use mercury to process the gold ore. Experts estimate that miners extract more than 30 tons (27t) of gold in the Amazon every year, releasing more than 100 tons (90t) of toxic mercury into the air and water. The mercury is so deadly that even a little bit can kill fish, birds, and people.

Some people think that you should buy gold that comes only from mining operations that meet regulations and take care of the land. Others say it's best to buy jewelry made from safer substitutes. What do you think? How would you find out about safer alternatives?

Malls Across America

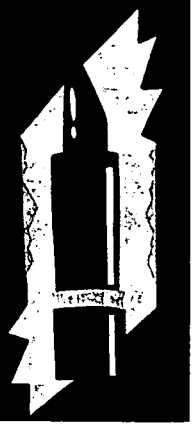
Malls are as American as apple pie. But are malls good for the environment? Do they benefit the community? Do they save energy? Space? Are they easy to get to by mass transit? Do they encourage recycling? How would you weigh the pros and cons?

Pizza Pizzazz

Mozzarella. Provolone. Goat cheese. To many people, the best pizzas have lots of cheese. Ever wondered why cheeses taste different from one another? The reason for this "cheesy" diversity is that each kind of cheese gets its flavor from a different bacteria or mold!

The Cosmetic Connection

Did you know the red color in some face powders, lipsticks, blushes, and eye makeup comes from the bodies of crushed insects? It's true! What's more, cocoa butter comes from the seeds of the cacao tree. And the luminous, translucent look of some eye shadows comes from ground-up fish scales!

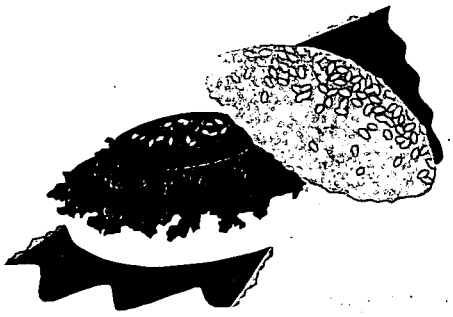


The Jeans Scene

Jeans. Flannel shirts. Towels. Socks. It's amazing how many different things are made out of cotton. The raw materials for all these fabrics come from cotton plants. But growing and processing cotton—dyeing it different colors, making it wrinkle-free, and so on—use a lot of chemicals. In fact, more pesticides and fertilizers are used for cotton than almost any other crop.

Because of our increased awareness of the dangers of pesticides and other chemicals, people are now developing ways to make cotton production less harmful. For example, a woman named Sally Fox has cultivated cotton that naturally grows in shades of brown, tan, and green. Her method eliminates the pollution and high energy required for manufacturing dyes and dyeing the fabric. And several companies now sell clothes made from her "FoxFibre" cotton.

A Large Order of Fries And 500 Gallons of Water—To Go



Believe it or not, it can take more than 500 gallons (1900 l) of water and five pounds (2.3 kg) of grain to make four quarter-pound hamburgers. And in some areas, the amount of water could be 2500 gallons (9500 l)! Seem like a lot? The fact is, producing beef is not the most efficient way to convert natural resources into protein for our diets. That's because it takes a lot of land, food, and water to raise a herd of cattle. And when you compare the resources it takes to produce beef versus other foods, you can see one reason why a "beefy" society like the United States uses so many of the Earth's resources. While chomping away on your next burger, consider the following:

- The average American consumes the equivalent of about 120 quarter-pounders every year.
- Over 70% of the grain produced in the United States is fed to livestock.
- Some experts estimate that it takes 40% more fossil fuels to make a pound of protein from beef than from soybeans.
- In some areas it can take as much as ten times more water to produce a pound of beef than a pound of wheat.

Besides using enormous amounts of water, grain, and energy, raising beef can cause other environmental problems. If not properly managed, too many cattle in too small an area can mean a loss of natural vegetation, packed-down soil, and lots of cow manure that can contaminate rivers and streams. And in some parts of the world, forests are being cleared to make way for more cattle ranches or to grow crops to feed cattle.

So should you stop your burger binges? Before you decide, it's important to think about all sides of the issue and do your homework. For example, many people are working to improve grazing practices and make beef production more eco-friendly. Some nutritionists say that lean beef can be a good source of protein in your diet. And lots of people earn their living by raising and selling beef.

Veggieburger or hamburger or both? It's a meaty dilemma, but only you can decide.

Recycled Soles

One person's trash is another person's...shoe?! That's right if you're talking about Deja shoes, which are made almost entirely out of recycled garbage. The shoes are made from old tires, wet suit manufacturing waste, magazines, reject coffee filters, polystyrene cups, milk jugs, and even soda bottles. For example, tire rubber is used to make more than 40 percent of the soles, and reject coffee filters and file folders are mixed into a paste and then dried to make the inner soles.

There are more and more companies like Deja Shoe, that are using recycled materials instead of virgin materials. Although recycled products often use less energy and resources, the recycled stamp doesn't automatically mean the products are great for the environment. It's always important to ask how products are manufactured, whether or not they can be recycled, and what happens when the products are thrown away. Many companies have consumer hotlines to answer your questions about their products.

Career Profiles

Suzanne Iudicello: Legal Eagle

Karen F. Elliott

Ever thought about hugging a halibut? How about cuddling a shark? According to Suzanne Iudicello (YOU-dih-CHELL-oh), general counsel for the Center for Marine Conservation (CMC) in Washington, D.C., it's tough to get people fired up about protecting fish because fish aren't exactly warm and fuzzy. So, her job involves conducting newspaper and broadcast interviews to boost the public image of sea life.

But that's just a small part of what keeps Iudicello on her toes each day in the nation's capital. As the top lawyer for CMC, she spends much of her time testifying before congressional committees that deal with ocean-related issues. She also meets with representatives of the fishing industry and works with conservation groups that share CMC's goals. Through all these means, Iudicello is determined to protect the health and diversity of the nation's oceans.

Iudicello has simple advice for students who might be thinking about an environmental career. "Get your dog or a friend and go for a walk in the woods or along a beach," she says. "There's nothing more inspiring for this kind of work than being outdoors!"

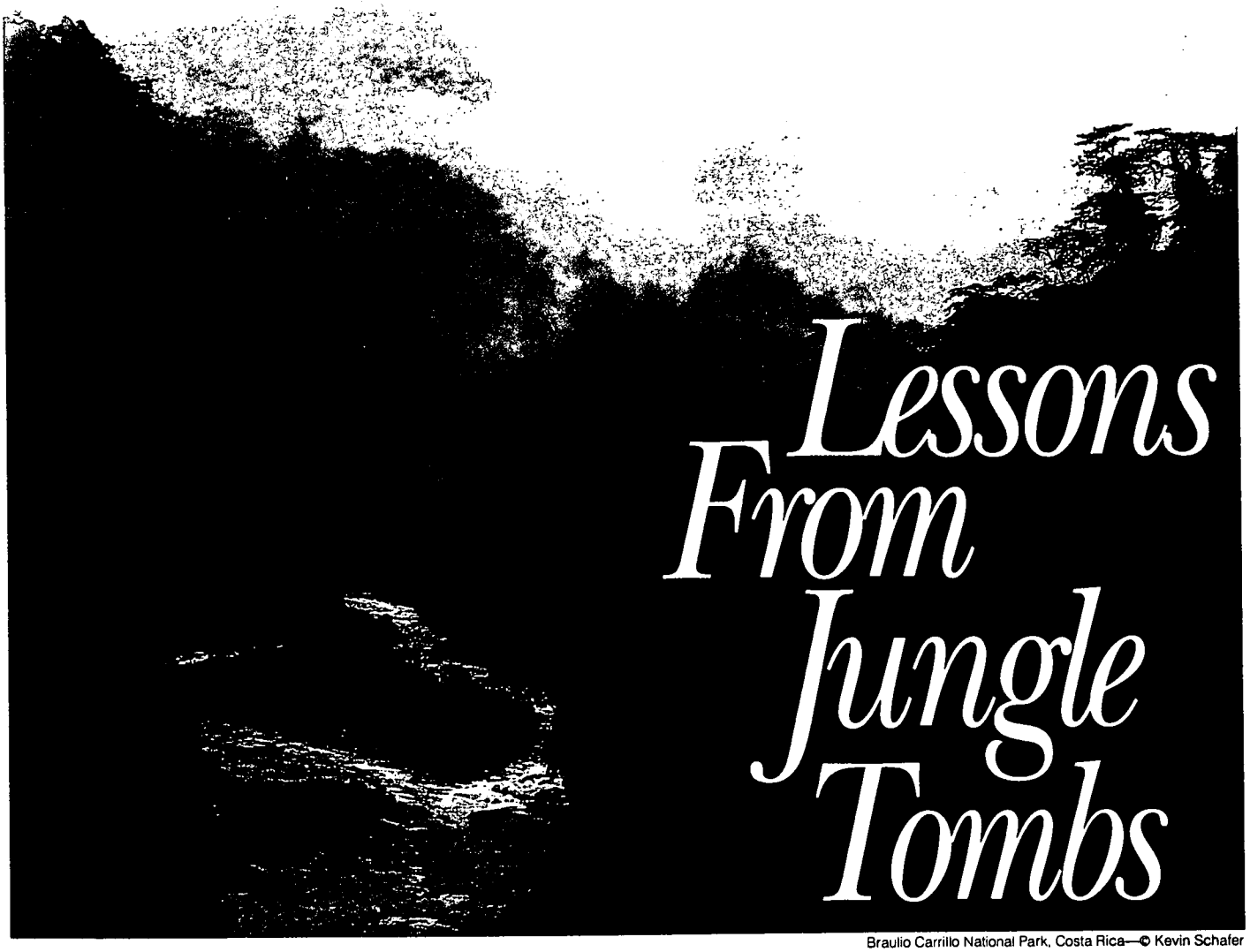
Dani Sjahalam: The Good Wood Man

"Green" products are turning up more and more these days. Consumers can buy everything from organic vegetables to recycled toilet paper. And it's business people like Dani Sjahalam (DAN-ee sah-HAH-lahm), vice president of Lynn-Nusantara Marketing Company in Oregon, who make "buying green" a real option.

© Gerry Ellis Nature Photography

Sjahalam sells "smart" rain forest wood products to furniture distributors and catalog companies in the United States and Canada. His products are made from trees grown in Indonesia, the country where he grew up. The trees are harvested in a way that minimizes disturbance to the forest. Because of that, the Rainforest Alliance, a U.S. conservation group, has given Sjahalam's products a "smart wood" label.

Sjahalam explains that his business gives him the chance to educate importers about the value of buying wood products that don't destroy rain forests. But best of all, Sjahalam and his company are showing other countries that they, too, can do the "smart" thing—profit from rain forests, while adopting techniques to minimize biodiversity loss.



Lessons From Jungle Tombs

Braulio Carrillo National Park, Costa Rica—© Kevin Schafer

by Chris Wille and Jonathan Adams

One thousand years ago the Maya people enjoyed a spectacular civilization in what is now Guatemala, Belize, and Mexico. The Maya built amazing temples and well-planned cities, roads, and sewer systems. They also studied astronomy, developed calendars, and played a game that was sort of a cross between soccer and basketball. (They played for keeps—the losing team was sometimes beheaded!)

They grew crops using clever irrigation systems, managed fish farms, and hunted wild pigs and turkeys. The population grew very quickly, until there were more people in this part of Latin America than there are today.

Then something happened. The entire civilization collapsed and disappeared. Archaeologists have spent decades sifting through Maya tombs to decipher their ancient language and to learn what wiped the Maya out.

Today these experts may be closer to solving the mystery. Many of them believe the Maya pushed their environment too hard: They cut the forests, which allowed soil erosion to eat away their farmland. They hunted game until it was too scarce to feed the growing population. Eventually, most of the people vanished, leaving behind

What Does Sustainable Mean?

A sustainable way of living is one in which people get what they need without diminishing the ability of other people, wild species, or future generations to survive. For example, a fishery is sustainable only if people limit the number of fish they catch, leaving enough fish to reproduce and maintain a healthy population.

vast empty cities that were soon covered by jungle.

Even though the Maya had developed complex farming systems, many experts feel that they couldn't continue to feed their growing population. It's very possible that they made too many demands on nature, causing their way of life to collapse. In short, the Maya civilization wasn't environmentally sustainable!

Now, ten centuries later, people around the world are facing some of the same problems that might have toppled the Maya. In many countries, forests are disappearing, water supplies are drying up, rich topsoil is eroding, and growing human populations are putting too much pressure on the environment. Despite lessons from history, we're having a difficult time recognizing our problems, facing up to them, and figuring out what it means to live in a sustainable way. In many parts of the world, we're using both renewable resources (such as trees, soil, and water) and nonrenewable resources (such as minerals and fossil fuels) faster than they can be replanted, replenished, or replaced with human-made substitutes or new technologies.

Building sustainable communities is going to take new thinking—about what we buy, how businesses are allowed to operate, how we trade with other nations, how much energy we use, how we get our food, and how we live our lives. On the next few pages, you'll see examples of ways people are already making some important changes. But this is just a start. We need a new generation of creative and committed thinkers to build a more sustainable society.

A DEAL WITH DUCKS

The people of Jocotal in El Salvador don't have much money, but fortunately they live near a small lake that provides plenty of fish and birds to eat. At one time, though, the birds were not very plentiful. But the people of Jocotal, working together with scientists from the capital city, San Salvador, came up with a plan to benefit people and wildlife.

For a long time, the people of Jocotal had hunted ducks, especially black-bellied whistling ducks. Unlike most ducks, which lay their eggs in reeds near water, whistlers nest in holes in trees.

Photographs: © Lynda Richardson

Whistling ducks and the villagers of Jocotal have a great partnership. The ducks get sturdy nesting boxes near the water, where they feed on water hyacinth and other aquatic plants. And the people get fresh duck eggs.

The Salvadorans had cut most of the nearby trees for firewood. Ducks that managed to escape the hunters had no place to nest. And by the mid-1970s, only about 500 whistlers were left.

Biologists and Jocotal village leaders studied the situation and devised a plan to help the birds recover: They made wooden nesting boxes and nailed them to the remaining trees. In the first year of the program, the villagers watched in satisfaction as 800 ducklings emerged from the nesting boxes.

Then the biologists made an important discovery. The duck hens were laying more eggs in each box than they could possibly hatch. Some boxes had more than 80 eggs, but even the most ambitious duck mom could care for only 25 or 30 eggs. The biologists thought the "excess" eggs could be an important source of food for the people of Jocotal.

The villagers hung up more nest boxes and began protecting the ducks from hunting. Special duck wardens began patrolling Jocotal to make sure nobody harmed the birds. Now, at certain times of the year, the wardens take the extra

eggs from each box and distribute them to the villagers.

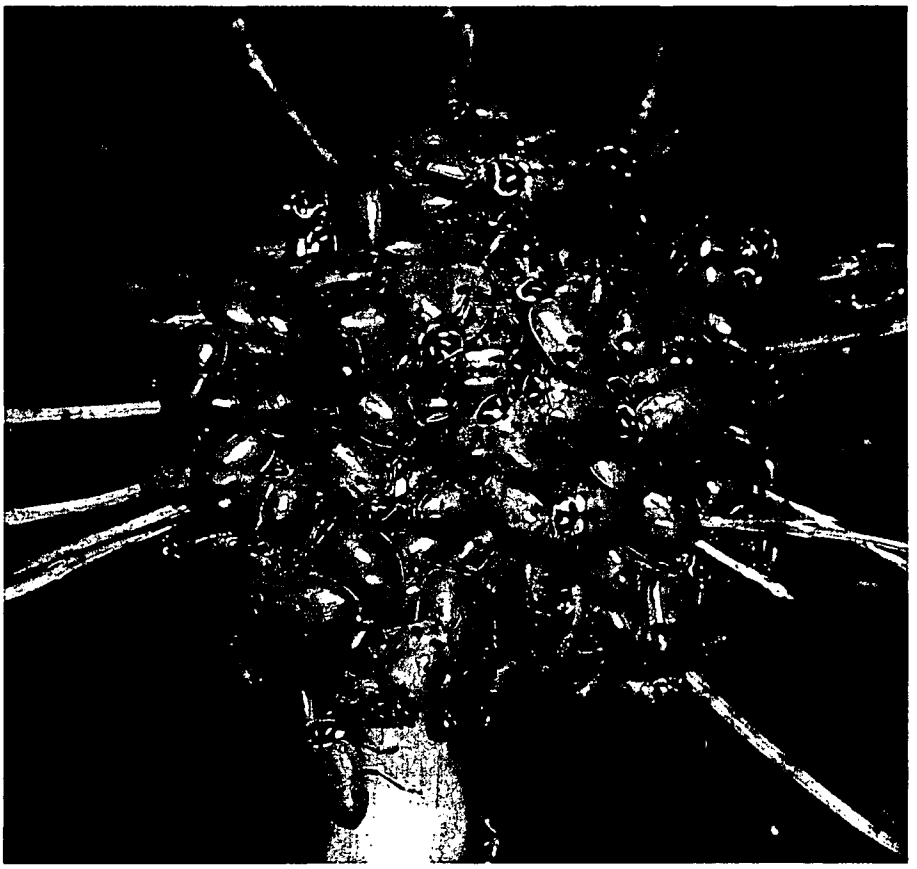
With almost 500 nesting boxes around the lake, the duck population has climbed to more than 15,000. And the people of Jocotal use eggs as a sustainable food source. That's a win-win deal for people and ducks.

FARMING FOR THE FUTURE

The Spray brothers in central Ohio haven't used pesticides on their 720-acre (288-ha) farm in 15 years. They don't need to. Instead of using chemicals to grow healthy crops, these creative farmers use a variety of safer alternatives. One of the most important things they do is to rotate their crops each season. For example, they might grow corn one year, clover the next, alfalfa the next, and broccoli the next. This crop rotation interrupts the natural life cycles of weeds, crop diseases, and insects and other pests. And because some crops add nitrogen to the soil, the rotation method helps keep the soil rich in nutrients. The Spray brothers also do hand weeding and use manure to enrich the soil. The results speak for themselves. They get good harvests, have limited problems with pests, and don't pollute the soil and water.

Thousands of miles to the west, the 1500-acre (600-ha) Pavich grape farm is also trying alternative farming techniques. The farm, located along the California-Arizona border, supplies about 1 percent of all grapes that are used to make table wines in the United States—and it does so without using weed-killing chemicals or tilling the land. The farmers cover the soil with a mulch made from leftover crops and manure. The mulch reduces soil erosion, holds in moisture, and acts as a natural fertilizer. And by not tilling the soil with heavy equipment, they protect it from erosion—and reduce energy and labor costs. Just like the Spray brothers' farm, Pavich grows great crops with no chemicals and fewer resources than traditional farming.

Eco-friendly farming is catching on across the country. From small co-ops to larger-scale farms, people are experimenting with sustainable agriculture. Although not all experiments work, we are learning how to feed more people without using as many pesticides and without destroying the soil's productivity. Many people are also using these techniques in smaller family gardens and schoolyard plots. And in many communities, consumers are pushing for safer practices by buying organic produce and refusing to buy products that don't meet environmental standards. ►



© Kevin Schafer

Ladybugs, like the ones clustered on this tree, can be a farmer's best friend. These beetles are natural predators and help control pests by eating them. And that means farmers don't have to use as many deadly chemicals.

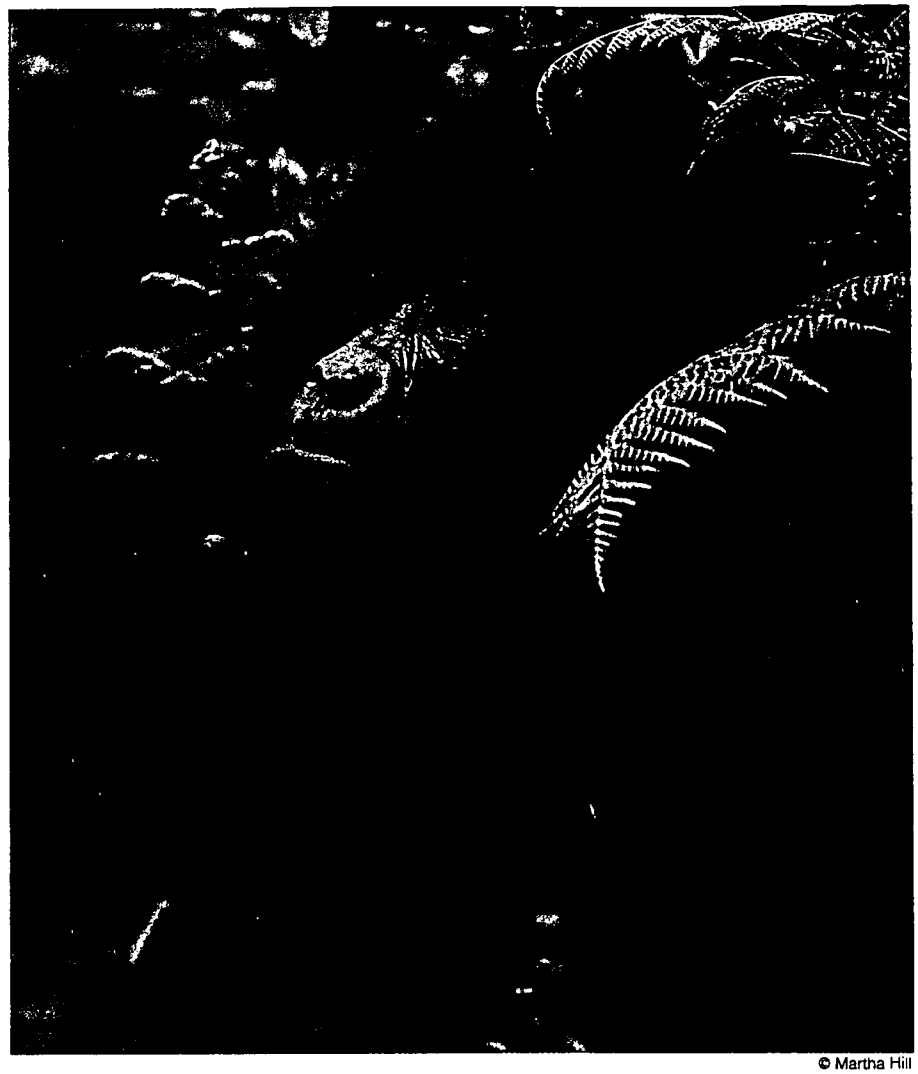
GORILLA COUNTRY

Tucked away in the heart of Africa lies the tiny nation of Rwanda—one of the most densely populated countries in the world. Nearly every hill and valley has been turned into farmland. With so many people, there's not much room left for the country's most magnificent wild creatures: mountain gorillas.

The International Gorilla Conservation Project (IGCP), sponsored by local and international conservation groups, was designed to protect the gorillas while also helping the Rwandans. Getting everyone together was the first step. Most Rwandans had never seen the gorillas. And farmers who lived near the gorillas were concerned mostly about protecting the forest to save their water supplies. The conservationists were worried that if people continued to put pressure on the park that had been established, the gorillas and their habitat would disappear.

After many discussions, the IGCP began to take shape. It was based on the assumption that if a tourist industry could be created, then more money would flow into the community. This money could help pay for protecting forests, gorillas, and water supplies. Because tourists pay for food, hotels, and guides, increased tourism would also mean more money for individuals. At the same time, an education program could help communities better understand why the park was important.

The park now raises hundreds of thousands of dollars every year from tourism. The money is used for everything from paying park guards to educating tourists and the public about water issues and conservation. For Rwanda, taking care of gorilla habitat means taking care of the local community.



© Martha Hill

Despite efforts to protect mountain gorillas, there are fewer than 650 of these primates left in the forests of Rwanda, Zaire, and Uganda.

MOUNTAIN OF MAJESTY

The country of Nepal in the Himalayas is the site of an innovative conservation project that links people and wildlife. In central Nepal is Annapurna, one of the tallest mountains on Earth. The land around Annapurna ranges from deserts to forests and supports a variety of species such as blue sheep, snow leopards, orchids, and bamboo. Five ethnic groups also live in the area.

Annapurna's striking beauty

© Galen Rowell

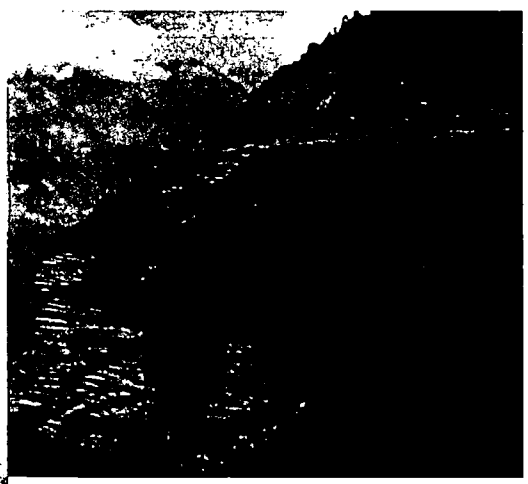
draws an increasing number of tourists every year. These people come to trek, or hike, through the Himalayas. Although trekkers bring badly needed money to the local economy, they need wood for campfires and cooking. And they have created a growing demand for milk and other dairy products. As a result, local people have cleared more and more forests to provide firewood for the tourists and pastures for milk-producing cows and yaks.

The government of Nepal, along with conservation organizations, has developed a plan to balance the needs of the local population, the tourists, and the environment. The plan, called the Annapurna Conservation Area Project, provides local people with the resources they need to care for their families. It also provides training to help them better manage the tourist industry.

The project was designed and put into practice by people who live in the area. One of their greatest successes was requiring trekking companies to use kerosene instead of wood for heating and cooking. Far fewer trees are now cut down, and that's saving more habitat for wildlife.

The Annapurna Conservation Area Project directly links the needs of wildlife with the needs of people. And that's critical to the success of any conservation project.

Trekkers come to Nepal from all around the world to climb the world's highest mountains. Local groups are working to educate the trekkers about how to take better care of the land when they visit.



MAYA IN MEXICO

© Chris Wille/Rainforest Alliance

Maya farmers in Mexico are developing sustainable farming practices to provide as much food as possible for the community without destroying the productivity of the land.

When their civilization collapsed a millenium ago, the surviving Maya scattered and lived in small groups. Today, the Maya population, along with that of other groups living in the area, is once again increasing rapidly. In southern Mexico and northern Guatemala, people are cutting and burning the forest—a technique known as "slash and burn" agriculture—to plant corn and beans. This method of agriculture can be sustainable if it's done on a small scale and if the land can lie fallow for at least 20 years between plantings. But it becomes a problem when too many people practice it in one area and don't allow enough time for the cleared land to regenerate.

Rosa Maria Vidal is working in Maya villages in southern Mexico near the Guatemalan border to help look for new solutions. She is a Mexican biologist and the president of an environmental group called Pronatura-Chiapas.

"We want to save the forest and

its wildlife," Vidal says. "And we want to help the people living in the highlands grow enough food to feed their families. They know slash-and-burn farming is not sustainable for the number of people we have, so we're helping them look for alternatives."

The Maya invite Pronatura specialists in farming and forestry to live in their villages and work side by side with them. The specialists learn ancient Maya secrets, such as how to use forest plants as medicine. In exchange, they teach farmers new ways to produce as much food as possible without destroying the land.

Other groups are also working with the Maya to find ways to make a living without harming the environment. One option is to harvest forest products without cutting down the trees. For example, some farmers gather sap from chicle trees for use in chewing gum. They also collect allspice (used in cooking), ornamental plants (such as orchids), and valuable sap from rubber trees—all in ways that don't harm the forests as much as slash-and-burn agriculture.

Both the Maya and the specialists who work with them understand that they have to work with nature to keep the system going. They know that people depend on productive soils, clean rivers, and healthy forests to survive.

"Help people. Conserve the forest. It's the same job," Vidal adds. "We need a healthy environment to guarantee the future of any village, city, or country."

Career Profile

Henri Nsanjama: Crafting Conservation Plans That Work

Cruising down the Okavango River in Botswana, Henri Nsanjama (N-sah-NJAH-mah) spots a crocodile slipping off the riverbank into the water. Nsanjama turns to the Batswanan guide standing behind him. "Tourists would pay thousands of dollars for a sight like that," he says, gesturing toward the creature.

Nsanjama, who is vice president of World Wildlife Fund's Africa/Madagascar program, grew up in Malawi. He had his first encounters with wildlife there as a boy on hunting trips with his grandfather. But over the years, Nsanjama began to notice that wildlife populations were dwindling while human populations kept growing and spreading. By the time he was 19, Nsanjama was so concerned about what he saw that he knew he would make wildlife conservation his life's work. He went on to study wildlife biology, resource economics, and environmental management.

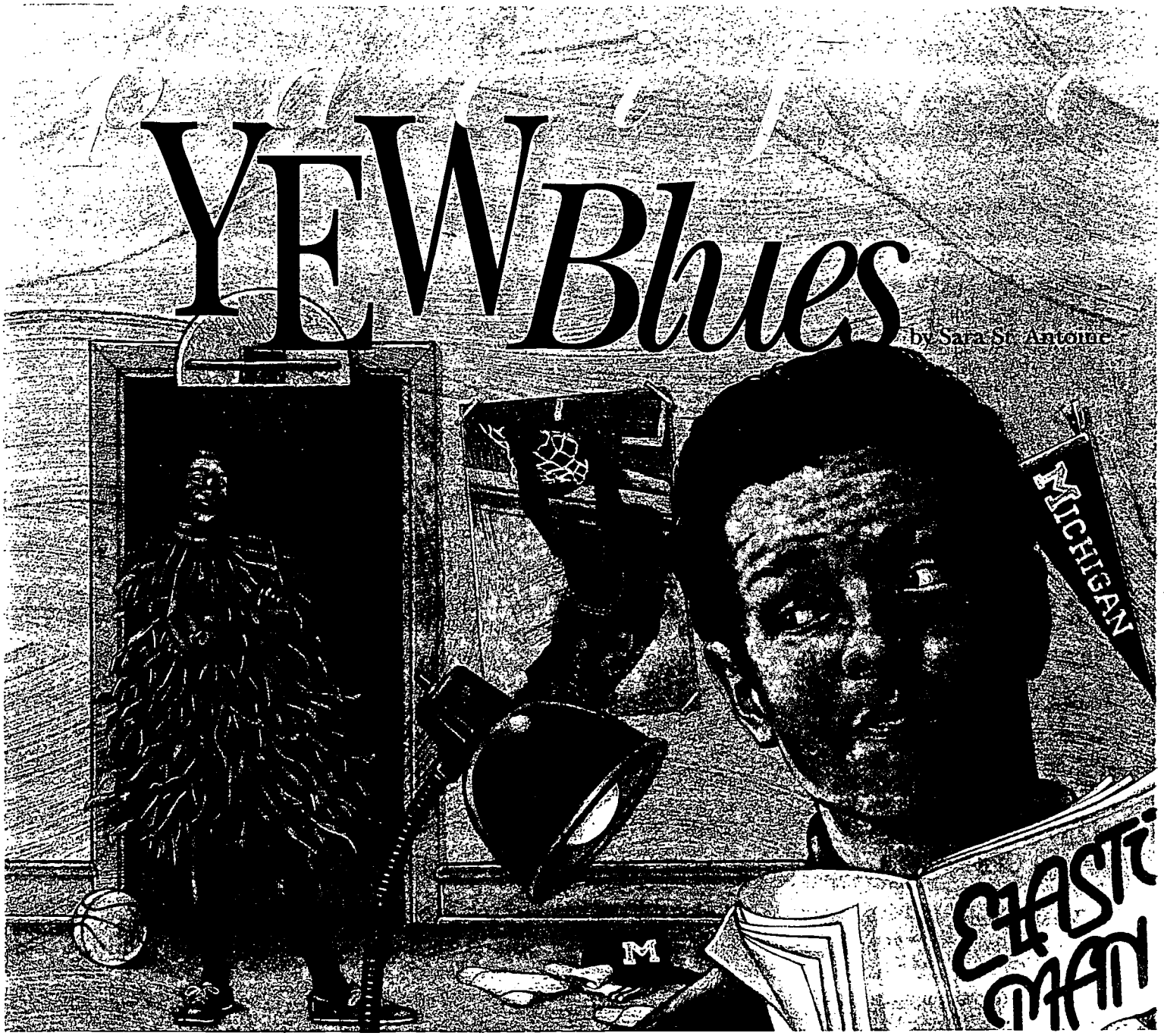
Today, the projects that Nsanjama oversees help protect rhinos in Cameroon, elephants in Zambia, giant lobelia plants in Uganda, and lemurs in Madagascar. All these projects are also designed to benefit local people. Nsanjama believes that the key to conserving African wildlife is to find ways for local communities to "have a stake in it." And wherever he travels—from wild rivers in Africa to his office in downtown Washington, D.C.—Nsanjama promotes the many benefits of wildlife conservation.

Nsanjama's work is demanding, but he doesn't doubt his career choice. "I don't think I could have done anything better with my life than this."

© Sam Simon

YEW Blues

by Sara St. Antoine



"Joe! Get down here! We're late for my show! Joe?"

Joe Cordova sat in his bedroom reading Elasto-Man comic books and pretending his sister, Elena, could be shrunk down smaller than her fifth grade self. Like maybe pea size. That way nobody would have to listen to her shouting. That way she'd be too small to organize environmental rallies and petitions too. And the next time she tried to get Joe to go to something like a Biodiversity Show, he could pick her up between his first and second fingers and place her gently inside his Detroit Tigers thermos. With the lid on. Out of everybody's way.

There was a gentle knock at the door and Joe's father poked his head into the room. "Time to go, son."

Joe closed his comic book and tried to give his dad a man-to-man look. "But, Dad, Michigan has a basketball game tonight," he said. "Can't I stay home and watch it?"

Mr. Cordova paused to consider. Joe knew basketball had been a good excuse. His father had graduated from the University of Michigan, and he had a soft spot for every Michigan sports team.

"Elena will be disappointed," his father said. "She's put a lot of energy into this show."

"Dad," Joe said in a steady voice. "I gave up tuna melts for dolphins, I rode my blue bike to save the blue whale, and I helped build a seven-foot African elephant out of old egg cartons. I've *shown* my support for Elena and her animal obsession. Can't I have a break? Just this once?"

Mr. Cordova chuckled. "It *should* be a good game," he agreed. "Be sure to do your geometry homework, OK?"

Joe grinned and nodded. When his father closed the

Illustrations by Randy Hamblin

door he leaped up, grabbed his foam basketball from the floor, and tossed it through the hoop over his doorway in a perfect swish. Life was sweet!

It was funny the way Elena managed to influence the family, especially since she was only in the fifth grade. But somehow she seemed like the mightiest voice in the Cordova household. Ever since she'd seen a movie about dolphins with her fourth grade class, she'd spent her spare time trying to save the world's plants and animals. Joe's friend Henry had told him not to worry. "In a few years she'll be more interested in two-legged creatures," he'd laughed. "She'll forget about dolphins—you'll see."

Joe wasn't so sure he could wait.

"Joe?" Elena walked in wearing a green costume that tapered away from her body in dozens of snake-like projections. Disappointment filled her face.

"What *are* you?" Joe asked. "An octopus?"

"I'm a Pacific yew tree," Elena said matter-of-factly. "They grow in the Northwest and they're very important. Doctors have used chemicals from their bark to make an anti-cancer drug."

"You look more like seaweed than a tree," Joe said.

"That's not funny, Joe," Elena said angrily. "What if the Pacific yew had gone extinct before people discovered its medical value? What if nobody had protected it once people found out how valuable the bark was?"

Joe grinned. "You mean it's possible we could 'yews' those trees up?!"

Elena rolled her eyes. "I can't believe you're skipping my Biodiversity Show."

Joe shrugged.

"I know, basketball," Elena said. "Fine. I guess you don't care that for the grand finale your little sister is going to get up in front of two hundred people and sing the first public performance of 'Pacific Yew Blues.' I bet you don't even care the world is losing its biodiversity. Do you?"

Joe didn't answer her at first. He was beginning to think it *would* be pretty funny to see his sister dressed like a green octopus singing a song about a tree. But he wasn't going to change his decision.

"I'm just not the nature lover you are, Elena. I've got much more important things to think about."

"Protecting biodiversity *is* important!" Elena insisted.

"Not to me," Joe said. "Break a leg, Sis. Or should I say, break a limb!"

Elena shook her head and trudged out into the hall.

Joe chuckled to himself. When he heard the car doors slam, he knew he had the house to himself. He grabbed his geometry book and headed downstairs. After making a bowl of popcorn, he plopped into his favorite chair and switched on the television with the remote control.

"This is the life," he sighed, munching on the popcorn.

It was an exciting game, with Michigan up 36-34 at the half. Having finished all but one geometry problem, Joe decided he'd earned the right to put down his pencil and pick up the remote for a little channel surfing. This was another advantage of having his family gone. Elena hated it when Joe zipped through the channels without stopping. "Wait! That was an old episode of 'Wild Kingdom!'" she'd cry. "Wait! An endangered whooping crane!"

"Big whoop," Joe would say, skipping on past rock videos and talk shows and old sitcoms.

This time, Joe found that skipping through the channels wasn't quite as much fun without Elena to torment. He paused to watch a few minutes of "Murder She Wrote" and even took a peek at a nature program on African elephants. Then, just as he was cruising past a rerun of "Cheers!" he heard a strange squishing sound coming from the kitchen.

"Elena? Mom? Dad?" he called uneasily.

No one answered. He heard the squishing noise again.

"Hey, who's in there?" Joe yelled, reaching for the phone. He knew he could always call the police if he needed some help. But then a strange figure appeared in the doorway, and Joe was too surprised to dial the phone. It was a man with gray hair and pale gray skin and a strange ability to stretch.

"Elasto-Man?" Joe asked in disbelief.

"I am the ghost of Elasto-Man," the figure explained. "I disappeared from the planet many decades ago."

"No way, man," Joe said. "I was just reading about you this afternoon. You were right in the middle of that battle with the Evil Wart Thing."

Elasto-Man shook his head. "Never mind. I've come to take you on a trip."

"Oh, sorry. Not tonight. I'm catching the game and ..."

"You have no choice," Elasto-Man said sternly. He grabbed Joe around the wrist, then oozed through a keyhole in the front door. He pulled Joe behind him.

"Hey, how'd you do that?" Joe asked. Then, looking around, he added, "Where are we, anyway?" There weren't any houses; instead, the full moon illuminated a small clearing surrounded by tall trees.

"We're in the past," Elasto-Man told him. "How do you like it?"

Joe didn't have time to question whether or not this was real because he was too busy looking around. Across the clearing he could see a small group of deer nibbling on something and raising their heads from time to time in the moonlight. Overhead—even with the full moon—he could see more stars than he'd ever seen from his house.

"Hey, how far back are we?" he asked. "It's gotta be before Nintendo was invented!"

Suddenly something large and dark appeared at the edge of the clearing. It moved along the trees quickly and almost silently. Joe squinted to see what it was.

"Whoa!" Joe exclaimed. "Is that a bear?"

Elasto-Man didn't answer. Instead, he tugged on Joe's arm and pulled him through a hole in the ground.

"I know where we're going now," Joe said. "The future, right?"

Elasto-Man nodded.

"Cool. Maybe I can find out what position I'll play when I go pro," Joe said with a grin.

The next thing Joe knew, they were standing on the street in his neighborhood.

"Wait, is this the future or the present? It doesn't look *that* different to me," Joe said. There were a few new houses on his street and the usual line of parked cars was missing, but otherwise it wasn't so different.

"Where are the power lines?" Elasto-Man asked crypti-

cally. He didn't give Joe a chance to answer, but pulled his wrist again, drawing him inside the door of the nearest house.

Inside what used to be Joe's house, a young boy was watching a baseball game on television. Elasto-Man explained that he couldn't see or hear them, so Joe could move about freely.

"Hey, he's watching the Detroit Tigers!" Joe announced.

"Look again, Joe."

Joe peered at the set. The score flashed on the screen and Joe burst out laughing. "The Detroit *Tires*?" he exclaimed. "What's the deal? Where are the Tigers?"

"Gone," Elasto-Man said somberly. "Extinct."

Joe stared at the TV. He thought about a tiger he'd seen on one of Elena's nature programs once and how awesome it had been. He *was* kind of sorry to find out they'd disappeared. "Well, that doesn't mean you can't say their name," Joe said out loud.

"It's been a while. People started feeling worse and worse about the fact there were no real tigers. They just decided to change the name."

"Hey, how are the Detroit Lions doing then?" asked Joe.

"You mean the Detroit Lightbulbs?"

"Oh."

"Next I suppose you're going to ask about the Michigan Polystyrenes?"

Joe rolled his eyes. "What kind of a name is that? Who's going to be intimidated by a squad of Styrofoam?"

Just then he noticed the kid watching television was eating something out of a bowl. "Hey, what's he eating? Chocolate-covered nuts?"

"It's imitation chocolate," Elasto-Man said. "With most of the rain forest gone now and many cacao tree plantations wiped out by disease, cacao trees are rare and real chocolate is too expensive for most people. So are cashews and Brazil nuts and ..."

"Hardly any rain forest?" Joe asked, thinking how upset the news would make Elena.

"Well ... a few pockets here and there, plus what's in the zoos," Elasto-Man explained. "Would you like to go visit the zoo's rain forest? They have fake waterfalls and plastic parrots, and they even have a stuffed sloth that ..."

"Thanks, but I'll skip it."

The more Joe walked around the house, the more changes he found. Elasto-Man told him how a series of terrible wars had broken out in many parts of the world over resources like water and forests. After the wars ended, people everywhere started working to protect biodiversity. But by then it was almost too late. Still, people had taken action that had saved quite a bit. Every house was now heated and cooled with some combination of solar, wind, and fusion energy, which meant a lot less habitat was being destroyed in the search for coal and oil.

There was a lot less pollution too. They'd cut consumption of just about everything. And human population growth was finally under control. But there were so few wild areas left now that people had to make reservations three years in advance to get into national parks. And people had only paintings, old photos, and nature recordings to remind them of how some animals had looked and sounded.

"Well, at least people still have you to keep them laughing," Joe said, forcing a grin. This future world was beginning to make him uneasy.

Elasto-Man shook his head. "I told you before, Joe. I'm a ghost. With most of the rain forest gone, real rubber—the super-stretchy stuff I was made of—is gone too. But there are new comic book characters now, like Techno-Man and his enemy the Rad-Waste Beast. Besides, this kid watching the game doesn't care about—doesn't even really realize—what's missing. And neither do most other people. They grew up in this world—this is what's normal."

"What?!" cried Joe. "Half the stuff they eat is fake and about all they ever see is people. Every place is either a city or a park they can't get into for years!" He was beginning to feel a little hysterical. "How could they just let all that life go? Didn't people care what they were doing? Didn't people think about protecting ... what's Elena's word ... BIODIVERSITY?!"

Elasto-Man shrugged. "Like I said, they thought about it too late for a lot of things. Most people just didn't understand biodiversity and how it related to their own lives."

"And I've been telling her it's all a waste of time!" Then Joe had a new thought. "Elasto-Man, aren't I supposed to get back to the present now?"

Elasto-Man nodded.

"Well let's go." said Joe impatiently. "I want to get back to my living room. Can you do it?"

Joe didn't even hear an answer. Something had made him squeeze his eyes closed, and when he opened them, he was sitting on his living room chair with his geometry book in his lap. Michigan was ahead by six points and a half-eaten bowl of popcorn sat beside him.

He jumped up and checked the clock. Eight thirty-three.

"Cool!" he exclaimed as he grabbed his jacket off the chair. If he ran, he might still catch the world debut of "Pacific Yew Blues."

BIO-BEAT

by Cin[illegible]n Cleef

Bad news about the world got you down in the dumps? Are you ticked off about toxic waste? Exasperated by extinction? Indignant about indifference? Do you feel like everyone else is screwing up the world and there's nothing you can do about it? Well, read on. Here are some individuals and groups out to prove that each one of us can help preserve biodiversity. From purchasing acres of rain forest to producing music videos, they're tackling projects that are making a real difference.

MAKING BEAUTIFUL MUSIC

Seattle, Washington: Imagine having to audition to help out the environment! That was the first step for dozens of prospective "Ecosounders." "Ecosound" uses music to raise awareness about the environment. The organizers, led by a local county councilman and a representative from Seattle's Office for Education, held citywide auditions for singers, dancers, and musicians. The 100 talented winners then went through environmental "training" so they were up to speed on a variety of environmental issues. They toured a local hatchery, a tree farm, a landfill, a sewage treatment plant, and an urban toxic dump. They also listened to presentations on a variety of environmental topics. Afterward, they worked for months to write their own environmental songs—in every style from rap to soul—and they choreographed dances to go with each one. Finally, they put everything together to create a music video. The "Ecosound" package, including a curriculum guide, will be distributed to all schools in the Seattle area.

© Brian Hallett

Raysard Jones, an Ecosound rap artist and dancer, says the video can definitely change the way people view the environment. "People really feel different after they've seen it. Still, we need to reach a whole lot of people all over the world. If everybody would get into it, change would happen more and more." ►

In addition to creating the video, the Ecosounders are starting to change things right at home by encouraging urban residents to take part in the city's Adopt-a-Street program. Participants in Adopt-a-Street plant trees and gardens, paint storm drains to reduce toxic dumping, and help with other activities designed to improve the environment in their own neighborhoods.

RAGS TO RAIN FORESTS

© John Maniaci/*Wisconsin Rapids Daily Tribune*

Wisconsin Rapids, Wisconsin: Like many people around the world, students at Lincoln High School were looking for a way they could help save tropical rain forests. They found the answer right at home—in their closets. As a way to raise funds to help preserve rain forests, the students collected more than 2500 pounds (1125 kg) of clothing and donated it to a store that resells the clothes. Half of the proceeds from sales will go to protect rain forests around the world. As organizer Jeremy Marmes said, "We had a lot of fun doing it. Each homeroom tried to get the most clothing, and the winning one had a pizza party. We never thought we'd be able collect so much!"

The Lincoln High group is a chapter of Save the Rainforest (STR), an organization started in 1988. Today, 30,000 schools nationwide participate in STR programs. Each school decides its own way of raising funds, from holding bake sales to designing and selling T-shirts and postcards. And if they want, schools can decide to send their funds to a specific rain forest program.

Altogether, schools involved in STR have raised more than $400,000 nationwide! The project has also inspired some students to attend summer programs in Latin America to see rain forests for themselves.

FROM INDIANA TO INDONESIA

Fort Wayne, Indiana: To Earl Wells, it seemed obvious: Zoos have to do more than house endangered species—they also have to find a way to protect wild species' habitat. As director of the Fort Wayne Children's Zoo, Wells convinced the zoo to donate one year's profits from its gift shop to the island of Mentawai in Indonesia, where a U.S. scientist was leading an effort to preserve the island's rain forests. Then Wells turned to schools in the area to help raise additional funds and to educate the general public about why this effort was important.

Thousands of students responded by participating in a variety of activities, from selling ice cream cones to holding dances to recycling aluminum. At Lane Middle School, students turned their hallway into a rain forest to help teach others why it's important to save these unique habitats. They also raised more than $400 to help set aside land in Mentawai.

In the end, all the schools involved raised more than $14,000! Their effort accomplished more than raising money: All the publicity convinced the Indonesian government to outlaw further logging in the forests on Mentawai. And because logging is the greatest threat to these habitats, things are looking up for this fragile forest ecosystem.

HABITATS CLOSE TO HOME

Halifax, Massachusetts: Preserving biodiversity doesn't begin and end with tropical rain forests—it's also important to save habitats you see every day. According to eighth grader Ryan McCary, "I'm going to live in Halifax most of my life, and I don't want to see it polluted." Ryan is part of the Halifax chapter of Kids for Saving Earth (KSE). For six months, members of the environmental club met after school and on Saturdays to study Monponsett Pond and the waterways that feed it. "I thought taking water samples would be boring," commented John Mather, "but I really liked it. It has really changed the way I look at nature."

As one measure of biodiversity in their local pond, club members studied insect life. They discovered that the streams feeding the pond are healthy—so pollution problems in the pond must be coming from other sources. "I expected the water in the streams to be a lot more polluted than it actually was," noted Gretchen Snoeyenbos.

KSE members also interviewed older people in the community and studied the area's history. KSE found that Monponsett Pond has been an important resource for people for hundreds of years. Then they put together and published a book on the history of the pond. The work they did was so impressive that they were invited to present their book and findings during a special meeting at the United Nations. Their work also convinced their congressman, Barney Frank, to promise to make preserving Monponsett Pond a priority. And they used the money they raised from selling the book to buy infrared pictures of the area, which the town is using to protect wetlands.

The Halifax club isn't stopping there, though. They're expanding their studies to the nearby Winnetuxet River, and they're helping the Massachusetts Audubon Society count all amphibians and reptiles, or "herps," found in Massachusetts. The KSE members are responsible for counting all the herps in one quadrant of the state, which includes the area around the Winnetuxet. After that, they'll search for other ways to safeguard their local environment.

ENERGY SAVERS

San Diego, California: Did you know that teenagers use about 80 percent of the energy in the average household? But around San Diego, that number may be dropping, thanks to students at Memorial Academy.

After ninth graders at Memorial learned about energy in their science class, they decided to take some conservation action. They formed the Energy Club and started a schoolwide recycling program. They collected and recycled over a ton of paper—saving energy by saving resources.

But that wasn't enough for this energetic bunch. The students, who speak both Spanish and English, next decided to spread the word about energy issues by teaching two Spanish-speaking fifth grade classes at a nearby school. "It was scary to be up in front teaching," one student admitted. "But it was great when they remembered what we had told them."

To cap off the project, the group designed an energy fair filled with educational games and exhibits. The fifth grade students spent the day looking at exhibits and playing energy bingo and other games. Students from Tijuana, Mexico, also participated in the fair, making it an international event.

The Energy Club's "teachers" helped their fifth grade students understand the connection between energy and other environmental issues. The students found out that by reducing the amount of energy they use, they can cut down on pollution and reduce the pressures to develop wild places. Saving energy, saving resources, saving wildlife. That's what Memorial Academy's Energy Club is all about. ►

Memorial Academy Energy Club

TURTLES IN TROUBLE

Barrington, Rhode Island: It was a trip to Central America that inspired Kate McCalmont to single-handedly take on an effort to save an endangered species in her own home town. On a family vacation in Costa Rica, Kate watched endangered olive ridley sea turtles crawling onto a beach to lay their eggs, then later saw the hatchlings make their way out to sea. Returning to Rhode Island, Kate contacted local biologists to find out about turtles native to her area. They told her about the diamondback terrapin, an endangered species that, in Rhode Island, is found only in Hundred Acre Cove near Kate's hometown of Barrington.

© Peter McCalmont

Kate then organized an exhibit to tell people in the community about the terrapin. She put together a huge display with posters telling about the endangered diamondback terrapin and its connection to the threatened Runnins River. The exhibit included a map showing the terrapin's nesting ground in Hundred Acre Cove and all the sources of pollution along the Runnins River, which empties into the cove. Kate presented the exhibit at other schools and to teachers who had gathered at the University of Connecticut for a special conference. She also exhibited it in the local library. She circulated petitions in local schools, then convinced the town council to declare the troubled terrapin to be Barrington's official town animal. And Kate designed and sold a Protect-the-Terrapin T-shirt to raise money. Altogether Kate raised more than $500 to donate to the local Barrington Land Trust, which has established a special terrapin research fund.

Kate's efforts have made a real difference for the diamondback terrapin. "A lot of people didn't even know that the turtle existed until I did my project," she says. By working to curb pollution of the Runnins River, she's continuing her efforts to try and save the turtle. She advises other conservationists to focus on a variety of projects to get their message across. "Anyone can help save the environment if they want to. They just have to do lots of different things to help make other people aware of the problems and to motivate them to get involved."

THE BROOK TROUT BUNCH

Hopatcong, New Jersey: For students at Hopatcong Middle School, a class project turned into a statewide campaign to save the brook trout. In class, students learned that the fish is a threatened species in New Jersey and that numbers of these fish have been decreasing in the state because of habitat destruction. They also discovered that the fish is extremely sensitive to changes in

© Maryellen Soriano

environmental quality and that its plight indicates an increasing danger to other aquatic species. These students decided to do something about it.

They joined other students in New Jersey in petitioning lawmakers to name the brook trout as the state fish. They wrote letters to their state representatives and senators. They also wrote to the governor. When the law finally passed, the governor made a special trip to Hopatcong Middle School to sign the bill.

But students at Hopatcong didn't stop working to help the trout once it had become the state fish. Instead, they formed their own after-school group called the Brook Trout Bunch (BTB). Then they put together exhibits and participated in other activities to make the public aware of the threatened fish and to encourage people to do things to protect its habitat. And with the help of a local chapter of Trout Unlimited, a conservation group, they started Project H.A.T.C.H.

Using a 55-gallon (209 l) aquarium that they placed in the classroom of their club leader, Maryellen Soriano, the BTB members raise trout from eggs. Each spring, members clean up a local stream, then release the hatchlings they've raised. For BTB member Becca Caruso, "That's the part I like best—setting the trout free and helping to restock these fish in the wild."

Are you looking for ways to get involved in helping to preserve biodiversity? Here are some national organizations you might want to contact as well as some ideas for getting involved locally.

On the national level:

- Children's Alliance for the Protection of the Environment, Inc. (CAPE), P.O. Box 307, Austin, TX 78767.
- Earth Force, 1501 Wilson Blvd., Twelfth Floor, Arlington, VA 22209.
- Izaak Walton League, 1401 Wilson Blvd., Level B, Arlington, VA 22209. (Address your letters to the stream monitoring program called Save Our Streams.)
- Kids Against Pollution, P.O. Box 775, High St., Closter, NJ 07624.
- Kids F.A.C.E., P.O. Box 158254, Nashville, TN 37215.
- Kids for Saving Earth, P.O. Box 47247, Plymouth, MN 55447-0247.
- KiDS S.T.O.P., Box 471, Forest Hills, NY 11375. (Send a 9" x 12" stamped, self-addressed envelope and include $2.00 for postage.)
- The Natural Guard, 142 Howard Ave., New Haven, CT 06519.
- Save the Rainforest, 604 Jamie St., Dodgeville, WI 53533.
- The U.S. Environmental Protection Agency, Office of Public Affairs, 401 M St., S.W., Washington, DC 20460.
- National conservation and environmental organizations. Some run environmental summer camps.

On the local level:

- Be sure to take a look in the activities/volunteer section of your community newspaper—local environmental organizations often advertise stream clean-ups and other activities that you might want to get involved in.
- Get in touch with state or local departments of environmental conservation.
- Contact local environmental organizations, state and local departments of natural resources, and zoos and botanical gardens.
- Ask your teachers for ideas. Many successful projects have been launched from ideas that started in classrooms.
- Brainstorm with other interested neighbors and friends—and remember: "Think globally, act locally."

Biodiversity Rap-Up

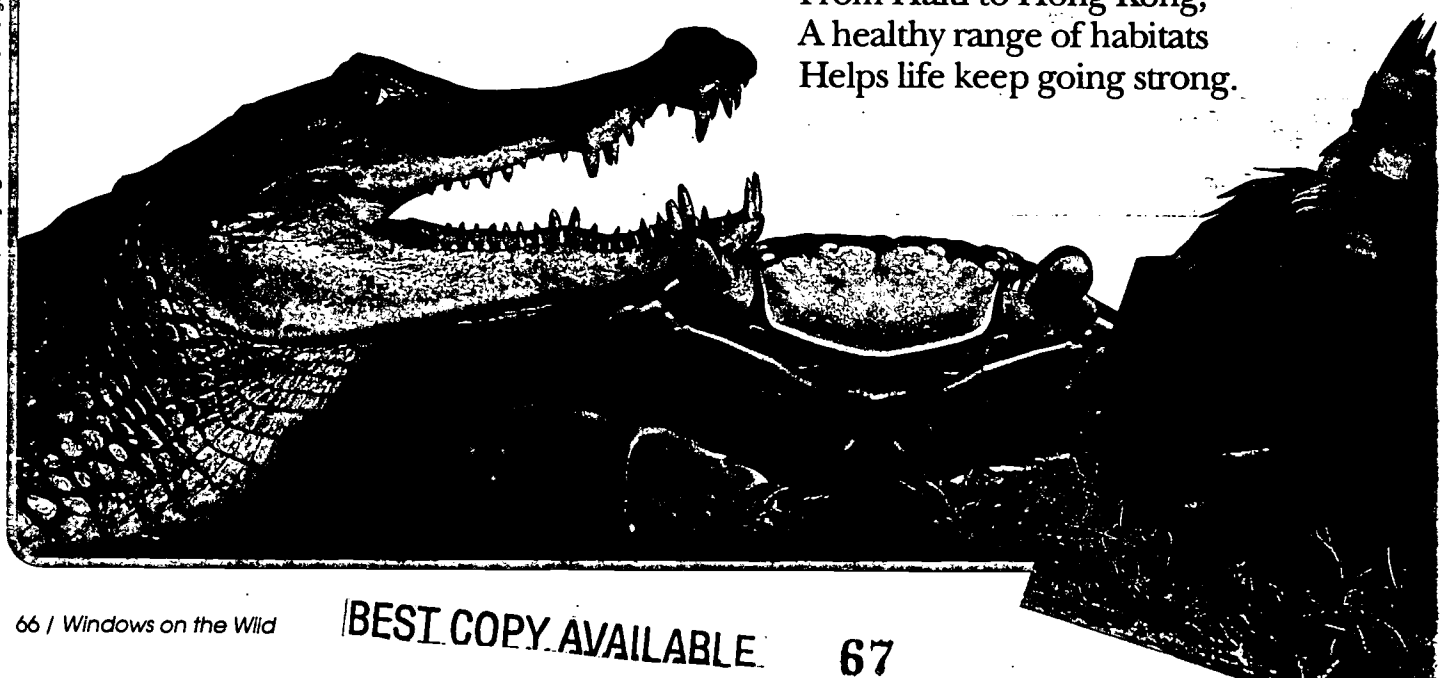
by Brian Lloyd

Wake up, everybody,
Really open your eyes.
Look outside the door—
You'll see a major surprise.
It's cooler than the Shaq Attack,
It's hotter than Spike Lee.
It's got more sounds and got more moves
Than even MTV.

Yeah, I'm talking 'bout the places
That span across this planet,
And the host of crazy critters
That we often take for granted.
You don't need a diploma
From a big university
To learn the word for all this life
Is BIODIVERSITY.

BIODIVERSITY means difference
In three kinds of scenes:
In HABITATS, in SPECIES,
And in our basic GENES.
Don't freak if this sounds tricky,
Stay cool, because I'll claim
That all of this is simpler
Than your average video game.

HABITATS are places
Made up of special features—
Vegetation, nutrients,
Climate, soils, and creatures.
From Senegal to Central Park,
From Haiti to Hong Kong,
A healthy range of habitats
Helps life keep going strong.



spectacled caiman—© Kevin Schafer; **Sally light-foot crab**—© Wolfgang Kaehler; **orangutan**—©Gail Shumway

SPECIES are the animals
And plants that fill our nations—
From cockatoos to kinkajous,
From melons to carnations.
Species pollinate our crops,
They're mascots for our teams,
They give us food and medicines,
They dazzle life and dreams.

GENES are what determine
How populations vary—
How tall we are, how strong we are,
How intelligent, how hairy.
A healthy, varied gene pool
Makes all of life more brilliant,
And species in the face of change
Are adaptable, resilient.

Now I hate to be a downer,
I hate to burst your bubble.
But you ought to know the truth:
Biodiversity's in trouble.
The reason? People everywhere
Pollute and build and grow.
The wildest life will be in malls
Unless we stop, you know.

A world with only cities?
A little dull, I'd think.
A world with only roaches?
Now that would really stink.
A world without a range of genes?
Now that would be a grim one.
Imagine every human being
A clone of Homer Simpson!

"Protect our many races,"
Said Martin Luther King.
"Protect the tribes and forests
Of the Amazon," says Sting.
From decades past to present day
The rally cry has grown:
Diversity's what life's about—
We can't survive alone.

Refrain:
Deserts, peat bogs,
Passion fruit, and tree frogs.
Spiders, seaweed,
Centipedes, and sheep dogs.
Mule deer, killdeer,
Crocodile, and ginkgo.
Diversity's dull?
No, I don't think so.

passion flower © Kevin Schafer & Martha Hill/Tom Stack & Associates. **assassin bug** © 1992 David M. Dennis/Tom Stack & Associates. **hoatzin** © Kevin Schafer. **gannet** © Wolfgang Kaehler

Windows on the Wild is an environmental education program o
World Wildlife Fund with support from Eastman Kodak Company

Supported by Kodak

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement (OERI)
Educational Resources Information Center (ERIC)

NOTICE

REPRODUCTION BASIS

☑ This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

☐ This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").