

Coral Death

Human Influence or Nature's Way?

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Coral reefs are one of the most diverse, productive, and economically significant habitats on Earth, and around the world they are changing.

Some of this change is the result of natural variability, and some reflects human influences. Recognizing the distinction between man-made impacts and natural variability in reefs can be a difficult task, but the distinction is crucial to our understanding of reefs and our ability to protect reef environments.

In tropical regions throughout the world, the deleterious effects of specific human activities are clear. Boat groundings and anchoring, dynamiting and the use of cyanide for fishing, and removal of coral for sale in souvenir shops have direct and obvious impacts.

Overfishing of herbivorous fish or the direct release of sewage into clear, nutrient-poor waters can promote rapid and destructive algae or sponge growth and possibly coral disease. High levels of silt from agricultural runoff or the release of pesticide-containing waters has also been shown to kill corals.

While these influences are clear, there is another class of reef decline in which the distinction between human and natural effects is not as easily discerned. Throughout the 400-million-year history of coral reefs, sea-level rise and storms (including *El Nino* events—the warming of ocean currents in the eastern Pacific which affects weather patterns throughout the region) have modified and altered coral growth.

Geologists have identified numerous sites where reefs flourished in the past, but many of these reefs are now dead or buried. Examples exist in the deep and shallow waters off the Florida Keys. Similar reefs once grew more than 50 miles off the west coast of Florida, an area now recognized as the Florida Middle Grounds. These reefs were growing some 2,000 to 10,000 years ago, when human influences on the sea were minimal. If we examine the rate of sea-level rise and typical coral growth rates, all of these reefs should have been able to keep pace with sea-level rise. So why did these reefs stop growing?

The Crowded World of Coral Reefs

Today, reefs show signs of decline even in remote areas throughout the world, making one wonder whether reef decline is a product of natural processes or instead reflects the global spread of human activities. Space on coral reefs is extremely limited. Therefore, some scientists believe that periodic disturbance is a necessary and natural part of sustaining a reef's high diversity. Storm waves commonly break corals and open new space, allowing for renewed colonization and increased competition.

In the Florida Keys, the last major storm event occurred in 1965. USGS research has indicated that before 1965, large storms hit the area every six or seven years. What effect has the last 33 years without a major storm had on Florida's reef system? In 1983 a Caribbean-wide plague killed approximately 95 percent of all the spiny sea urchins, *Diadema antillarum*, a natural grazer of algae growing on reef surfaces. Before that time, the *Diadema* population was extremely dense. Was this die-off a natural response to an excessive population?

How has the removal of the sea urchin population affected the composition of Caribbean reefs? Over the last decade, several diseases have infected corals world-wide—white-band disease, black-band disease, a spotty white pox disease, and a fungal infection on sea fans.

These diseases are believed to be the result of a coral pathogen or bacteria, but where it originates and why it strikes remains a mystery. One hypothesis is that these diseases have always been present in the ocean, but corals only become vulnerable to attack when already stressed by some other factor, such as pollution.



Above, coral bleaching occurs when the coral expels the color-giving, symbiotic algae from within its tissues. In this photograph, half of the coral head appears a healthy brown color and half is bleached white.

At right, USGS scientists drill a core from an individual coral head to examine a reef's growth history and investigate both human and natural impacts.



Are coral diseases a symptom of stress due to human intervention in the sea, or are they a natural phenomenon which is only now being recognized as longer time records become available and more reefs are being carefully scrutinized?

Human or Naturally-Induced Death

Coral bleaching is another phenomenon recognized world-wide. Bleaching occurs when corals expel the color-giving symbiotic algae living within their tissues. Bleaching has been shown to occur as a result of increased temperatures or ultraviolet (UV) radiation.

Has periodic and sporadic bleaching always occurred, or is it now more prevalent because we are beginning to see the widespread and intensified impacts of human population growth? Or is the perceived increase simply the result of more people looking more closely at the water than ever before? Scientists throughout the world are attempting to answer these questions through research.

At the USGS, scientists are using various techniques to study reef history and to differentiate human from natural impacts. Cores have been collected from large reefs to examine the reef's composition, age, growth, and geologic history.

Geochemical techniques are utilized to examine temperature variations, sea-level rise, and storm history. Monitoring wells have been emplaced to investigate the infiltration and content of sewage nutrients and pollutants in groundwaters beneath reefs.

A comprehensive survey and mapping of sand composition in the Keys suggests that study of the sediments may provide a means to assess and predict reef vitality. New studies have been proposed to examine the impacts of atmospheric dust, turbid coastal waters, and sediments on reefs. And other investigators continue to study sites of past reef growth and search for explanations for their demise.

A continuing USGS priority is to increase our scientific understanding of the critical interplay between the natural environment and human intervention. Further research is clearly needed to better differentiate man-made from natural impacts and variability in coral reefs. However,

given what we already know, it is possible to protect reefs and hope they flourish while we search for more answers.

The establishment of the **Florida Keys National Marine Sanctuary** and development of a management plan are an attempt to aggressively protect coral reefs from those activities that we know are harmful. Without such efforts, loss of coral reefs in Florida and around the world will cause devastating changes in the health of the physical environment that sustains life on Earth and the economic well-being of Earth's population.



Ship groundings, such as the one shown here in the Florida Keys, do extensive and permanent damage to the reef framework.

Coral reefs are built by tiny coral polyps—simple animals that work together in huge colonies. The polyps are mostly soft stomach surrounded by a hard limestone skeleton. When the animals die their skeletons—by the billions—add new layers of limestone to the reefs over the centuries. Coral reefs grow in tropical waters where the temperature is more than 70 degrees Fahrenheit year-round. They are found in more than 100 countries.



Saving Swainson's Hawk

Patricia Fisher

A wildlife puzzle involving a precipitous decline in the number of Swainson's hawks returning to the United States each spring was solved recently. During special ceremonies at the Embassy of Argentina in Washington, D.C., the U.S. Fish and Wildlife Service recognized the exemplary on-the-ground effort by Argentinean wildlife agencies in helping to save the hawks.

In recent years, biologists knew the number of Swainson's hawks breeding in some areas of North America was plummeting but they couldn't determine why because no one knew exactly where the birds wintered. During the past three years, U.S. wildlife biologists fitted a number of birds with miniature satellite transmitters. They followed the hawks' flight and located the wintering grounds in the Pampas region of central Argentina.

Researchers discovered thousands of Swainson's hawks dying from the misuse of the pesticide monocrotophos to control grasshopper devastation in Argentinean alfalfa fields. The birds were literally falling from the trees as they roosted during the night. During the winter of 1995-1996, wildlife biologists estimated 20,000 hawks died from ingesting grasshoppers that had been sprayed with the pesticide. Grasshoppers are one of the birds' favorite foods.

Recognizing that quick action was necessary to stem this loss, the Service facilitated a partnership made up of several Argentinean wildlife agencies, the academic community, the private sector, and other concerned organizations, including the prominent

chemical manufacturer Ciba-Geigy, a producer of monocrotophos.

The partners launched an intense effort to educate farmers and provide them with alternatives to monocrotophos, which is not registered for use on either grasshoppers or alfalfa. As the result of this cooperation, only 24 hawk deaths were reported this winter. Through its International Affairs Office, the Service provided Argentinean counterparts nearly \$150,000 to help fund activities such as the education campaign, surveys to monitor die-offs, and training in detection of pesticides.

"Migratory birds don't recognize borders," said **Acting Service Director John Rogers**. "This makes it important to look beyond our own backyards and be good neighbors saving wildlife."

Rogers recognized the special partnership between the United States and Argentina as he honored the Argentinean wildlife agencies whose grassroots work with the agricultural community was so crucial to the operation's success. At the May 8 ceremony, he presented Special Commendation awards to the *Instituto Nacional de*



The Swainson's hawk is an impressive brown and tawny bird about 24 inches long, with a 54-inch wingspan. These birds of prey are long-distance migrants, flying more than 6,000 miles between their breeding grounds in the western North American prairies and grasslands and their wintering grounds in Argentina's grasslands. They have voracious appetites for insects and small mammals and are often found near agricultural fields.



Tecnología Agropecuaria, Servicio Nacional de Sanidad y Calidad Agroalimentaria, and the Secretaría de Recursos Naturales y Desarrollo Sustentable. Ambassador Raúl Granillo Ocampo accepted the awards on behalf of the three agencies.

"This year marks the 35th anniversary of the publication of Rachel Carson's *Silent Spring* in which she warned that the continued use of pesticides would doom migratory birds," said Rogers. "The episode of the Swainson's hawks puts us on notice that we must continue to be vigilant and take quick action when birds are threatened by pesticides."

The International Affairs Office implements the Western Hemisphere Program, a regional initiative that develops and strengthens the capacity of Latin American and Caribbean nations to manage and conserve biological diversity for the benefit of local communities. The program supports projects related to human resource development, information exchange, and environmental education.



Students from Belmont Elementary School in Woodbridge, Virginia, and the *Escuela Argentina de Washington* also participated in the May 8 event celebrating the successful multi-national effort. Fourth-, fifth-, and sixth-graders from each school took part in a Swainson's hawk poster contest to reflect the theme, "Good Neighbors Saving Wildlife." Acting Director John Rogers presented special certificates to the top three winners from each school. The first-place artists exchanged their posters, which will be exhibited at the two schools. "The children said it all with their great designs," said Rogers. Ambassador Raúl Granillo Ocampo is at far right in photo on left. Photos by Tami Heileman, ISC



Beetle Mania Sweeps Great Lakes Region

Larry Dean

Just as the rush to the music stores for the Beatles Anthology collection has subsided, natural resource agencies are getting lined up for yet another beetles release, also from Europe.

These are beetles of the insect variety, however, bred by staff at Cornell University in a project funded by the Fish and Wildlife Service's Federal Aid program. And these insects hold the key to controlling the spread of purple loosestrife (*Lythrum salicaria*).

Loosestrife plants are hardy perennials originating in Europe and Asia with a beautiful purple flowerhead. The plant forms dense stands in a wide range of wetland and lakeshore habitats, replacing native plants, degrading food, shelter, and nesting sites for wildlife. There are no current chemical or mechanical means to provide long-term control against the spread of loosestrife, but insects from Europe—leaf- and flower-eating beetles and root-feeding weevils—are natural predators capable of minimizing the number of plants. However, these insects are not native to North America.

Research into this form of biological control, begun at Cornell University in the mid-1980s and in 1992, led to the introduction of four species of European insects in North America. The insects were tested on various plants, including farm crops, to make sure they would not attack beneficial plants and therefore become nuisances themselves. Research indicated the insects would starve rather than eat anything other than loosestrife and the project moved on to the breeding and placement phases.

The Service's Great Lakes-Big Rivers region was part of the first release of these insects, with about \$300,000 from the Service's Federal Aid program going toward this effort. The program has been so successful that refuges such as Sherburne, Horicon, Shiawassee, and the Upper Mississippi River MacGregor and Winona Districts have taken on propagation of these insects for future releases as needed on Service lands. The grant sources for the initial production came from a combination of Federal Aid and North American Wetlands Conservation Act monies.

Jim Mattson, purple loosestrife coordinator for the region, pointed out, "The goal of this biological

control effort is not elimination of purple loosestrife, but rather keeping the plants at a manageable level. If all of the plants are gone, the insects won't have the food they need to survive and any reintroduction of loosestrife would rekindle the problem of the plants spreading uncontrolled."

Mattson also noted that purple loosestrife has a 175-year head start and would be difficult to eliminate totally. However, distributing the European insects shows clear signs of success at reducing populations of healthy plants. A minimum of 500 to 1,000 insects are normally released per site. This often results in visibly defoliated loosestrife plants after the first year and a combination of large reductions in the plant mass and the rebounding of native plant species by the second year.

To date, about 25,000 insects have been released on Service lands in the Great Lakes-Big Rivers Region. An additional one million are anticipated for release this year throughout North America. Purple loosestrife is found in 49 states and Canada.

Interior has helped to develop a national strategy to fight the war on non-native invasive plants, page 21.



December Deadline For Community Nominations

Communities interested in winning a first-round designation as an American Heritage River must submit nominations by early December.

An interagency committee will review the nominations before making its recommendations. President Clinton will designate the first ten American Heritage Rivers by year's end. The program's principles and criteria were developed through an interagency team convened by the White House Council on Environmental Quality. Federal agencies hosted a series of 12 meetings across the country in April and May that enabled the interagency team to discuss the proposal with local community representatives and private sector leaders and learn of their needs. On May 19, the draft American Heritage Rivers initiative was published in the Federal Register to gather more public comment by mid-August. After that, the Cabinet will review the comments and prepare final recommendations for the President.

Because of its majestic waterfalls, the Niagara River, which flows through part of New York State, has become one of the better known rivers in the nation, drawing millions of visitors annually.

American Heritage Rivers

Roger Stephenson, National Park Service

Great rivers define America.

They helped to build the nation, linking communities through transportation and commerce, providing critical natural resources for development, enriching cultures and aesthetic appreciation, while creating unique American ways of life.

The continent's first inhabitants developed thriving agricultural civilizations along the major waterways. The rivers and estuaries of the eastern seaboard—from the Hudson and Delaware to the Savannah and James—nourished the first European settlements. The fledgling USA was a union of river communities before it was a continental nation.

The majestic Mississippi and its tributaries—from the Missouri and Ohio in the north to the Arkansas, Tennessee, and Red Rivers in the south, opened the interior of the continent, linking the vast American heartland from the Great Lakes to the Gulf of Mexico. And the awe-inspiring watercourses of the West, from the mighty Columbia to the rugged Colorado, continue to provide the region's life blood for development.

Yet, as important as these rivers were to America's past, they are equally vital to the nation's future. Recognizing their continuing commercial and cultural significance, many American communities are working with government and private groups to revitalize their river corridors.

The Mississippi River, the greatest of America's waterways, has served not only as a vital commercial artery for the nation's heartland but also as an inspiration for American artists. While Samuel Clemens (Mark Twain) may be the best known writer influenced by the river, thousands of others, including poets, songwriters, painters, and photographers have heard its siren song. The Mississippi's heritage, often associated with the paddle-wheel riverboat, continues to be a valuable regional resource, generating tourism and recreational opportunities for local communities.



"From the Pine River in Michigan to the Blackstone River in New England, community groups are cleaning up their rivers and breathing new life into their towns," said **Secretary Babbitt**, who has met with coalitions working to protect more than 70 waterfronts around the nation.

"These meetings not only highlighted the successful interaction of local and federal programs, but also demonstrated the tremendous potential to integrate those programs and spread these ideas across the country."

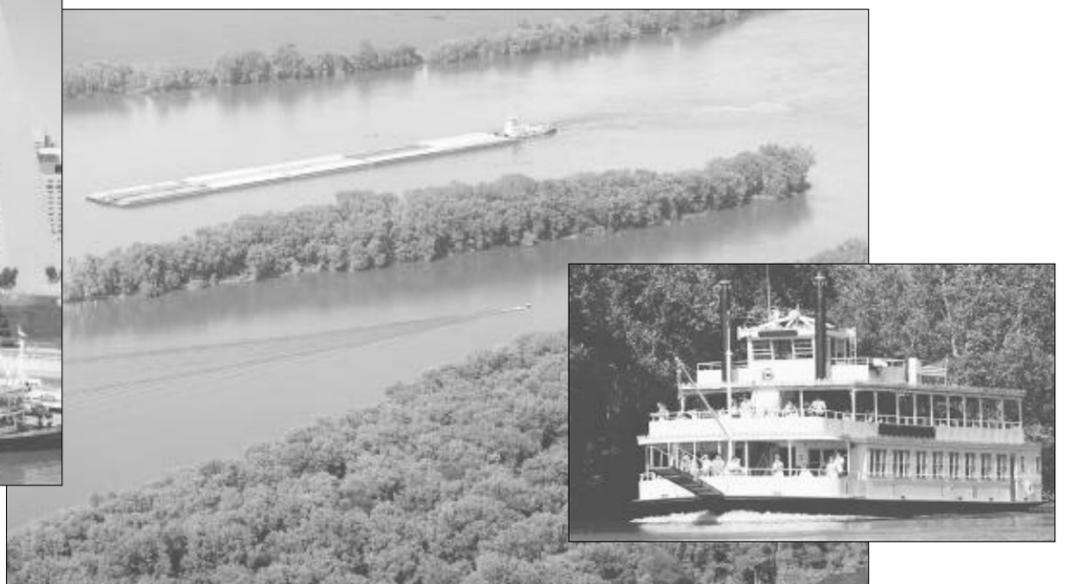
To help these communities restore the legacy of their rivers, **President Clinton** has launched a Cabinet-level initiative to refocus and redirect federal programs, grants, and technical assistance to provide special support to local groups that are working to improve stretches of America's heritage waterways.

First announced in his State of the Union Address earlier this year, the American Heritage Rivers initiative aims to recognize the ambitious efforts that many river communities are making to revitalize their surroundings, create a healthy environment, and protect their historical and cultural heritage.

"This initiative is intended to support community plans—including environmental and public health protection, recreation, and job creation," said Secretary Babbitt. "To accomplish this, the Administration will better coordinate federal environmental and cultural programs with the communities along the rivers, and provide these groups better access to existing federal resources."

The partnership will be created from the community up—through local, state, tribal, and federal governments—rather than from the top down, Babbitt explained. "It is not a land grab for rivers. On the contrary, it is an effort to increase community stewardship of rivers, not to increase federal management around rivers," he emphasized.

"This program is not about more regulation. It is about more effective action. It redirects federal resources toward communities that are striving to preserve their cultural heritage. This initiative does not alter state, local, or federal laws," Babbitt said. "Our experience has been that greater community involvement and careful consideration of a community's needs can mean that federal agencies make different—and better—decisions."



The projects that will be undertaken will be funded under existing budgets through smarter utilization of existing resources. The program is an organizational tool to make a broad array of dozens of existing federal programs more effective. Each project will be different. Depending on a specific community's proposal, it may be appropriate to fund activities within clean water projects, or under habitat restoration partnerships, or possibly under humanities grants.

What Does It Mean To Be Designated?

American Heritage River designations will recognize outstanding community-based efforts to ensure the vitality and place of the river in community life for future generations.

In Denver this could mean developing parks along a river. In Mesa and Phoenix, Arizona, it might mean enhanced recreation in the river. In Cleveland, it could encourage riverside commercial development that will revitalize the surrounding community. In Chicago, it might give urban youths the opportunity to teach others about their river—opening the door for those students to become scientists and environmental professionals.

The President will designate rivers where communities have demonstrated, through a one-stop application process, that local partnerships are in place to protect distinctive qualities of their river and surroundings.

To qualify for the American Heritage Rivers program, sponsoring communities or organizations must demonstrate broad community support for a revitalization plan that includes a commitment of non-federal resources; local and regional partnership agreements; strategies that lead to action; and an ability to achieve measurable results. The nominations should include information on the importance of the river to the culture, history, economic development, public health, and environmental quality, as well as the way of the life of the locality.

Designated rivers will receive special recognition from President Clinton. Each American Heritage River will serve as a model of the most innovative, economically successful, and ecologically sustainable approaches to river restoration and protection for communities across the United States.

Designated communities will receive focused support in the form of programs and enhanced services, including a "river navigator"—a federal employee who will work with and alongside the community to provide access to the federal agencies and simplify program delivery. The programs that would be involved would depend on the community's specific needs.

Each community also will receive a commitment from federal agencies to act as "Good Neighbors"—to formally and thoroughly consider the effects of their actions on American Heritage Rivers in making decisions that affect communities.

During the first year, federal agencies not only will focus on improving service and program delivery to the designated river communities, but also will improve information access and service delivery to all river communities. There will be an emphasis on establishing stronger intra- and interagency communications systems and incentives for field staff to rely more on partnerships with other federal agencies.

Implications for Interior Agencies

Taking advantage of designated American Heritage Rivers as reinvention laboratories, federal agencies can examine new ways in which to coordinate people and resources to assist all river communities in their river restoration and community revitalization efforts.

Interior agencies have historically helped local efforts to restore and revitalize river communities, and this work will continue. But the Interior employees who will be coordinating the Department's participation in the new initiative expect to be especially busy this summer.

That's what the National Park Service's **Chris Brown**, of the Rivers, Trails, and Conservation Assistance program, anticipates as he and others active in the interagency venture inform and educate Interior employees, and promote those Interior programs that can best serve river communities.

Brown represents Interior on the interagency panel charged with blending the environmental, historic preservation, and economic development programs which exist in the federal government and can be tapped to benefit river communities.

The initiative also offers important benefits to Interior agencies, Brown points out. "The initiative will encourage businesses and other nongovernmental partners to engage in restoration efforts, and in so doing will introduce government workers to innovative, non-traditional solutions that can extend an agency's ability to serve the public."

"Front-line employees will learn about programs and services available not only from other federal departments, but from corporations, and local institutions as well," Brown explains. "Federal employees active with an American Heritage River will be able to learn from and take advantage of new-found expertise, and in turn become more informed providers of services to the American public."

As part of the initiative, the National Park Service is compiling what may be the first (and largest) river restoration publication of its kind—a nationwide, interagency directory of specialists from participating federal agencies, including the Departments of Interior, Agriculture, Commerce, Defense, Energy, Justice, and Housing and Urban Development, the Environmental Protection Agency, Advisory Council on Historic Preservation, Army Corps of Engineers, and the National Endowment for the Humanities. The directory will be a valuable toolbox for river communities.

Interior field staff also participated in a 2-hour video orientation to the initiative. The briefing originated in Washington, D.C., on June 17, and was made available to dozens of downlink sites across the country. (Call **Jennifer Pitt** at (202) 565-1185 for more information.)

These men and women will serve as important local contacts whether a community chooses to compete for a designation, or decides simply to seek information and guidance. The field staff will be listed in a resource packet mailed out in late June to more than 40,000 individuals and organizations with an interest in river restoration.

Roger Stephenson is a special assistant for communications to the director of the National Park Service.



Internet Communication Services and Interior Bureau Contacts

The American Heritage Rivers Home Page is located at <http://www.epa.gov/OWOW/heritage/rivers.html>. It will provide links to all participating federal agencies. An American Heritage Rivers Riverfront Internet Page will present a broad array of goods and services from which to choose. This electronic tool kit will be customer-driven, so that users can easily scan the tools available and quickly find and obtain those that best fit their community's interests. The information is intended to provide hands-on, step-by-step help to communities that are just beginning to protect historic structures, define cultural landscapes along the river, or restore and revitalize their rivers.

Interior employees interested in learning more about the American Heritage River Initiative may do so by calling **Karen Hobbs** of The Council for Environmental Quality/American Heritage Rivers at (202) 395-7417, or by calling their agency contact listed below:

Chris Brown, National Park Service-Rivers, Trails, and Conservation Programs, at (202) 565-1200; **Jennifer Pitt**, NPS-RTCA, at (202) 565 1185 and **Kevin Foster**, at (202) 343-5969; **Steve Blanchard**, U.S. Geological Survey, at (703) 648-5033; **Craig Czarnecki**, U.S. Fish and Wildlife Service, at (703) 358-1718; **Fred Fox**, OSM, at (202) 208-2567; **Jim Handlon**, Bureau of Reclamation, at (202) 208-6252; **Gary Marsh**, Bureau of Land Management, at (202) 452-7795.