EcoAméricas

A monthly report on development and the environment in Latin America

Colombian president praised for nixing road route

When Juan Manuel Santos became president of Colombia in 2010, environmentalists were suspicious of his support for what they believed were destructive mining, agro-industrial and infrastructure projects. Those criticisms have not entirely disappeared. But as Santos prepares to finish his second and last term on Aug. 7 of this year, he is receiving accolades from former skeptics. They credit him not only for his protection of the nation's water-rich páramos and wetlands, but for a massive expansion of national parklands to 29 million hectares (112,000 sq. miles), more than double their former land area.

Most recently, Santos has won praise for his decision not to proceed with a major road project that many experts had deemed a threat to key ecosystems. On March 9, he announced work would not begin as planned on a 381-kilometer (237-mile) portion of the Marginal de la Selva highway connecting the southern cities of San Vicente del Caguán and San José del Guaviare. Santos described construction of the road through the Amazon as "completely counterproductive from an environmental point of view." The government has since indicated the road could be built farther north, in a region of the Andes that is less environmentally sensitive.

The Marginal de la Selva project was launched in 1963 to unite the Amazonian regions of Colombia, Ecuador and Peru, as well

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Bee die-off in Argentina blamed on agrochemicals

Argentina

On March 10, beekeeper Pablo Olmos paid a morning visit to the bee hives that he and a partner tend in the Traslasierra Valley, located in the central Argentine province of Córdoba. The hives occupy a portion of cattle pasture that the property's owner allows Olmos to use in exchange for a share of the honey, an arrangement many of the country's beekeepers maintain with landowners. Though his visit to check on the hives was routine, he was greeted by a sight he'd never seen in his 15 years as a honey producer: all of his bees were dead.

Argentine beekeepers view their country's intensive agrochemical use as deadly not only to bees, but also to biodiversity. (Photo courtesy of SADA)

The sudden die-off was not an isolated incident. When he reported it to authorities, he learned that within a radius of some 30 kilometers (19 miles), more than 900 hives had been similarly affected. Producers estimate that some 70 million bees died, since each hive holds 60,000 to 90,000 bees.

Investigating the phenomenon, Argentina's National Service of Agri-Food Health and Quality (Senasa) had not pinpointed the cause as of the end of April. But Olmos and other local beekeepers say they know the answer. "We are convinced that this is the result of some type of aerially applied pesticide, since in that period planes were seen in the area," Olmos told EcoAméricas on April 20.

News of the die-off drew nationwide condemnation from honey producers. They have warned increasingly in recent years that bee

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Around the Region

Plan to convert military base to park raises rights concerns

Campo de Mayo, the biggest military base in metropolitan Buenos Aires and one of the largest in the country, would be converted into a national park under a proposal announced recently by Argentine President Mauricio Macri.

Located 30 kilometers (19 miles) from the national capital, the 4,000-hectare (9,900-acre) base is associated with political turbulence and human rights violations. In 1930, the country's first military coup was launched from Campo de Mayo. And in the 1970s, it was the site of one of the largest clandestine centers of imprisonment and torture operated by the military regime then prosecuting the so-called "dirty war" on terrorism.

The more recent of those two historical chapters has come into play in debate about the park proposal. The Mothers of the Plaza de Mayo and other human rights groups complain that evidence-gathering in connection with human rights investigations at the site are still ongoing and might be jeopardized by park-conversion work.

In order to become reality the Campo de Mayo proposal, announced by Macri on March 1, must win the approval of the Buenos Aires provincial legislature as well as the national Congress. Deliberations don't look likely to begin anytime soon. That's because the Macri administration has yet to introduce the appropriate legislation, a key reason being that it has yet to determine the planned park's proposed boundaries.

"Campo de Mayo is a very attractive chocolate for the real estate business, and we should avoid the urbanization," says Emiliano Ezcurra, vice president of the Argentina National Parks Administration. "Without doubt it is one of the great green spaces surrounding Buenos Aires that we should save for the benefit of the community."

A leading Argentine green group, the Environment and Natural Resources Foundation (FARN), opposes the plan, arguing that Campo de Mayo has "lost its natural character" since being converted from rural land and put to intensive use.

Counters Ezcurra: "We want it to be a sort of laboratory where we experiment with the restoration of pampas grassland. We are convinced that it can be restored."

The Campo de Mayo proposal comes amid various parks initiatives underway or completed in Argentina. In March, the Argentine Congress approved the establishment of Traslasierra National Park on 105,000 hectares (260,000 acres) in the province of Córdoba's portion of the arid but species-rich Chaco eco-region. The former ranch land had been bought by the nonprofit organization Argentine Birds and donated to the government.

Congress also is preparing to establish two other national parks—Aconquija on 80,000 hectares (198,000 acres) in the province of Tucumán, and Iberá, on 150,000 hectares (370,000 acres) in Corrientes province.

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Dolphin deaths from virus have subsided in Brazil

A viral epidemic that has killed dolphins in a highly polluted bay on the outskirts of Rio de Janeiro appears to have subsided, scientists say, but has wiped out one quarter of the roughly 800 members of the animals' local population.

The deaths of some 200 Guiana dolphins (Sotalia guianensis) began last December in Sepetiba Bay when the first dolphin carcasses were found bobbing in bay waters, their fins decomposing, their bellies bloated and blood seeping from their eyes.

Scientists blamed the die-off on morbillivirus, a genus of typically airborne viruses that attack the immune systems of mammals. In humans, the virus can cause measles; in mammals, it can trigger everything from rashes and fever to respiratory infections as a result of weakened immune-system defenses. Its other natural hosts range from dogs, cats, sheep and goats to seals and cetaceans.

Outbreaks of the virus have appeared in marine dolphin populations elsewhere, but not in Latin American waters outside the Gulf of Mexico. In the U.S. east coast—mainly Florida—and the Gulf of Mexico, it has attacked common bottlenose dolphins (Tursiops truncatus), and in the Mediterranean Sea it has broken out in striped dolphins (Stenella coeruleoalba).

Experts say the virus spread among the Guiana dolphins in Brazil in part because these cetaceans, given their perch atop the marine-fauna food chain, eat fish in which pollutants from the busy industrial port have bio-accumulated. The toxins weaken the dolphins, making them vulnerable to the virus.

Indeed, dolphins often are described as sentinels, in that their health problems can provide advance warning about degradation of the marine environment. Guiana dolphins, found from the east coast of

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Frog reintroduction seeks chytrid-fungus answers

In 2008, researchers in Panama began an urgent effort to rescue frogs from Chytridiomycosis, a disease causing massive mortality among the country's 219 species of amphibians. Their solution: an Amphibian Ark that housed and fed endangered species collected from the wild in a modified shipping container until a cure could be found and the animals could be released. (See "In a former shipping container, salvation for frogs"—EcoAméricas, April '12.)

Today, the chytrid fungus that causes the disease still kills frogs in Panama and has contributed to declines in the populations of amphibian species worldwide. But the frogs housed in the air-conditioned and sterilized container by the multi-institutional Amphibian Rescue and Conservation Project (PARC) have grown strong and disease-free over several generations in captivity. The only question is whether they can survive in the wild.

Researchers have decided to find out. On Jan. 17, some 500 variable harlequin frogs (Atelopus varius) were released with tracking devices into the lowlands of Panama's province of Colón. Many are expected to die. Still, information gathered on those that don't, including where they locate, may guide researchers' plans for future releases. A prime beneficiary in the long run would be the critically endangered variable harlequin, a dazzling amphibian of varying colors including orange, green, red or blue whose population has declined by some 80% in its native habitats in Costa Rica and Panama.

"With the surplus population [of harlequins] we've bred, we can monitor all the things that affect the frogs' survival," says Brian Gratwicke, an amphibian biologist at the U.S.-based Smithsonian Conservation Biology Institute, one of the organizations leading the project.

Key juncture

The experiment comes at a critical moment in the fight against Chytridiomycosis, a usually fatal disease that impedes amphibians' ability to absorb electrolytes through their skin and leads to cardiac arrest. Scientists in recent years have discovered frog species that seem to avoid infection or fight it off, sparking hope solutions might be found. In Australia, where six species have disappeared altogether since the outbreak of the disease in the 1990s, researchers have found some species making a comeback and others, such as the Stony Creek frog (Litoria lesueurii), avoiding infection by spending time in warmer areas where the fungus is unable to propagate.

In Spain, three species affected by the disease appear to be rebounding—perhaps, researchers say, because warmer weather related to climate change is similarly inhibiting the fungus. And in Panama, scientists have found populations of nine species, including the variable harlequin, returning to previous levels at sites where they were devastated, perhaps due to protections they developed in their skin.

Jamie Voyles, lead author of a study in the journal Science that describes the Panama findings, says researchers tested skin secretions containing anti-microbial properties from some of the recovering species. When those secretions were placed in a petri dish with the fungus, they were two to five times more effective at fighting it than the secretions of frogs descended from individuals captured in Panama before the outbreak of the disease. Exposure to the disease, it seemed, was creating better defenses.

"Some individuals may have traits that allow them to ward off infection," says Voyles, an assistant professor at the University of Nevada, Reno in the United States. "Because those individuals go on to survive and reproduce, we may be seeing a process of selection that's creating a population better able to resist the disease."

A lot to learn

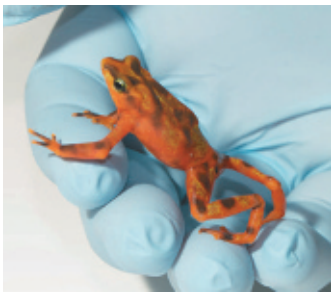
She emphasizes it is probably not the only explanation for such rebounds. "Just in the area of Panama [where] we were working, some frogs may go up into the canopy where they warm their body temperature to a temperature where the fungus can't grow. And some frogs with very high, fast reproductive cycles may stand a better chance of having a few individuals go on to survive and reproduce...There's still a lot we don't understand about this disease."

In the current experiment, researchers released some 500 frogs in warm lowlands rather than in the cold, moist environments where the chytrid fungus thrives. The frogs have been implanted with a fluorescent dye scientists can see using UV light. A few dozen frogs have been outfitted with a 0.3-gram radio transmitter so they can be tracked in real time.

Researchers will test the idea that different locations and temperatures favor frog survival. The project also could shed light on whether certain frogs have indeed developed a genetic or other resistance to Chytridiomycosis, and whether the disease is as widespread and virulent in Panama as when it erupted in the 1980s.

Ultimately, the survival of amphibian species may depend on finding a cure. At present, frogs can be saved in captivity with anti-fungal baths, which is not practical in the wild. Says Gratwicke: "In parts of the world we are seeing populations of some species recovering. So that gives us hope that if we can understand why, we'll have something to focus on, including breeding resistance and developing vaccines."

–Steven Ambrus



Variable harlequin
(Photo by Brian Gratwicke)

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In Brazil two companies accused of river pollution

Brazil

Anglo American's Minas-Rio mine
(Photo courtesy of Anglo American)

Two foreign mining companies operating in Brazil, Norsk Hydro of Norway and Anglo American of South Africa and Britain, are drawing criticism—and lawsuits—over pollution of several rivers with iron ore and bauxite, the ore used to make aluminum.

Norsk Hydro came under the spotlight in February, when the Evandro Chagas Institute (IEC), an independently managed public-health unit of the Brazilian Health Ministry, reported that overflows of untreated bauxite waste had polluted the Pará River in the eastern Amazon state of Pará with heavy metals. Some 400 households in Barcarena, a city of 100,000 in Pará, were left without water service.

Citing the report, Pará prosecutors secured a Feb. 28 court injunction ordering a 50% reduction in output at Hydro Alunorte, a Norsk Hydro-owned plant in Barcarena that is the world's leading maker of alumina, or aluminum oxide, a key ingredient in aluminum production.

The plant uses bauxite to produce alumina for Norsk Hydro's adjacent Albras smelter, Brazil's second largest aluminum-manufacturing facility. The 50% cut in Hydro Alunorte's output forced Norsk Hydro on April 10 to halve the Albras aluminum output due to a lack of sufficient alumina feedstock.

Pushback on cause

Hydro Alunorte insists the pollution was not caused by an overflow of its bauxite-waste reservoir, and issued a report by a Brazilian environmental consultancy that backs up its claim. The Pará State Environment and Sustainability Secretariat (Semas) issued a statement on Feb. 27 agreeing that overflows from the plant's reservoir were not to blame. But it said "an irregular release of untreated effluents" came from a flooded industrial area inside the alumina refinery.

In an interview with EcoAméricas, Halvor Molland, Norsk Hydro's senior vice president for media relations and public affairs, reiterated that the reservoir did not overflow. But he acknowledged that "an alumina plant drainpipe may have leaked water containing bauxite dust from a factory floor flooded by heavy rains."

On Feb. 16 and again on Feb. 17, the day the IEC began testing water quality in the Pará River, Barcarena experienced torrential rains. Semas later ordered Hydro Alunorte to reduce its bauxite-waste reservoir levels by at least one meter in case more rains came.

On April 9, a state-court judge in Barcarena ordered Hydro Alunorte to deposit R$150 million (US$43.3 million) in an escrow account to offset damages caused by bauxite-waste pollution of the Pará River. The judge will later rule on the amount of damages Hydro Alunorte must ultimately pay. A lawsuit filed by the Pará State Attorney General, meanwhile, seeks R$250 million (US$72.3 million) in damages. These include social and environmental impacts caused by the river's contamination and reimbursement of costs that the state incurred in trucking in drinking water, treating people affected by contaminated water and investigating the cause of the pollution.

For its part, Anglo American drew scrutiny in March in connection with two ruptures of a pressurized iron-ore slurry pipeline in east-central Minas Gerais state, one on March 12 and the second on March 29.

The 529-kilometer (328-mile) pipeline runs from the company's Minas-Rio mine to an industrial port in neighboring Rio de Janeiro state. The first break sent 300 tons of slurry, a mix of 70% crushed iron ore and 30% water, into the Santo Antônio River, which flows into the Doce River, a major waterway in eastern Brazil. The second dumped 174 tons of slurry into the same river.

Sued and fined

Minas Gerais state prosecutors filed a lawsuit against Anglo American on March 13 seeking R$10 million reais (US$2.9 million) in financial guarantees for damages caused by the March 12 spill. A judge has not yet ruled on the lawsuit. Separately, the Minas Gerais State Environment and Sustainable Development Secretariat (Semad) and Ibama, the Brazilian Environment Ministry's enforcement arm, have fined Anglo American a total of R$197.5 million (US$57.1 million) in connection with the spills.

Ibama has ordered the company to carry out a thorough inspection of the entire pipeline, and says it will monitor Anglo American's implementation of a recovery plan for areas affected by the spilled iron-ore slurry. In the meantime, Minas-Rio's mining operations have been suspended indefinitely. Environmentalists blame the three accidents on poor safety practices at Norsk Hydro and Anglo American, and on inadequate oversight of the foreign companies' operations by state and federal regulators.

"The recent Norsk Hydro alumina plant and Anglo American slurry pipeline accidents, especially the latter's second slurry spill in the same month, make it clear that these companies have inadequate accident control and prevention measures," says Adriana Ramos, public policy coordinator of the Socio-Environmental Institute, a Brasilia-based nonprofit. "As a result federal and state environmental agencies need to monitor and inspect the safety of operations they license more rigorously."

–Michael Kepp

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Documents:

The IEC report is available in Portuguese at: http://www.iec.gov.br/portal/coletiva-hydro/

CEC tallies huge food-waste cost in Nafta nations

North America

Here's something to think about the next time your waiter asks whether you're done with your meal: North Americans are wasting 168 million metric tons of food annually, and it's a big environmental problem.

According to a report issued on March 27 by the Montreal-based Commission for Environmental Cooperation (CEC), the life cycle of wasted food results in annual emissions of 193 million tons of greenhouse gasses. That's equivalent to the greenhouse-gas output of 41 million cars driven continuously for a year.

The CEC, the trilateral environmental-protection body created under a side agreement to the North American Free Trade Agreement (Nafta), compared food-waste levels in all three Nafta signatory countries—Canada, Mexico and the United States. U.S. residents were found to be squandering the most food, some 415 kilograms (915 pounds) per capita per year, followed by Canadians and Mexicans, whose food waste amounted to 396 kilograms (873 pounds) and 249 kilograms (549 pounds), respectively.

Overall, the greatest waste occurs at the consumer level, the report says, with 67 million tons of food squandered annually, followed by 52 million tons at the industrial, commercial and institutional levels and 49 million tons at the pre-harvest level. The market value of all of this lost food is estimated at US$286 billion a year.

Standing to gain

Can businesses profit by reducing food waste? Yes, says David Donaldson, program manager for Green Growth at the CEC, which was established in 1994 to ensure the three Nafta nations share and develop information aimed at enhancing environmental protection.

"In our work we found that a lot of organizations, a lot of businesses, don't really want to open up the hood and see what's under there because they're worried about the blemishes to their reputation," Donaldson said in a telephone interview with EcoAméricas. "So, one of the first steps is really convincing them that in fact if you take these hard-to-take steps, you can both save money in your operations and you can promote yourself as taking positive environmental steps."

The CEC says companies across the three Nafta countries pay US$1.9 billion in fees to dispose of their food waste in landfills every year. Annual energy loss associated with the food waste is equivalent to the amount of power consumed in a year by 274 million homes, according to the report. Companies could see big savings if the production-to-consumption chain is redesigned to minimize waste, Donaldson argues.

"It starts when the food is harvested," he says. "It's the producers, the food processors, the folks involved in the wholesale and distribution and then the retail and the food services sector. These are the organizations that have a lot of potential to save [money]."

Some, such as the U.S. food company Campbell's, are taking action. In 2012, Campbell's began sending 35% to 50% of its food-processing waste to a biogas plant in Ohio, where the waste is turned into energy, rather than shipping it to local landfills. Some of its food waste also is used in animal feed and compost.

But source reduction is just one of two solutions proposed by the CEC in its report. The second and perhaps more important one is waste-rescue at the consumer level, where most food is lost. The CEC proposes that safe and nutritious food be donated rather than thrown out. It says financial incentives could be offered to spur these donations, create online food-rescue platforms or increase funding to improve infrastructure for a rescue-and-recovery system.

Urgency in Mexico

While Mexicans waste the least amount of food per capita in North America, the country has perhaps the most pressing reason to use food more efficiently: over 58 million Mexicans live below the poverty line, with about 11.7 million of these living in extreme poverty. This makes food waste in Mexico especially objectionable, says Lorena Vázquez, head of the Mexico chapter of The Hunger Project (THP), a non-governmental organization working to end hunger across the world.

"The issue is often approached from a very partial, sectorial perspective," Vázquez says. "Some ask, 'There's waste, how do we eliminate waste?' Then on the other side others are asking, 'There are people who have nothing to eat, so how do we solve that?' So part of our work at The Hunger Project has been to understand the problem of food as a whole, from production to consumption."

Data compiled by The Hunger Project shows Mexicans who struggle most to find food are, paradoxically, in rural areas, where food is produced. That's because farmers sell most of their harvest for money and consume low-quality food distributed for free by the government as part of a support program. In 2015, the government reported close to 33% of the population suffers from obesity, a problem attributed in part to consumption of low-quality foods.

Vázquez urges the creation of food banks in such areas coupled with promotion of healthier diets. A proposal for these and other steps is being drafted with Mexico's Agriculture Ministry, with the goal of presenting it to the new government due to take office in December.

–Isabella Cota

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Documents & Resources

For CEC food report:
www.cec.org/news-and-outreach/press-releases/new-report-shows-ways-help-solve-north-americas-food-loss-and-waste-problem

For CEC food info-graphic:
http://cec.org/sites/default/fwinteractive/index-en.html

Centerpiece

Whale-watch boom raising hopes in Mexico

Mexico

Arturo Mellin is wagering on whales. Once a year-round fisherman in Mexico's Pacific coast village of Barra de Potosí, he now ferries up to six tourists at a time in his outboard boat to observe the humpback whales that take up residence in local waters from December to March. "This has been one of the best years, like 2015," Mellin says of the recently concluded season. "We have a lot of whales. There are many mothers with calves."

Although fishing continues in Barra de Potosí and neighboring coastal communities, Mellin says a two-thirds reduction in the commercial catch in recent years has prompted local fishermen to try their hand at ecotourism, particularly whale watching. Mellin belongs to the Servicios Turísticos Morros de Potosí, a seven-year-old cooperative that provides boat tours in the waters off Barra de Potosí, which is located in the southern Mexican state of Guerrero. Passengers see humpbacks (Megaptera novaeanglia), as well as manta rays, dolphins and other marine life. Barra de Potosí also is home to a tropical lagoon, where crocodiles can be sighted, and is extraordinarily rich in bird and butterfly species.

Migrating humpbacks made themselves conspicuous during the recently concluded whale-watching season off Mexico's Pacific coast. (Photo by Astrid Frisch Jordán)

The 33-member, ten-vessel cooperative reflects the growth of whale watching in Mexico and around the world in recent decades. Surveys by the International Fund for Animal Welfare (IFAW), a leading world wildlife conservation charity, showed that the industry expanded from US$1.25 billion to US$2.1 billion during the period 2001-09, and an update now being prepared by the organization is expected to record further gains. To be sure, the whale-watching growth has fueled concern that unless proper standards are applied and enforced, marine spectating could disturb and ultimately harm migrating whale populations. But experts say that when conducted in line with strict safeguards, the activity can bring valuable benefits, key among them stronger public appreciation and support for marine conservation, and an environmentally friendly, yet economically powerful, alternative to fishing.

Servicios Turísticos Morros de Potosí serves as an encouraging example, says Katherina Audley, founder of the Whales of Guerrero Research Project (WGRP), a nonprofit that promotes eco-friendly development, marine conservation and environmental education in Guerrero and other Mexican states. Says Audley: "[The cooperative] has definitely succeeded. The tourism co-op now outnumbers the [local] fishing co-op in numbers."

For Barra de Potosí fishing families, the hunt for alternative livelihoods is a need, not a choice. Fish stocks in local waters have become so depleted that residents sometimes buy fish in Acapulco. The phenomenon is not isolated: interest in providing whale-watching tours is evident in numerous Mexican coastal communities. That's why the Whales of Guerrero Research Project has extended its work northwest along the Pacific coast to help guide whale-watching efforts in Zihuatanejo, near the international resort of Ixtapa, among other places.

In the season that concluded in March, tour participants in the region had a great deal to see. Audley calls 2018 a "baby-boom year" for the humpback. She says humpbacks visiting southern Mexico's Pacific coast hail from two North Pacific sub-groups: an endangered set of about 400 animals found in the warm feeding months off southern California but which travels as far as Central America for the winter, and a larger population that passes the feeding season between Monterey, California, and British Columbia, Canada.

For Audley and her colleagues, winter is packed with whale watching excursions, classroom education, public presentations, and photo identifications of humpbacks, which are individually recognized by color patterns on their tails. The research project trains guides in whale-watching rules drafted by Mexico's Secretariat of Environment and Natural Resources (Semarnat), instruction that has increased the number of certified whale-tour operators from 27 to 51 during the past two years, Audley says.

Semarnat regulations require that vessels must:

- remain at least 240 meters from whales if they are not certified;
- stay at least 80 meters away if the vessel is large, and at least 60 meters away if it is small;
- operate at reduced speeds of four to nine kilometers an hour (2.2 to 4.9 knots) in the vicinity of whales;
- limit whale viewing to 30 minutes;
- not allow snorkeling fishing or feeding of whales;
- not exceed four in number when observing any individual whale or pod;
- and exercise special care observing whales with calves.

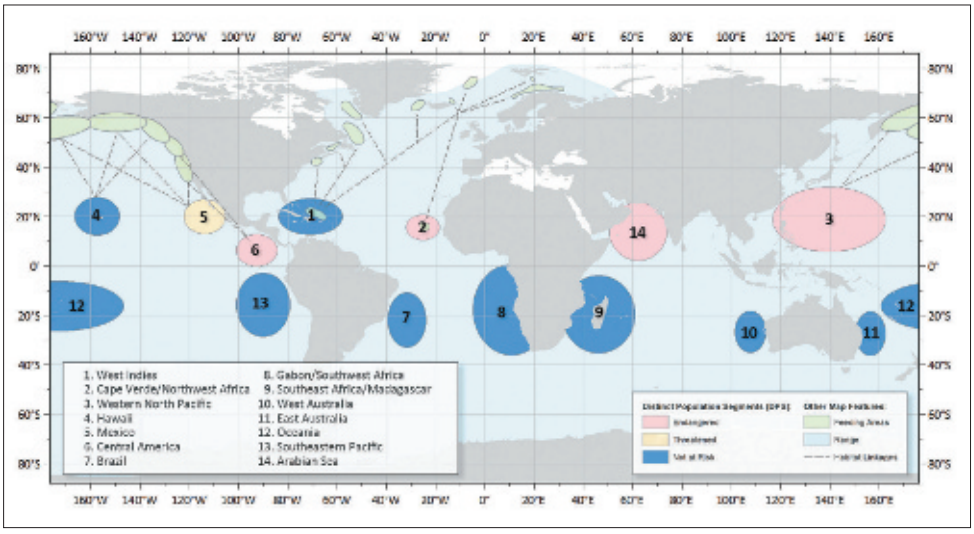
Educating youth and "citizen scientists" also is central to the research project's mission. Audley says the group reaches 1,200 school children a year, teaching computer skills while encouraging future scholars of the marine sciences. Loading more than 150 kids this season onto boats where they could hear the humpbacks' famed underwater "songs" via hydrophones, the outings surpassed an annual goal of 50 young whale watchers. Additionally, high school students from Zihuatanejo and the U.S. community of Sandy, Oregon, meet online to match whale photos taken during different times of the year along their respective coasts.

Audley argues early engagement in science and ecotourism can provide constructive alternatives in Mexican states like Guer-

rero, in which the violent, illegal drug trade ensnares many young people. "As fisheries collapse, a lot of kids turn to cartel activities because that pays," she says. "I can't get to everybody, but I can focus on one village... For the research project, saving the oceans and its marine life goes hand-in-hand with local development. You have to heal the communities to heal the oceans."

Among those reached by the project's programming is Yocsan Albarrán, 12, a Barra de Potosí middle schooler who recently delivered a presentation on the humpback whale to a largely adult audience at Eco-Tianguis Zanka, a weekly farmers' and artisans' market in Zihuatanejo. "I like when they jump and show their tails," he said after the talk. "It's a good thing to take care of them so there will be more in the region." The young whale enthusiast has "adopted" a newborn humpback calf he has named Violet Cabrera Solís after the family names of Yocsan and his friends.

As tracking technology advances, Violet and other whales are increasingly valued by the public as individuals rather than as an abstract, unknowable species. A website, happywhale.com, now allows anyone to post cetacean photos and—if a whale's identity is confirmed and the animal is spotted subsequently—monitor the whale's travels.



Distribution and status of world humpback-whale populations. (Source: National Oceanic and Atmospheric Administration)

Busy as whale watching along the state of Guerrero's northern coastline can be, it's even busier farther up the coast in Banderas Bay. The vast bay—shared by the states of Nayarit and Jalisco, where the resort city of Puerto Vallarta is located—is "the [humpback] hotspot of the Mexican Pacific," says Mexican biologist Astrid Frisch Jordán.

Frisch, a founder of the Puerto Vallarta-based organization Ecology and Conservation of Whales (Ecobac), estimates that 500 to 700 humpbacks winter in and near Banderas Bay. This year whale watchers there also were treated to numerous sightings of humpbacks breaching and tail splashing. After appearing only intermittently for a period of two years, the whales were regularly spotted off the port city's malecon, or seaside promenade, sometimes in groups of four or five.

María Azucena Macías of Bay Tours, another Puerto Vallarta water-touring company, also reported a steady pace of whale watching. She says foreign tourists frequently rank whale sightings as their day's main objective, while national clients prefer "two-for-one" packages that include activities such as visits to the Marietas Islands, which lie off Puerto Vallarta.

University of Guadalajara researchers José Luis Cornejo Ortega and Rosa María Chávez say organized whale watching in Mexico got started off the Baja Peninsula in the 1940s. Drawing on estimates made from government statistics and university surveys, Cornejo estimates the current direct and indirect economic impact of Banderas Bay whale-watching to be in the neighborhood of US$200 million a year. In Banderas Bay alone, the number of whale watching tourists has soared from 76,000 in 2011 to about 300,000 in 2017, Cornejo says, with the total for 2018 likely to be even higher once the final figures are tallied. He forecasts that by 2030, whale watch tours will serve 20% of the region's visitors, who currently are estimated to number more than six million annually in the Banderas Bay region. Says Cornejo: "Every year, records are being broken."

In Guerrero, on-water observation of whales is seen as a powerful means of engaging local children in science and ecotourism. (Photo by Whales of Guerrero Research Project)

Underlying the forecasts is the simultaneous annual migration to Mexico of two species: whales coming to calve, and human "snowbirds" flocking from Canada and the United States to escape winter. In addition to humpbacks, cetacean visitors include gray whales, which return each year to calve in Baja Peninsula coastal waters and have spurred tourism there as well.

Experts say whale-watching and other ecotourism is benefiting from growing green consciousness among tourists. As in Guerrero, civil society organizations and individuals in the Banderas Bay region are promoting whale conservation and ecotourism. Ecobac, for instance, trains whale watching operators there and in other regions of the country in the Semarnat regulations, which it helped draft; monitors regulatory compliance on the water with the assistance of a Mexican naval officer; contributes to the expanding catalogues of photo-identified humpbacks used in scientific research; and co-sponsors a biannual environmental fair. Once certified, whale watch professionals are issued a permit by Semarnat.

Patrick Ramage, marine conservation

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program director for the International Fund for Animal Welfare, calls Semarnat's regulations "relatively state of the art." But Ramage, who has studied safeguards worldwide, says such rules are "meaningless if they are not adhered to, and that's true in the U.S. as well as in Mexico."

Ecobac helps the Mexican Navy and other agencies monitor compliance in Banderas Bay, which has significantly more whale-watching history and vessel traffic than Guerrero does. The group reports steady improvement in the practices of water-tour operators, but Frisch acknowledges that deviations from best practice are a "constant" concern requiring ongoing attention. Experts agree that it is crucial to know how much of the activity is too much from the whales' perspective. Cornejo believes Banderas Bay can handle greater whale-watching volume as long as regulations are observed; but he cautions that research is needed to pinpoint areas where special controls are needed.

No-go zones

Semarnat prohibited whale watching near the Marietas Islands and along a small section of Banderas Bay's northern coastline due to concentrations of mother humpbacks with calves in those areas. And Ramage points out that worries about tour impacts worldwide have prompted the International Whaling Commission to study the issue, particularly the possible disruption of whale breeding, feeding and communication.

There's also the danger of whales growing too accustomed to humans. When John Calambokidis, a biologist with the Olympia, Washington-based Cascadia Research Collective, began researching humpbacks in the 1980s, there were "almost no encounters with friendly whales," he says. But the situation had changed by the 1990s, as Calambokidis discovered one day while alone in a small rubber craft off the southern California coast. Two humpbacks circled him, then one slipped under the boat and playfully lifted him into the air again and again for more than an hour, thankfully without harming the stunned human. Says Calambokidis, laughing: "Their size is not fully appreciated."

Whale watching clearly is helping to boost knowledge of the travels of individual whales. Ecobac's roster of photo-identified humpbacks in Banderas Bay increased from 991 individuals in 2007 to 1,965 in 2013, with hundreds of other photos awaiting analysis, says Frisch. Drawing on over 20 years of humpback observations, she now recognizes some whales by sight. Among them is a big male known as El Camello, or The Camel, that has visited every year since about 1999. Like the human tourists who travel to Banderas Bay, Frisch notes, many humpbacks visit only once while others keep returning.

Experts say the North Pacific humpback population has rebounded since hunting of the species terminated in 1966. The comprehensive census known as Splash (the acronym for Structure of Populations, Levels of Abundance and Status of Humpback Whales) estimated the North Pacific humpback population at over 20,000 a decade ago, Calambokidis says.

"They've increased past that 2004-2006 period when we did that North Pacific estimate, though it has leveled off," he adds. Based on Splash, Calambokidis estimates that 4,000 to 5,000 humpbacks likely winter in Mexican waters, with others heading for Hawaii or the far western Pacific. Jorge Urbán Ramírez, chief of the marine mammal program at the Autonomous University of Baja California Sur, says some 6,000 humpbacks could seasonally inhabit Pacific coastal areas of the Mexican mainland while another 2,000 frequent the remote Revillagigedo Islands south of the Baja peninsula. A recent government census, meanwhile, reported 1,365 gray whales this year in Baja's coastal waters. But conservationists fear that in an era of climate change, increasing frequency of ocean-warming El Niño weather patterns could force whales to abandon their traditional haunts.

Multiple pressures

Urbán is cautious about gauging the long-term effects of climate change on whales, but ventures that the warming of ocean temperatures in El Niño years could cause humpbacks to avoid places like Banderas Bay or coastal Guerrero state, where whale sightings diminished significantly during the El Niño of 2016. "This is very complicated, but in a simple way what we can say about La Niña [and] El Niño is that when the temperature is a little warmer, whales distribute more to the north," Urbán says. Meanwhile, Calambokidis pinpoints three "major" pressures on migratory whales aside from climate change and water pollution: ship strikes; underwater noise; and entanglements in fishing gear and other materials.

Researchers monitoring such problems face an array of challenges, including public and private funding cutbacks, but they are moving ahead with projects. Urbán, for instance, plans workshops to improve coordination among scientists, non-governmental groups and Mexican authorities in identifying and protecting humpbacks. He also advocates an initiative of benefit both to the whales and the humans eager to see them: a humpback biological corridor from Mexico south to Central America and, eventually, north to the United States. Asked to describe his strategy, he answers simply: "Step by step."

–Kent Paterson

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Colombian highway
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as the plains of Venezuela and Bolivia. Conceived as a means of enabling cargo-hauling by truck between the Atlantic and Pacific oceans, the 5,584-kilomter (3,470-mile) route along interlocking highways is nearly complete. But the path planned for the Colombian portion, seen as a boon for oil palm and petroleum companies, ran near four national parks, bisecting biological corridors that unite ecosystems of the Andes, Amazon and Orinoco.

"This [decision] is Colombia's most important environmental decision of the last 10 or 20 years," says Rodrigo Botero, director of the Foundation for Conservation and Sustainable Development (FDCS), a Bogotá-based non-governmental organization. "It protects the essential biological structure of Colombia and sets a precedent for taking biological corridors into account in the building of infrastructure and other development projects."

The government's decision comes after two years of spiking deforestation in the Colombian Amazon as farmers, ranchers and land speculators moved into areas previously occupied by the Revolutionary Armed Forces of Colombia (FARC). The leftist insurgent group signed a peace agreement with the government in 2016 after nearly six decades of war.

Chaotic vacuum

Though the FARC is no longer on the scene, the state has not filled the void. That and the lack of an organized system of land titling have prompted a free-for-all scramble for property. Fires blacken large tracts as investors use slash-and-burn techniques to clear state-owned forest and take possession of land illegally, then sometimes turn around and sell the property on the black market for huge profit.

The scramble was fueled by expectations that Colombia would build its Marginal de la Selva section as originally planned, with work starting this year and wrapping up by 2023. Not coincidentally, experts say, the Colombian Amazon experienced a 44% increase in forest loss during 2016, the most recent year for which reliable figures are available, and an estimated five-fold surge in land values near the highway route over the last two years.

On Feb. 21, the government announced the expansion of Chiribiquete National Park, one of the protected areas close to the original route. As a result, the park, already the nation's largest, increased in size by 15,000 square kilometers (5,792 sq. mi) to 43,000 square kilometers (16,602 sq. mi), or an area roughly the size of Denmark. The decision to cancel the road followed, and the government has said it will move to destroy numerous illegal side roads and airstrips that have sprouted up in the area in anticipation of a commercial boom.

"Some roads we've analyzed have been built in protected areas and others have been built to seize lands, extract natural resources or engage in illegal activities," said Environment and Sustainable Development Minister Luis Gilberto Murillo in a March 9 interview with El Tiempo, a daily. "In the case of the Marginal de la Selva, it's clear there was a direct correlation between the [anticipated] construction of the road and the increase in deforestation."

Experts say the road would have severed biological corridors between Chiribiquete, the 6,200 square-kilometer (2,400-sq-mi) Serranía Macarena National Park, the 2,018 square-kilometer (779-sq-mi) Tinigua National Park and the 4,477 square-kilometer (1,729-sq-mi) Cordillera de los Picachos National Park.

Rainfall effects

Mammal species including jaguars, deer and monkeys crisscross those areas, which also host hundreds of species of birds and plants. The corridors also serve as conduits for moisture moving from the Atlantic Ocean through Amazonian forests and into the Andes in cycles of evapotranspiration that provide water for small- and large-scale agriculture and for some of Colombia's biggest cities. Says Botero: "Large-scale deforestation in this area would have resulted in a significant decrease in rain, large impacts on rural development and the eventual collapse of ecosystems."

The government plans to reroute the road northwest to an Andean area between San Vicente del Caguán and Neiva. This portion would connect to existing roads that run west to the Pacific port of Buenaventura and east to Puerto Carreño on the Venezuelan border. The government says it also will develop a network of carefully planned smaller Amazon roads to allow delivery of key social services and transport of locally produced goods to market—goals seen as key to cementing peace in the wake of the country's long civil conflict.

Meanwhile, projects are underway to boost community-based sustainable forestry projects and agro-ecological projects in the Amazon, many potentially involving former members of the FARC.

"It's absolutely critical to establish authority in the area because people who want to cut down forests and clear land can do so much faster than the government and conservationists can stop them," says Andrew Crawford, a biology professor at the University of Los Andes in Bogotá. "That and sustainable development projects could make a big difference."

–Steven Ambrus

Juan Manuel Santos (Shutterstock.com)

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Bee die-off
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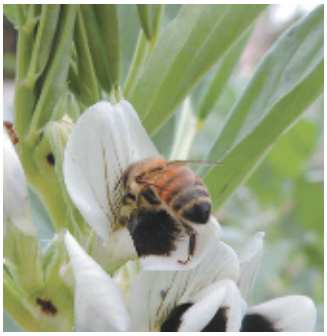

(Photo courtesy of SADA)

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populations—along with wildlife habitat and biodiversity generally—are being threatened by the expansion of the country's large-scale model of monocrop farming, mainly of soy. That model is based on the heavy use of agrochemicals in conjunction with seeds genetically modified to tolerate them.

Shrinking industry

Underlying their concern is a dramatic contraction in Argentina's once burgeoning honey industry—the Latin American leader, with output of 60,000 to 70,000 tons annually. According to government figures, there were 9,227 beekeepers tending 2,322,975 hives nationwide in February of this year. That compares to 33,781 and 4,151,178, respectively, in 2010, the official data shows.

"The bees are disappearing. Because their natural land, their forests, their flowers are disappearing," the Argentine Society of Apiculturists (SADA) said in a press statement issued this month. "The countryside has become brown and submerged in poisons. The bees don't have healthy food, and what they have is scarce, without variety and, in the majority of cases, polluted with agrochemicals."

The SADA statement added: "The current agro-industrial model Argentina uses is sustained by genetically modified seeds and the use of millions of liters of chemical insecticide, herbicide and fungicide, which destroy flowers, ecosystems and the rest of the fruit and vegetable varieties, flora and forest fauna."

SADA's statement followed a tense meeting on March 27 of the National Apiculture Council, a unit of the Argentine Agroindustry Ministry in which a wide range of public and private honey-production stakeholders are represented. According to SADA, when one honey producer at the meeting raised the concern that Argentina's agricultural model was killing bees and threatening biodiversity, Agroindustry Minister Luis Etchevehere responded: "How do you think you can live with it? Because this model is not going to change."

Etchevere has neither confirmed nor denied that he made the remark, and his ministry did not respond to a request from EcoAméricas for comment. But on April 17, the government news agency Télam quoted an unnamed Agroindustry Ministry spokesman as saying that apiculture "can coexist perfectly well with the rest of the agricultural activities," as long as farmers adopt "best practices" being promoted by the government.

The Télam dispatch came a day before SADA leaders appeared before the Argentine Senate's Environment and Sustainable Development Commission to discuss the decline in bee populations. The commission's president, Sen. Fernando Solanas, expressed strong support for the apiculturists' position. "Without bees, there is no life," he said. "And that is not just a problem involving soy, because today in Argentine agriculture there is a culture of fumigation that applies to all grains, fruits and vegetables."

Solanas pledged to push legislation filed last year that would require that croplands include natural areas. Such action is viewed as long overdue by many experts, among them Gervasio Piñeiro, ecology professor at the University of Buenos Aires.

"The decline in the quantity of bees is a symptom of something more serious, which is the loss of biodiversity," Piñeiro says. "Agricultural producers must understand that their activity, aside from producing soy, wheat or milk, causes a deterioration of ecosystem services that is so great today that it is necessary to add ever-increasing amounts of inputs to keep producing."

He adds: "In Argentina, a producer that a few years ago spent US$30 per hectare on agrochemicals now spends more than $100 due to the weeds becoming resistant. If the producers don't engage in agriculture that also produces bees, the problems will become their own because nobody will transport pollen to their crops, and yields will continue falling."

Pattern revealed

Among the honey producers who have warned for years about the impacts of expansion of Argentina's monocrop farming frontier is Carlos Muñoz, who tends 30 hives in the community of Guernica, 35 kilometers (22 miles) outside Buenos Aires. An agricultural engineer who specialized in remote sensing and geographical information systems, he used satellite images to study land-use change around honey-production sites during the period 2007-15. He then cross-referenced the data with figures on the honey-yield of hives.

"We showed that when agricultural surface increases, the yield of hives can decrease from 25% to 40%," Muñoz says. "The bees look for flowers to feed on within [a radius] of 2,000 meters. If they don't find a variety of plant species, it is difficult to achieve a good yield."

Adds Muñoz: "This situation can change. In Ohio, in the United States, the opposite is occurring. The proximity [to hives] of agricultural areas increases the yield of hives. The difference is that there, buffer zones were established in which [farming does not occur]. In the Argentine countryside, all of the land is used for cultivation."

–Daniel Gutman

Around the Region
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Honduras to the southern shores of Brazil, make particularly good sentinels, scientists say, because of the 26 species of cetaceans found off Brazil, it is the only one to inhabit nearshore waters. Some of Brazil's coastal bays are highly polluted due to their proximity to industry or urban populations.

Sepetiba Bay seemed to provide ideal conditions for the virus to spread because it shelters the world's largest concentration of Guiana dolphins and is heavily polluted. Over the past 30 years, industry has transformed a beachside fishing hamlet in Rio's western suburbs into a major shipping outlet for exports in southeastern Brazil, the country's manufacturing hub.

The bay also is now home to a major industrial port with some 600 factories operating near its docks and along the two rivers that empty into the estuary. The plants manufacture steel, chemicals and other products, discharging effluent that eventually enters the bay. Untreated sewage also reaches the bay from the once-sleepy region's urban population, which includes nearly one million slum-dwellers along the two rivers.

Biologists also believe that so-called "emerging contaminants", together with classic contaminants, could have further lowered Guiana dolphin resistance to the virus.

These pollutants range from pharmaceuticals and personal care products to UV filters used in sunscreens. Emerging and classic contaminants are endocrine disrupters that change the hormone levels in mammals and interfere with immune, reproductive and neurological systems.

"This lethal cocktail of contaminants made those Guiana dolphins in Sepetiba Bay with lower disease immunity more susceptible and unable to resist the virus," says Mariana Alonso, a marine biologist at the Federal University of Rio de Janeiro who is investigating the cause of their deaths. "Others of their members likely built up antibodies that made them more immune and resistant to it. But, like all viral epidemics, this one appears to have peaked because dolphin deaths have in recent months dropped off rapidly."

Leonardo Flach, scientific coordinator of the Grey Dolphin Institute, a Rio de Janeiro state cetacean research center, says that in the month-long period from mid December to mid January, the peak mortality period, some 140 carcasses were fished out of the bay. Some 65% of the carcasses were those of calves or adult females, the least resistant to the virus. From mid January to late February only 36 carcasses were found, says Flach, who also is taking part in the investigation of the die-off. And from March 1 to April 15, he adds, only 14 carcasses were found.

Kátia Groch, the University of São Paulo veterinarian who first identified morbillivirus in Guiana dolphins, says females in the local population proved more susceptible to the virus because the energy demands of dolphin mothers raising calves reduces their immunity to disease. She says that calves, for their part, are more vulnerable because their immune systems have not fully developed.

She adds that the virus is most likely spread by air through dolphin blowholes, but also could be transmitted through mother dolphins' placentas and milk, or by means of contact with open sores and wounds of virus-infected dolphins. Like Flack and Alonso, Groch believes the viral epidemic has passed, but she says this particular virus has epidemic cycles and could return to Brazil.

"The virus won't likely again break out in Guiana dolphins that have been immunized against it," Groch says. "But it could break out in their future offspring, which have not acquired an immune system resistance to it."

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Mexican officials at a loss to explain sea lion deaths

Mexican authorities say they have yet to turn up information explaining a spate of sea-lion deaths near the Pacific coast community of Mazatlán.

The Federal Attorney for Environmental Protection (Profepa) reports that a dozen dead sea lions have been found at different locations in Mazatlán's harbor since late December with no apparent injuries or wounds.

Officials said the sheer number of deaths was highly unusual, adding that the carcasses were too decomposed to determine the cause.

"We know that this is something that happens in this coastal area, but it was shocking to know there were [so many] of them," says Jesús Avendaño, a Profepa representative in the state of Sinaloa.

In Mazatlán, there was speculation that members of the fishing community were to blame, as sea lions are known to snatch fish from their nets. In 2015, Profepa had created a network of surveillance to safeguard sea lions, training citizens in the area as well as local and state officials and even academics, to promote protection of the animals.

Yet the number of marine mammals found dead in the waters off Mazatlán so far this year—fourteen including dolphins according to local media reports—is worrisome, says Emiliano Arroyo, professor at the Universidad Autónoma de México (UNAM) and a biologist who specializes in marine mammals.

"I've never seen numbers like these," he says. "In my eight years studying this I'd never heard or seen anything similar to mass deaths of sea lions like this."

Arroyo says that a competition for fish resources between sea lions and fishermen in and near Mazatlán is well known among academics and marine conservationists.

Authorities themselves addressed this speculation by sending out a memo to local fishing communities, urging them to adopt preventative measures, such as regular monitoring, to ensure the safety of sea lions.

Fishermen responded by asking their work not be "demonized," according to local media reports.

"The problem of the interaction of marine mammals with fisheries is serious, but in this case we can't prove this is the cause of their death and so the mystery continues," says Óscar Guzón, an oceanographer who specializes in marine ecology and owns Onca Explorations, a company that finances research projects with tours and whale watching.

Adds Guzón: "Beyond that, we know that the problem exists, and what's important is that we tackle it from the social side, to do the work necessary to teach the community that conserving biodiversity is important for them, too."

Follow-up: Emiliano Arroyo, Professor, Universidad Nacional Autónoma de México (UNAM), Mexico City, Mexico, +(56) 224-800, ext. 44723, zappata@ciencias.unam.mx; Óscar Guzón, Oceanographer and Director, Onca Explorations, Mazatlán, Mexico, oscarguzon@gmail.com.

Q&A:

Monoculture putting pollinators, biodiversity at risk, expert says

Lucas Garibaldi, an Argentine agricultural scientist, researches ecological, social and economic sustainability of food and forestry production. A faculty member at the National University of Río Negro in Bariloche, Argentina, Garibaldi worked with scientists from different regions of the world on a 2016 global assessment of pollinators and pollination in food production. Commissioned by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), an independent, intergovernmental body created in 2012 to monitor the state of biodiversity and the ecosystem services it provides. The assessment concluded that 75% of food crops and nearly 90% of wild flowering plants depend at least to some extent on animal pollination. Garibaldi, a member of the International Federation of Beekeepers Associations' scientific panel on pollination and bee flora, has advanced the view that bee die-offs in Argentina are a serious symptom of deteriorating biodiversity. He spoke by telephone this month from Bariloche with Buenos Aires-based EcoAméricas correspondent Daniel Gutman.

Lucas Garibaldi

Describe the relationship between biodiversity and food production.

The presence of biodiversity increases food production, as we established in the research we did with more than 50 scientists on 600 areas of cropland on all continents. The bee visits flowers of different crops, and through pollination contributes to the formation of fruits and seeds that we then eat. Worldwide there are more than 20,000 bee species. Pollination is also performed by birds, bats, beetles, butterflies and flies. All are necessary because the climate changes, crops flower at different times and different pollinators fit different conditions. So to have adequate pollination, one needs different species that complement one another.

In that context, what is the impact of monocrop agriculture?

Monocrop farming runs counter to good pollination in various ways. Imagine we have 1,000 hectares [2,500 acres] of one crop whose flowers all bloom at once and in a short period, for example over two weeks. The flowers are resources for the pollinators, which need a diversity of flowers during their whole life cycle, which is much longer than two weeks, so they can't survive. Monoculture replaces the heterogeneity of nature with one species, which becomes dominant, hoards all of the ecosystem resources and does away with the diversity of pollinators. The dominant model today is large-scale monocropping, with an increase in the use of agrochemicals and the homogenization of the landscape with ever-larger [land] parcels. This process is very intense in Latin America in general and in Argentina in particular. In the cultivated areas, our diversity is among the lowest in the world. The principal cause of the loss of biodiversity is not climate change or deforestation, but instead the crops that we develop and the animals we raise to consume. They occupy 40% of the [world's] land surface. And they have the best land because a good part of the remaining 60% is desert or is occupied by cities.

What would your outlook be if it were certain that the current system of production will remain in place?

The trends are alarming. If over the next 40 years we have to double food production, this requires greater expansion of the agricultural landscape to the detriment of plant diversity, which in turn means lesser diversity of pollinators, less pollen in the flowers and, therefore, lower crop yields. If our crops yield less and we have to produce the same quantity of food we will have to expand more. Again, that would require more agricultural land, less plant diversity, fewer pollinators, less pollen and lower crop yield per hectare. It is a negative cycle that puts us in an ever-worsening situation.

You drafted legislation presented last year in the Argentine Senate to promote biodiversity where cultivation occurs. What's that about?

To promote a greater diversity of birds, insects and plants. Agricultural producers have to bring diversity back to the countryside. A multiplicity of plants and trees should be favored to give refuge to pollinators in the fragments of habitat remaining amid the agricultural activity. Practices that are pollinator-friendly are human-friendly. It is essential to promote diverse habitats, as is already being done in Europe. It's about, for example, conserving a portion of grassland in flood-prone areas where flowers can appear, which benefits pollinators and predators of pests.

What, in this context, is happening to Argentina's bees?

Argentine apiculture is in a serious crisis associated with environmental questions. It is a delicate situation because our health depends on the health of the ecosystems, and when the ecosystems degrade for the pollinators they degrade as well in other respects—for instance in their capacity to provide water or air in sufficient quantity and quality or to prevent erosion of the soil. Of course, food production also depends on such factors as rain, irrigation, genetics or fertilizers. But biodiversity has a significant impact, and the deficit of pollination puts a brake on the growth in yields.

What solutions do you see?

The need to produce more food must be reconciled with the protection of biodiversity. The agricultural frontier expands in response to market forces, not as a result of food-security reasons. A good part of our crops are not used in food, but instead for biofuels. A more rational use of resources needs to be promoted. Intensive animal production requires a great deal of agricultural land area and are inefficient. When soy in Argentina is produced to feed pigs in China, there is a loss of energy that would not occur if crops were consumed directly by people. The principal epidemics at a global level, such as diabetes or heart disease, are related to poor or excessive eating. Many people go hungry in the world, but there are many more who eat too much. Today there is sufficient food for everyone. That's why the growing demand for agricultural products is not related to food production. The problem is not quantity, but instead access and utilization. Instead of continuing to deforest and degrade land for economic reasons, we should move toward crops that are more important for our food security, such as greens, legumes and dried fruits.