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AMPLIFY

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Anticipate, Innovate, Transform

**The Role of the
Enterprise in a Nature
Positive World, Part II**

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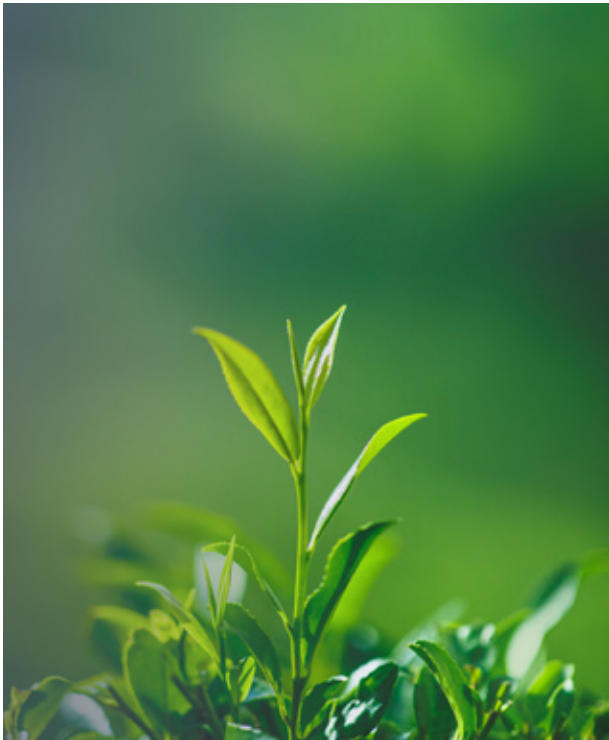
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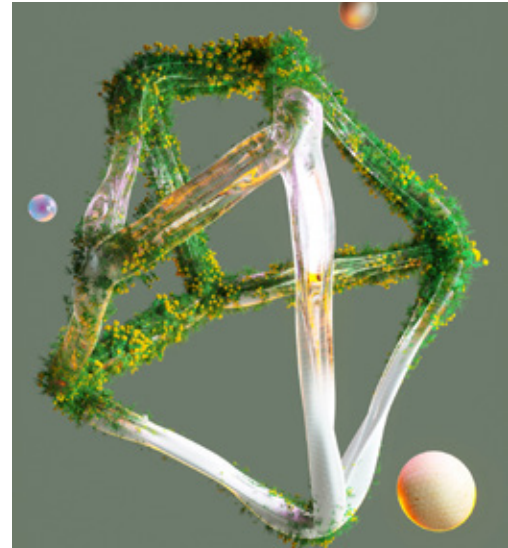
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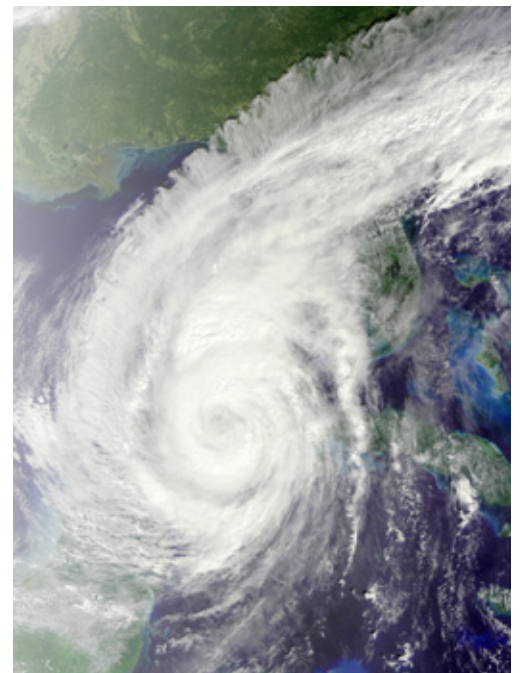
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THE ROLE OF THE ENTERPRISE IN A NATURE POSITIVE WORLD, PART II

BY MARGARET O'GORMAN, GUEST EDITOR

This issue is the second in a two-part *Amplify* series on nature and private enterprise. Part I focused on policy and introduced the concept of nature positivity and the frameworks that support it.¹ This issue explores practice — because at the end of the day, it is the practice of place-based action that will deliver a nature positive future.

Action for nature has many names. It can be called “ecological restoration,” “site remediation,” “reclamation,” and “rewilding.” Action for nature can also be contained in protection, preservation, and conservation, as encapsulated in calls for 30% of Earth to be protected by 2030.² These terms encompass worlds of diverse approaches that share a singular purpose: creating a nature positive world. Action for nature can be as simple as planting a tree or as complex as restoring a coastal wetland, both of which are covered in this issue. But regardless of the words used and the approaches taken, action is where the rhetoric stops and the difference is made.

In this issue’s five articles, the reader will explore how business can act for nature and read case studies of robust conservation or restoration efforts in diverse locales across the globe. The case studies explore places like the city of Detroit, Michigan, USA, where historic disinvestment in the city’s tree canopy has caused declines in community health and well-being. The case studies also touch on addressing a singular species like the northern red-bellied cooter, a group of species like arboreal mammals, and an entire ecosystem like the US Gulf Coast. Many of the articles touch on the co-benefits of acting for nature, and all highlight a science-based approach to their respective efforts.

IN THIS ISSUE

There is a key difference between governmental and nongovernmental organization (NGO) actors for nature and the private sector. Fish and wildlife departments in the US and natural heritage agencies elsewhere, for example, are chartered to act for nature. NGOs and other civil society groups are driven by a mission to enhance the natural world — the corporate world is not. On the contrary, for-profit companies must satisfy shareholders and stakeholders. They must be in compliance with environmental, health, and safety regulations. They must meet budgets, address risks, secure their supply chain, and support their workforce.

When it comes to nature, much business action will be beyond compliance and done for reasons that support the bottom line but do not drive it. To overcome these conditions, as Sara Cook highlights in our first article, business must adopt a strategy for nature: aligning corporate ambitions with place-based action that is both stakeholder-informed and fully resourced. Cook provides examples from GM, Holcim, WM (formerly Lafarge), Owens Corning, CEMEX, and others that show the importance of developing a nature-based strategy, providing the toolkits to make it happen, and ensuring sustainability of engagement through management, monitoring,

and intersections with community needs and priorities. By identifying these intersections, corporate nature action can deliver multiple co-benefits.

In our next article, Kate Mitchell illustrates this concept by introducing the Detroit Tree Equity Partnership (DTEP) led by DTE, the energy company that serves electricity to 2.2 million customers in Michigan. DTEP brought DTE and its partners together with a goal to plant 75,000 trees across the city, delivering co-benefits like training 300 Detroiters as urban foresters, storing 152,000 pounds of carbon, absorbing 303 million gallons of stormwater, and saving Detroit residents US \$12 million in energy costs.

Using locally sourced trees from Urban Farm Development Managers LLC and working with a local tree group, DTE is planning to *plant for impact* by installing trees along freeway corridors and areas known for blight. The placement is further informed by the City of Detroit's Planting Priority Index, which explores 15 factors (e.g., canopy inequity, traffic volume, asthma rates, and school locations) to ensure urban forestry investments are directed to the right places.

To support efforts like this across the country and beyond, the Wildlife Habitat Council (WHC) developed *Across Fence Lines*, a suite of products to inspire action and guide implementation of community-first efforts for forestry.³ As Mitchell states in her article, a major piece of the effort is getting the right trees and putting them in the right place. In other words, the partnership is informed by science.

Next, a group of authors from the Smithsonian Conservation Biology Institute explore the idea of science-informed nature action in more depth. Jessica L. Deichmann et al. use compelling case studies from the cutting edge of the Smithsonian's conservation research to show how problems that impact nature across the life-cycle of a development project can be solved.

Looking through the lens of development projects along the stages of planning, construction, operations, and closure, the Smithsonian article shows that scientific research, creative thinking, and supportive business partnerships can deliver effective solutions like tree bridges over pipelines to address habitat fragmentation in the Peruvian Amazon and data visualization

tools to support adaptive management in restored ecosystems in the Andes Mountains. In each case study, the impact extends beyond science into policy, like the Peruvian government requesting tree bridges across all possible pipelines and the Smithsonian producing a white paper detailing waste management protocols in Gabon, Central Africa, to reduce human-elephant conflicts. Innovation, the authors point out, is an integral component of business models. Through the case studies presented, it's clear that innovation is also key to solving conservation challenges.



In an article far removed from Peru or Gabon, Christine J. Miller, Benjamin J. Langey, and Scott E. Bush take innovation to the broken places on planet Earth by showing the opportunities for collaboration when endangered species colonize ecosystems on contaminated lands. Brownfield sites are a classification of contaminated properties in the US; in many cases, their abandoned nature and relative inaccessibility create circumstances for adaptable species like the northern red-bellied cooter (an endangered turtle in Pennsylvania) to establish populations.

Protected status need not be an obstacle to development if stakeholders engage in honest dialogue and science supports proposed interventions. Remedial design that incorporates

such nature on-site can deliver benefits such as enhanced water quality and increased community access. Overall, redevelopment projects are covered by a complex web of local, state, and federal regulations, and nature is rarely a key consideration, so early stakeholder intervention is essential, along with scientific monitoring before, during, and after development.

In the final article in this wide-ranging, action-oriented issue, Rob Campbell-Watt explores the Gulf Coast in Louisiana and highlights a different set of co-benefits resulting from restoring coastal wetlands. In this case, a restoration effort becomes a nature-based solution that in turn becomes a carbon offset, achieving a positive ROI.

Marshes, swamps, and other aquatic ecosystems contain a significant store of carbon, with coastal wetlands covering less than 2% of the total ocean but accounting for 50% of the carbon stored in ocean sediments. Add this to the importance of marshes and mangrove swamps for nature and for storm protection — and a strong business case for their restoration can be built.

Campbell-Watt lays out the reasons coastal restoration is a sound investment and shows how, with verification and measurement, the investment can turn a profit by being monetized as an offset. Offsets are a critical part of the climate mitigation equation and, when done properly to meet standards like those set out in the Oxford Offsetting Principles, they can have a measurable result on our global carbon budget.⁴ When they're done holistically, like in the approach outlined by Campbell-Watt, they deliver both for carbon and a nature positive future.

IT'S TIME FOR ACTION

These two *Amplify* issues seek to highlight the need for business to incorporate nature positive ambitions and actions into corporate citizenship and sustainability portfolios. The Global Biodiversity Framework recently adopted by the Convention on Biological Diversity (CBD) at the *15th Conference for the Parties (COP15)* for the first time suggests that businesses report and disclose nature-related risks and dependencies.



But risk reporting changes nothing without attendant action. This second issue of *Amplify* shows clearly that action can happen, supported by a robust body of scientific research and an enthusiastic cohort of passionate conservation. Connecting the dots from dependencies to delivery of positive biodiversity outcomes is what will move us toward a nature positive future. Action is key.

Nobel Peace Prize Laureate Wangari Maathai noted that “you don’t need a diploma to plant a tree” to express how simple the act of nature restoration can be.⁵ Business can learn from this assertion, using science, planning tools, stakeholders, policy, and best practices like those described in this issue of *Amplify* to move easily from ambition to understanding and onward to action for nature.

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About the guest editor

MARGARET O’GORMAN

Margaret O’Gorman operates at the intersection of business and nature. She is President of the Wildlife Habitat Council (WHC), an organization that assists multinational corporations in integrating conservation objectives into their sustainability efforts. Ms. O’Gorman helps companies drive long-term sustainability through WHC’s signature Conservation Certification recognition, which serves to define the standard for corporate conservation worldwide. She inspires companies to enhance their ecosystems, connect with communities, and engage their employees. Ms. O’Gorman has consulted with *Fortune* 500 companies like General Motors, Exelon, Chevron, BASF, and many others to develop strategies and frameworks toward biodiversity in business. These strategies have been deployed across more than 1,000 conservation programs in 28 countries and have connected simple and complex acts of conservation to larger corporate goals.

Ms. O’Gorman is a compelling writer and speaker on the need to act for nature. She is the author of *Strategic Corporate Conservation Planning*, which advances the idea that business value can be realized from conservation action. Ms. O’Gorman uses her platform and audience to promote private sector engagement in conservation action to restore ecosystems, recover species, connect people, and make a positive difference to people and planet. Prior to her work with WHC, she led the Conserve Wildlife Foundation of New Jersey and also led fundraising efforts for New Jersey Future and Pinelands Preservation Alliance. Ms. O’Gorman earned a master of science degree in micropaleontology from the University of Southampton, UK. She can be reached at mogorman@wildlifehc.org.

A STRATEGIC APPROACH TO CREATING NATURE UPLIFT ON CORPORATE LANDS



Author

Sara Cook

The columns of words written about how the private sector can engage with nature have been dominated by high-level initiatives and frameworks aimed at helping businesses understand their impact on nature; assess risks and dependencies on water, air, and biodiversity; and account for these items in complex ways. Far fewer words have been expended on moving a company from understanding its dependencies to understanding its opportunities — and how to create intersections between corporate ambition and action for nature. With more than three decades of engagement at the action end of corporate conservation, Wildlife Habitat Council (WHC) offers various actions for nature, including the four imperatives highlighted in this article.

1. START WITH A STRATEGY

Strategic planning is more than a half-century-old. Small nonprofits and large corporations alike use it to set priorities and create common goals around which resources, employees, and stakeholders can be deployed. Strategic planning connects corporate priorities to site-based activities and ensures that operations support financial and other needs at headquarters. Good strategic plans can remove distractions, eliminate uncertainties, and provide clear pathways for progress and performance assessments.

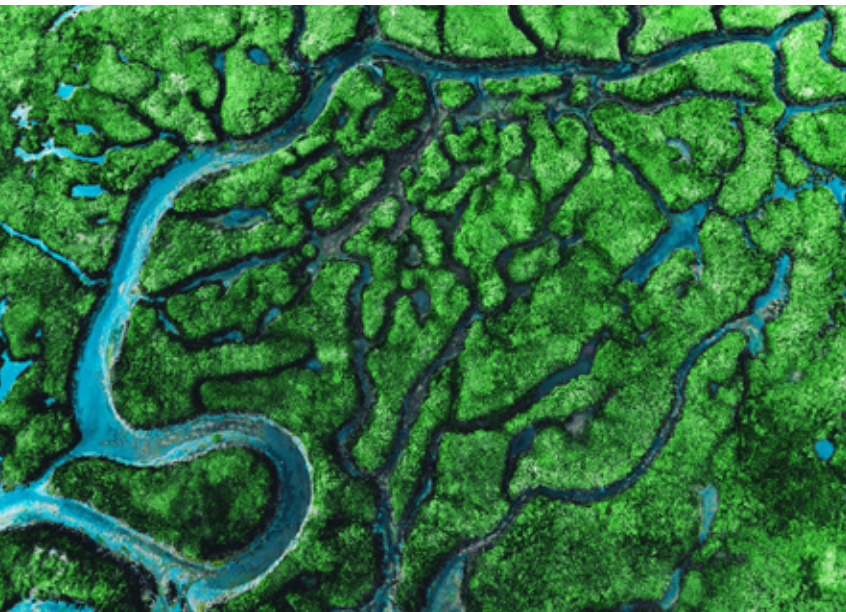
**WHEN COMPANIES
LOOK TO CREATE
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PROGRESS ON
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SHOULD REACH
BACK TO BASIC
BUSINESS
MANAGEMENT
AND CREATE A
STRATEGIC PLAN**

When companies look to create pathways for progress on nature, they should reach back to basic business management and create a strategic plan. Because nature is not acknowledged by many businesses as a materiality,¹ it's even more important that any corporate ambition toward nature positivity be framed as a strategy. And because action for nature is not central to most industrial processes (or most environmental health and safety regulations), it's imperative that it be resourced accordingly.

When former building materials company Lafarge (now Holcim) adopted a net positive impact (NPI) goal for its quarries worldwide, it knew a strategy was needed to ensure that its more than 700 quarries worldwide would act for biodiversity. In 2014, the company worked with WWF and an international biodiversity panel to create the Lafarge Biodiversity Strategy.² It pulled together existing processes to address biodiversity efforts like group-level guidance documents, site-based stakeholder engagement efforts, biodiversity management plans, and rehabilitation plans.

Importantly, the strategy overlaid Lafarge's commitment to the mitigation hierarchy, to NPI, and to not opening new sites in World Heritage areas or areas designated (at the time) as International Union for Conservation of Nature (IUCN) priority areas.

The strategy laid out biodiversity risks and opportunities, presented tools and processes that could be deployed at the sites, and highlighted the results of a screening process that determined the proximity of locations to sensitive biodiversity areas. It was an early example of a company working to frame its impacts and ambitions by using tools and screening exercises to prioritize action.



2. OFFER ACTION-BASED TOOLKITS

Action for nature can be complex. For example, restoring wetland complexes requires knowledge of hydrology, and managing rare/protected species can only be successful with knowledge of both regulations and biology. In instances like these, corporate land managers reach out to experts from government agencies and civic society. But for many private sector lands, experts are not required, and best management practices exist to support basic restoration and habitat management programs.

For example, place-based efforts can be supported with toolkits and decision trees that are typically deployed across companies for a variety of uses, from business improvement initiatives to the introduction of new processes and products. Toolkits and decision trees can be likewise deployed for nature-based efforts.

In 2016, when General Motors (GM) announced its goal to have 100% of its manufacturing facilities engaged in nature-based programs,³ the declaration was made from corporate headquarters, but operations across the world lost the imperative in translation. Proving grounds in China, assembly plants in South Korea, and the iconic GM Tech Center in Michigan, USA, were all expected to participate, but because each location has a unique conservation context, culture of engagement, and available resources, a blanket statement of intent was not sufficient to drive action.

Over the next five years, GM developed toolkits for every location covered by the sustainability goal. The toolkits did the following:

- Spelled out the importance of biodiversity and the crisis of biodiversity loss.
- Placed this issue within the company's sustainability ambition and highlighted the specific goal to have all manufacturing facilities implementing biodiversity efforts by 2020.
- Set out the conservation context in which the location sat, outlining the ecoregion, the conservation priorities pertinent to that place, and the opportunities to act for specific species or habitat types.
- Reckoned with the specific culture of the operation, understanding that some sites would be able to engage employees in voluntary conservation efforts while others would need to reach out to community partners.

Specific project recommendations aligned with local conservation priorities and explained the necessary resources in terms of people, money, and intensity of future management. Because GM encouraged sites to seek verification for these efforts, the toolkits aligned with WHC's certification requirements for ease of reporting.

In part because of these toolkits, GM met its sustainability goal in 2020, with its global manufacturing group implementing nature programs and seeking verification. GM exceeded expectations when locations outside of the manufacturing sector joined the effort. Subsequently, when the company divested many of its European operations, the programs continued outside of the sustainability goal.

3. SUPPORT ONGOING MANAGEMENT & MONITORING

New biodiversity projects can garner a lot of support from employees and managers interested in designing and implementing efforts for nature. Long-term maintenance and monitoring is less exciting and can lead to a project failing or underperforming. A lack of monitoring can make it difficult for a program to seek or secure verification — most certification and recognition programs require evidence of upkeep and impact.

Management and monitoring range from simple to complex, time efficient to time intensive, and specialized to general. Successful development and implementation of these regimens starts with initial project design. It should take into consideration the type of ecoregion and its size, the availability of financial and human resources, and the type of site.

For example, is the industrial location staffed on a continual basis like a factory, mine, or steel plant, or is it sparsely populated like an electric transmission line, a brownfield site, or an office campus in a post-pandemic world? If the nature program is designed to fit the site, management and monitoring will flow more easily.

The most sustainable nature-based efforts on corporate lands have support for management and monitoring. There are many ways this support can be given:⁴

- Financial support can provide the nature-based project with the materials and tools needed to both implement the project and monitor it. Such support does not have to be a huge expense, but it does need to be commensurate with the proposed effort.
- Giving employees the time to engage can be powerful and can support both a biodiversity goal and employee engagement goals. Employees who act for nature at their place of work are engaging in healthy, collegiate, positive activities. By providing time for employees to implement, manage, and monitor a nature project, a sense of pride and ownership is generated. For example, global materials company Owens Corning hosts employee lunch-and-learn presentations that focus on the conservation programs happening at its 40-acre facility. The presentations teach

employees about ongoing nature projects and how to get involved. External speakers from project partners bring in-depth knowledge of the topic to the presentations.

- Encouraging and allowing community partners to participate in a nature program on corporate lands can bring numerous benefits, including securing a social license to operate and increasing community engagement. Local Audubon chapters or less formal nature-related groups can bring the time and expertise needed to manage and monitor efforts and provide access to normally restricted areas. At the US headquarters of automaker Stellantis, the local Audubon chapter is allowed into a restricted area to monitor one of the largest heron rookeries in the county. This partnership lets Stellantis secure program verification while giving the chapter access to an exciting location.
- WM, the largest solid waste management company in the US, allows its facilities to develop their own employee engagement and community outreach and determine the strategies that work best for each site. This self-determination allows each location to design contextual programs. At its Bucks County, Pennsylvania, landfill, WM brings a local school, a senior center, and its own employees together to implement pollinator gardens across generations and the host community. This effort, which began years ago, has fostered learning and strengthened community relations.

4. INTERSECT WITH OTHER CORPORATE & COMMUNITY NEEDS

A company can achieve multiple benefits by leveraging its nature programs in support of other corporate social responsibility priorities. By crossing fence lines into communities, a company can address impacts and enhance relations. By using its nature programs for education, a company can meet its STEM (science, technology, engineering, and math) goals and provide value to learners of all ages.

Indeed, when a company deploys nature-based solutions, it can mitigate the impact of stormwater runoff, fugitive dust, noise pollution, and heat island effects. The intersections of place-based efforts create a multiplier effect whereby a simple tree planting can deliver multiple benefits.

To address local environmental challenges and increase residents' knowledge of these issues, CEMEX, a global building materials company headquartered in Mexico, has developed an environmental stewardship program for local teens associated with its Tepeaca site in the state of Puebla.⁵ Teens from the Tepeaca area and nearby Cuatinchán learn about the environmental issues impacting their communities, including habitat destruction and fragmentation due to development driven by 13% population growth in recent years.

A STRATEGY CAN ESTABLISH A ROADMAP FOR ACTION THAT CAN CORRAL RESOURCES AND HIGHLIGHT PRIORITIES

The Tepeaca quarry operation maintains a forestland of acacia and mesquite trees where students learn about the nursery business and sustainable agriculture. Through classroom and virtual learning, as well as field research in their communities, students come to understand local environmental challenges. They also participate in habitat restoration, maintenance and monitoring activities, and submit data to citizen science platform iNaturalist.

The program's intersections deliver benefits to nature through the habitats on site, benefits to youth through learning opportunities, and benefits to the community by having educated and environmentally literate members.

CONCLUSION

As more companies seek to act for nature at their locations and across their supply chains, many models and examples exist to guide them. The four elements of a successful implementation effort outlined in this article have been tested and found effective in pushing corporate ambition toward place-based action and providing support for voluntary programs and those that are not central to operations.

A strategy can establish a roadmap for action that can corral resources and highlight priorities. Toolkits can deliver checklists, decision trees, and contextual information to drive implementation at a site. Support (financial or human) can make a conservation effort more sustainable and enable local ownership of the effort and the outcome. Finally, intersections with other corporate citizenship efforts can leverage resources to meet one or more other corporate responsibility goals and deliver multiple benefits.

There are thousands of examples across the world of forward-thinking companies like CEMEX, WM, GM, and Stellantis that have built nature-action programs and developed approaches and methodologies that fit their corporate cultures, apply to diverse land holdings in a variety of geographies, and sustain themselves. At the end of the day and despite all the differences, these efforts create uplifts for nature and benefits for biodiversity that grow across budget cycles and growing seasons and persist through corporate disruptions, employee turnover, and even global pandemics.

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About the author

Sara Cook is Director of Business Development at Wildlife Habitat Council (WHC), where she links WHC's mission and conservation priorities to corporate performance, fostering responsible action for environment and communities. As a senior sustainability and environmental professional, with more than 18 years' experience in the industrial minerals and resources sector, she brings industry-recognized best practices to design strategic sustainability and nature-based solutions for the corporate sector. Ms. Cook's background includes large-scale project management and supervision, corporate social responsibility programming, and managing sustainability and environmental media performance. She is also a board member of the Arizona Sustainability Alliance. She can be reached at scook@wildlifehc.org.

FROM BLIGHT TO BEAUTY:
**A WAY FORWARD
FOR URBAN
FORESTRY**

Author

Kate Mitchell

The event began with a hole. Beside it was the tree that would soon call it home, the ball of roots still wrapped in burlap, waiting to be planted in the earth on a median near a church in Detroit, Michigan, USA. But with a podium nearby and a crowd gathered to see the urban forestry experts do their work, this tree wasn't your average landscaping project. Instead, it was among the first of tens of thousands to be planted across targeted areas of the city as part of the Detroit Tree Equity Partnership (DTEP).

This initiative, formally launched with a press conference on 11 October 2022, is a US \$30 million investment in Detroit to increase the city's tree canopy and all the benefits that come with that. Led by American Forests, DTE Energy, Detroit Future City, the Greening of Detroit, and the City of Detroit, DTEP will plant 75,000 trees in highlighted areas across the city over five years while hiring 300 Detroiters and training them in the craft of tree planting and maintenance.

The October event may have been the formal launch of the partnership, but work began long before trees were put in the ground that day. The core partners had been coordinating for months to figure out how to best execute the ambitious goal of ensuring every urban neighborhood has sufficient trees to ensure every person benefits. A major piece of that was finding the right trees and putting them in the right places.

"We're not putting these trees in areas that don't need it," explains Jeff Chaney, a planting crew leader with the Greening of Detroit. "We're putting them in front of scrap yards and on service drives. There's a beautification aspect to it. Trees speak for themselves."

The trees the program has selected were picked to "speak" for a long time. The varieties sourced for the project were locally grown by Urban Farm Development Managers LLC and include evergreen and deciduous trees.

All are species that are either indigenous to Michigan or will thrive in every environment the Great Lakes state has to offer — from the sometimes brutal winters to the sweltering summers. Some are trees that will bloom in spring or provide vibrant color in the fall. All are meant to put down literal and proverbial far-reaching roots in the Motor City as DTEP looks to create positive change beyond just the initial span of the project.

THE TREES THE PROGRAM HAS SELECTED WERE PICKED TO "SPEAK" FOR A LONG TIME

The pilot program is taking a scalable approach to growing Detroit's tree canopy. Planting (which began in late September, shortly before the formal launch) began at a slower pace at the end of 2022, with 2,500 trees set to go in the ground before the end of the year. Ranging in size from six feet to 10 feet in height, these trees will be installed along freeway corridors and areas known for blight.

In 2023, the work will accelerate, with a priority on gateways, highways, and commercial corridors. The focus will shift to commercial corridors and blight sites in 2024 and then to blight sites and public spaces in 2025.

As the targeted areas change over time, the partnership will grow to accommodate them, planting 8,000 to 15,000 trees and training 75 to 100 workers to plant and care for the trees every year. As the pilot comes to a close and DTEP shifts to an ongoing partnership, the program will plant 17,000 trees and train 108 new workers every year.



IT TAKES A VILLAGE

Although numerous organizations and businesses have been working to add to Detroit's tree canopy and improve quality of life for its residents for years, the ambitious nature of the DTEP project is only feasible because of its partners.

"When we first engaged with American Forests about this, we asked what it would take to build an amazing tree equity program," says Shawn Patterson, DTE Energy VP of environmental management and safety. "We were very careful around aligning everyone and their interests around this partnership. There were a lot of one-on-one conversations. We didn't want to launch something that sounded flashy; we wanted to build something with these stakeholders."

The partnership is indeed working toward something meaningful. The benefits of adding trees to a community go far beyond the superficial. Adding 75,000 trees to the city will sequester 152,000 pounds of carbon over 40 years, reduce stormwater runoff by 303 million gallons over the same time frame, and save residents US \$12 million in energy costs, according to the Tree Equity Score (TES) by American Forests.¹

Adding as many trees as DTEP intends will also help mitigate climate change impacts and improve public health outcomes. Per TES, street trees decrease temperature within 30 meters (about 34 yards) by .4 to 4 degrees Celsius (32.7-39.2 degrees Fahrenheit), a big impact since an increase of 1 degree Celsius (33.8 degrees Fahrenheit) can increase all-cause mortality rates by 3% to 5.5%. For every additional 340 trees per square mile, the rate of childhood asthma decreases by 25%. This can greatly benefit area residents: Detroit's childhood asthma rate is 74% higher than the rest of Michigan. There are economic benefits, too. Street trees add nearly 1% to property values, and the jobs portion of the project will add \$23 million in earnings to Detroit households.

The Greening of Detroit is more than familiar with all the benefits trees offer to an urban landscape. Bringing those benefits home to Detroit has long been a core part of the work they do, and becoming an integral part of DTEP was a natural fit.

"Improving the quality of life for Detroiters has been our mission," says Monica Tabares, VP of operations and development for the Greening of Detroit. "That's why the organization was formed, to meet those environmental needs and the community needs. The priority being increasing the city's tree equity and providing that green space, a tree canopy that a city of this size and its residents deserve."

Access to trees and the benefits that come from them in urban areas is becoming increasingly important. By 2030, nearly 80% of the population of the US will live in cities or suburbs, according to TES, making those benefits harder to come by in daily life.

Although this will be a challenge on a national scale, American Forests was eager to show how it could be tackled through work with DTEP.

“Detroit’s reputation and history of ingenuity in everything from manufacturing to music makes it a great place to show how improving tree equity can contribute to a city’s vitality in the 21st century,” says Eric Candela, American Forests’ director of local government relations. “American Forests is trying to do three innovative things simultaneously that we hope will contribute to our success in Detroit and have broad appeal beyond. We are leading with tree equity, trying to improve canopy in the areas of the city where trees can do the most good.

“Secondarily, by making room for more stakeholders (like DTE Energy) to participate in the work, we have effectively increased the management capacity that Detroit is able to apply to urban forestry. Finally, by treating trees as assets and monetizing the benefits they provide, we are increasing the funding available to support this work. American Forests is confident that cities throughout the country will want to replicate this approach.”

THE ROLE OF THE CITY

The city itself has been integral to the approach crafted by the partnership. A core partner in the work, the city has identified the planting sites that will have the greatest impact on the community’s well-being.

Using a 15-factor score called the Planting Priority Index, the city uses identifiers like low tree canopy, vulnerable populations, asthma rates, proximity to high traffic volume, and proximity to schools to identify potential planting sites. Finding the right places to plant is critical, given the city’s tree-related struggles.

Detroit once had a vibrant tree canopy, but Dutch elm disease and the emerald ash borer beetle killed or damaged many trees. The city’s bankruptcy also affected the tree canopy, reducing funds spent on tree planting and maintenance for years.

“The combination of these conditions led to residents not having strong assurances around new tree plantings until maintenance and removal of dead/diseased trees is addressed,” says Dan Rieden, lead landscape architect with the City of Detroit. “By listening to community responses to past tree plantings and the feedback we received from the network of participants of the Detroit Reforestation Initiative, we believe we can address community concerns with programs that not only address maintenance needs, but also create a new generation of certified arborists and foresters from Detroit. Showing the community that trees are planted and cared for by other Detroit residents will hopefully have a positive impact.”

ACCESS TO TREES AND THE BENEFITS THAT COME FROM THEM IN URBAN AREAS IS BECOMING INCREASINGLY IMPORTANT

The jobs piece is the second major component of DTEP’s plan. It’s not enough to just add trees to the city — like all living things, they require care and maintenance to last and have a meaningful impact in their communities. This is where the urban forestry specialists come in. Trained through the Greening of Detroit, these men and women will plant and care for the new trees.

An important part of the jobs portion includes working with Detroiters who have not had the same employment opportunities as others. Recent immigrants, people without high school degrees, those reintegrating into society after incarceration, and others can undergo the training and earn a living wage, a life-changing impact for many.

“For me, it’s an opportunity to go forward in my life,” says Alex Rosario, one of the planting crew members. “It’s an opportunity to grow in knowledge, and the opportunity is so awesome.”

That the work is so impactful for the community is an added bonus for the crews, who are currently planting around 100 trees per week (see Figure 1).

“People who live in the neighborhood walk by or stop and look, and I think they appreciate what we’re doing,” says Greening of Detroit’s Chaney. “This is not just big buildings going up; this is out in the neighborhoods where people can enjoy the tree, whether walking their dog or walking their child. It fosters a sense of community and of neighborhood pride.”

That positive impact, from the trees themselves and the communities they will help create, is DTEP’s big-picture goal. Although it’s taken a lot of work to bring together numerous organizations, businesses, and community partners, keeping an eye on the big picture has helped make the 75,000-tree pilot a reality. It’s a model that could be adopted by cities across the US to the benefit of those who live in those cities and beyond.

“There are incredible benefits to urban reforestation,” says DTE’s Patterson. “You read so much about major forests, but you can’t forget about the amount of land, the amount of opportunity, and the potential benefits that exist in our urban areas.”

With hundreds of trees already planted and newly trained arborists on the job, the benefits of bringing together these organizations and businesses are apparent. “There are so many organizations doing amazing things,” says Patterson. “It’s always been about how to amplify the contributions those organizations can make. For us, this is about coming together in ways we haven’t yet to build a coalition that helps amplify the contributions we make beyond what we could do if we were doing it on our own.”

The work of the partnership brings the mission of these organizations together to create a cleaner future, one with numerous health, environmental, and societal benefits for everyone in Detroit.



Figure 1. Detroit Tree Equity Partnership crews plant a locally sourced tree in one of the partnership’s targeted areas

“It really does exemplify our purpose, which is to improve lives with our energy,” says Jerry Norcia, DTE’s energy chairman and CEO. “Planting trees in areas where there are tree inequities can really get at that purpose.... The idea of beautifying Detroit as well as the environmental benefits of planting trees — the cooling benefits as well as the carbon-capture benefits — creates a lot of inspiration and excitement for us to move forward with this exciting project.”

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About the author

Kate Mitchell is a Corporate Communications Senior Strategist for DTE Energy. With a decade of experience in journalism before shifting to the corporate communications world, she is passionate about telling the stories that matter most to the communities where she lives and works. Ms. Mitchell also cares deeply about empowering individuals, businesses, and communities with the information and knowledge necessary to build a cleaner future for all. She can be reached at katherine.mitchell@dteenergy.com.

A SCIENCE-BASED APPROACH FOR NATURE POSITIVE GOALS



Authors

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As a result of new international standards and increased interest from stakeholders in infrastructure development projects, requirements for companies to disclose and mitigate their nature-related impacts are increasing. With biodiversity in crisis and many companies aiming to deliver net-positive biodiversity impacts, it is more and more important to identify the biodiversity challenges businesses face and design efficient management actions to address them. The Smithsonian Institute (SI) has been collaborating with the private sector for more than two decades, using a scientific approach to identify impacts and provide solutions for supporting biodiversity throughout the cycle of operations for projects in the energy and agricultural development sectors.

A scientific approach to devising solutions to mitigate impacts on nature can benefit business in many ways, such as through the following:

- Quantifiable results that support environmental, social, and governance (ESG) reporting and alignment with national and international frameworks
- Transparency and credibility conferred by peer-reviewed publications
- Measurable co-benefits of biodiversity actions that support other aspects of corporate social responsibility (CSR), namely climate and social commitments
- Collecting data that provides a basis for adaptive management to address new or changing challenges
- Examples that shape policy through innovation and experimentation, allowing companies to become a model for their sector

In this article, we present five case studies demonstrating the scientific approach to solutions for business biodiversity challenges, with additional examples listed in Table 1 at the end of the article. Each case study is associated with one of four phases of development projects (scoping/exploration, construction, operations, restoration/closing). The examples highlight how the resulting evidence has been channeled into nature positive management actions.

SCOPING/EXPLORATION: A SCIENCE-BASED WEB-MAPPING TOOL TO SUPPORT STRATEGIC LANDSCAPE PLANNING

Scoping/exploration is the first phase of development projects. Project scoping should identify potential impacts on biodiversity, determine likelihood or risk of negative impacts, and identify alternatives for avoiding impacts. A scientific and systematic scoping or screening assessment may involve additional time and effort but ultimately reduces costs by identifying strategies for avoiding impacts, assessing potential offsetting opportunities, and prioritizing fieldwork to better manage biodiversity risks during project implementation.

In 2019, SI began collaborating with International Finance Corporation (IFC) to address concerns related to environmental risks of development in the Paraguayan Chaco. The Paraguayan Chaco represents a region of biodiversity and economic importance that urgently needs a landscape-planning approach to minimize further deforestation and ensure conservation of its remaining natural habitats (see Figure 1).



Figure 1. Aerial view of the Northern Paraguayan Chaco, where large forest patches are still present and where evidence-based scoping can reduce deforestation rates (source: Ana Maria Sanchez)

SI and IFC are co-developing an innovative web-mapping tool, grounded in IFC's Performance Standard 6 (PS6), to support informed decision making for sustainable investment and development.^{1,2} The scientific data incorporated in the decision-support tool aligns with the key variables identified in the PS6 framework. These include natural and modified habitats, number of Priority Biodiversity Values, three levels of critical habitats based on their likelihood of occurrence, legally protected areas and internationally recognized areas, and environmental risk ranks based on the biodiversity conservation importance of the area.

Using a participatory stakeholder approach, this web-mapping platform, known as ASIST-Chaco, is the first to upscale key PS6 variables from the project to the landscape level for a specific region. The methodology applied was defined during technical meetings with SI scientists and IFC biodiversity experts, and specific data is being gathered through consultations with local and international experts. This process ensures transparency and reliability of spatial information, alignment with PS6, and accuracy of spatial analyses performed.

ASIST-Chaco will inform transparent, nature positive, evidence-based decision making for sustainable development investments by identifying environmental risk areas based on ecological and environmental variables customized for the Paraguayan Chaco, providing science-based, up-to-date spatial data to support environmental criteria widely used among financial institutions. It also allows for compilation of environmental and ecological spatial data for an area of interest provided by the user. The platform will launch in 2023. It will require regular data updates, and it will be possible to extrapolate the model to other regions.

CONSTRUCTION: REDUCING FOREST FRAGMENTATION THROUGH EVIDENCE-BASED MITIGATION

Infrastructure construction can damage ecosystems and disrupt wildlife movement, especially in forested habitats. As part of a conservation-business collaboration that began in 2010,³ SI proposed natural canopy bridges (tree branch connections above linear infrastructure) as a way to mitigate fragmentation caused by pipeline construction in the Peruvian Amazon. With our collaborators, we designed a study to evaluate whether natural canopy bridges mitigate the fragmentation impacts of a pipeline right-of-way for arboreal mammals.

We installed camera traps in natural bridges and on the ground, both where bridges were present and absent, and monitored right-of-way crossings for a year (see Figure 2). In the canopy bridges, we recorded more than 200 times as many crossings and four times as many arboreal species versus the ground.

The results demonstrated that canopy bridges are used frequently and that arboreal mammals avoid crossing on the ground.⁴ The study serves as a verifiable, permanent record that can be used to support tree branch preservation as a mitigation measure. Additional data can be used to report on species-level business biodiversity impact metrics, such as the numbers of threatened, protected, or endemic species recorded.

The primary recommendation for the company was to leave as much natural canopy connectivity as possible along the right-of-way to allow arboreal mammals to cross. Natural bridges are a virtually no-cost solution, requiring only careful clearing to prevent branch and trunk damage. Natural canopy bridges may have add-on effects, including facilitation of forest regrowth near the right-of-way by reducing evapotranspiration relative to bare areas and providing habitat for animals that disperse seeds.

To provide the technical and logistical information necessary to replicate and scale up the incorporation of natural canopy bridges into other projects, we have communicated the results to diverse audiences via seven academic and industry publications, several blogs and videos, more than a dozen conference presentations, and more than 20 presentations to government officials and the public.^{5,6} The project has also won scientific and industry awards.

Since the conclusion and dissemination of this project, the Peruvian government has requested that new pipeline projects in the country include natural canopy bridges, and the method has served as an example for several other projects across the globe. Researchers are extending this study to understand how the installation of artificial bridges (made of rope and cable) can increase connectivity for arboreal mammals in places where companies must retrofit older projects.

OPERATIONS: MINIMIZING NEGATIVE INTERACTIONS BETWEEN SEABIRDS & PORT INFRASTRUCTURE

Large ports support coastal communities through fishing as well as shipping/storing energy, mineral, and agricultural products. However, the resulting modification of the seascape can introduce multiple environmental challenges, including decreased water quality, increased sedimentation, and the need to coexist with wildlife.

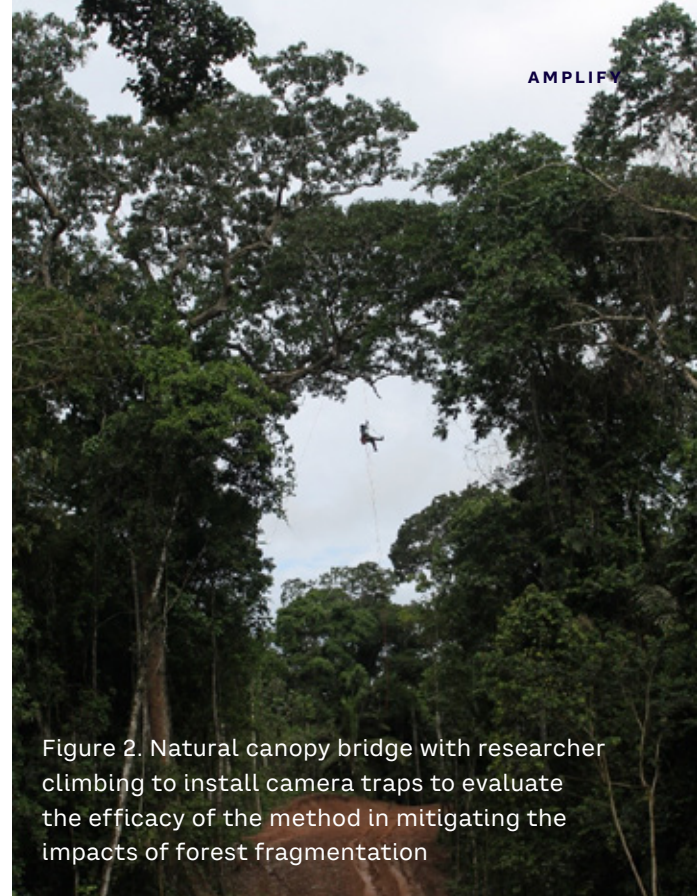


Figure 2. Natural canopy bridge with researcher climbing to install camera traps to evaluate the efficacy of the method in mitigating the impacts of forest fragmentation

In 2010, South America's first international port terminal to export liquified natural gas was built along the central coast of Peru, a marine area that's part of the highly productive Humboldt Current Large Ecosystem (HCLE). The port includes a 1.5 kilometer main pier and two breakwaters that were built with concrete and natural rock from a nearby quarry. The site was selected because of its distance from natural protected areas and urban areas and for its lower levels of biodiversity, among other factors.

The new infrastructure provided a new habitat for seabirds. The HCLE sustains one of the largest populations of seabirds on the planet, and the pier and breakwater provided new perching and nesting spaces for several species. The metal cages along the pier that hold gas, water, and outfall pipes were quickly occupied, primarily by the threatened Inca tern (*Larosterna inca*).

Although providing a refuge for a threatened species is a positive outcome in a sense, the presence of thousands of terns and their guano quickly became a problem for the company, threatening the structure's integrity and increasing maintenance costs. The company's attempts to dissuade the seabirds from using the area included mesh nets, nylon thread grids, trained raptors, loud sounds, and visual cues (bright orange buoys thrown into the air). These strategies had mixed results.

Through trial and error, Smithsonian scientists learned that scaring the birds from their perching areas was not cost-effective. About half the seabirds returned to perch in the same area minutes after being driven away. An initial attempt to dissuade birds from using the infrastructure using mesh covers was promising but required further study. For 18 months, we investigated seabird-perching behavior in areas with mesh nets, without mesh nets, with nylon thread grids, and after the use of bright orange buoy deterrents. We found that mesh net covers and a diffuse network of nylon threads reduced the number of birds on the port by about 98%, with many birds safely moving to the breakwaters (see Figure 3).⁷ Visual cues had no long-term effect on the seabirds.

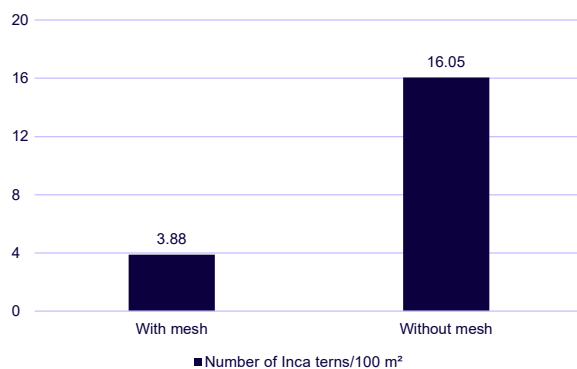


Figure 3. Experimental data revealed that the use of mesh net covers was the best way to minimize negative interactions between seabirds and port infrastructure

We recommended extending the area covered by mesh to include all the pipeline along the main pier and continuing the use of nylon thread grids. This strategy significantly reduced the density of seabirds along the main pier. The breakwaters, which are adjacent to the main pier, offered hospitable conditions for the displaced seabirds to settle and reproduce. Our findings have been presented as a thesis dissertation and are currently under review at a peer-reviewed scientific journal.

OPERATIONS: REDUCING RISK OF HUMAN-WILDLIFE INTERACTIONS IN BIODIVERSITY-RICH INDUSTRIAL CONCESSIONS

Many extractive industries in the tropics are working in environments rich in biodiversity, including those with species that are potentially dangerous to humans but are on IUCN's Red List of threatened species. The question for research is how to avoid or minimize risk to infrastructure, people, and wildlife while promoting cohabitation.

For example, forest elephants, a critically endangered and nationally protected species, have broad distribution in the 85% forested country of Gabon in Central Africa. Their movement corridors cross industrial concessions, and they can be attracted by exotic plants like mango trees in residential camps. In some areas, poor food waste management has allowed them to access potentially harmful waste and increases the likelihood of elephants and people coming into close proximity (see Figure 4).

Smithsonian scientists are collaborating with the hydrocarbon industry in Gabon to find solutions, including the design of elephant-proof waste enclosures (built using old oil pipes). It took a stepwise process to design a way to lock the enclosures. Elephants progressively learned to open initial designs with horizontal, and then vertical, bolts. A shackle with bolt and nut was then designed. It takes two hands to open, and an elephant has only one trunk, solving the problem.



Figure 4. Bull elephant feeding on waste in a residential camp in Gabon

When waste became inaccessible, elephant visits diminished over time, reducing risk to staffers disposing of waste and preventing elephants from ingesting toxic materials like plastic bags and aluminum foil.

However, physical solutions only work if people implement them. Wildlife information and risk-reduction behaviors were incorporated into mandatory site-specific safety inductions to increase operators' knowledge about elephants and promote safety-conscious behaviors. Scientists provided input to supplement the company's wildlife safety rules and conducted information sessions on elephant biology and human behaviors that minimize risk (maintaining a safe distance, not provoking elephants, etc.).

Ongoing monitoring of waste sites and elephants enables any necessary changes to be made quickly; awareness sessions ensure that rotational and new staff are reached. This approach has been adapted to other potentially dangerous and high conservation-value species (e.g., crocodiles near underwater infrastructure being worked on by divers, leopards attracted by feral dogs seeking poorly managed waste, and snakes in/near company infrastructure). Our recommendations for improved waste management to minimize human-wildlife conflict are being prepared as a white paper for industry in Gabon.

RESTORATION/CLOSING: LONG-TERM MONITORING FACILITATES RESTORATION

Transportation, extraction, and energy production infrastructure are economic and social necessities, but they are one of the main causes of habitat fragmentation. Extraction and transport of natural gas from the Camisea deposits in Amazonia to the Pacific coast in Peru required building a 408-kilometer underground pipeline system crossing the Andes Mountains, a biodiversity hotspot.

Pipeline design and careful evaluation of route placement were important in avoiding sensitive areas and habitats, as were construction considerations like reducing the width of access roads and pipeline rights-of-way. A major advantage of burying the pipeline was that it allowed recovery of aboveground vegetation. The problem was how to accurately measure vegetation recovery along such an extensive, complex, heterogeneous, biodiverse area.

In the tropical high Andes, important ecosystems include streams, grasslands, and wetlands (bofedales). The latter plays a critical role in receiving, retaining, filtering, and regulating underground water, as well as carbon storage. Smithsonian scientists designed a vegetation-monitoring program based on a network of intensively surveyed permanent plot pairs. Each pair consisted of one plot directly above the buried pipeline (to assess recovery) and one plot in an adjacent representative undisturbed area (to control for regional environmental and local anthropogenic changes).

The control plots proved extremely valuable because climate change and local human impacts (e.g., overgrazing, land use changes) can alter the structure, composition, and dynamics of ecosystems. Moreover, characteristics of an ecosystem described 15 years ago in the environmental impact assessment may no longer be representative of its current or future condition because of climate change. Restoration efforts and objectives must adapt to these changes. Adaptive management measures included: (1) designing a rapid vegetation assessment system to provide information the company needed for decision making and (2) excluding livestock to protect recovering vegetation.

The project scientists developed a data visualization tool that allows managers to see the history of restoration across the monitored ecosystems through maps and charts. The tool helps managers identify areas with better-than-expected recovery so they can make more effective decisions about resource allocation. Ongoing monitoring has shown that areas above the pipeline are recovering their plant cover and diversity, providing the company with information to measure the success of restoration efforts (see Figure 5).

THE SCIENTIFIC APPROACH HELPS SOLVE BIODIVERSITY CHALLENGES

The scientific approach provides businesses with independent, quantifiable, credible assessments that allow companies to assess their performance with respect to biodiversity, facilitating ESG reporting. Involving scientists early in project development contributes to establishing robust baseline metrics against which changes throughout the process (from construction to decommissioning) can be evaluated. Moreover, peer review of scientific publications based on impact assessment and mitigation research provides transparency, credibility, and a verifiable data source, which may be required for some reporting frameworks.

Biodiversity-focused scientific studies can also produce measurable co-benefits of biodiversity actions that support other aspects of CSR, namely climate and social commitments. For example, the ASIST-Chaco platform provides data on themes related to social commitments, such as the location of protected indigenous reserves, which allows private companies to more broadly screen for CSR criteria. Similarly, the study in Gabon evolved into interventions that not only reduced food waste, but also increased local agricultural yields through experimentation with composting.

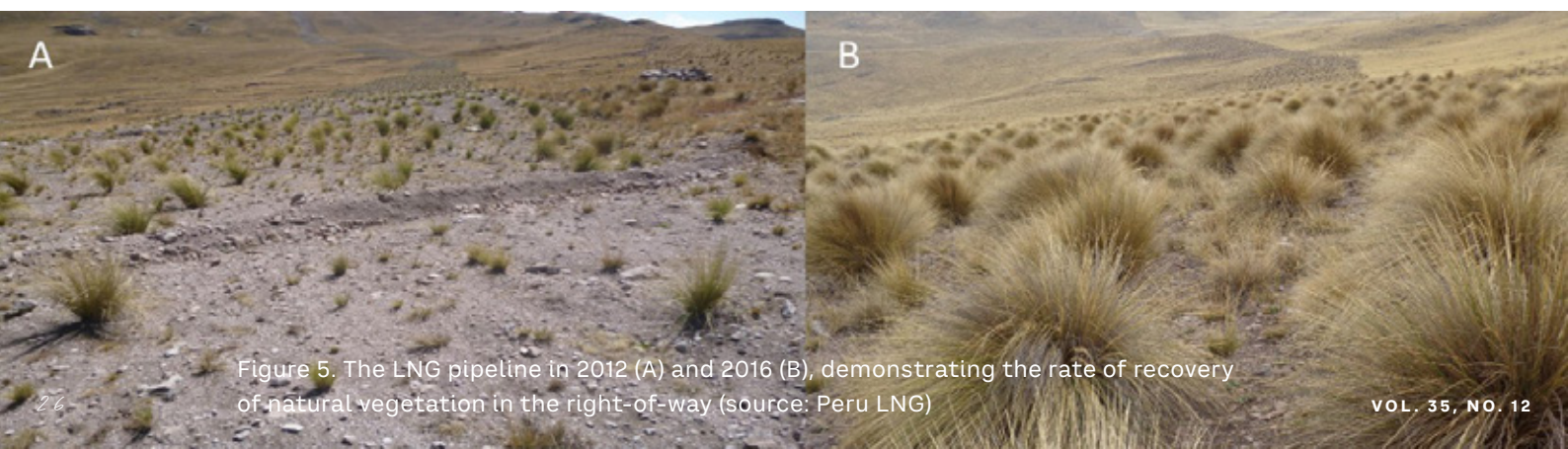


Figure 5. The LNG pipeline in 2012 (A) and 2016 (B), demonstrating the rate of recovery of natural vegetation in the right-of-way (source: Peru LNG)

In the longer term, the scientific approach produces monitoring data to support adaptive management. Business operations do affect natural environments, but so do climate change, other anthropogenic changes, and natural variations. In Peru, high concentrations of cadmium detected in marine habitats were initially attributed to a company's water discharge, but closer data examination revealed they were caused by natural erosion of rock higher up in the watershed. Being able to accurately distinguish causality with respect to biodiversity impacts is crucial for ESG reporting and project management.

Innovation is not only an integral component of a healthy business model, it's also key to developing science-based solutions to conservation challenges. This makes science and business collaborations fertile ground for co-developing novel practices that can shape policy and change the way business is done. Straightforward nature-based solutions, such as leaving natural canopy bridges in place or enabling natural restoration, are often low cost and easily replicated. Where nature needs more of a helping hand, innovation through experimentation can be clearly documented to establish proven methodologies that can be shared and even become industry standards.

CONCLUSION

Science-based approaches, including question-driven experimentation and well-planned biodiversity and ecosystem monitoring, provide indispensable information to improve environmental risk management, identify practical and successful strategies for mitigating direct and indirect impacts, and restore affected habitats. They also provide key information to define potential offsetting strategies and additional conservation actions.

Science-based approaches have long-term benefits that are worth the time and costs incurred. As consensus on standardized metrics for reporting business impacts on nature continues to evolve (e.g., Science Based Targets Network, the Taskforce on Nature-related Financial Disclosures, and the Global Reporting Initiative), companies can lead the way by using the best science-based approaches to identify the biodiversity challenges they face, address those challenges head on, and deliver high-quality reporting on the context-specific projects under their purview.

**INNOVATION
IS NOT ONLY
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IT'S ALSO KEY
TO DEVELOPING
SCIENCE-BASED
SOLUTIONS TO
CONSERVATION
CHALLENGES**

BIODIVERSITY CHALLENGE	PRIMARY QUESTION	RESEARCH	RESULT	RECOMMENDATION/ACTION
Artificial light at night ¹	How can a project minimize the impact of artificial light at night on wildlife?	Tested attraction of insects to different types of light bulbs.	Amber light bulbs had the least negative impacts on insects.	Use primarily amber lighting in outdoor operations; turn off lighting when not in use.
Food waste	How can human domestic/food waste sites be protected from access by elephants?	Tested various enclosure-locking mechanisms (and enclosure design).	Lock design that is easy for people to open, but impossible for elephants.	All enclosures should use this elephant-proof lock.
Biodiversity-infrastructure interaction ²	How can the use of jetty infrastructure by seabirds be minimized to mitigate the corrosion of maritime structures?	Tested the efficacy of three deterrence methods: exclusion mesh nets, nylon thread grids, and brightly colored buoys thrown into the air.	Exclusion nets have a longer deterrence effect on seabirds.	Use exclusion nets around critical port infrastructure (pipelines) to reduce costs associated with infrastructure maintenance.
Seismic exploration ³	Does seismic exploration impact the way mammals use their habitat?	Used camera traps (ocelots) and distance sampling (primates) to test density of ocelots and abundance of primates before and during seismic exploration.	Ocelot density did not change significantly; primate group size was reduced during seismic disturbance.	Continue to use narrow seismic trails so forest can reclose after exploration and locate worker camps far apart to reduce the disturbance footprint of camps.
Vegetation removal ⁴	How long does it take to recover native species on the right-of-way of a buried pipeline?	Vegetation sampling, identifying species and determining coverage compared to areas not affected.	Vegetation restoration index shows that most studied areas have been colonized by native species and attained vegetation cover similar to control areas.	Use topsoil as a restoration tool to increase growth of native species; focus energy and resources on the areas that still need attention based on monitoring data.
Forest fragmentation ⁵	Do canopy bridges mitigate fragmentation impacts of a pipeline right-of-way?	Camera trapping in natural bridges and on the ground where bridges are not present.	Canopy bridges are used frequently, arboreal mammals do not cross on the ground, even where bridges are absent.	Leave natural canopy connectivity as much as possible along the right-of-way to allow arboreal mammals to cross.
Noise ⁶	How do noises associated with construction and operation of infrastructure impact biodiversity?	Used passive acoustic monitoring to evaluate changes in vocal activity and species composition of sound-producing animals.	Birds and frogs responded differently, with insectivorous birds found further away and some frogs found closer to human sounds.	In operational planning stages, soundscapes should be used to identify areas with high acoustic diversity so impact can be avoided during development; soundscapes should guide mitigation strategies during operations; machinery should be muffled to reduce sound penetration.
Unplanned expansion/development ⁷	How will development activities impact ecosystem services and land use across Madre de Dios landscape over the next 40 years?	Conducted a participatory future-scenario planning study to quantitatively model and evaluate outcomes of four scenarios of future changes for region.	Active landscape management and planning results in more successful outcomes across three dimensions of sustainability (economic, human well-being, environment).	Holistic territorial management plans should be developed with all key stakeholders and consider quantitative indicators; national, regional, and district governments must improve coordination and delegation of responsibilities for territorial planning and implementation.
Poaching and maintenance of ecological integrity ^{8,9}	What are the impacts of industrial concessions on biodiversity?	Systematic monitoring of snare removal and of other illegal activities within concessions.	Trends in anthropogenic impacts in industrial concessions documented.	Limit access to production roads; reinforce wildlife safety rules and national biodiversity-related legislation to company staff; maintain animal-movement corridors across landscape.
Maintaining landscape connectivity ¹⁰	Where are the priority areas for conservation and restoration of connectivity between protected areas?	Conducted a multi-scale habitat-suitability analysis for 15 species to map connectivity; combined them in various scenarios with socioeconomic factors.	Inclusion of socioeconomic data reduced representation of connectivity by up to 15% but decreased potential human conflicts.	Inclusion of socioeconomic factors in prioritizing key areas for connectivity; forest restoration outside protected areas is needed to improve connectivity.

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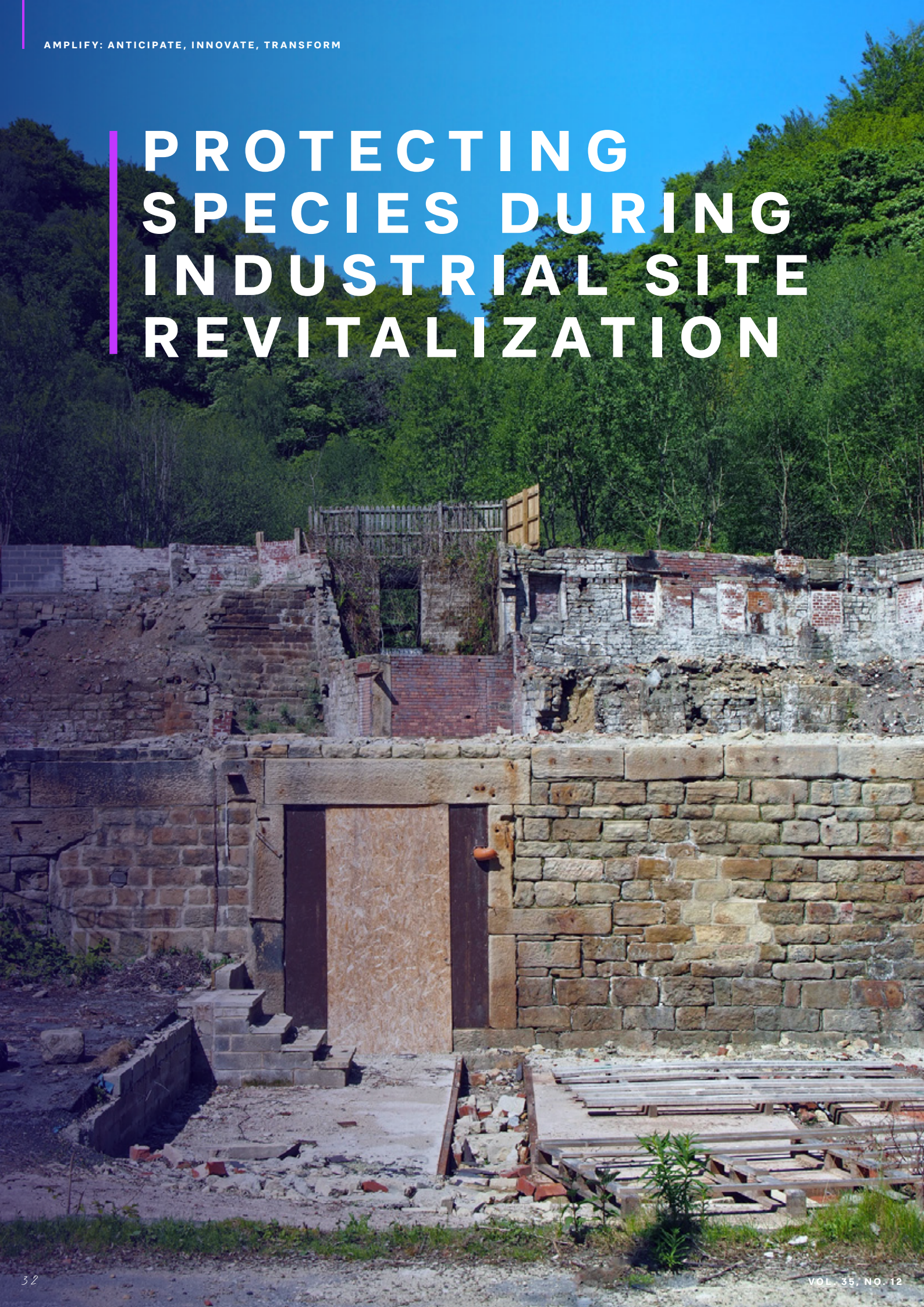
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PROTECTING SPECIES DURING INDUSTRIAL SITE REVITALIZATION



Authors

Christine J. Miller, Benjamin J. Langey, and Scott E. Bush

Legacy industrial sites can be found across the US. In places where industry once thrived, supporting a growing economy and global war efforts through the 1960s, a paradigm shift in global manufacturing processes took hold in the 1970s and 1980s. For instance, there was a dramatic decrease in US manufactured steel during the late 1970s and the 1980s.¹ The resulting global restructuring of the steel industry led to abandoned mills, leaving behind large tracts of contaminated industrial land.²

Commonly referred to as “brownfield sites,” these properties pockmark major US riverways and urban transport hubs and host a plethora of environmental contaminants. Brownfields are defined as “underutilized properties where the presence or potential presence of hazardous substances, pollutants, or contaminants complicates expansion, redevelopment, or reuse of the properties” by the Pennsylvania Department of Environmental Protection.³

There are an estimated 450,000 to 1 million brownfield sites in the US.⁴ They are often located within major US urban areas and have established access to transportation, being located near waterways and/or rail lines. With a growing demand for housing and infrastructure to support a fast-paced e-commerce economy, these sites are highly desirable.

Legacy industrial site redevelopment is commonplace in the US, especially along the Eastern Seaboard, a stronghold of former industrial sites. These once-robust economic centers have been underused for three decades or more, and their existence has been identified by stakeholders in both the public and private sector as holding essential real estate value.

Demand for housing in and around urban centers, which were once heavily industrial, has dramatically increased since the mid-1990s.⁵ In addition, the rising e-commerce industry requires a robust network of warehouse distribution centers. Consequently, legacy industrial sites are in high demand by developers for light industrial, commercial, and residential redevelopment.

Common obstructions to reutilization include environmental contamination cleanup activities and site-preparation costs.⁶ However, one factor often overlooked when planners and developers consider brownfield sites is the potential for encountering protected species or their habitats.⁷

Many of these sites have undergone a level of ecological succession during decades of unused. This, combined with their proximity to major waterways, makes them prime locations for occupation by endemic (local) species. Historic habitat loss and development pressure have resulted in limited available habitats for local wildlife in urban centers. Due to natural succession creating early successional cover types, endemic species are often found utilizing brownfield sites, along with nearby natural habitats.

Site remediation and redevelopment often require site features occupied by local wildlife to be rehabilitated or removed. Conflicts between redevelopment, on-site habitats, and endemic wildlife warrant careful navigation of the legislative environment and coordination of site activities with wildlife resource agencies.

Although legacy environmental contamination remediation is generally well studied and understood, there are important nuances in balancing site redevelopment with conservation of local biodiversity and critical habitats. Every site is unique, but the intersection between environmental site remediation, site redevelopment, and biodiversity conservation can be successfully navigated and benefit industry and society if there's concerted stakeholder effort throughout the process.

In this article, we provide an overview of brownfield redevelopment through the lens of biodiversity and species conflicts. Subsequently, we present a case study illustrating the remediation and redevelopment of a legacy industrial site while meeting the regulatory requirements to preserve protected species and their habitats.

TYPICAL LEGACY INDUSTRIAL SITES

Following the shutdown and decommissioning of industrial facilities, site features like previously managed and maintained stormwater facilities, treatment lagoons, and landfills often undergo vegetational succession — turning former industrial operations into wetland and upland habitats (see Figure 1).

Despite being man-made and degraded, these areas contain favorable wildlife habitats that are subject to colonization by endemic species (e.g., herbaceous and woody plants, mammals, fish, waterfowl, amphibians, and reptiles) from adjoining natural areas. In some instances, site redevelopment requires special attention to state or federally threatened or endangered species.

The Endangered Species Act of 1973 codified the protection of species at risk of extinction due to

the “consequence of economic growth and development untempered by adequate concern and conservation.”⁸ Aside from regulatory requirements, a major reason for taking measures to protect species on a legacy industrial site is that in protecting the species, society is choosing to conserve the habitat in which the species resides and, in so doing, protect or enhance associated ecosystem services. For instance, aquatic water bodies, and more broadly wetland habitats, provide US \$26.4 trillion per year of ecosystem services; aggregate studies estimate global ecosystem services loss at rates ranging from of \$4.3 to \$20.2 trillion per year, driven primarily by land use change.⁹

One important ecosystem service provided by wetlands is flood mitigation and storm surge buffering. Most wetlands, but especially large wetlands along major rivers, naturally act to attenuate floods and lower site flood risk, potentially saving businesses millions in the construction of levees or flood walls, flood damage, and flood insurance.¹⁰ Wetlands also give local communities opportunities to actively manage them for public access and enhancing habitats for protected species. Brownfield site redevelopment not only promotes reuse of previously developed and contaminated land, it can also be an economic driver for inclusion of habitat enhancement projects within the overall redevelopment plans.



Figure 1. Man-made open water habitat, typical of legacy industrial sites

REGULATORY FRAMEWORK

Although on-site habitats on legacy industrial sites are typically man-made and degraded, they often contain suitable habitat for a variety of species, some of which may be legally protected.

Generally, all states incorporate pre-construction screening requirements for protected species. Parties seeking to develop land, either brownfield or greenfield, must complete an initial screening process to determine potential conflicts with threatened, endangered, or special-concern species. If the initial screening reveals a potential conflict, the presence or absence of the species in question is determined by conducting species-specific habitat assessments and, if suitable habitat is present, presence-absence surveys. If no potential conflict is determined, there is no requirement to complete such surveys.

Proposed redevelopment projects are generally required to comply with all state laws for remediating legacy contamination to some level of human health and ecological risk standards. During remediation and redevelopment activities, alteration or elimination of man-made habitats occupied by endemic wildlife may be necessary.

Depending on the species in question, the habitat being altered, and the governing resource agency, different approaches can be considered to allow the redevelopment of the brownfield site, despite a species conflict. In certain cases, some parts of a brownfield site may have to be left undeveloped.

Examples include natural wetlands or streams that don't require remedial work and certain habitat types that might not be able to be replaced. However, for many fauna species occupying degraded man-made industrial habitats, governing resource agencies require a project proponent to capture and relocate any native species from occupied areas prior to remediation or redevelopment.

Engaging stakeholders early in the planning process is critical to meeting project objectives. Stakeholders usually include the project proponent, their engineering and environmental professionals, and regulatory agencies. Reaching a consensus between the stakeholders early in the process on project objectives, design considerations, and species avoidance and conservation requirements up front allows the redevelopment to proceed in a predictable manner desirable for all.

Projects that incorporate habitat features into the design (e.g., including innovative stormwater management facilities and buffers on existing natural habitats) are generally well received by permitting agencies. Replacing degraded habitats with more natural habitats and enhancing or preserving existing natural habitats on a brownfield site also tend to be well received by regulatory agencies.

Independent of regulatory requirements, many large corporations that engage in brownfield redevelopment have their own corporate biodiversity and sustainability goals, often certified by third parties like the Wildlife Habitat Council (WHC).

Conservation, protection, and innovative site designs that incorporate habitat creation and enhancement usually qualify a project, contributing to company certification and corporate goal achievement.

EASTERN PENNSYLVANIA CASE STUDY

Our case study is located on a former heavy industrial site along a navigable river, which encompasses a variety of habitat cover types, including areas on former industrial lands and areas outside the former industrial development. The natural habitats include emergent and forested wetlands and uplands. A variety of man-made industrial habitats also occur on the site, including industrial uplands, treatment lagoons, and stormwater management facilities associated with former industrial operations. The site is strategically located near a deepwater port and has ready access to rail and interstate routes, making it desirable for redevelopment.

The site underwent the previously discussed initial screening process to determine whether potential species, habitat, and resource conflicts existed. The screening determined potential conflicts with several species. The project proponent engaged environmental professionals to assist in navigating the protected species and project-clearance process. Through habitat assessments and presence-absence surveys, it was confirmed that several protected species occupied man-made industrial habitats in areas slated for redevelopment on-site.



Figure 2. Adult male RBC captured during a trapping and relocation effort

In Eastern and South Central Pennsylvania, one of the more common protected species encountered on legacy industrial sites in close proximity to deepwater habitats is the northern red-bellied cooter (RBC). RBCs primarily inhabit open water like ponds, lakes, large slow-moving creeks, rivers, and large marshes (see Figure 2). RBC nesting sites are typically located in sandy or loamy soils with a relatively open canopy, features common to many brownfields. RBCs are threatened by habitat destruction, poor water quality, and competition with invasive turtle species that share the species' range and habitat.

On-site investigations confirmed that man-made water bodies were occupied by RBCs, having entered these areas via overland travel from nearby aquatic habitats. Identified at the screening stage, the project proponent proposed several site redevelopment plans, exploring options with stakeholders and agencies to mitigate the loss of man-made industrial habitats by replacing or avoiding them. These development scenarios minimized habitat disturbances in natural areas while allowing development to proceed in previously developed industrial areas on the site.

As is typical of large projects, some of the man-made industrial open water areas had to be eliminated to accomplish the project goals. Although these areas are man-made, RBCs and other aquatic species were able to colonize the degraded habitats. Due to the RBCs' protected status, avoidance measures had to be implemented for remediation and redevelopment.

Recognizing the special circumstances regarding this site, the agencies agreed to avoidance measures dictating the relocation of all native species

from man-made industrial waterbodies to natural habitats nearby. For the unavoidable habitat loss, compensation was provided in the form of habitat creation or enhancement. All these activities required state and federal permits, which could be obtained through early stakeholder communications and project planning transparency. This allowed the project to proceed while protecting the animals and their natural habitats. The salvage and relocation were conducted in accordance with regulatory agency guidelines.

To understand the effort involved in planning for and executing these types of activities, it is useful to understand the methods. Herpetofauna trapping in aquatic environments usually involves hoop net traps and floating basking traps. These are effective, can be used with a variety of bait, and maintain some portion of the trap above water so the turtles can surface to breathe.

A wildlife exclusion barrier is typically installed prior to trapping to prevent transient individuals and gravid females from returning to the habitat in the time between trapping and remediation/redevelopment activities. Timelines for effective trapping vary by site but can take anywhere from two weeks to several months to complete. For on-site habitats that remain undisturbed, regulatory agencies usually require a wildlife barrier between occupied areas and ongoing redevelopment areas. These include standard wildlife barriers made up of silt fence backed by metal chain-link fence and aquatic barriers consisting of silt curtains weighted with chains to ensure contact with substrate and prevent movement of species into the portions of the open water being impacted. If not installed properly and inspected regularly, these types of barriers can fail, and species conflicts can occur; all of which can lead to costly project delays.

This project resulted in the relocation of more than 400 native turtles from man-made industrial areas to natural habitats. The results met the expectations of the stakeholders outlined at the outset of the project, satisfied the permitting requirements, and fulfilled the project proponent's expectations.

CONCLUSION

Brownfield sites can be successfully redeveloped, but early coordination with all stakeholders and special attention to protected species is essential.

Our case study showcases a site that initially met all the requirements for redevelopment, then encountered some challenges with a protected species, and ultimately was able to navigate a pathway to success.

Choosing to remediate and redevelop a legacy industrial site is a complex, multidisciplinary task. However, the redevelopment of legacy industrial sites provides economic incentive for site cleanups, generates local community benefits, and reduces development pressures on undeveloped land (greenfield sites), thereby protecting natural habitats and native species.

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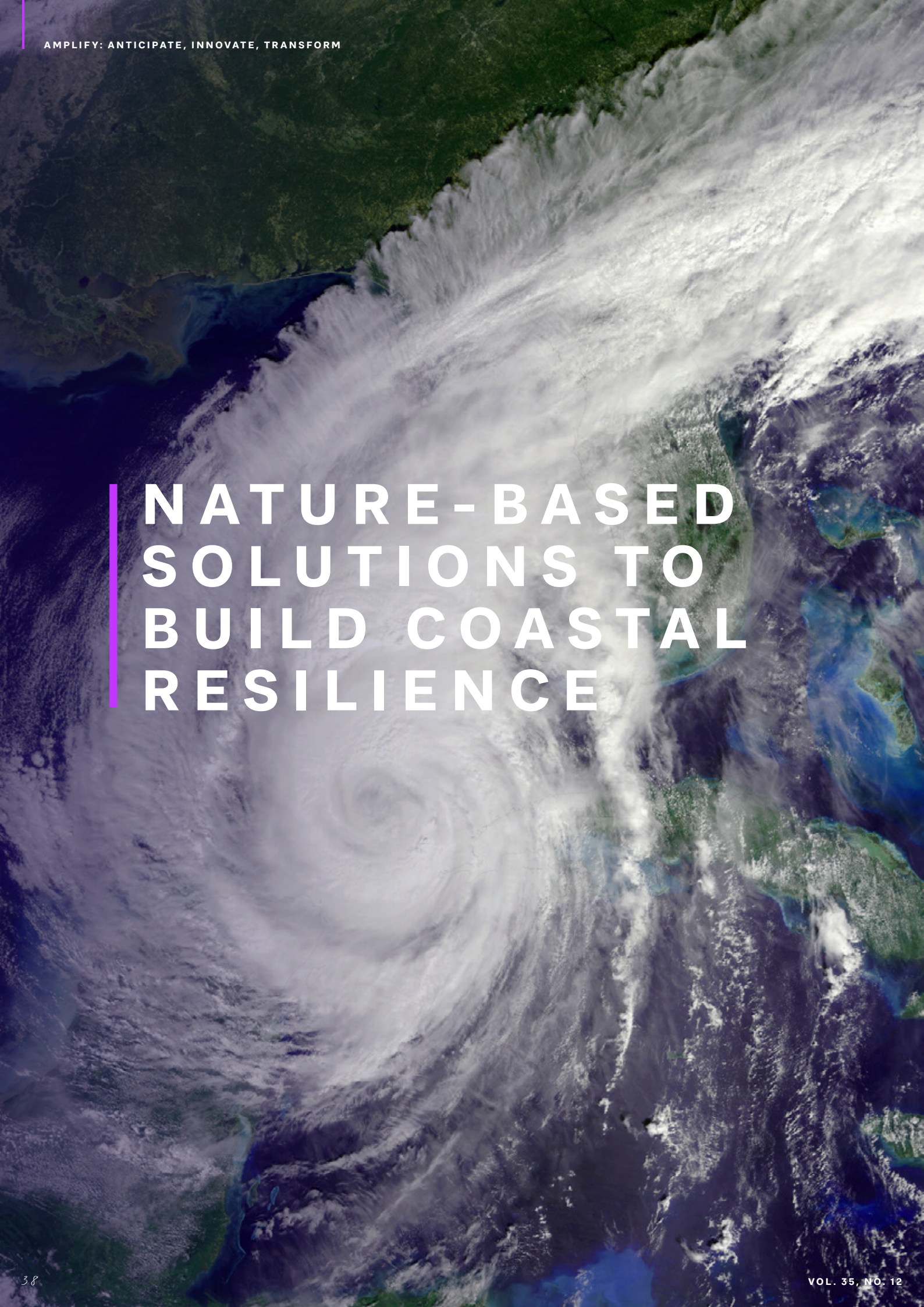
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NATURE-BASED SOLUTIONS TO BUILD COASTAL RESILIENCE

Author

Rob Campbell-Watt

Areas of the US Gulf Coast are increasingly being impacted by storm damage, storm surge, erosion, and subsidence. Nature-based, green infrastructure solutions are an often-overlooked option to improve resilience, helping to mitigate and even prevent these types of climate risks. This article looks at how coastal and wetland vegetation is being used on the Gulf Coast to that end.

Work done by consultancy GHD in Texas, builds on previous work done in Port Fourchon, Louisiana, demonstrating that nature-based solutions designed to mitigate coastal climate risks can generate positive cash flow from carbon offsets.¹ The key limitation is scale: net present value (NPV) for developing nature-based, green infrastructure is dependent on the available area for vegetation growth, with smaller areas taking longer to achieve a positive ROI.

In addition to protection from climate risks, benefits from nature-based solutions include improved water quality, habitat protection for aquatic and land-based species, and enhanced cultural/recreational (including fishing) amenities.

In the Port Fourchon pilot project, GHD found the following:

- When saltmarsh growth is blended with wetland vegetation like mangrove, growth and carbon offsets are maximized.
- The most relevant carbon-offset methodology for the saltmarsh and mangrove combination is Verra Verified Carbon Standard (VCS) methodology VM0024 (Methodology for Coastal Wetland Creation), which is used to generate carbon offsets through a registry managed by Verra VCS.
- A project to develop nature-based solutions can generate positive cash flow through carbon offsets under VM0024. Earning financial returns while mitigating coastal climate risks is possible with sufficient scale.

THRESHOLD QUESTIONS

Companies, public bodies, and private individuals that own or operate along the Gulf Coast should ask the question, "Are we prepared for climate events?" If the answer is "no" or "I do not know," they should ask:

1. Are we prepared to allocate coastal and wetland areas to nature-based solutions as part of our plans to address climate risk?
2. Are we interested in the potential to reduce carbon emissions from other activities in doing so?

For those who answer questions one and two affirmatively, GHD recommends investigating nature-based solutions.

APPROACH & METHOD

The feasibility of a nature-based coastal planning project should begin with the following objectives:

- Prevent coastal erosion.
- Improve storm resilience.
- Provide opportunities for expanded wildlife habitat.
- Improve amenities associated with other land- and water-use activities.
- Produce a positive ROI.

In port operations, “beneficial use” is a term used for the application of dredged material (from construction or maintenance of waterways) to uses with other benefits, rather than just as waste material. Beneficial use is important to nature-based climate risk solutions in port areas, with the potential to generate new wetland areas.

To meet the objectives above, the following were determined to be the best nature-based solutions for the project area:

- Coastal vegetation options, including (1) salt-marsh growth blended with wetland vegetation (like mangrove) to maximize growth potential; and (2) mangrove, specifically black mangrove (*Avicennia germinans*), as a species growing across much of the Gulf Coast
- Beneficial use of wetland development in a port area

WE FOUND A BLEND OF SALTMARSH WITH MANGROVE TO BE THE OPTIMAL SOLUTION

Importantly, we also assessed relevant voluntary carbon-offset methodologies for coastal nature-based projects.

We found a blend of saltmarsh with mangrove to be the optimal solution because saltmarsh species are more tolerant of extended freezes and lower elevations with strong tidal fluctuations. Annual growth of the saltmarsh species provides ground cover and carbon-offset potential in areas where mangroves have not yet expanded or are unable to do so.

Mangroves take several years to reach maturity but can successfully vegetate the higher elevations, where saltmarsh species are not as successful. Studies have shown that mangrove has encroached into saltmarsh areas; however, this dominance has shifted several times throughout time due to climate preferences of each species. The blended approach allows for a more resilient marsh system.

ASSESSING CARBON-OFFSET POTENTIAL

In general, a carbon offset refers to the reduction or removal of carbon dioxide (CO₂) or other greenhouse gas (GHG) from the atmosphere that mitigates emissions produced elsewhere (measured in CO₂ equivalent, or CO₂e).

Carbon-offset projects can range from renewable energy projects, energy efficiency, and forestry (afforestation, reforestation, or avoided deforestation) to methane capture/avoidance and waste management. Surrounding this concept are a multitude of protocols, methodologies, standards, and registries that evaluate, track, and monitor the progress of projects developed specifically for this purpose.

The term “blue carbon” is used to describe carbon stored in marine and coastal ecosystems, including seagrass meadows, salt marshes, tidal marshes, and mangroves that can sequester and store more carbon per unit area than terrestrial forests, establishing them as significant carbon sinks.

Although coastal wetlands cover less than 2% of the total ocean area, they account for approximately 50% of all carbon stored within ocean sediments. Consistent efforts are needed to ensure that such ecosystems are neither degraded nor damaged. This would result in the loss of their carbon-sink capacity, resulting in the release of large quantities of CO₂ into the atmosphere. Projects to conserve, manage, and/or restore coastal ecosystems are essential to preventing this.

Blue carbon activities are one type of nature-based solution that have the potential to achieve most of the emission-reduction targets to keep warming levels below two degrees. Unfortunately, they lack sufficient funding, receiving only 3% of total global climate investments.² For this reason, project proponents with coastal access are an essential part of developing this offset type and protecting these areas.

To develop a carbon-offset project, proponents undertake a series of assessments to determine viability of the project and calculate carbon-offset potential. Figure 1 shows the steps involved in establishing an offset project and the processes required before offsets can be generated and claimed under a project registry.

Proponents first determine whether the project area and activities will meet the criteria of the project methodology; then a baseline scenario is developed. The baseline scenario reflects the activities, GHG emissions, and sequestration that would occur at the project site should no project activities take place.

Next, proponents map out the project activities and the respective carbon reductions that would be achieved by the project. Proponents then develop the project scenario in line with a selected methodology to ensure that project outcomes do not vary excessively from the feasibility phase to the implementation phase.

In the case of this project, offset methodology VM0024 was identified as the most suitable option for consideration.

Similar projects were identified that have used or propose to use the selected methodologies and were assessed for their relative carbon-sequestration potential and costs. Specifically, an in-development project registered with VCS as Bonos del Jaguar Azul (also within the Gulf of Mexico, in Yucatán, Mexico) showed the potential for success.³

The Bonos del Jaguar Azul project showed emissions reductions of 48,250 tCO₂e (tonnes of CO₂ equivalent) for 2020. The estimated annual emissions reductions by 2046 (end of the project life) will be 158,986 tCO₂e. The difference in values is due to the rate of biomass generation, in which plant growth continues to increase the carbon-sequestration potential. Table 1 shows the applicability to this type of project for the Gulf Coast.

In addition to meeting the methodology applicability requirements, a carbon project must satisfy an additionality requirement to ensure that the project would not have occurred in the absence of carbon market incentives or as part of business-as-usual activities. For the purposes of the project options, the additionality is assessed on whether project activities are mandated by law, statute, or another regulatory framework.



Figure 1. Offset project development roadmap

VM0024 METHODOLOGY APPLICABILITY REQUIREMENTS

Project activities must include those intended to create new wetlands in coastal ecosystems through substrate establishment, vegetation establishment, or both.

Project activities must not actively lower the water table depth.

The project area must meet the definitions of tidal or estuarine, open water, and degraded wetland before project activities can be implemented (and would have remained so in the absence of the project activities).

The project area must be entirely within tidal or estuarine areas within the US coastal zone boundary and must meet the definition of the US Environmental Protection Agency's "Waters of the United States," excluding the Great Lakes.

When afforestation, reforestation, revegetation, and restoring wetland ecosystems for a project include the establishment of woody vegetation, there must not be commercial harvest activities, nitrogen fertilization, or active peatland drainage.

The project proponent must have obtained the necessary permits to demonstrate that the project will not have a significant negative impact on hydrologically connected areas. This applicability condition must be satisfied at validation or at the first verification event.

Table 1. Applicability of VM0024 carbon-offset methodologies for the Gulf Coast

CARBON-ACCOUNTING APPROACH

The carbon benefits of project activities are subject to an accounting of what additional carbon storage occurs in the biomass and the soil organic carbon pool from the conversion of current state (baseline) to shoreline and tidal wetland.

Carbon benefits are calculated based on the difference between emissions in the baseline and those "with project," meaning net sequestration after growth and wetland creation occur. The project GHG accounting considers changes in soil and biomass stocks, plus any emissions of methane and nitrous oxide emissions caused by project activities.

Table 2 identifies assumptions in the baseline and project case. The unit of measurement accounts for GHG with global warming potential, measured in CO₂e.

The VCS registry and other voluntary carbon-offset registers require project proponents to demonstrate carbon ownership by a right of use. Given that this is a land-use project, a right of use can arise through property rights in land of the project area or by an enforceable and irrevocable agreement with the landowner that transfers such

rights to the project proponent. This means the project proponent can enter into agreements with surrounding landowners for the purposes of this project to expand the project area if needed.

When carbon-offset projects are developed on land with multiple owners, agreements are signed for the landowners (or a project developer) to receive the carbon offsets from the project and distribute the carbon revenues. Discussions with landowners and interested parties should include a discussion of the opportunity and costs, as well as the process and responsibilities associated with those carbon-offset rights. There are many examples of standard form agreements between landowners and for such transactions.

FINANCIAL FEASIBILITY ANALYSIS

The financial feasibility of a potential project can be determined using analysis like the one shown in Table 2.

The analysis shows that the project can achieve more carbon offsets, faster cash flows, and positive NPV as the land area increases and as mangrove coverage increases (due to higher biomass accruals than saltmarsh coverage).

CONSIDERATION	METRIC OR RANGE	COMMENT
Project area for vegetation growth	<ul style="list-style-type: none"> Shoreline options Wetland beneficial use options 	Identify what is possible
Carbon-offset potential	<ul style="list-style-type: none"> <i>Mangrove</i>: 7.59 tons of CO₂e/hectare/year <i>Saltmarsh</i>: 11 tons of CO₂e in growth year 	Range will be project specific
Project start date	2023	Project must be listed, registered, and validated to begin generating carbon offsets
Mangrove/marsh coverage	Blended percent	Assume 50%-70%. Final percent to be determined by start date
Non-permanence deduction	10% to 15%	Amount of carbon offsets dedicated (pooled) to cover loss from hurricanes, freeze events, fires, pests, etc.
Carbon price	<ul style="list-style-type: none"> Above US \$15 per ton CO₂e (at publication time) \$50-\$100 per ton CO₂e by 2051 	Current carbon-offset price on carbon exchange at the time of the report in 2022, increasing annually under market projections, assuming a minimum period of 30 years
Nursery & planting costs	\$25,000 to \$40,000	Indicative range, depending on scale of project and schedule
Project registration	\$40,000 to \$60,000 (one time)	Estimate for preparing project description and registration documents (one time)
Validation	\$20,000 (one time)	Validation costs to register project, including third-party validator required under VCS standards
Carbon monitoring and verification costs	\$40,000 (every five years)	Requirements to collect field biomass and soil organic data and prepare and verify VCS monitoring report
Discount rate	TBD	A discount rate of 10% is not uncommon and significantly increases financial feasibility

Table 2. List of project assumptions for financial feasibility

Several grants and incentives have been set up to support nature-based solutions along the Gulf Coast, including:

- The National Fish and Wildlife Foundation's (NFWF) National Coastal Resilience Fund.
- US Federal Emergency Management Agency (FEMA), with grants associated with hazard mitigation assistance submitted through/with the state hazard mitigation officer or a FEMA regional office.
- NFWF's Resilient Communities grants.
- FEMA's Flood Mitigation Assistance and similar hazard-reduction grants.
- US National Coastal Zone Management projects from the National Oceanic and Atmospheric Administration (NOAA), awarded based on merit.
- US Environmental Protection Agency (EPA) and Department of Interior (DOI) grants.
- State programs like the Coastal Conservation Association (CCA) of Texas, which funds research and hatcheries projects.
- Investment funding through Green Bond, Climate Bond, or Resilience Bond issuance. The International Capital Markets Association (ICMA)

and other international financial associations and organizations have developed principles and avenues to market for issuance of bonds to finance environmentally beneficial initiatives. Public bodies, private companies, and organizations like the Conservation Fund are actively participating and enabling the funding of projects through bond issuance, public-private partnerships, and structured financing of resilience projects and similar financial instruments.

BENEFITS & STAKEHOLDERS

Apart from carbon sequestration through wetland vegetation, coastal ecosystems provide services such as food security for coastal species and communities, protection and resilience against storms and rising sea levels, and grounds for establishing healthy fisheries. As a result, it is important that project proponents engage meaningfully with stakeholders and community groups surrounding the proposed project area, including potential partners, regulators, federal agencies, and surrounding landowners.



Should any of these groups become involved in the project development, monitoring, or maintenance, they must be identified as being part of the project-development process. Any subsequent land ownership involvement must have legal agreements detailing environmental attribute ownership, permanence stipulations, and protection agreements to ensure the longevity and health of the project area.

Potential benefits from this engagement include a common understanding of the project and benefits identified, greater insights and learnings, opportunities for community engagement and support (e.g., volunteer planting days), and enhanced use and enjoyment of the project areas

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