

FORESTS: THE CARBON REMOVAL TECHNOLOGY FOR TODAY



WHY WE SHOULD INCENTIVIZE FOREST CARBON CAPTURE AS OUR BRIDGE TO A NET-ZERO FUTURE

The headline could not have been clearer: “We have 12 years to limit climate change catastrophe, warns UN,”¹ posted the UK news site *The Guardian*, just hours after the UN Intergovernmental Panel on Climate Change (IPCC) released its *Fifth Assessment Report* on the likely impacts of climate change on global ecosystems.

Based on improved climate science and advanced computer modeling, the report forecasts that humans have only until 2030 to reduce carbon emissions to a level that would limit global warming to 1.5°C above preindustrial levels—the “tipping point” past which unprecedented and irreversible ecosystem damage would most likely occur.

“We have pointed out the enormous benefits of keeping to 1.5°C,” said Jim Skea, a co-chair of the panel’s working group on mitigation. “We show it can be done within laws of physics and chemistry. Then the final tick box is political will. We cannot answer that. Only our audience can.”²

This audience includes world governments, businesses, and citizens, of course; but also the broad-based community of entrepreneurs, investors, philanthropists, researchers, reporters, verifiers, monitors,

registries, and advocacy organizations that make up the climate-solutions community. And while much of this community is focused on reducing carbon emissions from existing sources, the IPCC report makes it clear that reduction measures alone will not be able to limit temperature rise to 1.5°C, without also including active measures to remove carbon dioxide from the atmosphere.

“We cannot afford to close it off as an option,” wrote London School of Economics Professor Nicholas Stern about strategies for carbon capture and storage. “We must reverse the degradation of our land, soils and forests so that they are more productive and absorb more carbon dioxide. All of this is both possible and extremely attractive.”³



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STRATEGIES FOR A “BOTH/AND” WORLD



Professor Stern represents a new line of thinking that has grown and is gaining prominence in professional climate-change circles. In light of the IPCC report and related news that shows that annual global carbon emissions are *accelerating* rather than retreating, as data from earlier in the decade suggested, scientists and policymakers are coming to a clear consensus that carbon reduction measures must be joined with financially viable offsetting strategies—and that no option should be off the table.

This perspective represents a change, in particular in the way that climate-change advocates have received the efforts of carbon-emitting industries to offset the impact of their business activities while undertaking the difficult task of re-engineering their business operations for a carbon-neutral future.

When in early December 2018, Royal Dutch Shell announced a comprehensive carbon-reduction plan that integrates technological solutions to shrink the climate footprint of its core energy products along with mitigation strategies to address the “Scope 3” emissions generated by its customers, institutional investors and the climate-action community applauded. “This progress sets Shell apart from its peers and it raises the bar for major oil and gas companies moving forward,”⁴ said Mindy Lubber, CEO and President of Ceres and founding partner of the Climate Action 100+, a group of institutional investors that engaged with Shell to bring about this planned initiative.

For climate advocates concerned about the “moral hazard” of permitting carbon emitters to use offsetting approaches as a means to avoid making fundamental changes to their operations and product lines, this shift to “both/and” thinking underscores the reality that carbon-emission growth is outstripping our ability to invent our way out of the problem within a time-frame that avoids an undesired—and unnecessary—day of reckoning. While industry retools for a carbon-neutral future, offsetting technologies—both technological solutions in development and those closer at hand and ready to deploy today—are essential to meeting the IPCC’s 2030 target.

“The time has come and gone for rigid thinking on either side of the climate-change discussion,” said Marvin G. Marshall, CEO of Restore the Earth Foundation. “We must both continue to promote business transition to a net-zero economy and also support businesses down this path by providing cost-effective carbon-removal solutions that they can adopt right now to help bridge them into that future.”

CARBON REMOVAL: TOMORROW AND TODAY

Carbon removal technologies have been a front-burner item for economists and the business community, in great part due to the promise they hold to ease the transition to a net-zero economy without introducing regulations or other market interventions that might slow economic growth and therefore risk public backlash. On a timeline beyond 2030, they also offer promise to eventually bend down the carbon curve to a level where the planet achieves climate stability at a temperature below 1.5°C.

For technological solutions, the questions continue to be “when?” and “at what cost?” Direct-air carbon capture, which would pull existing air-borne carbon out of the atmosphere rather than sequester it at source, is in development at several research institutions around the world, and a Harvard team recently announced that it had developed a direct-air carbon-capture process that could potentially be brought online as early as 2021, capturing carbon at a cost of between \$94 and \$232 per metric ton, or the equivalent of a gasoline tax of between \$1 and \$2.50 per gallon.⁵ This compares favorably to earlier experiments that estimated the cost of direct-air capture at between \$600-\$1000 per metric ton, but still widely outside of what economists consider to be a viable price on carbon, which the World Bank in 2017 pegged at between \$40-\$80 per metric ton.⁶ At \$100 per ton, world economies would need to invest roughly 5 percent of global GDP (currently estimated at close to \$90 trillion) to make this technology pay off, stated Ken Caldeira, senior scientist at Carnegie Institution for Science.⁷

If direct-air carbon capture follow the classic “s” cost curve of typical technological innovations, the price per metric ton captured could reach as low as \$20 by sometime in the 2040s, according to William Murray, federal energy policy manager with the R Street Institute.⁸ Meanwhile, such prices are at hand today, in the form of “natural climate solutions” including, first and foremost, landscape-scale forest restoration.

In a recent peer-reviewed study published in November 2018 in *Science Advances* magazine, a team of 38 scientists from around the United States concluded that an inventory of 21 natural climate solutions—led by forest restoration and improved forest management—could contribute to reducing the US annual carbon footprint by approximately 21 percent, at a price of between \$10 and \$100 per metric ton.⁹ Forest restoration alone, the authors stated,

could produce emission reductions of over 300 million metric tons of carbon annually by 2025, equivalent to taking 65 million automobiles off the road.¹⁰

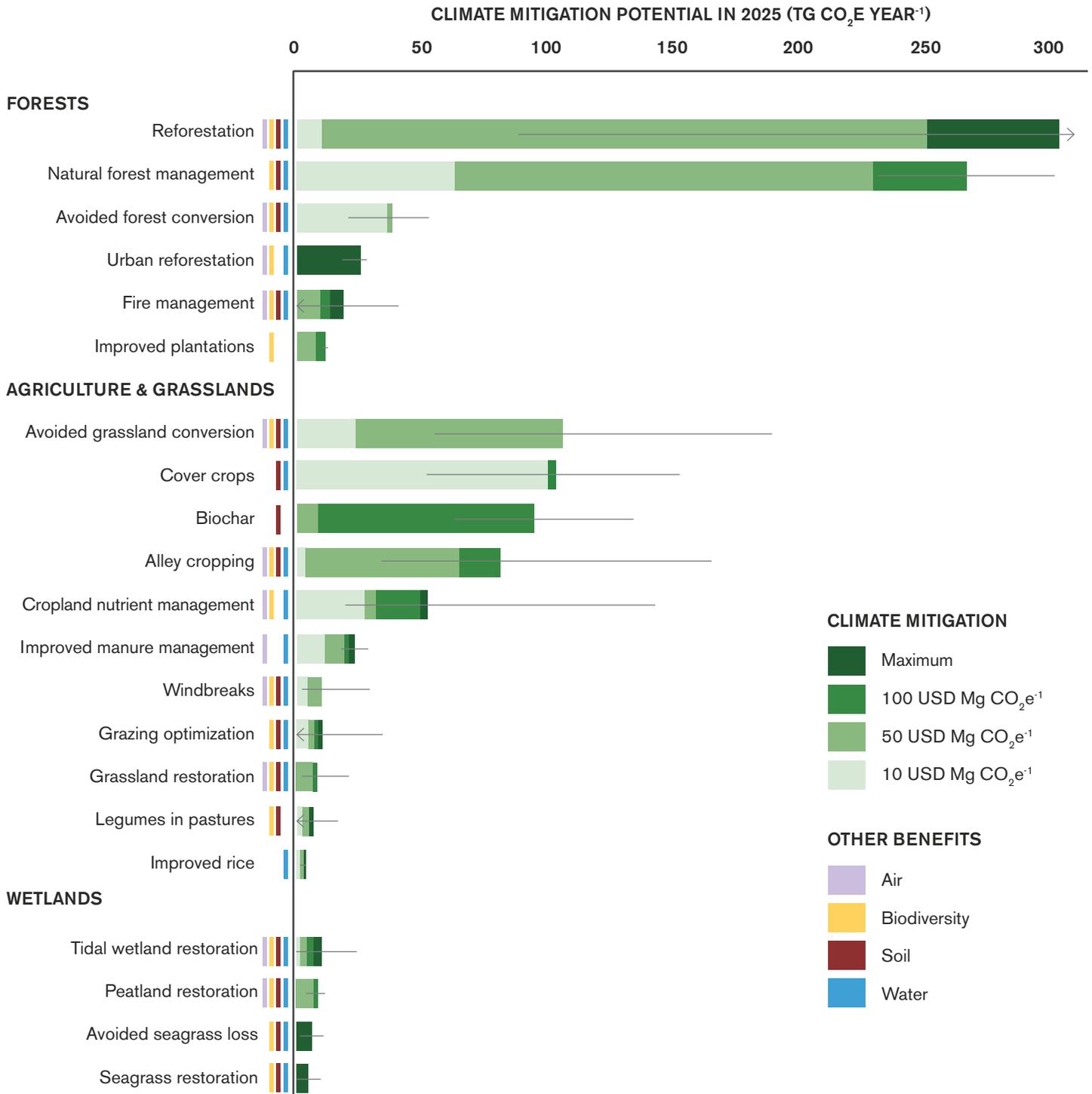
The *Science Advances* team is not the only one to come to similar conclusions about the efficacy of natural climate solutions to dramatically reverse climate change at an economically feasible price. In a 2017 paper published in the *Proceedings of the National Academy of the Sciences*, a research team of more than two dozen scientists organized by The Nature Conservancy found that natural climate solutions—led again by forest restoration—could provide up to 37 percent of the emission reductions needed by 2030 to keep global temperature increases under 2°C—30 percent more than previously estimated, if deployed over the next 10 to 15 years.¹¹

Using solutions priced at or below \$10 per metric ton (50 percent less than the most aggressive estimates for direct-air carbon capture), nature’s mitigation potential was estimated at 11.3 billion tons in 2030—the equivalent of stopping the burning of oil globally.¹² In addition, the paper reported that these natural climate solutions would also offer additional benefits that were not priced in the study’s model, such as water filtration, flood buffering, improved soil health, protection of habitat, and enhanced climate resilience.

With such a preponderance of evidence pointing to natural climate solutions—and forest restoration in particular—as a technically and economically feasible pathway forward for atmospheric carbon removal today, why isn’t investment streaming into this sector, both as a ready and immediate response to the urgency of the 2030 deadline and as an insurance policy against the possibility that clean-energy sources and carbon-removal technologies could take longer than expected to gain scale and achieve economic viability?

Forest Restoration Offers the Greatest Potential for Cost-Effective Carbon Removal

According to a peer-reviewed study published in the November 2018 issue of Science Advances magazine, forest restoration led among 21 natural climate solutions in terms of cost-effectiveness for removing carbon from the atmosphere.



CARBON MARKETS: YESTERDAY AND TODAY

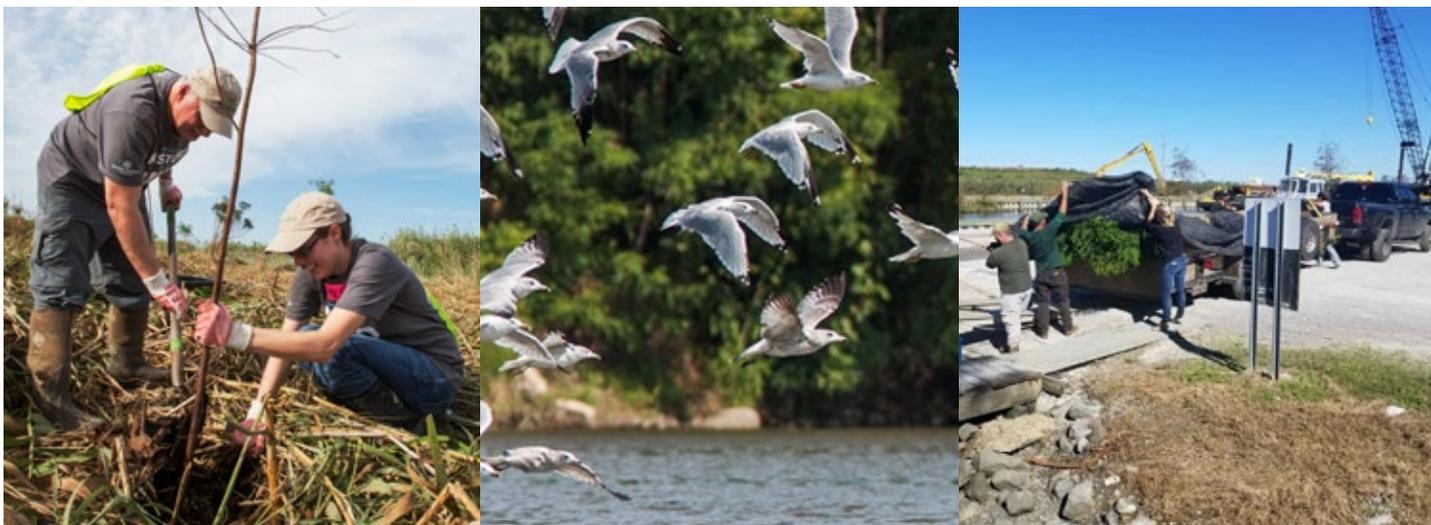
In fact, after years in the doldrums, global spending on carbon trading and taxes is in the midst of comeback, driven by strong performance in China and the European Union, according to a May 2018 report by the World Bank. The total value of the world's carbon markets and taxes is estimated to jump in 2018 by 57 percent to \$82 billion versus \$52 billion in 2017. Driving this performance is the fact that 88 countries that are parties to the 2015 Paris agreement have implemented, or are in the process of implementing, a carbon pricing mechanism.¹³

In the United States, where a market primarily exists for voluntary carbon offsets, voluntary offsets have been responsible for sequestering over 437 million metric tons of carbon between 2005-18, roughly equal to Australia's annual carbon emissions output, according to Forest Trends.¹⁴ In 2016, the total market value of the voluntary market hit over \$190 million, a large portion of which was transacted through the so-called "primary market" (sales from project developers directly to end buyers). Voluntary offset issuances hit a peak of 62.7 million metric tons in 2017, and retirements also jumped to 42.8 million metric tons.¹⁵

While at a very small scale relative to the United States' total carbon emissions output of 5.14 billion metric tons in 2017,¹⁶ increased supply and demand in voluntary markets reflects a gelling consensus within the global corporate and investment communities that climate inaction represents an intolerable business risk, and that "both/and" reduction strategies must come into play if future economic disruption is to be avoided. With this background, climate actors across the public-private spectrum have been on the hunt for innovative ways to remove the barriers to "both/and" climate action and take decisive private measures to turn the US carbon growth curve down, in the absence of a broad-based compliance regime or carbon tax.



CLIMATE FORWARD: ADDRESSING THE CARBON FINANCE DILEMMA



One of the greatest challenges in the voluntary offset markets is in finding the “best fit” between project developers’ capabilities and corporate buyers’ requirements. Corporate buyers have shown a demonstrated preference for offsets purchased direct from developers on the primary market as opposed to those sold on the secondary market via exchanges. According to Forest Trends, although offsets sold in the primary market accounted for only 29 percent of the volume traded in 2017, they accounted for 40 percent of the value produced.¹⁷

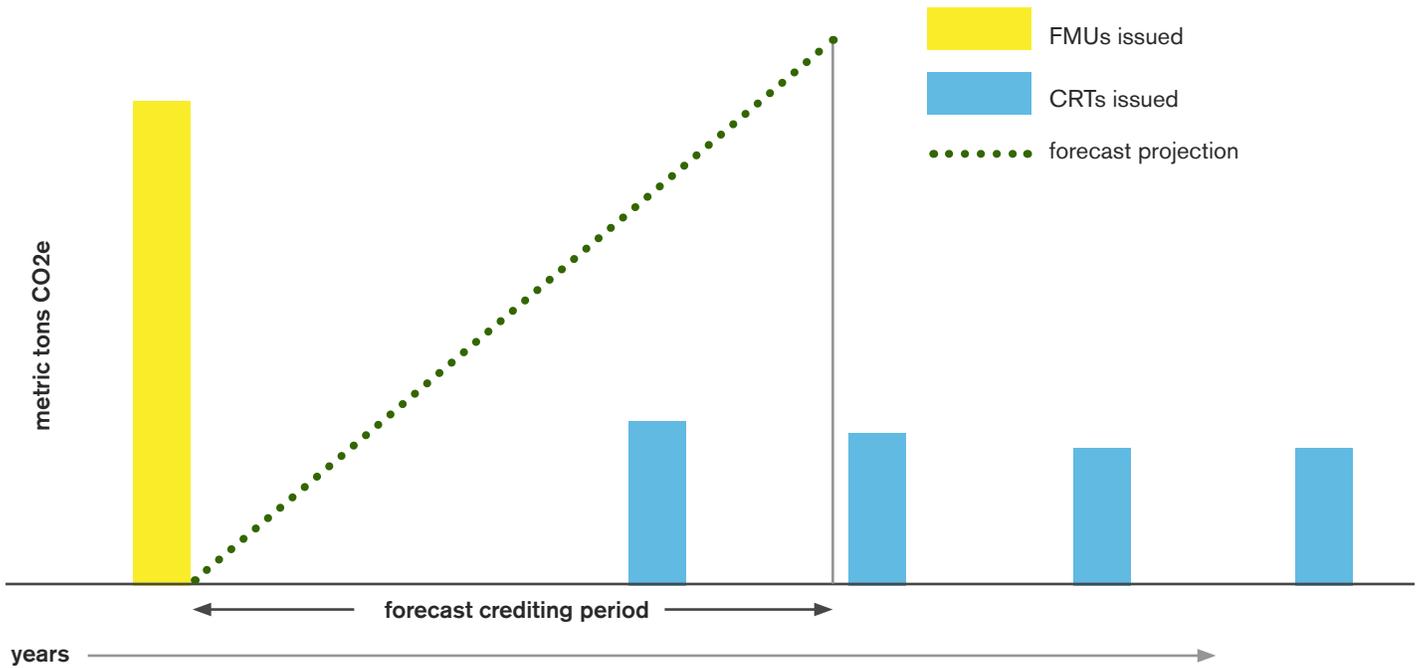
The reasons for this demonstrated preference are clear. Developers can customize carbon offset projects to meet buyers’ specific needs, often siting these projects in regions considered important or particularly valuable by their customers. Because natural climate-solution projects like forest restoration produce numerous co-benefits in terms of improved water quality, storm protection, wildlife habitat, and recreational space, customers often become more aware of these co-benefits than they are of the relatively invisible benefit of carbon sequestration. And increasingly, these co-benefits can be measured and valued in financial terms through advanced assessment regimes, such as Restore the Earth’s EcoMetrics forecasting and assessment platform. None of these co-benefits accrue to buyers who purchase offsets on secondary exchanges.

Where developers and buyers often face challenges is in the financing of these innovative projects. Because forest restoration projects take time from inception to begin sequestering carbon and therefore minting offsets, the time gap between initial funding and offset assignment can often be too long for corporate buyers to reasonably incorporate into their “both/and” carbon reduction plans under conventional registry requirements.

Forward crediting of offsets (or *ex-ante* issuance), in which credits are awarded at the time of purchase as opposed to when they become physically mature, offers a theoretically viable solution to this dilemma; but until recently, no major registry had developed an approach to forward crediting that met the requirements for permanence and verifiability that are essential to the integrity of the offset marketplace.

Restore the Earth's Innovative Climate Forward Methodology

Restore the Earth leverages forward-crediting protocols to incentivize investment in carbon mitigation while producing "Climate Reserve Tonnes" over time via rigorous monitoring and verification regimes.



In November 2018, Climate Action Reserve, one of the world's most prominent carbon offset registries, responsible for managing close to 80 percent of the North American voluntary offset market and the project registry for the State of California's compliance offset program, stepped into this gap with *Climate Forward*, a new crediting program designed to accelerate the transition to a net-zero economy by encouraging developers and buyers to proactively invest in innovative projects designed to anticipate and address future carbon emissions from new business activities and future projected Scope 3 emissions, for example.

Developers can adopt a carbon-accounting methodology that has been previously approved for use on the Climate Forward public registry, or they can develop and submit one of their own for approval. Methodologies must meet a strict set of standards for the conservative *ex-ante* accounting of future emissions reductions, along with meeting all the other standards expected from a conventional offset registry. Projects must be "real" (projections based on a comprehensive and scientifically credible methodology); "additional" (cause carbon removal that otherwise would not have taken place in the absence of the project); "permanent" (must persist for at least 100 years, accounting for reversals, via a risk pool); "confirmable" (project implementation confirmed by an approved third party prior to the issuance of

credits); and "enforceable" (no other party may claim credit for the carbon reductions).

Upon confirmation of the project, the Climate Forward registry issues "Forecasted Mitigation Units" ("FMUs"), each of which represent one metric ton of carbon that will be sequestered and removed from the atmosphere during the project term. After the initial monitoring and crediting period, projects are eligible to transition to an ongoing *ex-post* monitoring and verification regime approved by the Reserve and potentially be issued "Climate Reserve Tonnes" ("CRTs"). This flexibility provides enormous benefits to both project developers and buyers, incentivizing proactive efforts to remove carbon from the atmosphere via forest carbon capture, and rewarding developers that invest in ensuring long-term project integrity via periodic monitoring and verification.

Recognizing the potential of the Climate Forward program to drive natural climate-solution projects like forest restoration to the forefront of efforts to reverse climate change, Restore the Earth Foundation partnered with the carbon finance advisory firm Terracarbon LLC to develop one of the first forward-crediting accounting methodologies to be approved for use in the Climate Forward program. This methodology incorporates the concept of converting FMUs to CRTs via a conventional monitoring and verification regime.

In addition, Restore the Earth intends to assess and report on all co-benefits produced by its Climate Forward projects using Restore the Earth EcoMetrics, its platform for calculating and valuing the full financial, environmental, and social returns produced by natural climate-solution projects such as forest restoration. Restore the Earth's first Climate Forward project will be sited at Pointe-aux-Chenes Wildlife Management Area in Terrebonne Parish, Louisiana, at the mouth of the Mississippi River. This 5,000-acre pilot project is expected to remove over 1,000,000 metric tons of carbon from the atmosphere over its 40-year project lifetime. Restore the Earth's mission and long-range goal is to reforest one million acres of degraded land in the Mississippi River Basin, "North America's Amazon."

One of the first funders of Restore the Earth's Pointe-aux-Chenes project is VMware, a "climate-forward," Silicon-Valley technology firm that has actively embraced a "both/and" climate action strategy and has consistently earned positive ratings from CDP (formerly Climate Disclosure Project). VMware's core product offering assists its customers to reduce their climate footprints by sharing compute power via virtualized servers in the "cloud." It has invested in rigorous facilities management and in clean energy credits to drive down production of Scope 2 emissions. VMware also invests in offsets to reduce Scope 3 emissions from such activities as employee travel.

VMware's investment in the Pointe-aux-Chenes project is an ideal example of how the Climate Action Reserve's Climate Forward program can incentivize a company that seeks to proactively advance a "both/and" strategy to accelerate its march toward carbon neutrality.

Another firm that exemplifies this commitment to deploying a "both/and" climate action strategy is FivePoint Communities, developer of the 21,500-home Newhall Ranch master-planned community located northwest of Los Angeles, California. Developers of this ambitious project, dubbed "Net Zero Newhall," have designed the single-family homes with solar panels, electric car chargers, and other green-building technologies and practices to maximize the percentage of renewable energy produced and consumed by residents. Carbon offsets that cannot be eliminated at source can be offset by projects like Pointe-aux-Chenes and others located in the Mississippi River Basin. Point-aux-Chenes is also registered with the American Carbon Registry.

"We asked, 'What can we do to get to zero?'" remarked Emile Haddad, FivePoint's CEO. "Not sometime in the future, but now, and with this project. We knew the answer lay in using all the available tools at our disposal. As a result, we think that Newhall Ranch will create a new model for living and working sustainably in California."



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A NEW ERA FOR CLIMATE ACTION

Developments such as the Climate Action Reserve's Climate Forward program and Restore the Earth's Pointe-aux-Chenes project signal a new era of urgency and hope in the race to balance the Earth's carbon budget. Natural climate solutions such as landscape-scale forest restoration have emerged on the cutting edge of this effort. By helping to crack the climate-finance code, these programs stand to make a real and lasting impact—in a time-frame that matters.

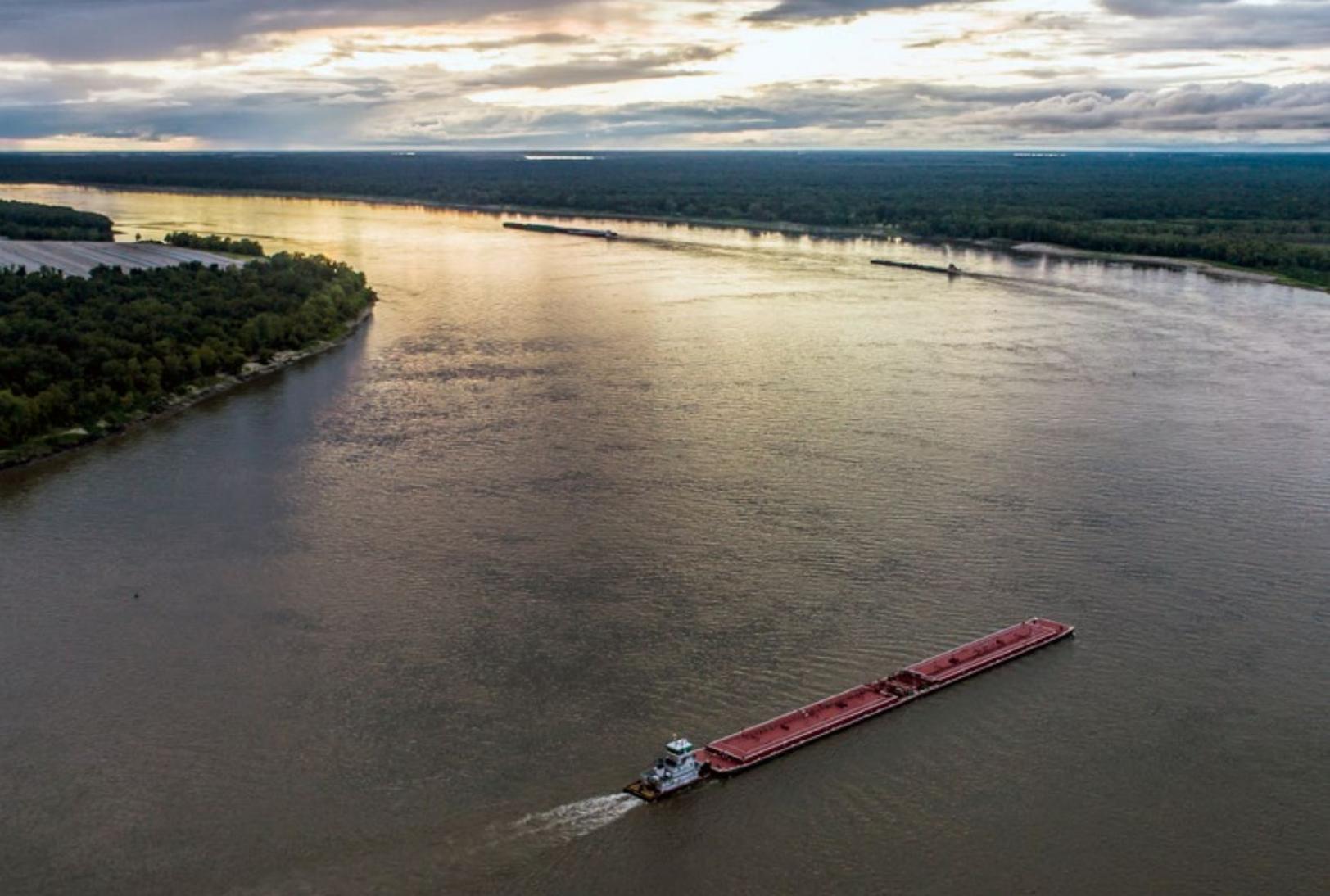
Said Climate Action Reserve CEO Craig Ebert, "The world is running out of time to address climate change. We need more strategies and investment in climate mitigation.

Climate Forward represents a new option to accelerate climate action; and Restore the Earth Foundation should be recognized for taking a strong and innovative leadership position in bringing a market-based solution forward that meets the highest standards of integrity while incentivizing investment in a well-understood, highly scalable, and effective natural capital solution like forest restoration."

Industry leaders concur. **"We applaud Restore the Earth Foundation, Climate Action Reserve, VMware, and FivePoint for demonstrating effective leadership at this crucial time when climate action is imperative, and 'both/and' strategies for carbon footprint reduction are welcome and needed,"** said CDP Director of Climate Change Nicolette Bartlett.

"Over 500 companies have now committed to setting emission reduction targets in line with climate science, with some offsetting their current emissions at the same time. We need to see more of this to safeguard a prosperous world for future generations."





¹ Jonathan Watts, "We have 12 years to limit climate change catastrophe, warns UN," *The Guardian*, 8 October 2018.

² Ibid.

³ Nicholas Stern, "We must reduce greenhouse gas emissions to net zero or face more floods," *The Guardian*, 7 October 2018.

⁴ "Shell's new climate commitments and the power of investor engagement," Ceres email, 4 December 2018.

⁵ Robinson Meyer, "Climate Change Can Be Stopped by Turning Air into Gasoline," *The Atlantic*, 7 June 2018.

⁶ World Bank, "Guidance note on the shadow price of carbon in economic analysis," 12 November 2017, p. 2.

⁷ Meyer, "Climate Change," *The Atlantic*.

⁸ William Murray, "If Carbon Tech Follows the Path of Batteries, CO2 Capture Could be Super Cheap by the 2040s," *Greentechmedia.com*, 6 September 2018.

⁹ Joseph E. Fargione, et al., "Natural climate solutions for the United States," *Science Advances*, 14 November 2018.

¹⁰ "Natural solutions reduce global warming: Clark University + The Nature Conservancy," Clark University press release, 14 November 2018.

¹¹ "Nature's Make or Break Potential for Climate Change," *The Nature Conservancy*, 16 October 2017.

¹² Ibid.

¹³ Fiona Harvey, "Carbon markets back from the brink of collapse, says the World Bank," *The Guardian*, 22 May 2018.

¹⁴ *Voluntary Carbon Market Insights: 2018 Outlook and First-Quarter Trends*, Forest Trends, August 2018, p. 4

¹⁵ *Unlocking Potential: State of the Voluntary Carbon Markets 2017*, Forest Trends, May 2017, p. 3.

¹⁶ "US energy-related CO2 emissions fell slightly in 2017," *Today in Energy*, US Energy Information Administration, 5 September 2018.

¹⁷ *Unlocking Potential*, p.3



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