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It's Closing Time: The Huge Bill to Abandon Oilfields Comes Early

Robert Schuwerk and Greg Rogers
Carbon Tracker

Editor's Introduction

This article was adapted from Carbon Tracker's report of the same name.

Once an oil or gas well is no longer in use, it must be properly sealed shut and decommissioned to prevent leakage of oil and gas. This leakage can cause local pollution problems, negatively impacting the quality of air, water, and soil nearby, and risks explosion, a significant safety hazard. It also is a significant source of methane, an atmosphere-heating greenhouse gas considerably more potent than carbon dioxide.

Done correctly, decommissioning a well involves sealing it with cement and multiple metal barriers to prevent leakage, then continuing to monitor the site to ensure that it remains sealed. The majority of inactive oil and gas wells in the United States have not been properly decommissioned. According to an EPA report,¹ as of 2016 there were 3.2 million inactive wells in the U.S. Of these, 69 percent – more than 2 million – are unplugged or improperly closed. These are referred to as “orphan” wells.

Introduction

By law, after production ceases, all oil and gas wells must be permanently plugged and abandoned. In finance, these debt-like legal obligations to Plug and Abandon wells are called “asset retirement obligations” (AROs). They are reported in company financial statements on a discounted present value basis.

Companies typically assume that the bulk of ARO costs will be incurred in the distant future, but the low

carbon energy transition will bring them forward – further accelerating the industry's woes brought on by the coronavirus pandemic. There's no money set aside to cover retirement costs, and lax regulations are to blame.

And this illuminates the problem: regulators have not required the industry to set aside funds to retire these wells. In short, the industry cannot afford to retire. If industry can't pay, then its lenders, investors, creditors and ultimately oil producing states will eventually be forced to foot the bill. Otherwise, landowners and citizens will be left to live with the consequences of millions of unplugged wells.

How did this happen? Going back to the 1800s, the purpose of oil and gas regulation was to promote oil and gas production not to protect the environment. When oil and gas drilling began in the U.S., there was no regulation regarding the treatment of a well at the end of its useful life. Drillers simply “abandoned” unusable wells as gaping holes in the ground. When plugging and abandonment (P&A) regulations came along, they were designed to protect the production zones from flooding by fresh water. As the number of abandoned wells mounted and the adverse environmental and safety implications of improperly abandoned wells became better understood, states began setting plugging and abandonment standards designed to protect groundwater resources.

As plugging and abandonment standards evolved costs increased, and states began to require financial assurance (or “bonding”) from oil companies to assure timely completion of permanent well closure and site restoration. Oil companies successfully argued for low bonding levels on the grounds that full bonding – bond

¹ https://www.epa.gov/sites/production/files/2018-04/documents/ghgemissions_abandoned_wells.pdf

amounts equal to 100% of the estimated cost to complete the work – was unnecessary to protect the state’s financial interests and would make oil and gas production non-economic.

Plugging and abandonment and related bond carrying costs (annual premiums and collateral) provide no return on investment for oil companies, that want to keep capital expenditures and operating costs as low as possible. If a state proposed to increase bond levels, oil companies could threaten to move their activities elsewhere. Bonding became a race to the bottom.

With industry’s support, governments established “orphan” well programs funded by industry to pay for wells orphaned to the state by failed oil companies. The idea was simple: thriving oil companies would pick up the bill for failed ones. Low bonding levels were an acceptable risk, as long as the vast majority of oil companies remained good credit risks.

States, however, failed to realize that they had created a moral hazard: when bonding levels are far below actual plugging and abandonment costs, it’s always in the oil company’s financial interest to delay permanent retirement of wells as long as possible.² As a predictable result, inventories of largely “self-bonded” idle wells, including “zombie” wells that have been nonoperational for more than 100 years, have ballooned.

At the same time inventories of idle and orphan wells are sky-rocketing, the oil industry is entering a state of permanent decline. The ratio of thriving oil companies to failing ones is deteriorating and will continue to get worse. The assumption that the strong will pick up the bill for the weak is no longer valid. States must adopt new policies to reflect this new reality. The race to the bottom must be reversed.

As long as it remains financially optimal for companies to defer closure, this is the course they will take. To avoid this outcome, regulators must incentivize industry to fulfill its obligation to promptly retire non-economic wells in the ordinary course of operations, while there are still cashflows available to do so. This will require regulations that force industry to pay a market-based price – in the form of full bonding and fees on idle and marginal wells – for the option to defer permanent retirement. This requires an understanding of the actual costs to close wells.

Renewable Natural Resources Foundation

The Renewable Natural Resources Foundation (RNRF) is a nonprofit, public policy research organization. Its mission is to advance the application of science, engineering and design in decision-making, promote interdisciplinary collaboration, and educate policymakers and the public on managing and conserving renewable natural resources. Member organizations are:

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² Idle Oil Wells: Half Empty or Half Full? at p. 7.0 https://www.iaee.org/en/students/best_papers/Muehlenbachs.pdf

What Does it Cost to Close a Well?

Though wells are being closed all the time, data on industry well closure costs is surprisingly scarce. Moreover, damage from wear and tear over decades can complicate P&A and make it difficult to anticipate the cost of retiring any given well. However, to inform appropriate policies it is essential that states obtain reliable estimates of the average expected costs to plug and abandon all wells under their jurisdiction, including producing, marginal, idle and orphan wells.

States cannot expect the willing cooperation of industry, whose self-interest is to downplay P&A costs as negligible. A common industry theme is to imply that costs to close producing and idle wells will be the same as those incurred by states to close orphan wells. But this is a misleading comparison because orphan wells tend to be shallower and because states can time orphan closures to when rig costs are low and multiple wells in the same area can be plugged at the same time – a luxury industry may not always have.

Reliable estimates of the cost to lawfully retire the oil and gas industry are essential for states but a threat to industry. Lower P&A cost estimates allow industry to argue that existing bond levels are sufficient. Orphan well cost data provides a convenient chimera.

Because industry does not report actual or estimated P&A costs, available U.S. cost data comes entirely from state orphan well programs. This has led the unwary to assume that all wells, shallow or deep, producing or orphaned, will cost in the low tens of thousands of dollars to close. Research from Carbon Tracker indicates, however, that those expecting the cost of permanently retiring hundreds of thousands of unconventional shale wells to be \$20,000 to \$40,000 per well are in for sticker shock. A more realistic estimate may be an order of magnitude higher on average, and in extreme cases as much as \$1 million per well. This is because shale wells are deep; deep wells are expensive to close, and deep “problem” wells can cost an order of magnitude more than typical ones.

The true costs to plug deep U.S. shale wells may be one of industry’s best kept secrets. As many of the newer deep wells become candidates for permanent Covid-induced shut-ins, understanding these costs and assessing state-wide and company-specific exposure is imperative for every oil producing state.

Covid-19

The coronavirus pandemic has led to the fastest collapse of oil demand and prices in more than a generation. Nowhere have these impacts been more profoundly felt than in the U.S. shale patch. There is now talk of struggling companies being seized and operated by their lenders.³

Unlike most other industries, oil and gas is lawfully required to clean up its mess when the music stops. That moment is unavoidable for every well and eventually for the entire industry. The energy transition was already quickening the pace, but for U.S. shale producers, Covid-19 has brought that day of reckoning forward, front and center.

Covid-19 is impacting the short, medium, and long-term outlook for the industry:

Short term: Temporary shut-in of production because there is no place to store excess oil supply. Ironically, this includes many of the newest, most productive wells as these may be considered the most able to withstand the physical impact of being shut-in. It will cost money to restart them – Wood Mackenzie estimates that given restart costs – some portion of current production may never return.⁴ While granting leniency on extended shut-in of productive wells, regulators may require many long-term idle “zombie” wells to be permanently plugged. These are wells that have been idle, often for decades, long before Covid-19 struck and now look even less likely to be reopened.

³ <https://www.reuters.com/article/us-usa-banks-energy-assets-exclusive/exclusive-us-banks-prepare-to-seize-energy-assets-as-shale-boom-goes-bust-idUSKCN21R3J>

⁴ <https://www.bicmagazine.com/expansions/upstream/woodmac-how-will-the-oil-price-crash-hit-the-upstream-sector/>

Medium term: The virus is not going away anytime soon. And beyond the U.S. Energy Information Administration (EIA), most analysts believe that oil demand won't be snapping back overnight. Even industry is saying this may result in permanent changes to consumer preferences (i.e. less travel, more working remotely). Meanwhile, an extended reduction in demand for oil will give renewables and EVs time to take market share, leading some analysts to predict that 2019 was peak demand for oil. On the supply side, higher than expected decline curves in the U.S. shale patch were already causing concern about premature well failure. Add to that the risk that an extended shut-down could damage oil formations permanently. As a result, many new and highly productive wells will need to be plugged much sooner than expected.

Long term: Covid-19 puts particular pressure on the U.S. fracking industry, which has never been cash flow positive. Major lenders were backing away before the virus. Worse, the larger backdrop to the current crisis is climate change and the energy transition, forces that will not recede. Those with oil industry counter-party risk are now thinking about the implications of an industry in terminal decline. The most affected are U.S. petro-states, who are both losing severance tax and royalty revenues and facing likely default on billions of dollars in self-bonded well closure obligations. Fracking could not generate an acceptable return on investment even with free, unsecured credit on closure obligations. As states take long overdue steps to de-risk, the industry's financial situation will only get worse.

Asset Retirement Obligation Acceleration

"We have got to change and change profoundly.... I get it. The world does have a carbon budget, and it is running out fast." –Bernard Looney, CEO BP

Even industry leaders agree that some growth plans don't fit in a low carbon world. Were the trend not obvious, it can be seen in the ever more ambitious long-term emissions reduction targets that companies are announcing in response to investor demand.⁵

While climate change was already driving the oil and gas industry toward early retirement, the coronavirus pandemic hit the accelerator. The Covid-19 induced shut-ins⁶ are at least an analogue – and perhaps the prologue, of how the industry will be impacted by the energy transition.

The looming costs are significant. It will cost hundreds of billions of dollars to close the estimated 3.3 to 4 million active, idle and abandoned but unplugged onshore wells in the U.S. An estimated 2.3 to 3 million of these wells are already abandoned.⁷ Only a tiny fraction of that amount is bonded. And this ignores oilfield assets in the rest of the world as well as midstream and downstream assets everywhere.

If the U.S. shale oil industry were to live forever, its failure to save for retirement would not be a matter of immediate concern. Companies could pay retirement obligations as they come due from future earnings. But Covid-19, climate change and the energy transition obliterate the "forever" assumption. It is no longer reasonable, if it ever was, to assume that the U.S. oil industry will survive its longest living assets.

The prospect that the industry will not survive long enough to pay its environmental debts will lead other parties, such as equity investors and banks, to protect themselves.

At root, readers should understand this: acceleration of the industry's retirement debt is driven simply by stakeholders protecting their own interests. In other words, asset retirement obligation acceleration occurs when counterparties demand timely closure of non-economic wells, higher fees for marginal and idle wells, and higher bond levels for new and producing wells.

⁵ <https://carbontracker.org/totals-extended-emissions-ambition/>; <https://carbontracker.org/eni-the-first-oil-company-to-lay-out-a-strategy-of-managed-decline/>

⁶ https://www.texastribune.org/2020/04/06/texas-oil-producers-shutting-wells-coronavirus-dispute-plummet-prices/ghgemissions_abandoned_wells.pdf

⁷ https://www.epa.gov/sites/production/files/2018-04/documents/ghgemissions_abandoned_wells.pdf

Forever is over, costs underestimated, hiding in plain sight

If asset retirement obligation acceleration risk sounds unfamiliar, it's because it has not been viewed as a systemic, structural risk before now – the default assumption has been that the industry was essential to economic growth and therefore would live forever. That topline assumption began to erode with Mark Carney's 2015 Tragedy of the Horizons speech. With the onset of Covid-19, the implications are now becoming increasingly clear to other stakeholders. Even before the impact of the pandemic was widely understood, CNBC's Jim Cramer captured the emerging zeitgeist, proclaiming on air February 3, 2020 that fossil fuels are "in the death knell phase." BP's CEO would not have put it so bluntly, but his new vision for BP includes producing less oil and gas over time.

Now that the forced early retirement of the oil industry is seen as a matter of when, not if, companies, states, investors and taxpayers need to rethink their asset retirement obligation exposures. Financial data and analysis on plugging and abandonment costs that has not been important before is now essential.

Conclusion

Industry – not just a few insolvent companies but the entire U.S. oil and gas industry – may not have sufficient revenues and savings to satisfy liabilities for hundreds of billions of dollars in self-bonded asset retirement obligations as they come due. Industry-funded orphan well programs are barely a drop in the bucket.

Self-bonded asset retirement obligations have left industry and oil producing states in a deep hole. If millions of wells with no future beneficial value are to be plugged as the law requires, it will mostly be at taxpayer expense. If instead, they are not plugged, the price will be paid by landowners, citizens, and the environment.

By continuing to extend free unsecured credit for asset retirement obligations, states are subsidizing oil and gas to the detriment of their citizens, the environment, and the competitiveness of renewable energy needed to combat climate change.

All oil- and gas-producing states should be asking themselves these basic questions:

- What can I do to obtain cost data and estimates that are reflective of the true costs for industry to fulfill its obligation to retire producing and idle wells in my state in the ordinary course of operations?
- What will it cost industry to plug and retire the existing inventory of producing, idle and orphaned wells in my state?
- How much of this cost is currently secured by bonds or other collateral?
- What is the total asset retirement obligation liability exposure (both in and out of state) for operators in my state and what is the likelihood they will be able to satisfy those liabilities over the short, medium and long term?
- What actions can I take now to reduce the financial and environmental risks to my state?

This article was adapted from Carbon Tracker's report, "It's Closing Time: The Huge Bill to Abandon Oilfields Comes Early." The full report is available on Carbon Tracker's website [here](#).

Reflections on Two Tumultuous Decades in the Colorado River Basin

Colorado River Research Group

As the basin states gear up to critically review and then revise the Interim Guidelines, those of us in the Colorado River Research Group (CRRG) have chosen this moment to reflect upon the massive changes that have occurred in the basin thus far this century. This is not only helpful in identifying the agenda that should guide the renegotiation efforts, but other negotiating processes that undoubtedly will prove necessary to bring lasting stability and security to the full community of Colorado River interests.

Coming to Terms with the New Hydrologic Realities

The hydrologic changes that have befallen the Colorado River, while not unprecedented when viewed through the lens of the paleo records, demand that we revisit our notions of both what's normal and what's possible moving forward. The 19-year period from 2000 to 2018 was the driest in the basin since the Bureau of Reclamation began estimating natural runoff in 1906. This period was recently declared a "megadrought" and by one measure (reconstructed soil moisture) is the 2nd worst 19-year period in 1200 years. Reduced streamflows, paired with chronic overuse in the Lower Basin, has decimated reservoir storage: in October 1999, the basin's reservoirs were at 92% of storage capacity; as of September 2019, these reservoirs were at 53% of capacity. The initial freefall of reservoir storage in 2000-2004 has been effectively mitigated, as the basin has rallied to impose a variety of emergency and interim measures. That is a success story worth revisiting—as we do below. Many of these actions were implemented in the spirit of buying time for more clarity to emerge regarding the changing hydrology, and more discussion to occur regarding lasting solutions. To a large extent, that has happened. We now know that increasing drying (or "aridification" as we've dubbed it) should be expected and that extreme megadroughts seem inevitable; we have also learned that tremendous conservation, cooperative management, and overall "belt-

tightening" is also possible and is much less daunting than the socioeconomic fallout that could accompany empty reservoirs.

A Brief Chronology of Basin Responses

At the beginning of the new millennium, the other basin states were primarily concerned with getting California to reduce its uses from 5.1 (the average consumptive uses and losses for 1995-1999) to 4.4 million acre-feet (maf/yr), an action that took on new urgency as the completion of the Central Arizona Project in the 1990s had doubled that fellow Lower Basin state's consumption of mainstem supplies. The 2001 Interim Surplus Guidelines envisioned a gradual process (a "soft landing") for California to achieve this goal, but the extremely low runoff of 2002 and the associated hit to reservoir water storage prompted a dramatically accelerated schedule. This was provided by the 2003 Quantification Settlement Agreement resolving long-standing disagreements among California water users and establishing voluntary reallocations of portions of this entitlement from agricultural to urban water users. Rapidly reducing California's consumption to 4.4 maf/yr was a huge step forward for the basin, but it did not provide a lasting solution to tightening water supplies. By 2004, Upper Basin states raised concerns about the amount of water annually released from Lake Powell, questioning their legal obligation to make up any deficiency in the water to be provided to Mexico under the 1944 Treaty. In 2005, Secretary of the Interior Norton initiated a public process to review reservoir operations and deliveries of water when watershed runoff and reservoir storage approached critically low conditions. This negotiation process produced the 2007 Interim Guidelines. These guidelines tied releases from Lake Powell to reservoir elevations at both Mead and Powell, provided for reductions in deliveries of water to the Central Arizona Project and the Southern Nevada Water Authority whenever the elevation in

Lake Mead dropped to 1075 feet above mean sea level, and authorized the storage of “intentionally created surplus” water in Lake Mead.

Soon thereafter in 2009, Reclamation and the seven basin states joined together in a comprehensive study of the basin. The report, the Colorado River Basin Water Supply and Demand Study (the “Basin Study”), published in 2012, found that average annual consumptive uses and losses of water in the basin already exceeded annual average water additions, with this gap expanding to several million acre feet (depending upon the scenarios) by 2060. The Basin Study included an array of options and strategies to address the gap.

On a different front, the U.S. and Mexico took an important step towards better transboundary management of the Colorado River with Minute 319 in 2012. Mexico agreed to share shortages in water deliveries under specified conditions and extended its ability to store water (Intentionally Created Mexican Allocation) in Lake Mead. In addition, Minute 319 established the framework governing the delivery of environmental water, including an experimental “pulse” flow of water from Morelos Dam into the Colorado River Delta. Minute 323, adopted in 2017, expanded cooperative arrangements between the U.S. and Mexico both regarding water management and ecological restoration in the Colorado River Delta.

A further effort to reduce consumption was begun in 2014 after two very poor runoff years, when the basin states, some large water users, and the Bureau of Reclamation initiated a Drought Contingency Planning (DCP) process, and launched the Pilot System Conservation Program in 2014. With funding from the Central Arizona Water Conservancy District, the Metropolitan Water District, the Southern Nevada Water Authority, and Denver Water as well as from the Bureau, the program generated “system” water from a variety of sources through conservation and temporary forbearance of use to help bolster reservoir storage levels, especially in Lake Mead.

As water levels in Lake Mead flirted with a shortage declaration, the DCP (the Agreement Concerning Colorado River Drought Contingency Management and Operations) agreements were adopted by Congress in late 2019. The Lower Basin DCP includes commitments of water to Lake Mead annually from the three states in the Lower Basin and the Bureau of Reclamation, dependent on reservoir storage elevations. The agreement will reduce deliveries to the Central Arizona Project and the Southern Nevada Water Authority when Lake Mead reaches the level of 1090 feet above mean sea level (rather than 1075), and California will share shortages when Mead’s elevation drops to 1045 feet. The focus of the Upper Basin DCP is to protect critical elevations at Lake Powell, perhaps through a still conceptual Demand Management Program that would bank conserved water in Lake Powell.

What Has Worked

The 21st century has arguably seen the most innovative and collaborative period of Colorado River water-supply management in basin history. Some of the most notable features include:

A commitment to collaboration. Initially, the basins seemed to be moving toward litigating their differences. Instead they worked together through the Interim Guidelines process—and in separate agreements with Mexico—to revise operations of basin reservoirs and to provide a mechanism for allocating shortages in the Lower Basin. They joined together with Reclamation in the pathbreaking basin water study, establishing a shared understanding of basin supply and demand conditions. When it became clear that the Interim Guidelines were not sufficient, they joined in the Drought Contingency Planning process, resulting in additional modifications to the guidelines.

Practical modifications to the Law of the River. Among the important changes to the Law of the River made during this period were the Interstate Banking Agreement, direct involvement of the states in developing the Interim Surplus and Interim Shortage Guidelines, creation of Intentionally Created Surplus water and its storage in Lake Mead, authorization for Mexico to store water in Lake Mead, authorization for the Upper Basin to store conserved water in Lake Powell, and California’s commitment to sharing shortages. Each of these agreements represented a significant change of existing law and procedure, demonstrating an unparalleled degree of flexibility in basin governance.

Broadened participation in basin decision making. Historically, basin decision making has been the province of the states and the federal government. During this period, many of the decision processes opened up to include the Republic of Mexico, environmental interests, and Indian tribes. For example, Mexico negotiated to share shortages with the Lower Basin states. Environmental interests helped shape the Interim Guidelines negotiations with their “conservation before shortage” proposal. Through the International Boundary and Water Commission, Mexico, states and environmental interests negotiated additions to the Treaty that included the delivery of environmental water to the Delta. Most recently, the Ten Tribes Water Study (2019) marked an important step forward in tribal participation in basin water studies.

Reductions in consumptive water use. In 2001, the Bureau of Reclamation estimated annual consumptive uses and losses of basin water totaled about 18.3 maf; today, that value is approximately 17 maf. Despite rapid population growth, virtually every major city in the Southwest is using the same or less water today than in the late 20th century. Similarly, agricultural water use basinwide has also been stable while productivity has increased significantly. The transition from supply management to demand management is well underway.

Some Challenges Ahead

Despite these accomplishments, the agreements that are now in place have not balanced the water supply/demand budget, and the reduced water deliveries specified by the Interim Guidelines and Lower Basin DCP only limit consumption when reservoirs are critically low. Arizona and Nevada face the first such cutbacks in 2020. Additionally, the Interim Guidelines (and several supporting agreements) that provide the overarching guidance on how to manage the declining water supply expire after 2026, and new agreements must be negotiated. The following items—many discussed in detail in other CRRG publications—are priority actions:

Reach agreement on replacing the 2007 Interim Guidelines and the Drought Contingency Plan. The scope of the issues that will be considered in this process already is the subject of debate. At a minimum, the discussions will consider the effectiveness of the coordinated operating criteria for Lakes Powell and Mead and whether there are better measures than reservoir volume (such as yearly inflows) for managing releases and deliveries from these two massive reservoirs. No doubt the process also will revisit the commitments made in the 2019 DCP for sharing shortages in the Lower Basin and whether to implement a demand management program in the Upper Basin. The relationship between these operating regimes and environmental resources is also a notable omission that should be addressed.

Eliminate the “structural deficit.” As detailed in earlier CRRG publications, a gap of about 1.2 maf exists between minimum annual required releases of water from Lake Powell and normal uses and losses in the Lower Basin. While the curtailments specified in the Lower Basin DCP provide for cutbacks of a similar magnitude during crises, an agreement is needed to address this problem on an ongoing basis.

Satisfy existing but unused tribal water rights. The unquestioned legal right of tribes to someday put their very senior rights to use casts a shadow on efforts to bring the basin water budget into balance. Justice demands that tribes have control over, and receive value for, these rights.

Address continued water development in the Upper Basin. Upper Basin states continue to pursue projects to increase consumptive use of basin water. Such increased consumption without offsets raises the risk of the Upper Basin defaulting on its obligation not to deplete the flow at Lee Ferry below 75 maf in consecutive 10-year periods. Such new uses would unfairly threaten critically important established water uses and also run counter to Upper Basin demand management efforts to protect those uses.

Clarify sources of water to meet the Mexico Treaty obligation. As the flareup between the basins in 2004 illustrated, there is sharp disagreement respecting responsibility for meeting water delivery obligations to Mexico. It is time to resolve this long-standing source of conflict by reaching agreement about specific sources of water that will satisfy this requirement.

Develop a long-term strategy for the Colorado River delta. There is considerable binational support for continued efforts to restore a modified version of some parts of this shared ecosystem. Minute 323 takes an

important step toward that end, but a continuing agreement among the countries, states, tribes, and NGOs that sets out clear goals and provides the means for their achievement is needed.

Reconcile climate change water science and basin water use. In the more than 50 papers published since 2000, climate scientists agree that the basin is already much warmer and will continue to get warmer (over 1°C since the mid 20th century and potentially 2°C or more by mid century), resulting in reduced streamflows and increased system losses. This is a continuing trend, not a one-time perturbation to the status quo. This overarching issue makes solving every challenge in this list more difficult. Water users throughout the basin need to come to terms with this reality, fighting aggressively to halt climate change while preparing for unrelenting long-term reductions in water availability. A reckoning is overdue.

This article was originally published by the [Colorado River Research Group](#), a self-directed team of ten veteran Colorado River scholars.

The Biden Administration and International Climate Change Policy and Action

Robert N. Stavins

This article was originally published by the Lawfare Institute in cooperation with The Brookings Institution on January 14, 2021, prior to the inauguration of President Biden. Since its publication, the new administration has begun to implement its climate change agenda. The article is followed by a supplement, prepared by the editors, describing the administration's early initiatives to address climate change.

On Jan. 20, Joe Biden will be inaugurated as the 46th president of the United States. He will face an unprecedented set of challenges, including global climate change—one of **four stated policy priorities** of his administration (along with the coronavirus pandemic, economic recovery and racial equity)—in addition to the immediate issue of the looming Senate trial of President Trump and ongoing threats of violence from extremist supporters. Because climate change is a **global commons problem** and international cooperation is necessary to limit free-rider incentives, President-elect Biden has **pledged** to immediately initiate the process of rejoining the Paris Agreement (from which President Trump **withdrew** the United States on Nov. 4, 2020—the earliest date permitted by the agreement). Thirty days after the necessary paperwork is filed with the United Nations, the United States will again be a party to the agreement. That's the easy part. The hard part is coming up with a quantitative statement of how and by how much U.S. emissions of greenhouse gases will be reduced over time.

To fully appreciate the challenge the new

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administration will face, it is helpful to reflect on the history of international negotiations that brought us to this point. At the **Earth Summit** in Rio de Janeiro in 1992, the **U.N. Framework Convention on Climate Change** (UNFCCC) was first negotiated, **committing parties** to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would “prevent dangerous anthropogenic interference with the climate system.” Three years later in Berlin at the first annual Conference of the Parties, it was agreed that the wealthier countries (**listed in UNFCCC Annex I**) would commit to targets and timetables for emission reductions, but not the other 129 (largely developing) countries. This was an attempt to provide for distributional equity among nations —recognizing that the industrialized countries were responsible for the lion's share of accumulated greenhouse gases in the atmosphere, and by virtue of their wealth were more capable of taking action. Two years after that, in 1997, the **Kyoto Protocol** was enacted, codifying these objectives with quantitative targets for Annex I countries only.

The Clinton administration negotiated the protocol with considerable enthusiasm under the leadership of Vice President Gore, but it did not submit the protocol to the Senate for possible ratification, knowing that the protocol's lack of any emissions-reduction responsibility for the large emerging economies (China, India, Brazil, Korea, South Africa, Mexico and Indonesia) meant it would fail in the Senate. This was a reasonable assumption, given that the **Byrd-Hagel Resolution**, which said as much, had passed the Senate by a vote of 95-0 just four months before the Kyoto conference.

The Kyoto Protocol was highly flawed. First, the Annex I countries alone could not reduce global emissions, despite a particularly severe target for the U.S., as the **significant growth** in emissions came from the emerging economies. Second, because the protocol

excluded most countries (in particular, developing countries with relatively low costs of emissions mitigation), the costs were vastly greater than need be—**four times** the cost-effective level by conservative estimates. Third, it was questionable whether distributional equity was even achieved, given that 50 non-Annex I countries had **greater per-capita income** than the poorest of Annex I nations. So, the United States never ratified Kyoto, and eventually Australia, Canada, Japan and Russia dropped out, leaving the European Union and New Zealand as the only Annex I parties participating (together accounting for 14 percent of global emissions).

Almost two decades after Kyoto, a fundamentally different approach to international climate cooperation was taken by the **Paris Agreement** of 2015, which was developed under the joint leadership of the U.S. and China during the Obama administration.

The key attribute of the Paris Agreement is its hybrid structure, combining top-down (legally binding) and bottom-up elements. The former are largely procedural (but binding under international law), including a requirement in **Article 4** that countries submit **nationally determined contributions** (NDCs), statements of their emissions reductions from 2020 to 2025/2030), and update them by the end of 2020 and every five years thereafter. The key bottom-up element consists of the set of submitted NDCs, which are not part of the agreement but, rather, are assembled in a **separate public registry**. The notion is that the NDCs—unlike the negotiated Kyoto targets—arise from or are at least consistent with domestic policies, goals and politics in their respective countries. The “bindingness” of the targets, therefore, comes not from the Paris Agreement itself, but from any domestic laws and regulations put in place to achieve the NDCs. It was because of this structure, which avoided binding quantitative targets in the agreement itself, that the Obama administration felt it was able to ratify it as an **executive agreement**, without Senate approval.

One year after its approval in Paris, the agreement came into force in November 2016, when the **threshold** of 55 countries representing at least 55 percent of global emissions had ratified it. Remarkably, it had required seven years for the Kyoto Protocol to achieve the same threshold for coming into force. What caused the exceptionally rapid accumulation of Paris ratifications? The explanation lies in the fact that the agreement also provides that once it comes into force, there is a four-year **delay** before any ratifying country may withdraw. So, from 2015 to 2016, **international concern** that Donald Trump might be elected president and live up to his promise to pull the U.S. out of the agreement led countries to move as fast as they could, and the Paris Agreement came into force on Nov. 4, 2016. So, global fear of Trump gets credit (and explains why Trump’s withdrawal date of Nov. 4, 2020, was the earliest allowed).

The U.S. withdrawal from the agreement had no direct effect on domestic greenhouse gas emissions. Those emissions were affected by the Trump administration’s rollbacks of Obama-era domestic climate policies. The greatest concern was that such action by the U.S. would lead China, India, Brazil and other emerging economies to rethink their Paris pledges. But this did not happen, as far as we know. Of course, the comparison ought to be with what those countries would have done had the U.S. not withdrawn, but such a comparison would be with an unobservable hypothetical. It is too soon to assess achievement with the initial set of NDCs, since those describe reductions over the period 2020 to 2025/30, but as of early January 2021, only 23 countries had **submitted** their updated NDCs, due at the end of 2020.

As I said at the outset, the easy part will be submitting the necessary paperwork on Jan. 20 to rejoin the Paris Agreement, but the hard part will be coming up with the new U.S. NDC—a quantitative statement of how and by how much U.S. greenhouse gas emissions will be reduced over time. This will be challenging because the new NDC will need to be sufficiently ambitious to satisfy (at least to some degree) both **domestic green groups** and some of the key countries of the international community (despite the likelihood that Biden and his special envoy for climate change, John Kerry, will initially find a warm reception and abundant goodwill from most world leaders).

This essentially means that the NDC will need to be at least as ambitious as (and probably more so than) the Obama administration **target** of a 26-28 percent reduction in greenhouse gas emissions by 2025, compared with 2005 (which would have been difficult to achieve even if Hillary Clinton had become president). And it will need

to compare favorably with the targets now being announced by other major emitters. For example, the European Union is **enacting** a new target to cut its emissions 55 percent below its 1990 level by 2030. And China recently **said** it will achieve carbon neutrality (zero net emissions) by 2060.

But if significant ambition is one necessary condition for the new Biden NDC, the other necessary condition is that it be credible, that is, truly achievable given existing and reasonably anticipated policy actions. The only way that both of these necessary conditions can be achieved is with aggressive new domestic climate legislation.

Even with the Democratic-controlled Senate—with a one-vote margin—meaningful and ambitious climate legislation will be difficult, if not impossible. The **budget reconciliation process**, whereby only a simple majority is needed to pass legislation, rather than **the 60 votes required to cut off Senate debate**, can be used to reverse some of Trump’s last-minute policies that are connected to the tax code or mandatory spending if every Democrat or enough Republicans to make up for any defections support the given move. And the one-vote margin can be effective for confirming Biden’s appointees, and it can help for increasing the budgets of federal agencies. But for ambitious climate (or other) legislation, the 60-vote threshold will be the binding constraint.

Under these circumstances, it will be challenging, to say the least, for Democrats to enact **Biden’s climate plan**, including its \$2 trillion in spending over four years with the goal of making all U.S. electricity carbon free in 15 years and achieving net-zero emissions economy-wide by 2050. An **analysis** by the Rhodium Group suggests that to be on a steady path to achieve Biden’s 2050 goal, a cut of 43 percent below 2005 levels by 2030 would be necessary—in other words, a reduction of about 3 percent every year. Also, keep in mind that the Obama administration’s major climate legislation—the **American Clean Energy and Security Act of 2009** (the so-called Waxman-Markey bill)—failed to receive a vote in the Senate, even though Democrats (and independents who caucused with Democrats) then held a total of 59 seats. Although climate change is now taken more seriously by the public and receives considerably greater attention in political circles than it did 12 years ago, the prospects over the next two to four years for comprehensive climate legislation—such as a truly meaningful carbon-pricing system—are not good.

But other legislation that would help reduce greenhouse gas emissions in the long term appears more feasible. That includes a post-coronavirus economic stimulus bill, which might have a green tinge, if not a fully green hue. The Obama administration’s **stimulus package** enacted 13 years ago in response to the Great Recession included some \$90 billion in clean energy investments and tax incentives. Another candidate will be a future infrastructure bill, something both parties seem to recognize is important to upgrade aging U.S. infrastructure. This could include funding for improvements in the national electricity grid, which will be necessary to facilitate greater reliance on renewable sources of electricity generation.

Finally, there are possibilities for less ambitious but bipartisan climate legislation, with stringency and scope much less than what Biden’s climate plan calls for. The key approaches here might involve tax incentives, that is, nearly every politician’s favorite instrument—subsidies. This may fit well with Biden’s moderate approach to governing and his stated desire to work with both parties in Congress. Specific bipartisan options could include (explicit or implicit) subsidies targeting wind and solar power, carbon capture and storage/utilization, nuclear power, technology initiatives, and electric vehicles via a rebate program.

But such modest, bipartisan initiatives are unlikely to satisfy either the demands of domestic climate policy advocates or international calls for action. Because of this, the new administration—like the Obama administration—may have to opt for regulatory approaches.

The new president, under existing authority, could quickly take actions through executive orders in a number of areas to reverse many of Trump’s regulatory rollbacks. Will Democrats use the **Congressional Review Act**, which allows Congress to nullify a rule within 60 legislative days of its adoption? Republicans used this at the end of the Obama administration, but the law prohibits Congress from later adopting a regulation that is of “substantially the same form” as the disapproved rule unless it is specifically authorized by a subsequent law.

More generally, new oil and gas leasing on federal lands could again be prohibited, and the White House could

attempt to block the Keystone XL **pipeline** from being completed. More promising, the president could direct that the **social cost of carbon** (SCC) be revised, presumably returning it to the Obama administration's appropriate use of global (not just domestic) damages and a 3 percent (rather than 7 percent) discount rate in the calculations, thereby increasing the SCC from about \$1 to \$50 per ton, and directing federal agencies to use the revised SCC in their own decision-making. Presumably, the new administration will move to reinstate and surpass the Obama administration's ambitious **corporate average fuel economy** (CAFE) standards, which is justified by the SCC.

Also, there is the possibility of using the authority of the Securities and Exchange Commission to use financial regulation of publicly traded companies to raise the cost of capital for fossil energy development, or to set **standards for disclosure** of climate-related corporate information. Likewise, the **Commodity Futures Trading Commission** has itself begun to **explore options** via its Market Risk Advisory Committee.

Thus, regulatory approaches under existing statutory authority through rule-making often appear to be an attractive option, but using new regulations under existing legislation rather than enacting new laws raises another problem—the courts. Rule-making entails lengthy notice and comment periods and requires extensive records and interagency consultation. Furthermore, rules are frequently subject to litigation. The Obama administration promulgated its **Clean Power Plan** after the Senate failed to deliver on the administration's **comprehensive climate legislation**. And the Clean Power Plan was subject to a stay from the U.S. Supreme Court even before Trump entered office. Then Trump arrived and **killed the regulation outright**.

But the real challenge to the regulatory approach is that new regulations are much more likely to be successfully challenged in federal courts in 2021 than they were during the Obama years. This is partly because there are 228 Trump-appointed federal judges. But more importantly, the Supreme Court's new 6-3 conservative majority is likely to favor a relatively literal reading of statutes, giving executive departments and agencies much less flexibility to go beyond the letter of the law or to interpret statutes in "innovative ways." In particular, the Supreme Court may move to modify or even overrule the critical **Chevron Doctrine**, under which federal courts defer to administrative agencies when Congress was less than explicit on some issue in a statute (such as whether carbon dioxide can be regulated under sections of the Clean Air Act of 1970 intended for localized pollutants).

During the presidential transition, there has been considerable talk about a "**whole of government**" approach to climate change, in which the White House pushes virtually all departments and agencies to put in place changes that are supportive of decarbonizing the economy. This would be beyond or instead of the focused statutory and regulatory policies described above. Of course, the critical question is what such an approach can produce in terms of short-term emissions reductions and/or long-term decarbonizing of the economy. This is, at best, an open question.

Of course, even if little can be accomplished at the federal level over the next two to four years, surely the new administration will not be hostile to states and municipalities taking more aggressive action. Indeed, climate policies at the state level (**California**) and regional level (the **Regional Greenhouse Gas Initiative** in the Northeast) have become increasingly important, particularly during the four years of the Trump administration. Bottom-up evolution of national climate policy may continue to evolve from the Democratic-leaning states in the Northeast, Middle Atlantic, Upper Midwest, Southwest and West Coast (and Georgia!), which together represent more than half of the U.S. population and an even larger share of economic activity and greenhouse gas emissions.

The new administration may or may not find creative ways to break the logjam that has prevented ambitious national climate change policies from being enacted (or, if enacted, to be sustainable). My greatest source of optimism is that the Biden-Harris team, in sharp contrast to the Trump-Pence administration, gives every indication that it will embrace scientific and other expertise across the board—whether that means the best epidemiologists and infectious disease experts designing an effective strategy for the coronavirus, or the best scientists, lawyers and economists designing sound climate policies that are also politically feasible.

The Biden Administration's Early Progress on Addressing Climate Change

Since President Biden's inauguration on Wednesday, January 20, 2021, his administration has begun to implement its climate agenda. As of the date of this publication, following are the latest climate actions:

- On the day of his inauguration, Biden signed an executive order for the United States to rejoin the Paris Agreement. Since this process takes 30 days, the agreement will go into effect for the United States on February 19, 2021.
- Biden has announced that the U.S. will host a climate summit on Earth Day, April 22, 2021. The goal of this meeting will be to persuade the largest emitters of greenhouse gases to increase the ambition of their Nationally Determined Contributions (NDCs) under the Paris Agreement. The U.S., however, still needs to develop its new NDC.
- The administration has created two new cabinet-level positions to lead the implementation of its climate agenda domestically and internationally:
 - o Gina McCarthy, former EPA administrator and CEO of the Natural Resources Defense Council, has been appointed as National Climate Advisor, a position created to lead the new White House Office of Domestic Climate Policy.
 - o John Kerry, former Secretary of State and Senator from Massachusetts, will serve as the Special Presidential Envoy for Climate. In this role, he will be a leader of the U.S.'s international climate efforts and have a seat on the National Security Council.
- Also on the day of his inauguration, Biden signed an "Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis." Provisions of the order include the following:
 - o Immediately reviewing agency actions taken under the Trump administration, covering areas such as methane emissions in the oil and gas sector, fuel economy standards, airplane emissions standards, appliance and building efficiency standards, and hazardous air pollution.
 - o Placing a moratorium on implementation of federal oil and gas leasing programs in the Arctic National Wildlife Refuge.
 - o Beginning the process of reviewing and updating official estimates of the social cost of carbon, nitrous oxide, and methane.
 - o Revoking construction permits for the Keystone XL oil pipeline.
 - o Revoked numerous other Trump-era executive orders on a variety of environmental issues spanning energy, water, infrastructure, and greenhouse gas emissions.
- On Wednesday, January 27, Biden signed an executive order entitled "Tackling the Climate Crisis at Home and Abroad," which includes the following provisions, under seven categories:

Center the Climate Crisis in U.S. Foreign Policy and National Security Considerations

- Establishes that climate considerations will be central to U.S. foreign policy, and that the U.S. will exercise its leadership to promote a significant increase in global ambition.

- Begins the process of developing the U.S.'s new NDC, as well as a climate finance plan.
- Directs the Director of National Intelligence to prepare a National Intelligence Estimate on the security implications of climate change.
- Directs the Department of State to submit the Kigali Amendment to the Montreal Protocol, which would phase out hydrofluorocarbons (a type of potent greenhouse gas), to the Senate for ratification.

Take a Whole-of-Government Approach to the Climate Crisis

- Formally establishes the White House Office of Domestic Climate Policy, to be led by the first-ever National Climate Advisor. This will be the central office in the White House implementing and coordinating the President's domestic climate agenda.
- Establishes the National Climate Task Force, assembling leaders from across 21 federal agencies and departments to enable a whole-of-government approach to the climate crisis.

Leverage the Federal Government's Footprint and Buying Power to Lead by Example

- Directs federal agencies to procure carbon-free electricity and zero-emission vehicles, manufactured domestically.
- Directs each federal agency to develop a plan to increase the resilience of its facilities and operations to climate change impacts.
- Directs the Secretary of the Interior to implement a moratorium on new oil and gas leases on public lands and offshore waters. Also implements a review of all leasing and permitting practices for oil and gas on federal land and offshore, and identification of steps to double offshore wind capacity in the U.S. by 2030.
- Directs federal agencies to eliminate fossil fuel subsidies as consistent with applicable law.

Rebuild our Infrastructure for a Sustainable Economy

- Directs steps toward every federal infrastructure investment reducing climate pollution and toward accelerating clean energy and transmission projects under federal siting and permitting processes.

Advance Conservation, Agriculture, and Reforestation

- Establishes a goal of conserving 30% of federal land and water by 2030.
- Calls for the establishment of a Civilian Conservation Corps Initiative to employ young Americans conserving and restoring public lands and waters, increasing reforestation, increasing carbon sequestration in the agricultural sector, protecting biodiversity, improving access to recreation, and addressing the changing climate.
- Directs the Secretary of Agriculture to collect input from farmers, ranchers, and other stakeholders about how federal programs can encourage climate-smart agriculture.

Revitalize Energy Communities

- Establishes an Interagency Working Group to coordinate efforts that assist oil, natural gas, coal, and power plant communities, including reducing emissions from existing and abandoned infrastructure.

Secure Economic Justice and Spur Economic Opportunity

- Directs federal agencies to take measures that address the disproportionate health, environmental, economic, and climate impacts in disadvantaged communities.
- Establishes a White House Environmental Justice Interagency Council and a White House Environmental Justice Advisory Council to prioritize environmental justice through a whole-of-government approach.
- Creates an initiative to deliver 40% of the benefits of federal investment to disadvantaged communities.

This summary includes actions taken until February 1, 2021. More recent actions can be found on Columbia University's "Climate Reregulation Tracker," a tool which identifies steps taken by the Biden-Harris administration to reinstate and expand federal climate mitigation and adaptation measures. The tracker is available [here](#).

News and Announcements

Renewable Natural Resources Foundation

Now Accepting Nominations for RNRF's 2021 Awards Program



RNRF is now accepting nominations for its 2021 Awards Program.

The **Sustained Achievement Award** recognizes a long-term contribution and commitment to the protection and conservation of natural resources by an individual.

The **Outstanding Achievement Award** recognizes a project, publication, piece of legislation, or similar concrete accomplishment that occurred during the three years prior to nomination for the award.

The **Excellence in Journalism Award** honors and encourages excellence in print journalism about natural resources, recognizes work by an individual, group, or organization for both print and digital media.

Nominations will be accepted until June 1, 2021.

For more information on selection criteria, eligibility, and submission instructions, visit the [Call for 2021 Awards Nominations](#).

For more information on RNRF's Awards Program and lists of past winners, visit RNRF's [Awards Program page](#).

RNRF Round Table Report: The Impact of the COVID-19 Pandemic on Global Food Systems



Åsa Giertz, Senior Agriculture Economist working with the Africa region at the World Bank in Washington, D.C., spoke at a virtual meeting of the RNRF Washington Round Table on Public Policy on December 16, 2020. Her talk was titled, "The Impacts of the COVID-19 Pandemic on Global Food Systems."

The COVID-19 pandemic is taking place in the midst of several other ongoing crises, including a locust infestation in dozens of countries, several large-scale extreme weather events, conflicts in many regions, and the current displacement of 79.5 million people worldwide. The global food system was already under strain prior to the pandemic. Despite a UN commitment to end hunger and malnourishment by 2030, an estimated 690 million people were hungry and 2 billion were malnourished in 2019. Population growth is an ongoing concern, especially as the climate crisis remains urgent. By 2050, the global food system will need to support a global population of nearly 10 billion, at the same time as

countries will need to make changes to their agricultural systems and land use in order to achieve their commitments to reduce emissions under the Paris Agreement. On top of these immense pre-existing challenges, the COVID-19 pandemic has exposed countless deficiencies in our food system.

Supply Impacts

The pandemic has created a shock for food systems around the world both on the supply side and the demand side. This differs from many previous food crises, like the 2008 food price crisis, which were largely supply shocks. Giertz described the ways that the pandemic has caused disruptions on both sides, beginning with the food supply.

Already early on, the pandemic caused agricultural labor shortages in both low and high-income countries. Agriculture is a highly mobile sector that relies heavily on migrant workers. As countries started shutting down and restricting mobility, labor shortages resulted. Lockdowns also interrupted many farmers' access to markets. As a result, there were significant losses of fresh produce and animal products like eggs, especially in developing countries. However, this also occurred to a lesser extent in high-income countries like the United States. In these countries, restaurant demand decreased drastically and interrupted the highly organized supply chains that many farmers participated in. It is unclear if the breakdowns of these supply chains will have an impact on production in the medium-term but it is possible that farmers may be reluctant to take the risk of producing perishable foods going forward, having gone through this experience.

Retailers have reported problems with certification bodies for environmental, labor, and quality standards because certain controls have not been possible. This may also affect food quality and environmental and social standards for food production in the medium-term.

Input markets are an area of concern in the upcoming planting season. Giertz noted that in many countries, farmers reportedly do not have access to inputs and, in some cases, input markets are not functioning at all. However, early production data for the next season is positive. In the Q&A session of the round table, Giertz noted that early concern over input markets drove distribution of inputs by the governments, which may account for some of this discrepancy. Nevertheless, it is still early to project agricultural output for the coming year or exactly what impacts COVID-19 will have on food production in 2021.

In many places, migrants have been returning to rural areas during the pandemic. Giertz noted that there in some countries there have been concerns about the decline in remittances along with the potential increased pressure on land resources. However, it is too early to determine the exact impact that this influx of return migrants will have on rural areas.

Cereal stocks remained high in 2020 despite the pandemic, and production was adequate to meet demand. This was true for maize, wheat, rice, and soybeans. International trade and global food prices also remained relatively stable despite early fears that price hikes would materialize on a global level. However, despite this relative stability at global level, serious food system disruptions have occurred within countries. For instance, food inflation has occurred locally in many places, mainly due to the disruption of supply chains. However, inflation has been especially pronounced in countries dealing with other challenges that affected inflation already prior to the pandemic. Other food systems disruptions have been related to supply chain interruptions, especially affecting the markets for and availability of perishable foods.

In general, fewer supply-side disruptions have been observed in the second wave of the pandemic because governments have been able to more effectively respond than they did in the spring of 2020. Labeling actors in the food sector as providers of essential services was one measure that helped to reduce disruptions. However, issues still occur. The food processing industry, for example, was deemed essential by governments, yet has seen disruptions due to the spread of the virus among workers.

Demand Impacts

Giertz then described the demand impacts that the pandemic has had on the global food system. This year, the pandemic has impacted the availability of safe and nutritious food for the most vulnerable populations. In many regions, food prices have increased locally. Combined with losses of incomes, livelihoods, and remittances, this has significantly reduced purchasing power for many people to buy food.

The interruption of supply chains has decreased the availability of many foods, especially perishable foods like fresh produce and animal products. This impact has been especially seen in urban areas. Further, in some countries, fresh markets were closed due to lockdown restrictions during the first wave of the pandemic, which cut off access to food for many poor consumers. However, more recently, this has become less of an issue as markets have generally been labeled essential services and have remained open during lockdowns.

Many school lunch programs have been interrupted due to school closures. This has had a large impact in many

low and middle-income countries, but also in some areas of the U.S. School lunches often provide an essential meal with critical nutrients, for children from low-income families. Losing this source of nutrition can have serious impacts on children's health and development.

COVID-19 has also revealed new vulnerabilities that are caused by the inability of the current food system to make healthy diets accessible for everyone: Chronic malnutrition increases individuals' vulnerability to the COVID-19 virus, increasing the odds that they will become very sick if they contract the virus. This is the case for undernourished children, as well as obese and diabetic adults.

The decreased availability of nutritious food has caused food insecurity, malnutrition, and poverty to increase. It is estimated that between 83 and 132 million additional people will fall into acute food insecurity as a result of the pandemic. This has the potential to nearly double the pre-pandemic level of 135 million people.

This skyrocketing acute food insecurity is having especially dire impacts on children. Six million seven hundred thousand additional children may be wasted (a life-threatening form of malnutrition) this year, on top of the pre-pandemic level of 47 million children annually. Exact impacts on child stunting, a symptom of chronic malnutrition, are not clear at this time. However, reduction in nutrition and health services combined with increased poverty are likely to affect small children's nutrition status for some time. This can have long-term impacts on their cognitive development and learning potential.

Extreme poverty is expected to rise for the first time in twenty years, with 88 - 115 million people becoming newly impoverished, mainly in sub-Saharan Africa and South Asia. The main drivers of this increase in poverty include losses of jobs within the informal economy as well as in manufacturing and construction. This increase in poverty is inevitably affecting people's ability to purchase nutritious food.

The World Bank's Response to COVID-19

Giertz then discussed the World Bank's response to the pandemic. In total, the Bank has made available up to US\$ 160 billion in financing for COVID-19 response through June of 2021. Over US\$ 50 billion of this is International Development Association (IDA) resources, which goes to the World's poorest countries.

In response to the crisis, the World Bank is presently financing emergency support operations in over 100 countries. Their crisis response is comprised of three stages – relief, restructuring, and resilient recovery under four main areas. The first area is saving lives, an effort mainly undertaken through the health sector. The other three involve support for food systems: protecting poor and vulnerable people, ensuring sustainable business growth and job creation, and strengthening policies, institutions, and investments. Between April and September of 2020, US\$ 5.3 billion of funding was committed under IDA to support food security in the poorest countries, through social protection, agriculture and food processing, and other investments in the food system.

Examples of short-term measures in these food security and agriculture programs include: physical support to lower food import tariffs, which helps to alleviate supply chain disruptions; scaling up cash and food transfer programs; and investing in inputs for the next season's agricultural production. Long-term measures supported by the World Bank include regenerating and increasing food system incomes to help address the shortfall of employment; building early warning systems; promoting climate-resilient productivity growth; building capacity for preventing pests and diseases in crops and livestock; and improving agricultural markets and enhancing natural resources management. The World Bank's support is not only financial. It also provides governments with analytics and policy advice. Examples of areas where the World Bank is supporting with expertise include agriculture risk management, strategic food reserves, alternative feed and food sources such as insect production, and the One Health agenda, which works in the nexus between human and animal health to prevent emerging zoonotic diseases.

This pandemic has also changed how the World Bank works with projects and clients. It is preparing new models for preparing and supervising projects remotely. In most countries, interactions with their counterparts are currently virtual. They have almost 15,000 people connected worldwide, and almost overnight, all of them went

virtual. That transition has gone relatively smoothly, and they have been able to focus their efforts on aiding governments in response to this crisis.

Our Food System After COVID-19

COVID-19 has shed a light on the parts of the food system which were not functioning, including supply chains which were vulnerable to disruption, high food prices, lack of access to food, and pre-existing chronic malnourishment. It has highlighted inequalities: the vulnerable, including the poor, the informally employed, and the malnourished are those that have been most severely impacted by this crisis. It is evident that the system needs to be more flexible, and that the supply chains for perishable foods, which are very important for nutrition, need to be strengthened. Insufficient data has also been a challenge, often making it difficult to get a complete overview of exactly how the food system and its actors are being affected on the ground..

The development community recognizes the need to “build back better” in response to the pandemic. This is especially important in the face of food production challenges such as a growing global population and a changing climate. Investing in solutions to these problems now is important. Another major disruption to the food system will inevitably occur in the future, and we must prepare for it now, making the food system resilient and protecting against the impacts that the COVID-19 pandemic has caused.

– *Stephen Yaeger, RNR Program Manager*

To view Giertz’s PowerPoint Presentation, click [here](#).

More information about COVID-19, food security, and the World Bank’s response can be found at the following links:

[2020 Year in Review: The impact of COVID-19 in 12 charts](#)

[How the World Bank Group is helping countries with COVID-19 \(coronavirus\)](#)

[Food Security and COVID-19](#)

American Geophysical Union

The Best of Eos in 2020

What Earth and space science stories stood out this year, and what are we looking forward to in 2021?

What a year. The world endured a pandemic, civil unrest, and turbulent elections. At Eos, we kept on covering the geoscience news that taught us more and more about the natural world we live in. We welcomed our first Spanish translations, new international contributors, and a growing readership hungry for science news.

Our year-end roundup offers three takeaways:

- 1) How we see science is important.
- 2) Environmental justice is for everyone.
- 3) We can’t wait to go back to the office.

To view the best stories in Eos in 2020, click [here](#).

AGU Statement on President-elect Biden’s science nominations

On behalf of AGU’s community of 130,000 experts to enthusiasts from around the world, we applaud the strong and experienced science team who will be ready on day one to serve in President-elect Biden’s administration,

including AGU Fellow and Hess Medalist Maria Zuber. We also appreciate his decision to elevate the Office of Science and Technology Policy Director (OSTP) to a cabinet-level position. The issues that this team will be addressing – from COVID-19 to the climate crisis to removing systemic racism – are paramount to re-establishing a civil society that values science and facts. AGU’s community is ready to assist to foster a safe and healthy planet for all.

American Meteorological Society

New Research Examines Climate Change’s Role in 2019 Extreme Weather Events

Report advances scientists’ ability to quantify human influence on climate

Precipitation from Hurricane Dorian, South Africa’s extraordinary four-year drought, fires in Alaska and China, and devastating floods in southern Canada were some of the extreme weather events made more likely by human-caused climate change in 2019, according to new research published today in the *Bulletin of the American Meteorological Society (BAMS)*.

The 10th edition of the report, *Explaining Extreme Events in 2019 from a Climate Perspective*, presents 17 new peer-reviewed analyses of extreme weather across five continents and one sea during 2019. It features the research of 80 scientists from seven countries looking at both historical observations and model simulations to determine whether and by how much climate change may have influenced particular extreme events.

For more information, click [here](#).

American Society of Civil Engineers

New ASCE Report now available: Failure to Act

Every four years, the American Society of Civil Engineers (ASCE) publishes The Infrastructure Report Card, which grades the current state of national infrastructure categories on a scale of A through F. Since 1998, America’s infrastructure has earned persistent D averages, and the failure to close the investment gap with needed maintenance and improvements has continued. But the larger question at stake is the implication of D+ infrastructure on America’s economic future.

The Failure to Act report series answers this key question—how does the nation’s failure to act to improve the condition of U.S. infrastructure systems affect the nation’s economic performance? In 2011 and 2012, ASCE released four Failure to Act reports in a series covering 10 infrastructure sectors that are critical to the economic prosperity of the U.S.

These reports were followed by a fifth, comprehensive final report, Failure to Act: The Impact of Infrastructure Investment on America’s Economic Future, which addressed the aggregate economic impact of failing to act in more than one sector. The purpose was to provide an aggregate analysis of the economic implications for the U.S. of continuing its current investment trends in multiple infrastructure categories.

Failure to Act: Closing the Infrastructure Investment Gap for America’s Economic Future is an update to the Failure to Act comprehensive report; it addresses the current infrastructure gaps between today’s needs and investment and how they will affect the future productivity of industries, national competitiveness, and future costs to households.

The report can be found on ASCE’s website [here](#).

American Society of Landscape Architects Fund

America Is All In - And So Is ASLA

December 12, 2020 marks the fifth anniversary of the Paris Climate Agreement, a global agreement to limit global warming to well below 2°C (3.7°F), aggressively reducing greenhouse gas emissions. The American Society of Landscape Architects is marking this anniversary by recommitting to a national mobilization for climate action, joining over a thousand leaders from organizations, businesses, communities, and local governments across the United States as part of the “America Is All In” joint statement.

“In the face of the ongoing climate crisis, ASLA is committed to the goals and obligations put forth in the Paris Climate Agreement and to promoting the design of sustainable, resilient landscapes for all,” said ASLA CEO Torey Carter-Conneen.

To read more, click [here](#).

ASLA Statement Regarding the Horrific Wildfires Ravaging the Western United States

The following is a statement by Wendy Miller, FASLA, president of the American Society of Landscape Architects, regarding the horrific wildfires ravaging the western United States:

“Each time I turn on the news and see wildfires tear through communities and landscapes throughout the western United States, I feel shock and sorrow. My sympathies, and the sympathies of everyone at ASLA, go out to the people who have lost loved ones and everything they have to these devastating wildfires.

“These deadly fires are the unmistakable result of catastrophic climate effects. This ongoing tragedy shows that the climate crisis is not a problem for the future and we must act now.

“As landscape architects and design professionals, we have the power to combat climate change and reduce risk. Working with foresters and planners, landscape architects help communities avoid developing in highly fire-prone natural areas. Landscape architects also plan and design firewise communities with defensible spaces that incorporate naturally-resilient native trees and plants.

“ASLA will continue to provide our members and our profession with information, resources, and education necessary to plan for wildfires and help stop these devastating events before they begin.”

Learn more: [ASLA offers resources on wildfire-resilient planning and design](#).

American Water Resources Association

2021 Connecting Land and Water for Healthy Communities Conference

July 19-21, 2021

Join AWRA in The Mile High City for the AWRA 2021 Summer Land and Water Specialty Conference as they bring together stakeholders across multiple disciplines, types of organizations and professions to address the design, integration, and implementation of the programs necessary to better connect land and water planning and policy.

For more information, click [here](#).

Society of Environmental Toxicology and Chemistry

Upcoming Special Series: The Future of Marine Environmental Monitoring and Planning

To be able to regulate by principles of sustainability, impacts on marine ecosystems must be quantified and precise knowledge of the baseline and potential impacts is key. Recent advances in technologies like earth observations, sailing and underwater drones as well as online measurements makes it possible to develop a completely new approach to marine monitoring and determination of baselines in near-real time. Approaches combining advanced modelling and technologies validated against traditional, thoroughly tested techniques will guide sustainable marine management in the future by improving the knowledge base and predictability of management scenarios.

In the summer of 2021, Integrated Environmental Assessment and Management will publish a special series on the future of marine environmental monitoring and planning. The series will include papers about new developments in marine monitoring concepts combining both ecosystem modelling and new or traditional monitoring techniques or management best practices.

To learn more, click [here](#).

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