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Scaling Up Transformational Change: Facing Up to Global Megatrends and Their Environmental Impacts

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Abstract

In light of significant environmental impacts from past and projected global population, demographic, and environmental megatrends, this article makes the case why incremental change is insufficient to alter these environmental trends and that there is thereby a growing commitment to transformational change. In addition, there is increasing recognition of the urgent need for scaling up transformational change across entire sectors and systems to achieve systemwide changes that will be needed to reverse these negative environmental trends, help pull the Earth system within proposed planetary boundaries that have been exceeded, and achieve long-term global sustainability goals. This article makes the case for the need for transformational change and scaling up transformational change to achieve system-wide change.

Given the magnitude of what it will take to transform systems and the important role of the private sector due to its more direct environmental impacts, it will be important for companies to be leaders in these efforts to scale up transformational change, and their collaboration with key stakeholders will be vital. This article identifies examples of leading efforts by several companies and proposes that it will be important for many companies to combine such or similar efforts to not only protect habitats and species but to also restore critical habitats. There is a call for the private sector and also other stakeholder groups, such as governments, investors, civil society, and consumers, to jointly collaborate and collectively respond to these challenges and lead.

Keywords: Global megatrends, Transformational change, Deforestation, Biodiversity, Extinction rate, Collaboration

"A new type of thinking is essential if mankind is to survive and move toward higher levels."
- Albert Einstein, 1879-1955

1. Introduction

Over 10 years ago, Ehrenfeld (2008) pointed out the need for transformational change and the importance of referring to it as such:

> Change at the systemic level goes by many names: paradigm shift, transformation, revolution, and so on. … I prefer the more neutral word *transformation* to the starker notion of revolution, but, no matter what word is selected, sustainability demands a discontinuous leap from the existing basis of cultural action. Transformation is a very powerful concept, because it denotes a process in which the reality in front of us changes its form. (p. 66)

Over the past several years, there have been increased references to the need for transformational change. But will transformational change be sufficient or is a more expanded level of change needed? What scale of transformational change is needed? This article describes several past and projected global megatrends related to population, demographic, and environmental changes and discusses interconnections. In light of these global megatrends, the urgent need to scale up transformational change is the main focus of the article. Several companies are identified for public statements of the imperative for transformational change and the urgent need to scale it up. Leading efforts by several companies are discussed, but it will be important for many companies to combine such or similar efforts and not only protect habitats and species but also restore critical habitats. The article identifies examples of scaling up transformational change and key factors in setting it up.

2. Global Megatrends and Impacts

2.1 Past Global Megatrends

Consider these global population and demographic megatrends over the past 50 years (i.e., 1970-2020):

- The global population increased by over 110% (from 3.7 billion to 7.8 billion) (Worldometer, 2021).
- The global urban population increased by over 220% (from 1.354 billion to 4.379 billion) (Worldometer, 2021).
- The percentage of the global population living in urban areas increased by over 50% (1.354 billion urban and 2.346 billion rural [37% urban/rural] in 1970 to 4.379 billion urban and 3.416 billion rural [56% urban/rural] in 2020) (Worldometer, 2021).
- The size of the global middle class grew by approximately 500% (roughly .5 billion to roughly 3 billion) (Kharas, 2017).
- For the first time, the global urban population level represented over 50% of the global population in 2007 (United Nations, 2019b), and 11 years later more than 50% of the global population had income levels that were at or above the middle class (World Data Lab, 2019).

There have also been global environmental megatrends:

- The size of nearly 21,000 populations of monitored mammals, birds, fish, amphibians, and reptiles dropped by 68% on average between 1970 and 2016, an indicator or proxy of biodiversity loss (WWF, 2020).
- The biomass of insects declined by an estimated 80% over the past 25-30 years (Sánchez-Bayo and Wyckhuys, 2019; Carrington, 2019).
- The population of birds in North America declined by an estimated 29 percent (2.9 billion) in North America between 1970 and 2018 (Rosenberg et al., 2019).
- "The global rate of species extinction is already at least tens to hundreds of times higher than the average rate over the past 10 million years and is accelerating[1]." (IPBES, 2019, p. 24)
- Emerging infectious diseases have been dominated by zoonoses (60%), and over 70% of the zoonotic (i.e., non-human source) transmissions between 1940 and 2004 originated from wildlife (Jones et al., 2008).

It is important to recognize that these population, demographic, and environmental trends are connected - human impacts on the environment are largely responsible for the significant biodiversity loss. That is, there is a very consequential connection between humans and nature as well as between nature and human health and well-being:

> The most important direct driver of biodiversity loss in terrestrial systems in the last several decades has been land-use change, primarily the conversion of pristine native habitats (forests, grasslands and mangroves) into agricultural systems; while much of the oceans has been overfished. Since 1970, these trends have been driven in large part by a doubling of the world's human population, a fourfold increase in the global economy, and a tenfold increase in trade (WWF, 2020, p. 12).

The World Economic Forum (2020a, p. 9) considered economic growth over the past 50 years "has come at a heavy cost to the natural systems that underpin life on Earth - and which therefore underpin these economic achievements". WWF (2020) identified five direct drivers that accelerated threats to and loss of biodiversity:

- Land- and sea-use change - modifications to land and freshwater habitats;
- Species over-exploitation - unsustainable or unintentional killings of wildlife;
- Invasive species and disease;
- Pollution;
- Climate change.[2]

[1] The average or background rate had been 0.1-2 per million species per year over the past 10 million years (IPBES, 2019). Expressed another way, "the time it would take for species to naturally go extinct over 10,000 years has been compressed by human influence to about 100 years" (Schoonover et al., 2021, p. 19).

These drivers of nature loss, i.e., loss of biodiversity, accelerated since 1970 (World Economic Forum, 2020a). "Biodiversity … is fundamental to human life on Earth, and the evidence is unequivocal - it is being destroyed by us at a rate unprecedented in history." (WWF, 2020, p. 12) There are also human health impacts - "A number of infectious diseases have been connected to land-use changes from urbanization and deforestation[, including] West Nile Virus, Lyme Disease, and Hemorrhagic Fever." (Aidenvironment et al., 2020, para. 5)

Rockström et al. (2009a) proposed 9 scientifically-based planetary boundaries that must not be passed to avoid destabilizing the Earth system. They estimated that three of these boundaries (in order of severity - biodiversity loss, nitrogen cycle as part of biochemical flows, and climate change) had been exceeded. Steffen et al. (2015) updated this research - genetic diversity and biochemical flows of nitrogen and phosphorus were considered at high risk and climate change and land-system change (driven mostly by agricultural expansion and intensification - Rockström et al., 2009b) were considered at increased risk of exceeding their boundaries. They considered climate change and biosphere integrity (including functional diversity and genetic diversity) to be core planetary boundaries that if transgressed would lead the Earth system into a new state. Dinerstein et al. (2019), ICLEI-Local Governments for Sustainability (n.d.), and the Secretariat of the Convention on Biological Diversity (2009) discussed the interconnection between sequestering carbon, a key to climate stabilization and mitigation, and protecting biodiversity.

World Wildlife Fund (WWF) (2020) further explained the link between human impacts on land use and newly emerging infectious diseases:

> We do know that nearly half of all new emerging infectious diseases from animals are linked to land-use change, agricultural intensification and the food industry. Agricultural and industrial expansion into natural areas often disrupts ecological systems that regulate pathogenic risk, particularly in the biodiverse tropics. This can lead to close contact between wildlife, livestock and people, increasing the chance that a disease will spill over into humans. (p. 82)

One area where these disease-to-human contacts may be more pronounced is in tropical regions, where deforestation:

> poses a threat to global health because many of these regions are emerging disease hotspots - rich in wildlife biodiversity and probably rich in the diversity of microbes, many of which have not yet been encountered by people. Increased access to tropical forests for [mining, logging, plantation development, and oil and gas extraction] might increase the risk of zoonotic disease by changing habitat and vector community composition, modifying the distribution of wildlife populations and domestic animals, and increasing exposure to pathogens through increased human contact with animals. (Karesh et al., 2012, p. 1940)

[2] IPBES (2019) listed the drivers in a slightly different order: changes in land and sea use; direct exploitation of organisms; climate change; pollution; and invasion of alien species.

When considering recent emerging infectious diseases,

> anthropogenic factors including land-use change (e.g. deforestation, mining, oil extraction, etc.), food production changes, and global trade and travel are among the leading causes of disease emergence. Many of these underlying drivers also overlap with the leading drivers of biodiversity loss and ecosystem disruption. These practices are causing fundamental changes in the environment and facilitating increased human-animal contact. (Machalaba et al., 2015, p. 1)

The World Economic Forum (2020a) succinctly described the macro impacts of humans on nature:

> Although the world's 7.6 billion people represent only 0.01% of all living things by weight, humans have already caused the loss of 83% of all wild mammals and half of all plants. The current rate of extinction is tens to hundreds of times higher than the average over the past 10 million years - and it is accelerating. The impacts on the planet by a single species, humans, are so profound that scientists have coined a new geological epoch: the Anthropocene, or the period when humans are the key driver of geological change on the planet. We are breaching the planet's boundaries beyond the ability of natural systems to cope, which is increasing the risk of large-scale, irreversible environmental and societal changes. (p. 11)

2.2 Projected Future Global Megatrends

In conjunction with looking at past global megatrends, below are examples of what is projected over the next 30 years to the year 2050:

- The global population is expected to increase by over 20% (from 7.8 billion in 2020 to 9.7 billion in 2050) (United Nations, 2019a).
- The global population in urban areas is expected to increase by over 50% (from 4.38 billion to 6.68 billion) (United Nations, 2018; Worldometer, 2021).
- The global urbanization rate is expected to increase by over 20% (from 56% in 2020 to 68% in 2050) (United Nations, 2018; Worldometer, 2021).
- The global middle class is expected to grow by over 65% (from approximately 3.2 billion to approximately 5.3-5.4 billion) between 2016 and 2030 (Kharas, 2017; Wang, 2020).
- The global rate of species extinction is expected to accelerate; that is, "An average of around 25 percent of species in assessed animal and plant groups are threatened, suggesting that around 1 million species[3] already face extinction[4], many within decades, unless action is taken to reduce the intensity of drivers of biodiversity loss"[5] (IPBES, 2019; pp. 11-12).

[3] An average of 25% of animal and plant species assessed are threatened with extinction (IPBES, 2019).
[4] From an estimated 8.1 million plant and animal species (Purvis, n.d.).
[5] About 25% of species are threatened with extinction on average across many animal and plant species and

- "Zoonoses from wildlife represent the most significant, growing threat to global health of all [emerging infectious diseases]." (Jones et al., 2008, p. 992)

If species loss is a proxy or indicator of biodiversity loss, the resultant impact from this scale of species loss on nature, ecosystem services, and quality of life will be significant.

While the projected growth in population from 2020-2050 (i.e., 24%) is less than from the previous longer 1970-2020 period (i.e., 110%[6]), the impact of this growth (including increased populations in urban areas and the size of the global middle class) is projected to be cumulatively greater during this upcoming period. This point is conveyed by Kunreuther and Slovic (2020):

> Suppose each [lily pad in a pond] reproduces once a day so that on the second day there are two lily pads, on the third day there are four, on the fourth day there are eight, etc. On Day 48, the pond is covered completely. How long did it take to be covered halfway? The answer is 47 days. Moreover, even after 40 days of exponential growth, you would barely know the lily pads are there, as they would cover only 1/256th (0.4 percent) of the pond at that time. For a period of time, we can easily ignore the steady exponential growth of lily pads—until they smother the pond. (para. 5)

2.3 Environmental and Resource Implications

Some of the environmental and resource implications for these projected global megatrends include the following:

- Production of food is expected to increase 60-70% to feed the world population in 2050[7], as compared to 2018, due to projected changes in dietary habits following increased economic growth, income levels, and urbanization (Silva, 2018). Ranganathan et al. (2018) estimated 56% more food to be produced between 2010 and 2050.[8]
- Demand for food, water, and energy was expected to grow approximately 35%, 40%, and 50%, respectively, between 2010 and 2030 (U.S. National Intelligence Council, 2012).[9]
- The world economy to quadruple between 2010 and 2050, resulting in a growing demand for energy and natural resources (OECD, 2012).

These global megatrends and future implications are connected. For example, consider the impact of the decline in insects.

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there are about 2.5 million of these species. In addition, 10% of the approximately 5.5 million insect species are also threatened (Purvis, n.d.).

[6] The percent increase in the global population from 1990-2020 is 46%, almost twice the percent increase from 2020-2050.

[7] Assuming food wasting is not reduced.

[8] FAO (2009) projected food production would need to increase by 70% from 2008 to 2050.

[9] Global water demand is projected to increase by 55% between 2000 and 2050 (United Nations Educational, Scientific and Cultural Organization, 2015).

> The main drivers of [insect] species declines appear to be in order of importance: i) habitat loss and conversion to intensive agriculture and urbanisation; ii) pollution, mainly … by synthetic pesticides and fertilisers; iii) biological factors, including pathogens and introduced species; and iv) climate change. (Sánchez-Bayo and Wyckhuys, 2019, p. 8)

Cardoso et al. (2020, p. 1) identified human activity as mainly responsible for this decline: "We are causing insect extinctions by driving habitat loss, degradation, and fragmentation, use of polluting and harmful substances, the spread of invasive species, global climate change, direct overexploitation, and co-extinction of species dependent on other species."

Samways et al. (2020) and WWF (2016) stated that the fate of humans and insects is intertwined. For example, "Insects are … the world's top pollinators: 75% of the 115 top food crops rely on animal pollination, including nutrient-rich foods like fruit, vegetables, nuts and seeds, as well as cash crops such as coffee and cocoa." (World Economic Forum, 2020b, p. 49) Further declines in insects and biodiversity will complicate how to respond to the projected 35% increased demand for food. Furthermore, birds, reptiles, amphibians, and fish feed on insects. If this food source disappears, these animals may starve to death (Carrington, 2019), further exacerbating impacts on humans. In addition, the loss of key ecosystems can negatively affect the supply of food and medicines. Ecosystem fragmentation (discussed below) and increased human-wildlife interactions increase the risk of new zoonotic diseases emerging and new pandemics (Claes et al., 2020; FAO, 2020).

The concern over emerging infectious diseases and their derivation is quite high. "Emerging infectious diseases are a significant and growing threat to global health, economies and security. … Nearly three-fourths of emerging infectious diseases - and almost all recent pandemics - are zoonotic, that is they originate in animals, mostly wildlife"[10] (FAO, 2020, p. 1).

Furthermore, Jordà et al. (2020) claimed the long-term economic consequences, e.g., negligible or no economic growth, from global pandemics may persist for a generation or more. Fan et al. (2018) estimated the number of influenza-pandemic-related deaths globally to be 720,000 per year, with estimated economic losses globally of $500 billion per year.

To further emphasize the importance of protecting biodiversity, it is

> an essential part of tackling the climate crisis. Tropical forests around the world store about 25 percent of the world's carbon but are vulnerable to deforestation if countries do not protect them. … [P]art of the equation of protecting biodiversity is also part of the equation for getting climate change under control. (Price, 2020b, para. 11)

Tropical deforestation is the second-largest source of global anthropogenic greenhouse gas (GHG) emissions and a major driver of biodiversity loss (Pendrill et al., 2019). Indeed, "Deforestation [contributes] approximately 15 percent of annual greenhouse gas emissions. It also accelerates the biodiversity crisis, displaces indigenous peoples, and limits the potential of forests as a natural carbon sink to reverse the worst effects of climate change."

[10] Karesh et al. (2012) estimated this level to be almost two-thirds.

(Aidenvironment et al., 2020, para. 2)

Several companies have raised these concerns. For example, Olam (2020), PepsiCo (2020), and Unilever (2020c, 2020d) recognized these environmental challenges, including climate change and biodiversity impacts, faced by agriculture and that these will increase over the next 30 years unless there is systemic change in agriculture.

The environmental impact of agriculture is evident in the examples above - according to Willett et al. (2019, p. 449) "food production is the largest cause of global environmental change" in terms of percent of land use, land-use change (including land clearing, habitat loss and fragmentation), percent of global GHG emissions, and percent of freshwater use. Foley et al. (2011, p. 337) referred to agriculture as "a dominant force behind many environmental threats", including biodiversity loss. Furthermore, "80% of extinction threats to mammal and bird species are due to agriculture" (Willett et al., 2019, p. 467).

Maxwell et al. (2016) determined that 72% of near-threatened or threatened species assessed were affected by over-exploitation (in order of impact: unsustainable logging, hunting, fishing, and gathering plants) and 62% by agricultural activity (in order of impact: crop farming, livestock farming, timber plantations, and aquaculture).

Dasgupta (2021, p. 35) similarly concluded: "Food production is the most significant driver of terrestrial biodiversity loss." The percentage of agricultural land devoted to livestock or crop production for livestock feed is 77% (Dasgupta, 2021). Survey respondents to Credit Suisse (2021) considered the food and beverage sector to be most at risk from biodiversity loss. Dasgupta (2021 p. 27) also asserted, "Perhaps the most visceral sign of environmental degradation is species extinction."

It is important to note where global population growth is projected to take place and recognize the associated environmental implications. For example,

> By 2050, the population in the developing countries will be approximately 8 billion. The population in the developed countries will be 1.2 billion. … It is apparent that all of the population growth is taking place in developing countries. In particular, Asia will contribute a staggering 41 percent and Africa 47 percent towards this growth in 2050 (Silva, 2018, para. 1).

Wang (2020) and World Data Lab (2019) projected that 85% to nearly 90% of the people moving into the global middle class through 2030 will live in Asia. Furthermore, it is important to note that "developing countries … harbor most of the planet's biodiversity." (Wilson, 2002, p. 182) Furthermore, almost 90% of the increase in the global urban population is projected to occur in Asia and Africa (United Nations, 2019b), presenting environmental challenges discussed above.

There are also environmental implications from projected demographic changes - the growing global middle class is expected to

> fuel demand for more and new types of food. Developing economies - including China, India, other Asian countries and Africa - are projected to account for 35% of future

> increase in food demand, as population growth in these countries will coincide with a dietary shift to eating more meat and calorie-rich meals. (AlphaBeta, 2018, p. 8)

These dietary shifts have environmental implications - e.g., agricultural expansion and/or intensification - and health implications - e.g., zoonotic infectious diseases (Rohr et al., 2019). Furthermore, DeFries et al. (2010) identified urban population growth[11] and increased agricultural trade in Africa, Asia, and Latin America as positively correlated with tropical deforestation.

Reducing the impacts of food production and agriculture on the environment will be critical to protecting biodiversity and avoiding spillover effects with health, economic, and security implications when viruses "jump" from animals to humans.

> Experts have said that the more we push into rich, biodiverse habitats, the more frequent spillover events will occur. … Those studying the linkages between pandemics and biodiversity loss say there are three major factors driving the increase in spillover events: massive deforestation, industrial-scale animal farms too close to wild habitats and the hunting of wild animals, either for profit or food (Salzman and Sands, 2020, paras. 12, 14).

2.4 Global Risks

Between 2018 and 2020, the World Economic Forum's multi-stakeholder community considered biodiversity loss risk to have risen in terms of likelihood and impact (World Economic Forum, 2020a). This recognizes that "Biodiversity loss has critical implications for humanity, from the collapse of food and health systems to the disruption of entire supply chains." (World Economic Forum, 2020b, p. 7)

However, the World Economic Forum's (2020b) survey of business leaders revealed a different perspective:

> [N]one of the top 10 risks globally are environmental, suggesting a critical blind spot. … Overall, lack of consistent awareness-raising among business leaders may create first-mover advantages for some, but it also potentially demonstrates the much more concerning overarching risk: that many businesses may not be planning for the physical and financial risks that climate change may have on their activities and across their value chains. (p. 35)

3. Transformational Change

As discussed above and by AtKisson (2011), Elkington (2020), and Winston (2014, 2020), these global megatrends are exponential changes. If we want to fully respond to the impacts of these global megatrends and protect and restore the health of the environment, we need to respond in a countervailing way. That is, exponential change needs to be met by an equivalent or greater exponential change (to return to a prior or better-balanced state, analogous to Newton's third law of motion - for every action there is an equal and opposite reaction.

[11] "[U]rbanization raises consumption levels and increases demand for agricultural products. Urban consumers generally eat more processed foods and animal products than rural consumers" (Defries et al., 2010, p. 180).

3.1 Difference between Incremental and Transformational Change

Responses to these global environmental changes cannot be incremental. Incremental environmental improvements (e.g., increasing eco-efficiency of resources and energy use) would be dwarfed by the enormity of changes that have been built into and accumulated in the overall system. Scrase et al. (2009, p. 7) called for "radical 'step jumps' in the environmental and social performance of policy instruments, organisational practices, technological infrastructures and individual behaviours".

Indeed, responses need to be transformational and systemwide and at a minimum match up to these exponential changes so their impacts are counterbalanced. Examples of transformational change for a company can include converting its electricity supply to be sourced 100% renewable, moving from a linear to a safe and circular system, converting its supply chain to be deforestation-free or food supply chain to be regenerative[12], etc. Viewed more broadly, Winston (2014, p. 80) noted, "The size of any solution needs to match the scale of the challenge"; Polman and Winston (2021, p. 96) stated, "Our goals need to match the moment." AtKisson (2011) similarly asserted that the effort needs to match the "scale of the challenge" and that we need to scale up to achieve a sustainable world.

Incremental approaches are not suited for identifying exponential solutions to exponential problems (Elkington, 2020). The Organisation for Economic Co-operation and Development (OECD) (2013) referred to incremental solutions as locking in old or traditional behavior; IKEA (n.d.) and McDonough and Braungart (2002) referred to them as doing things less bad; McDonough and Braungart (2002) referred to eco-efficiency, an example of incremental improvement, as providing an illusion of change. Furthermore, incremental approaches will not lead to a decoupling of growth from environmental impacts (OECD, 2013), advance sustainability (Interface, 2019; Marks & Spencer, 2018; Nike, 2013), address climate change (CDP, 2019; Mars, 2020a; Wong and Petroy, 2020), or change an entire system (McDonough and Braungart, 2002).

3.2 Characteristics of a Transformational Company

What does a transformational change mean for a company? The Canadian Business for Social Responsibility (2015) described a transformational company as one that focus[es] on how to go beyond simply making their products less bad, to becoming a force for social good. Seeking to do more than reduce the negative impacts (footprints) of their products, some companies calculate and accelerate their 'handprint', the degree to which their customers' footprint is improved through the use of their sustainably positive products or services. (p. 9)

Kerrigan and Kulasooriya (2020) identified seven characteristics of companies that take transformative approaches to sustainability:

- opportunity-focused;
- transparent;

[12] Includes soil-based carbon storage strategies to improve soil health and provide climate change mitigation and resilience (Codur and Watson, 2018).

- purpose-driven;
- ecosystem-focused;
- collaborative;
- regenerative; and
- circular.

In addition, Grayson et al. (2018) identified key dimensions of a sustainability culture within leading companies:

- innovation;
- engagement;
- intrapreneurism;
- transparency;
- openness;
- stewardship;
- ethics;
- responsibility; and
- accountability.

These characteristics are related to the Canadian Business for Social Responsibility's (2015) framework for accelerating and scaling sustainability:

- What you do (purpose, products and services, solutions, and restorative);
- How you do it (vision, governance and culture, leadership, employee engagement, inclusivity, closed-loop, productivity, value chain, and accountability and transparency); and
- Whom you interact with (customers, standards, stakeholders, finance community, public sector, public policy).

3.3 Actions by a Transformational Company

In setting goals or targets to align with this transformation, "It's essential that companies adopt 'science-based targets for nature' that go beyond reducing their carbon emissions - adopting more sustainable production and waste management practices, restore degraded landscapes and seascapes, etc." (Bonini, 2020) Furthermore,

> Corporations can accelerate individual action and commit to meaningful short- and long-term absolute emission reductions. Companies in all sectors can do much more to reduce the emission intensity of their business and supply chains through measures that cost them little or nothing, and can offset residual emissions. All companies should actively

> monitor and manage their climate-related risks and increase their efforts to achieve a 1.5 ℃ world. … And all can develop new business models that contribute to achieving a low-carbon economy. (World Economic Forum, 2019, p. 16)

A company's supply chain can represent a large percentage of its environmental footprint, such as in the case of its carbon footprint - an average of 40-60% for manufacturing companies and nearly 80% for retail companies (Brickman and Ungerman, 2008). Berruti and Gravier (2020), Kashmanian (2015, 2018, 2019), Kashmanian and Moore (2014), and Lee and Kashmanian (2013) stressed the need for companies to more fully engage with their value chains and employ supportive procurement processes. Furthermore, multi-stakeholder collaborations will be important for sharing successes and collectively joining forces to reduce supplier emissions (Kashmanian**,** 2015**,** 2019; Kashmanian and Moore, 2014). SustainAbility, et al. (2008) presented a three-step ladder of approaches for companies to integrate sustainability value into their supply chain work - incremental; strategic; and transformational.

Tropical deforestation is a supply chain issue for companies, and consumers, shareholders, and governments are demanding they end it (Bloomgarden, 2021). Otherwise, companies are exposed to several business risks, including operational (e.g., a potential rise in costs and supply disruption), regulatory, and reputational (CDP, 2016). Furthermore, commodity supply chains will need to be transformed if the global Sustainable Development Goals (SDGs, discussed below) will be met by 2030 (CDP, 2015). Polman and Winston (2021) asserted that companies may outsource their supply chains but should not outsource responsibility for them.

Elkington and Zeitz (2014) presented a choice for companies - breakthrough or breakdown. "Breakthrough leaders - and increasingly their organizations - are coming to understand the need for new levels of ambition, innovation, and enterprise. They also acknowledge that it is now up to business to accept the challenge." (Elkington and Zeitz, 2014, p. 3) Elkington (2020) equated breakthrough with exponential.

3.4 What Companies have said about Transformational Change

Companies face increasing pressure from stakeholder groups to do more to protect biodiversity and ecosystem services (UNGC and IUCN, 2012). Based on a review of publicly available sustainability documents and/or webpages for several dozen companies, several companies are looking to the future, recognize transformation as an opportunity to abandon business-as-usual and reinvent their business models, help lead the transformation of their sectors through engagement with value chains to seek greater circularity, and strive toward global sustainability goals (Ford, 2020; General Mills, 2020; HP, 2020; IKEA, n.d., 2020; Intel (Brady, 2018); Interface, 2019); Kellogg, 2019; Mars, 2019, 2020d; PepsiCo, 2020; Starbucks (Johnson, 2020); Toyota, 2020; Unilever, 2020b; VF, 2020; and Volvo Group, 2019). To be successful, their expressed support for transformational change needs to be consistent with purpose-driven strategies and a reimagining of business going forward, including how it ties in with overarching goals, e.g., sustainable mobility, and the SDGs.

From these reviews (not meant to be an all-inclusive list), two sectors stand out based on multiple companies publicly stating their need for transformational change - auto/transportation and food. With heightened attention to climate change and GHG emissions reductions, the transportation/mobility sector is receiving greater scrutiny and focusing on increasing the industry's response. Similarly, the food sector is receiving greater scrutiny due to environmental impacts (discussed above), and is exposed to increased risk with declines in biodiversity and climate change impacts. Two other sectors also stand out in this review - fiber and information technology. These companies publicly acknowledge system-wide changes and their need for increased responsibility.

4. Scaling Up Transformational Change

While there has been a growing commitment to transformational change, there has also been increasing recognition of the urgent need for scaling up transformational change due to growing concerns over environmental and associated human health impacts. For example, "Far-reaching policies will be needed to transform industrial processes, transport, agriculture and land-use, alongside changes in consumer behaviours to scale the necessary critical solutions" (World Economic Forum, 2020b, p. 37).

Unilever (2020c, para. 13) considered widespread adoption of sustainable agriculture to be transformational in helping to address poverty, food insecurity, and climate change - "These systems need to protect and ultimately regenerate natural resources, become a carbon sink rather than a carbon contributor, feed 9 billion people in a healthier, less wasteful way, and provide a more prosperous and resilient lifestyle for farmers." Foley et al. (2011) were more specific:

> [T]he transformation of agriculture must deliver sufficient food and nutrition to the world … [and] also (1) cut greenhouse gas emissions by at least 80%; (2) reduce biodiversity and habitat losses; (3) reduce unsustainable water withdrawals, especially where water has competing demands; and (4) phase out water pollution from agricultural chemicals. (p. 339)

4.1 Need to Scale up to Meet Global Challenges

There are several key challenging and critical goals that necessitate a scaling up of transformational change, such as:

- SDGs[13] by 2030, to build a more sustainable future (https://sdgs.un.org/goals).
- Paris Agreement [14] by 2035, an international treaty on climate change (https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement).
- End tropical deforestation by 2030 (New York Declaration on Forests [15]) (https://forestdeclaration.org)[16].

[13] A diverse set of environmental, social, and economic measures of sustainable development.
[14] Adopted by 196 Parties (https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement).
[15] Endorsed by over 200 national governments, multinational companies, indigenous groups, and

- Convention on Biological Diversity's[17] (CBD's) 2030 targets and milestones and 2050 Vision for Biodiversity (https://www.cbd.int).

- Protect one-third of the land and sea area by 2030 to manage sufficient habitat for nature and save endangered species, as an interim goal toward protecting one-half of the land and sea area by 2050 (discussed below).

While the population/demographic and environmental megatrends are interconnected, so are the environmental impacts: "Climate change, nature degradation, biodiversity decline, water scarcity - all these issues are interconnected, and we must address them all simultaneously." (Unilever, 2020d, para. 3) Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and Intergovernmental Panel on Climate Change (IPCC) (2021) pointed to the scale of the transformational and systemwide changes needed to meet the SDGs as well as other global GHG and biodiversity goals.

To achieve its mission - "To influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable" (IUCN, 2016, p. 9) - the International Union for Conservation of Nature (IUCN) convenes diverse stakeholders and builds conservation knowledge. IUCN (n.d.) identified three solutions for conserving biodiversity: science, action, and influence. Indeed, "Key to IUCN's influence is its ability to bridge science and policy, linking knowledge to action, as well as linking governmental and non-governmental sectors, private and public and mobilising organisations … to support joint actions and solutions." (IUCN, 2016, p. 15) Along with this approach of applying science to influence action, there have been numerous examples of assessments and/or identifications of actions needed that have been identified in the scientific literature:

- Drivers of species extinction and loss of biodiversity and ecosystem services (e.g., population growth, per capita consumption, land modification, exploitation of resources, poaching of large animals, pollution, climate change, clearing of natural habitats for agriculture, deforestation, loss of habitats, land fragmentation) (Baillie and Zhang, 2018; Betts et al., 2017; Dinerstein et al., 2019; Dobson et al., 2020; Hannah et al., 2020; Jones et al., 2008; Karlsruhe Institute of Technology, 2020; Noss et al., 2012; Pimm et al., 2014; Wilcox and Ellis, 2006);

- Steps to protect habitats, species, and biodiversity (e.g., protect 30% and 50% of land and ocean waters by 2030 and 2050 (Global Deal for Nature), respectively, maintain intact ecosystems, provide contiguous areas, slow/stop land clearing for agriculture, retain forest cover, preservation of indigenous communities rights, address climate change) (Dinerstein et al., 2017; Dinerstein et al., 2019; Dobson et al., 2020; Hannah et

non-governmental organizations (https://forestdeclaration.org/about).

[16] In addition, Germany and IUCN launched the Bonn Challenge in 2011 as a global goal to restore 150 million hectares of degraded and deforested lands by 2020 and then 350 million hectares by 2030 (https://www.bonnchallenge.org).

[17] The Convention on Biological Diversity was originally signed by 150 government leaders during the 1992 Rio Earth Summit (https://www.cbd.int/convention).

al., 2020; Jones et al., 2008; Locke, 2013; Noss et al., 2012; Pimm et al., 2014; Wilson, 2016);

- Impact from loss of habitats and species (e.g., food production and food insecurity, the emergence of infectious diseases) (Dobson et al., 2020; Jones et al., 2008; Karesh et al., 2012; Karlsruhe Institute of Technology, 2020; Wilcox and Ellis, 2006; Willett et al., 2019).

According to the United Nations Global Compact (UNGC) and IUCN (2012, p. 5), "All businesses, regardless of their size, location or sector, depend upon and have a direct or indirect impact on biodiversity and ecosystem services … through their operations, supply chains[18] or investment choices."

Taking a sector perspective, Lambin et al. (2018) asserted the following:

> Sectoral standards are specific norms and criteria adopted by groups of companies to define their practices with respect to sustainability. The creation and availability of sectoral standards have helped to precipitate many of the company pledges. They help to operationalize and standardize codes of conduct across multiple actors within a supply chain. Standards may be defined by actors within the supply chain or through multi-stakeholder processes with external actors. They can be used by downstream manufacturers, retailers or consumers to allocate either positive incentives or market sanctions to upstream actors, such as producers or traders (p. 110).

4.2 What Companies have Said about Scaling up Transformational Change

There are public statements from several companies about the need to scale up transformational change (e.g., BMW Group, 2020; Danone, 2020b; H&M, 2019; HP, 2020; Interface; 2019; Mars, 2020c; Nestl é (Frutiger, 2018); Unilever, 2020a, 2020b, 2020c; VF, 2019, 2020; Volvo Group, 2019; Walmart, 2019, 2020). They recognize that the global environment has reached a critical state and that business as usual is no longer acceptable for themselves, their sector, and other sectors. They feel a responsibility to be leaders and help guide transformation to achieve sustainability goals, recognizing that it is an important role but they cannot achieve this scaling up on their own. They need to include their value chains; collaborate and partner with stakeholders, including government and NGOs (non-governmental organizations); and advocate for policy and regulations by the public sector. These companies seek environmental and social improvements because they are good for their businesses as well as the planet, and the companies look to the future. They are also working to create new business models, e.g., circular, low-carbon, and decoupling growth from resource consumption. In addition, companies like HP (2020), Mars (2020c), and Walmart (2020) have made clear that the stakes are very high and the need to act on climate change, deforestation, and/or nature loss is urgent.

The sectors that stand out from the companies listed above (not meant to be an all-inclusive list) are auto/transportation, food, and fiber. These companies recognize that changes are

[18] For most sectors, the majority of their impact on natural capital, i.e., the world's stock of natural resources, is from their supply chains (GreenBiz and Trucost, 2020).

needed to their business models to adapt to environmental challenges and increased scrutiny from stakeholders; they also recognize that systemwide changes are needed and these will present business opportunities if they respond responsibly and promptly.

Grayson et al. (2018, p. 13) asserted "Companies can only aspire to survive into the indefinite future if they help society find solutions to the most acute environmental, social, and economic challenges we face. There is also a moral imperative for business leadership in sustainability."

5. Importance of Collaboration

The Business & Sustainable Development Commission (2017, p. 98) made clear that business-as-usual will not drive the scaling up of transformational change. Indeed, "the whole sector has to move." Given a company's oftentimes low ability to influence change across a market segment, the scale of transformation needed in light of these global megatrends, and the complexities of reversing the widespread and significant environmental impacts, taking a step forward may be viewed as overwhelming.

Several companies (Danone, 2020a; General Mills, 2020; H&M, 2019; HP, 2020; IKEA, n.d., 2020; Mars, 2020c, 2020d, 2020e; Nestlé, 2021b; Patagonia, 2020; Unilever, 2014, 2020b) affirmed the importance of collaboration to move a market segment or sector. As exemplified by IKEA (n.d.) and Patagonia (2020), companies can provide further leadership by being founders or co-founders of collaborations or organizations that enhance transformational opportunities for companies and aid in scaling up transformational change.

Members of these collaborations need to be actively involved so that they leverage capabilities to reduce barriers and accelerate the achievement of goals (Kerrigan and Kulasooriya, 2020). Companies can help to lead from inside or outside of these collaborations - i.e., push or pull the groups forward by showing what is possible, setting examples, inspiring and motivating others (Zenger et al., 2009), and sharing learning. Shared, active learning can propel collaborators forward faster. Since actions by companies and their value chains have direct environmental impacts and the private sector is typically the driver of innovation, they need to be leaders because their actions can have more direct positive environmental consequences.

The World Economic Forum (2019) stressed the importance of collaboration in dealing with climate change:

> Ecosystem actions can overcome barriers, through collaborations along value chains or with industry peers. It will take a joint effort to overcome existing transformation barriers in sectors where decarbonization costs are too high for individual companies to bear alone. Through cooperation, companies can share the risks of technology development and coordinate related investments. They can generate a demand signal through joint commitments or standards, and set up self-regulating bodies where government policies fall short. (p. 16)

Indeed, one of the SDGs (#17) is focused on global partnerships because they are key to

achieving the other 16 goals.

Business associations can play an important role in scaling up corporate action across companies and within and across sectors (UNGC and ICC, 2015). In addition, IUCN's Business Engagement Strategy (2012, p. 9) "aims to encourage transformational and demonstrable change at the company and sectoral level in how biodiversity is valued and managed by businesses in order to conserve and restore biodiversity and to ensure that biodiversity benefits are shared equitably."

Collaborators must work together to combine resources, tools, expertise, and synergies to achieve this scale of change (Business & Sustainable Development Commission, 2017), especially to address complex and systemic issues (Mars, 2020b). For example, due to the collective efforts of PepsiCo, Red Bull, The Coca-Cola Company, and Unilever, as well as Greenpeace and UN Environment, in Refrigerants, Naturally!, three of the member companies achieved their goal of 100% natural refrigerant procurement in 2017 and the fourth member company achieved the goal in 2020. Natural refrigerants in cooling and freezing units allowed these companies to reduce their carbon footprints and set an example for other companies (Refrigerants, Naturally!, 2018).

Collaborations are an important component of scaling up, especially in consideration of pressing time constraints:

> As nature declines, the prospects for business success and future prosperity dwindle. Conversely, the business opportunities that await those committed to restoring natural ecosystems could be considerable. Solutions to the issue of nature loss are complex, but unless we take transformative action urgently, the risks and impacts of such loss will only accelerate. (World Economic Forum, 2020, p. 12)

Indeed, Grayson et al. (2018) asserted that collaboration is needed to scale up. Furthermore, Elkington (2020) stressed that successful solutions need to be replicated and scaled up.

Regarding the companies mentioned above, they are engaged in efforts to advance transformation in sustainability. These are examples of efforts that many of them are involved in:

- Business for Nature partners with over 70 NGOs to encourage companies to take action and support the implementation of ambitious policies to reverse the loss of nature during the 2020s (as of July 7, 2022). (https://www.businessfornature.org/our-partners)
- RE100 is a renewable energy initiative led by the Climate Group in collaboration with CDP "to accelerate change towards zero carbon grids at scale." (https://www.there100.org/about-us)
- Science-Based Targets initiative is a partnership between CDP, UNGC, World Resources Institute (WRI), and WWF that guides company setting of science-based targets for reducing greenhouse gas (GHG) emissions and provides technical assistance to help companies determine how much and how quickly to reduce these

> emissions to limit global warming to 1.5^{0}C.
> (https://sciencebasedtargets.org/about-us#who-we-are)

In addition to opportunities for companies to collaborate, these examples indicate that several NGOs are collaborating to share their expertise and help reach goals faster.

6. Land Protection

EcoAgriculture Partners and IUCN stated that landscape partnerships to advance sustainability were increasingly being used by companies with multiple stakeholders (e.g., NGOs, governments, farmer organizations, and other businesses) when alternative approaches, e.g., supply-chain management and certification, are not considered sufficient to protect natural resources. As an example, a landscape-scale goal could include zero deforestation (Scherr et al., 2017). Scherr et al. (2017) identified roles for key stakeholders.

Laurance et al. (2014) projected that between 2010 and 2050 at least 25 million kilometers of new roads will be built in the world, representing a 60% increase in the total length of roads, enough to encircle the globe over 600 times. "Nine-tenths of all road construction is expected to occur in developing nations, including many regions that sustain exceptional biodiversity and vital ecosystem services" (Laurance et al., 2014, p. 229), leading to more habitat loss and fragmentation. The authors proposed a global strategy for planning and prioritizing where to build and not to build new roads.

Wildlife-friendly steps taken to improve wildlife crossings and movement can reduce habitat fragmentation, improve the quality of degraded habitats, and enhance the mobility and resilience of wildlife. O'Gorman (2020) and Sorensen and Hunter (2020) identified several examples of wildlife needs - access to food, water, shelter, and space. Providing wildlife corridors and landscape linkages to improve wildlife movement and habitat connectivity can restore their habitat and help species to thrive.

According to its assessment of states in the U.S. on their use of incentives for habitat conservation, Defenders of Wildlife (2002) asserted

> Efforts to identify habitat conservation needs in various parts of the country indicate that 15-30% of the land in any state or ecoregion will need to be in some form of conservation status in order for our native biodiversity to be effectively conserved. Fully half of the land identified in these efforts is privately owned. (p. 1)

The lands most focused on for conservation by state incentive programs were forest (over 30%) and agricultural (30%) (Defenders of Wildlife, 2002). Sorensen and Hunter (2020) asserted that 80% of the world's terrestrial species live in forests.

Kamal et al. (2014) emphasized the importance of private lands for biodiversity conservation:

> protected areas (whether public or a combination of both public and private land) cannot be considered as sufficient measures for conservation as they contain a small fraction of the global biodiversity, occupy only 13.9%[19] of the total global land area, are susceptible

[19] 12% of U.S. land had been permanently protected (based on U.S. Geological Survey, 2019).

> to human degradation, can be downgraded in their protection and, finally, their effectiveness in isolation is questionable. (p. 576)

Furthermore, Rissman et al. (2006) noted the increased use of agreements between private landowners and government agencies in the U.S. through conservation easements (typically voluntary agreements, perhaps connected with payment and/or tax reduction) and asserted that "Some or all of the habitat for 85% of federally listed endangered species is found on private land" (Rissman et al., 2006, p. 710).

Relative to the 2030 and 2050 goals of the Global Deal for Nature, United Nations Environment Programme (UNEP) and IUCN (2021) estimated that 16.64% of the land and inland water ecosystems and 7.74% of coastal waters and the ocean are under protection.[20] The authors asserted that protected and conserved areas need to be better connected to reduce habitat fragmentation so species can move and ecological processes can function.

Sobrevila (2008) stated that indigenous peoples represented approximately 4% of the global population; however, their lands encompass up to 22% of the Earth's land surface and they manage 11% of its forests, which hold 80% of its biodiversity. Sobrevila also stated that indigenous peoples inhabit up to 85% of the world's protected areas. Environmental equity and environmental justice are gaining more attention for their importance when considering environmental impacts and making environmental decisions.

O'Gorman (2020) discussed the importance of conservation for companies and their stakeholders, provided a detailed guide for how they can engage with stakeholders to achieve mutually beneficial outcomes, and identified key elements in the planning process. O'Gorman stated a company's past success in a conservation project(s) creates greater receptivity and likelihood for future and larger conservation projects. Focusing on its property may be a good starting point for a company, e.g., increasing its potential as a carbon sink, increasing resilience for nature, and improving wildlife crossings and migrations (O'Gorman, 2020). In addition, the mitigation hierarchy (avoid, minimize, restore/reclaim, and offset) can provide a roadmap to guide companies as they move forward on these projects (Forest Trends & Wildlife Conservation Society, 2018; O'Gorman, 2020).

Land ownership is a key consideration as is the availability of investment funds. Deutz et al. (2020) noted,

> Catalyzing private sector capital must be a priority, given that it constitutes the largest available source of financing. However, … the potential for private capital to support biodiversity conservation will only be realized if appropriate governmental policies, regulations, and incentives are in place. (p. 9)

The World Economic Forum (2020) stated the imperatives:

> The accelerating negative impact of human activities on biodiversity and nature cannot be tackled without a proactive shift in the policies and practices that have driven much of the current growth model. With this in mind, companies, investors and policy-makers have a

[20] IPBES and IPCC (2021) estimated that 15% of the land and 7.5% of the ocean were under protection.

> vital role to play, working alongside civil society to bend the curve on nature loss by 2030. (p. 24)

7. Leading Company Goals

Nearly 30 years ago, Hawkens (updated in 2010) asked,

> Since business in its myriad forms is primarily responsible for this plunder, it is appropriate that a growing number of companies ask themselves, how do we conduct business honorably in the latter days of industrialism and the beginning of the ecological age? (p. xi)

Combine this statement with Polman and Winston's (2021, p. 13) - "Business cannot be a bystander in a system that gives it life."

Mars established a novel goal to not affect additional lands, which also reinforces its Deforestation Prevention Policy, which states "[t]here is no time to lose" (Mars, 2020c, para. 8) in preventing deforestation:

> Our goal is to hold flat the total land area associated with our value chain. Freezing the land footprint of Mars' full value chain will help reduce pressure on natural ecosystems. We have set a land budget analogous to the carbon budget used to limit our cumulative GHG emissions, and we will work with suppliers and farmers and design our products to operate within this budget, even as our business grows." (Mars, 2020e, para. 6)

Mars' goal aligns with Willett et al.'s (2019) proposal:

> a zero-expansion policy of new agricultural land into natural ecosystems and species-rich forests, management policies aimed at restoring and re-foresting degraded land, establishing mechanisms of international land-use governance, and adopting a Half Earth strategy for biodiversity conservation to safeguard resilience and productivity in food production. (p. 449)

Dinerstein et al. (2019, p. 12) considered "Slowing and stopping of clearing of intact natural habitat for agriculture, the dominant form of land use today" to be a critical part of a climate strategy. The authors recommended increasing crop intensification, directing cropland expansion to degraded lands, and reducing food wastage. Foley et al. (2011) also included changing dietary preferences, shifting crop production away from livestock feed and non-food applications, and reducing food waste.

Corporate and organizational goals to eliminate deforestation or achieve zero net deforestation by 2020 were not achieved (CDP, 2017). Tropical Forest Alliance 2020 and World Economic Forum (2017) contend that solutions to address commodity-driven deforestation exist and are ready to be scaled up. To end deforestation in agricultural supply chains, brand companies will need to lead. For example, to achieve sector-wide elimination of deforestation in the palm oil sector, the brand companies "must lead the way and drive change throughout the palm sector by taking control of and responsibility for their own supply chains." (Greenpeace, 2018, p. 29)

Several corporate goals provide examples of what may be possible, and when combined they may also provide examples of what is necessary.

- **Mars** (2020e) set a goal to hold flat the total land area associated with its value chain to reduce pressure on ecosystems. The company will engage with its suppliers and farmers to operate within this budget and decouple its land footprint from business growth. Mars considers this an important step toward reducing its GHG impacts.

- **Microsoft** set a goal to remove from the environment its historical carbon since its founding in 1975 (i.e., carbon emitted either directly or by its electrical consumption), in addition to its goal to be carbon negative by 2030. The company also established a $1 billion climate innovation fund to accelerate the development and deployment of new technologies to reduce or remove carbon from the atmosphere (Smith, 2020). During the plan's first year, Microsoft paid for the removal of 1.3 million metric tons of carbon from 15 suppliers (Smith, 2021).

- **Nestlé** (2021b, p. 3) recognized that its no-deforestation strategy would not be sufficient and thereby also developed a Forest Positive strategy to "[contribute] to regenerating forest landscapes, protecting natural habitats, helping farming communities thrive and supporting our planet in combatting the effects of climate change." Where forest degradation has occurred, Nestlé (2021b) set a reforestation goal to plant 200 million trees by 2030 in and near areas where it sources ingredients.

- **Danone** in 2017 and **Nestlé**, **PepsiCo**, and **Unilever** in 2021 announced plans to scale regenerative agriculture across their food supply chains:

  - **Danone** (2018, 2021a) works directly with over 50,000 farmers. Since agriculture represents 60% of its GHG emissions and approximately 90% of its water footprint, it has chosen a circular model for agriculture to regenerate resources (Danone, 2021a). The company will develop long-term contracts and a new price management system, as well as provide training, equipment, and financing, to support and assist farmers transition to regenerative agriculture (Danone, 2018), and has provided an open-source scorecard to define and assess the use of regenerative agricultural practices (Danone, 2021b).

  - **Nestlé** (2021a) will invest nearly $1.3 billion between 2021-2025 to transition its food system partners - 500,000 farmers and 150,000 suppliers - to a regenerative food system by applying state-of-the-art science and technology, providing technical assistance, offering investment support, paying premiums, and buying larger quantities for regenerative agriculture goods. Agriculture represents nearly two-thirds of Nestlé's total GHG emissions (dairy and livestock represent approximately half of this amount) - this plan is important for its SDG goals by 2030.

  - **PepsiCo** (2021) set a goal that regenerative farming practices would be used across 7 million acres - approximately 100% of the land used to grow crops and ingredients used in its products - by 2030. PepsiCo (2021, para. 1) estimates that this "effort will eliminate at least 3 million tons of [GHG emissions] by the end of the decade."

- **Unilever's** supply chain includes 4 million hectares (nearly 10 million acres) to grow the raw materials used in its products. The company set a goal for these farms to adopt regenerative farming practices. Unilever (2021a, para. 11) clearly stated the imperative to move in this direction: "[W]e need to acknowledge that the compliance-oriented approach has not been effective enough and introduce a new way of working. We need to urgently scale up the use of technologies and agriculture practices that can protect soils, increase water efficiency, manage on-farm vegetation and crop diversity and reduce emissions while maintaining yields." The company developed regenerative agriculture principles that provide guidance to growers and are publicly available (Unilever, 2021c).

- **Unilever**'s brands will collectively invest 1 billion euros (approximately $1.16 billion) in a Climate & Nature Fund between 2020-2030 for landscape restoration, reforestation, carbon sequestration, wildlife protection, and water preservation (Unilever, 2020d, 2021b).

- **Walmart**'s Acres for America Program, which was started in 2005, is committed to purchasing and preserving one acre of land of national significance to protect critical fish and wildlife habitats in the U.S. for every acre developed by its stores. Walmart's domestic facilities had an estimated 100,000 acres in 2005 (National Fish & Wildlife Foundation, 2021). Through matching funds and Walmart's partnership with the National Fish & Wildlife Foundation, the Program has protected more than 10 acres per 1 acre of company stores, and $1 billion overall has been used for habitat protection (National Fish & Wildlife Foundation, 2020; Walmart, 2016). As of 2021, 1.49 million acres have been protected "through permanent conservation of important wildlife habitats … and [connected] more than 10 million acres of public and private conservation lands across the country." (National Fish & Wildlife Foundation, 2021, para. 2) As part of its goal to become a regenerative company, Walmart (2020) and the Walmart Foundation announced a goal to protect, manage, or restore at least 50 million acres of land and one million square miles of ocean by 2030.

If these goals could be combined, companies would take significant steps to cause no further deforestation and address prior deforestation through reforestation measures, safeguarding land from further land disturbance, and restoring critical habitats (Cazzolla Gatti et al., 2019; Cazzolla Gatti and Velichevskaya, 2020)[21]. These are examples of companies transitioning from risk management (e.g., moving from no deforestation) to developing more of a long-term business continuity strategy as they advance further along their sustainability path (Kashmanian, 2015; Kashmanian et al., 2011).

Furthermore, WRI's (2020) Global Restoration Initiative, with initiatives in Africa (AFR100 - African Forest Landscape Restoration Initiative)[22], Latin America (Initiative 20x20), and South Asia (India and Indonesia) are large-scale efforts to restore millions of hectares of land

[21] Reports by Greenpeace (2018) and United Nations Environment Programme (Nellemann et al., 2007) provide vivid reminders of what is being lost.

[22] In addition, the Great Green Wall Initiative involves over 20 African countries and aims to plant a belt of trees, 15 km wide and 8,000 km long, by 2030 across central Africa to combat desertification (https://www.unccd.int/actions/great-green-wall-initiative; https://www.greatgreenwall.org).

that have been deforested and degraded. The environmental and economic benefits from these initiatives include increased capacity for climate change mitigation, resilience, and adaptation, increased biodiversity, and progress toward protecting half the Earth. Funding and investment support, multi-organization collaborations, and public sector support will be critical for such endeavors to succeed.

8. Opportunities for Other Key Stakeholders

Achieving scaling up to a systemwide level will require collaboration across the public and private sectors, civil society, and the financial sector (Grayson et al., 2018). IKEA (2018) considered investment mechanisms and incentives to be key enablers. Grayson et al. (2018, p. 186) asserted that "While the challenge for corporate sustainability activity to scale dramatically and immediately is starkly evident," it is essential and urgent that scaling corporate sustainability efforts should be the focus of every company. This sense of urgency necessitates collaboration across sectors and this needs to be communicated with stakeholders, including customers, suppliers, and policymakers (Ceres, 2021).

8.1 Investor Role

A survey of over 700 sustainability experts from over 70 countries, indicated much more needs to be done by national governments, institutional investors, and companies - respondents expressed an increasing urgency of sustainability challenges, with climate change topping their list, followed by biodiversity loss and water scarcity/pollution (GlobeScan and SustainAbility, 2020). Regarding protecting 30% of nature, The Nature Conservancy (2020, para. 3) added, "to be truly transformational, these commitments must involve key officials from finance, planning, transportation, energy and agriculture - people who have the political and economic clout to drive transformational changes that interweave nature preservation throughout political and economic systems." This perspective can also be applied more broadly.

Biodiversity loss creates significant risks for companies as well as the economy (F&C Asset Management, 2004); however, these risks may seem hidden because they are more closely tied to supply chains and not fully considered in company decision-making (World Economic Forum, 2020). Reduced productivity of natural systems was identified to be the main business risk from biodiversity loss (Credit Suisse, 2021). "By realizing how [biodiversity]-loss is material to their operations and growth models, businesses can and must be a key part of the solution." (Khatri, 2020, p. 5) A key collaborator in efforts to protect biodiversity must include indigenous peoples in respect of their land rights as well as their land conservation management experiences (Cereceda, 2019; Schuster et al., 2019; UNEP-WCMC and IUCN, 2016).

United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC) and IUCN (2016) stressed the importance of protected areas for maintaining a healthy environment, conserving biodiversity, and respecting local cultures and communities. As described by Mace et al. (2018),

> Traditional biodiversity conservation interventions such as protected areas and species

> conservation planning remain crucial, but actions must also address major drivers of biodiversity loss and ecosystem change. … The business and finance sectors … have the potential to become drivers of positive change. Their reach is global and their decisions can address biodiversity impacts across the entire value chain and in all aspects of investment. (pp. 449-450)

Elkington (2020) considers this scaling up to be a structural and global transformation. As with previous structural transformations, the financial system would need to play a major role in this process and its full potential would need to be harnessed to serve as an engine in the global economy's transition toward sustainable development. Foll (2019) stressed investors need to be concerned about biodiversity loss:

> For investors, biodiversity loss represents a risk to investment returns. For instance, companies which harm biodiversity through their activities will likely have to take on the punitive costs imposed on them because of their practices which harm the environment. In addition, firms which rely on biodiversity - food, materials, medicines - for their success will see their options and opportunities diminished. (p. 4)

Similarly, Credit Suisse (2021, p. 9) contended that the investor community needs to play a large role to limit biodiversity loss - "Private finance flows to projects and solutions supporting biodiversity need to be massively scaled up to meet global targets." A majority of investor respondents to a Credit Suisse (2021) survey believed that biodiversity will need to be addressed within 10 years and nearly 60% believed that biodiversity will need to be addressed within the next 2 years, which was characterized by the authors as a sense of urgency. Deutz et al. (2020) also expressed a sense of urgency to scale up finance for nature and biodiversity in the near term. However, "most [investors] have not yet assessed the impacts of their investments on biodiversity or set measurable biodiversity-linked targets." (Credit Suisse, 2021, p. 51) Furthermore, very few financial institutions consider deforestation as a material risk to their financial performance." (Tropical Forest Alliance 2020 and World Economic Forum, 2018, p. 10) However, "As the need to address biodiversity loss, climate change and ecosystem stability become more urgent, it's more important than ever that investors turn their attention to mitigating the risks deforestation poses to individual companies' supply chains and to their portfolios overall" (Waxman, 2020).

According to the World Economic Forum (2019):

> Investor action can enable transparency and support long-term decarbonization plans. Investors can coordinate to define and apply standards for disclosure and reporting. Even more importantly, they can increase scrutiny on long-term climate risks and opportunities, and incentivize asset managers to set long-term targets and strategies towards net-zero emissions. (p. 16)

Stakeholders, including the public, consumers, company employees, and investors, are urging companies to move faster. As an example,

> Growing public concern about the contribution of forest loss to climate change and

> biodiversity decline has spurred new initiatives by private sector actors to eliminate deforestation from their operations and supply chains. These efforts include the adoption of aspirational goals by single companies or coalitions of actors, corporate codes of conduct and sustainability standards that, in some cases, are implemented through certification schemes and moratoria (Lambin et al., 2018, p. 109).

In addition, according to Nestlé (2021b, p. 66), "As a leading food and beverage company, our consumers, customers, investors and stakeholders expect us to take the lead and contribute positively to the resilience of our environment and communities."

As Dasgupta (2021) pointed out, conservation is less costly than restoration, *ceteris paribus*. Indeed, to reduce the gap between the global ecological footprint and the biosphere's regenerative rate, investment in Nature through conservation and restoration is needed to increase the stock of Nature as well as its regenerative rate.

8.2 Government role

In addition to actions that companies can take, "There is a whole suite of possible conservation tools that governments can implement to protect biodiversity while benefiting from the land, including protected areas, national parks, community conservancies and indigenous-managed conservation areas" (Price, 2020a, para. 15).

Governments do not need to rely solely on environmental legislation and regulations. They can also undertake the following:

- provide market signals, support, clarity, and certainty;
- provide incentives, technical assistance, funding, and convening role;
- establish public/private partnerships;
- collect data;
- share leading practices;
- develop or support the development of consensus-based standards;
- develop national metrics in addition to or alternative to the gross domestic product (GDP, e.g., to measure well-being);
- raise public awareness (e.g., the importance of protecting and restoring biodiversity, the interconnection between the environment and well-being);
- identify critical habitats;
- protect lands;
- etc.

Similarly, Scrase et al. (2009) identified three key functions of government to bring about system-level changes, led by a critical mass of key stakeholders: enabling markets where there are market failures, strategic governance to guide system-level transformations, and

building pathways to facilitate visions. Governments can also be collaborators when facing environmental challenges with companies and also across countries when appropriate by setting and working together to achieve global goals that are of mutual interest (e.g., the SDGs, the CBD targets and milestones, and the Paris Agreement) and that are necessary to thrive and flourish. Multi-country, international agreements also inform and send signals to the marketplace, help ensure greater consistency across countries, and identify direction and timetable to seek greater transformational change.

Governments can also learn from the private sector, e.g., how their supply chains work and the most effective ways to influence and/or incentivize improvements in them. Focusing on supply chains will be critical to achieving the elimination of deforestation, climate change goals, and other sustainability goals.

In addition, there is an often-used adage applied to business - what gets measured gets managed. There is a disconnect between the GDP and environmental impacts such that while global GDP is projected to increase through 2050 (e.g., quadruple between 2010 and 2050 - OECD, 2012), loss of species and biodiversity and the spread of emerging infectious diseases are increasing as well as their consequences. Since the environment is a key contributor to quality of life, it should be included in a national measure to provide an indicator of well-being (Smith et al., 2013). This measure could be applied at the national level, i.e., measure a country's well-being, or quality of life, to motivate the country to improve it. Furthermore, what is measured also influences the policies that are undertaken, resources expended, and actions taken (Allgood et al., 2016).

The private sector can urge countries to take on a greater role. For example, the Alliance for the Preservation of Forests (2021), which includes companies like Nestlé and Unilever that are committed to zero deforestation, requested the European Union to fight against importing products that cause deforestation. In addition, Unilever (2020d) made a specific request:

> The race to zero must be a collective effort, and business alone cannot drive the transition at the speed that is required. We call on all governments to set ambitious net-zero targets, as well as short term emissions reduction targets, supported with enabling policy frameworks such as carbon pricing (para. 7).

More than 1,100 companies have joined with Business for Nature and called on governments to adopt policies by 2030 to reverse nature loss (as of July 7, 2022) (https://www.businessfornature.org/call-to-action#CTA-signatory-list). Furthermore, the World Business Council for Sustainable Development (2010) supported a more consistent and effective integration of biodiversity and ecosystem values into policy and regulation.

GlobeScan and SustainAbility (2020) reported the perceptions of sustainability experts regarding contributions to sustainability and they ranked the performance of national governments the lowest of the organizations considered - this ranking has not changed since 2012 and this perception has not changed much; their view of the private sector's contribution has been trending down since 2018 as has multi-sectoral partnerships/ collaborations. There has been an upward movement in the experts' perceptions of the

contributions of institutional investors since 2019 (the year this organization was added to the survey) and NGOs.

To further emphasize the important role of government, Bloomgarden (2021) makes the case that ending tropical deforestation is a business and economic imperative and that there is no solution to the climate crisis that cannot include ending tropical deforestation. To do so, effective public policy is needed and governments possess the tools and authority to address the fundamental drivers of tropical deforestation.

Recognizing the importance and imperative of sectors working together, IPBES (2019, p. 33) stated "Goals for conserving and sustainably using nature and achieving sustainability cannot be met by current trajectories, and goals for 2030 and beyond may only be achieved through transformative changes across economic, social, political and technological factors." Similarly, Ervin (2020) proposed a bold course of action:

> "We must act as one planet to solve our biodiversity crisis by crafting a bold, coordinated, comprehensive plan. … It is time for a Marshall Plan for nature, one that sufficiently invests in the protection, restoration and sustainable management of biodiversity, and that repositions nature at the heart of sustainable development (pp. 5-6).

9. Concluding Remarks

With the global megatrends showing dramatic changes in population and demographics that have spurred further global megatrends of losses in animal and plant species and biodiversity, there has been a call to action to reverse these impacts through protection and restoration efforts. The role of the private sector will be critical to these efforts.

Governments, consumers, and investors are increasingly applying pressure on companies to restore natural capital (World Economic Forum, 2021). Ceres (2021) made a strong case for why companies, governments, investors, and civil society need to collaborate to decouple growth from resource consumption and environmental impacts for a more sustainable future, bring resource use and environmental impacts within proposed planetary boundaries that have been exceeded, develop regenerative systems, and spur forth a culture of safe and circular (McDonough and Braungart, 2002) and a commitment by companies to become resource positive in their roadmap to 2030. Kashmanian et al. (2011) considered being restorative as perhaps the ultimate sustainability step for a company. This article highlights transformational goals and/or actions made by several companies that if combined could represent the additional type of action and collaboration efforts needed by more companies to hold the line on environmental impacts, restore key habitats, and help pull the Earth system at least back within planetary boundaries.

These transformational goals need to support and move toward a company's vision. Similarly, it is also important for such a company's vision to reflect a transformational outlook or future. Zenger et al. (2009) provided clarity in anticipating the successful likelihood of transformational change and moving away from business-as-usual –

> Visions of the preferred future can easily be created, but they are then injected into an existing organization with its current systems, policies, procedures, and behavioral norms. It is very unreasonable to believe that the new vision will survive in an environment that was not created to sustain it (pp. 125-126).

That is, the vision should not be "bolt-on" (Laszlo and Zhexembaryeva, 2011) but should reflect a systemic redesign or reimagining of a company's business model. A vision that does not reflect the realities of the past and projected global megatrends, such as those discussed in this article, is at best cloudy and at worse outdated and would not be expected to support transformational change. "As the understanding of boundaries and systems expands, so can the vision of the sustainability plan" (Polman and Winston, 2021, p. 102).

Furthermore, Grayson et al. (2018) advocated for a Regenerative Era and expected that this leadership among companies will be noticed within five years,

> characterized by commitments to the circular economy, including highly designed and efficient, fully closed-loop inputs and outputs. We also believe New Positive business models will emerge and apply full cost accounting to all business impact in the environmental, social, and economic spheres. A 'do no harm' mentality will soon feel highly antiquated, as expectations will be for leading companies to maximize their positive impacts with nearly zero downside. (p. 33)

It should be noted that over the past 10-20 years, there has been greater continuity and consistency in sustainability leadership from the private sector and civil society in the U.S. While this article has focused on companies who are among the leaders, it recognizes a leadership role is needed for a more continuous, consistent, and predictable basis from all segments of this ecosystem (i.e., industries inclusive of their supply chains, governments, investors, civil society, consumers) to collectively respond to the impacts from past and future projected global population, demographic, and environmental megatrends. That is, these segments need to lead together and accelerate their plans, actions, and pace (World Business Council for Sustainable Development, 2020). The urgency to work and lead together is recognized by Starbucks' CEO, Kevin Johnson (2020):

> Today, more than ever, the world needs leadership in environmental sustainability. We agree with the consensus of scientific experts who note that without drastic action from everyone - governments, companies and all of us as individuals - adapting to the impact of climate change in the future will be far more difficult and costly, taking a toll on our supply chains … (para. 6)

To this end, the article has relied heavily on public statements from companies. However, their words do not necessarily lead to actions. To assist in identifying these linkages, companies need to be more transparent in publicly reporting how they are progressing toward their goals. Furthermore, Ceres (2020) makes clear that a company's publicly-stated words need to be matched by its direct lobbying and the lobbying done on its behalf in policy advocacy.

Given the impacts from the past and projected future global megatrends, these company

words must be followed by actions. When looking over the 80 years covered in this article, equivalent to 3-4 generations, our collective thinking and values will need to change regarding understanding the impacts of our decisions and actions and how our decisions, actions, and values need to change if we are to collectively change our trajectory and the projected associated environmental impacts and consequences. As evident from this article, our value of biodiversity and relationship with and connection to nature need to significantly improve. It is important to note that it is estimated that over half of the world's GDP is dependent on nature and its services, exposing country economies to potentially significant risks from further nature loss (World Economic Forum, 2020). Ehrenfeld (2020, p. 152) stated, "A world without empathy and authentic action is a world without the possibility of flourishing".

When we consider the impacts of population growth, demographic changes, and the impacts of human actions (e.g., food production, overexploitation of species, development) on biodiversity, compounded with the interrelationship between climate change and biodiversity, there will need to be a decoupling of economic growth from environmental impacts through safe and circular cradle-to-cradle systems, elimination of waste (including in the food system), changes in food diets, a greater focus on adopting regenerative and/or more organic growing systems, etc. There will also need to be better metrics to determine baselines and assess performance and direction.

Along these lines, several companies have pledged to take dramatic, responsible actions; indeed, several companies have taken leadership roles to not only be transformational but also to scale up transformational change. Several organizations advocate for and support companies in their scaling-up efforts. Thus far over 360 companies have pledged that 100% of their electricity would be sourced from renewable energy and over 1,500 companies have set carbon emissions reduction targets (plus over 1,150 have made net-zero commitments) through the Science Based Targets initiative (as of July 7, 2022). As learned from summaries of efforts by several of the companies identified in this article, their transformation is aligned with their purpose-driven strategy and oftentimes they have reimagined their businesses going forward, including how their transformation ties in with an over-arching global goal.

However, given the scale of the past and projected future global megatrends, it will not be sufficient for only several companies to achieve waste-free, safe and circular, deforestation-free, zero-emissions, net-zero, absolute-zero, carbon-negative, climate-positive, forest-positive, regenerative, etc., status by a specified year. With the scale of environmental impacts over the past 50 years and projected over the next 30 years, such pledges may at best not harm or hold the line. Indeed, setting a 2050 goal, i.e., 30 or 35 years from when the goal was initially set, seems to demonstrate a less than full appreciation of the planetary warning signs that have been flashing. If these distant, long-term goals are kept in place, there will need to be milestones and public accountability. Alternatively, seeking improvements on a greater and more immediate time scale, such as carbon negative or forest positive by 2030, is necessary to reverse, repair, and restore at least some of what has been lost and help pull the Earth system within the proposed planetary boundaries. For example, eliminating or avoiding

deforestation is not the same as reversing past deforestation and restoring these forests, and indeed both will be necessary (World Economic Forum, 2021). Including intermediate milestones will also be critical to ensure that companies and collaborators stay on course, maintain the discipline to continue to change (Zenger et al., 2009), make adjustments, and be held accountable. These goals should not be viewed as endpoints but as part of a continuum to thrive and flourish.

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Disclaimer

The purpose of this article is to share information regarding connections between global megatrends and environmental impacts, as well as the role of companies in being among the leaders in transformational change and scaling up transformational change. The companies mentioned in this article do not constitute an all-inclusive list. The mention of companies does not imply verification of their claims.

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