Sustainable Inclusive Solutions

Dear Ms. Vanessa A. Countryman,

Secretary, Securities and Exchange Commission (SEC)

100 F Street NE, Washington, DC, 20549-1090

First of all, we would like to congratulate SEC for the initiative of including climate risks in the disclosure framework of public companies, in harmony with its mission of protecting investors interests in a sufficient and robust way.

However, we realize that the whole draft is based (even if this is not stated explicitly) in two false assumptions:

1) climate change is driven only by Green House Gases (GHG) emissions, when it is actually a consequence of GHG and water vapour concentration in the atmosphere; and the GHG concentration in the atmosphere is a result of two processes: a) GHG emissions, which has many other drivers beyond fossil fuels use; b) GHG capture (especially $CO_{2,}$, once carbon capture is part of the photosynthesis);
2) the only relevant GHG is CO_2, when there are others with a much bigger warming power, such as methane (20 to 80 times bigger, depending on the methodology) and nitrous oxide (296 times bigger).

These two assumptions ignore the scientific findings on the **major connections between climate change and biodiversity risks**, a topic for which deforestation (or destruction of other types of vegetation) is the most prominent example. In June 2021, the panels of scientists of UN Climate Change Convention (IPCC) and of the UN Convention on Biodiversity (IPBES) have published for the first time a joint report on the integration of climate and biodiversity issues, demonstrating how these two crisis need to be tackled together, both because of the risks of a separate approach (for example, renewable energies infrastructures that lead to more ecosystems destruction and

therefore reinforces climate change or at least does not mitigate it) and because of the enormous potential synergies. This UNEP-WCMC report published in 2020 illustrates that it's possible to associate carbon stocks areas with priority areas for biodiversity conservation targets, making it cheaper and faster to mitigate climate change and to prevent further ecosystems degradation.

Moreover, it is essential to remember that, besides GHG emissions resulting from the use of fossil fuels and from deforestation, there are many other sources of GHG emissions in the agriculture sector that must be considered as well.

We will explore both aspects in the next items.

1. The major importance of protecting natural sources of climate regulation (both for climate change mitigation and adaptation)

As it is now widely known, the most relevant driver of climate change (leading to the increase of average temperature in the planet) are Green House Gases (GHG) emissions, carbonic gas being the main one. However, in order to **reduce the concentration of GHG in the atmosphere**, it's necessary to address not only the sources of emissions (reducing them), but also the sources of capture (preserving them). Trying to mitigate climate change by only reducing emissions while at the same time continuing to destroy the natural sources of carbon capture (or carbon sinks) is equivalent to intend increasing the profits of a company by only increasing sales, while the expenses are also increasing – mathematics tells us that is not possible.

Hence, in order to include all the relevant factors in climate change mitigation, it's essential to focus **not only on GHG emissions**, but also on the natural sources of climate regulation, either through **carbon capture** (forests, wetlands, mangroves and oceans) or through other climate balance functions, such as the influence that forests have in the hydrological cycle through the **rainfall regime** [1]. And deforestation itself is a major source of Green House Gases (GHG) emissions, because it releases the stock of carbon that was stored in the soil and on biomass, and contribute to biodiversity loss.

[1] See, for example: "Forests, atmospheric water and an uncertain future: the new biology of the global water cycle": https://forestecosyst.springeropen.com/articles/0.1186/s40663-018-0138-y and also this study analysing the effects of Amazon deforestation, a pattern that might be valid for other tropical forests globally: https://d2ouvy59p0dg6k.cloudfront.net/downloads/the_future_climate_of_amazonia_report.pdf

Actually, climate is not only about GHG concentration in the atmosphere, but also about water vapor, which is another subproduct of photosynthesis, as much as oxygen. In Brazil, for example, it has been proved scientifically that the water vapor of the Amazon forest even "travels" for thousands of kilometers, directly affecting the rainfall regime in other regions of the country – a phenomenon that has been named "flying rivers". [2]

Conversely, regarding climate change adaptation, natural assets are able to provide a lot of **resilience to extreme weather events** – for example, forests with regards to landslides caused by storms in hills, and mangroves, that act as storm buffers for coastal communities [3]. They act like a green infrastructure [4].

Also, given the fact that climate change significantly increases water risks, any factor that affects **freshwater availability** (and hence also human health and food security) might be included in the concept of climate change relevant issue.

So, it's possible to distinguish, first, three main climate change relevant drivers:

a) **GHG emissions** (deriving both from fossil fuels use and deforestation, the latter being responsible alone for 25% of GHG emissions, once the carbon stored is emitted);
b) **carbon sequestration reduction** derived from nature degradation/destruction (oceans, forests, wetlands, mangroves, grasslands, savannas, etc) – a lasting effect;
c) **decrease in rainfalls** caused by deforestation.

Despite the extraction, production and use of fossil fuels receive most of the attention when dealing with climate change mitigation, the preservation and restoration of forests affects it in all three ways and also avoid negative impacts from extreme weather events (such as storms). And other ecosystems are also relevant because they capture carbon (mangroves, for example, capture four times more carbon than forests

[2] "Flying rivers are air currents that bring water vapour from Amazonia, in the equatorial zone of Northern South America, down as far south as Northern Argentina. The humidity carried by these "airborne rivers" is responsible for much of the rain that falls in the Centre-West, Southeast and South of Brazil." <http://riosvoadores.com.br/english/the-flying-rivers-phenomenon/>
[3] See, for example: https://www.conservation.org/act/share-the-facts-about-mangroves
[4] Green infrastructure is the hard infrastructure that emphasizes the use of natural ecological systems instead of concrete and steel. SAUNDRY, Peter and RUDDELL, Benjamin, in: The Food-Energy-Water Nexus (2020). Springer Nature.

and wetlands have been considered the most powerful carbon sinks [5], even more than mangroves), while some also increase the resilience to extreme weather events (again, mangroves).

Secondly, there are relevant **climate change adaptation factors**, that might affect the intensity of climate change effects (these effects include more floods in certain places and more droughts in others, decrease in food production due to extreme weather events, destruction of infrastructure and subsequent disruption of supply-chains), water scarcity being one of the most relevant ones [6]:

a) freshwater excessive use (a relevant input for many industries) or rivers pollution increase the **severity of water stress**;
b) the preservation of mangroves and forests increase the **resilience to extreme weather events**;
c) some agriculture techniques (like monoculture) increase the **risks of soil erosion**, while others (such as cultures rotation) decrease.

And it's important to highlight that **climate change adaptation needs to receive as much attention as mitigation**, once, as insurers already know, it's no longer a future phenomenon – the frequency and intensity of extreme weather events are already increasing every year in the last decade due to the temperature increase and sea-level rises (and subsequent land loss) have happened all over the world in coastal areas.

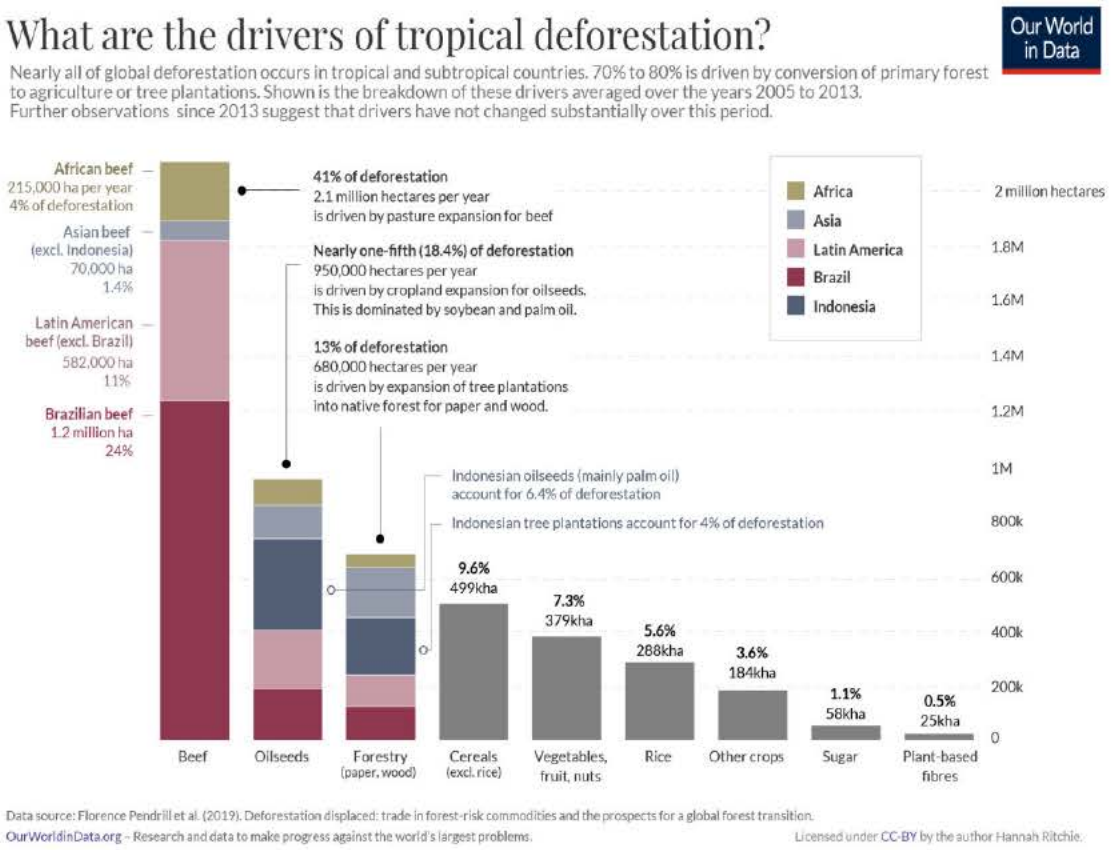
Furthermore, the preservation and restoration of ecosystems brings the additional advantage of conserving biodiversity, an environmental issue that has progressively been recognized as urgent and largely relevant, leading to the creation of the Taskforce on Nature-related Financial Disclosures (TNFD) [7].

2. Agriculture, deforestation and forest degradation: the destruction of natural climate regulation

[5] See, for example: https://www.ramsar.org/news/wetlands-crucial-in-addressing-climate-change-0 and also: https://royalsocietypublishing.org/doi/10.1098/rsfs.2019.0129
[6] See, for example, the case of Brazil, where droughts respond per more than 90% of the climate change related events, according to the World Bank country profile.
[7] See more information on: <tnfd.info>

According to data of FAO (Global Remote Sensing Survey) published during COP 26, agricultural expansion drives almost 90% of global deforestation. Moreover, the vast majority of the deforestation take place in tropical biomes.

This study on Drivers of Deforestation published in "Our World in Data" shows that 60% of tropical deforestation is driven by beef, soybeans and palm oil:



Other commodities that are relevant drivers of deforestation are pulp and paper and rubber. At the Congo River basin, for example, according to Forest and Finance data, most of the forest-risk commodity finance goes to timber and rubber.

In absolute figures, the table below illustrates where we are losing more forests:

Top 10 countries for primary forest loss in 2020

Country	Hectares of primary forests lost
Brazil	1,704,090
Congo	490,613
Bolivia	276,883
Indonesia	270,057
Peru	190,199

Colombia	166,485
Cameroon	100,295
Laos	82,240
Malaysia	72,977
Mexico	68,423

Source: https://research.wri.org/gfr/forest-pulse

In South America, 75% of deforestation is due to livestock grazing and, together with Africa and Southeast Asia, it is one of the three key areas where deforestation rates are highest globally. As we can see above, livestock (mainly **beef**) appears as the top key deforestation driver, accounting for about 40% of deforestation alone – and that is without full life-cycle assessment, which would also consider all physical inputs and outputs of agricultural crops (soybeans and corn) used as animal feed. The table below illustrates which are the largest global producers of beef.

Country	Million tons of beef
USA	12,6
Brazil	10,4
European Union	7,7
China	7,0
India	4,0
Argentina	3,1
Mexico	2,1
Australia	2,1
Global total	58,2

Source: USDA (2021)

In Brazil, deforestation for the expansion pasture areas is closely related with land tenure issues, since cattle ranching is used as a way to illegally grab public lands. Some recent data [8] show that deforestation in Amazon increased 56,5% in the period 2019-2021, compared to 2016-2018. Public lands (83% of which from the federal domain) concentrated 51% of deforestation in this period.

Another key driver of deforestation is the production of the cereal that is most commonly used as animal feed: **soybeans**, whose major global producer is Brazil. But

[8] Destinação de Florestas Públicas - um meio de combate à grilagem e ao desmatamento ilegal na Amazônia [Destination of Public Forests – a way to combat land grabbing and illegal deforestation in Amazon]: https://amazonia2030.org.br/wp-content/uploads/2022/03/AMZ2030_30.pdf (in Portuguese)

other South American countries (Argentina, Paraguay and Bolivia) are also among the top 10 producers (see table below), while Brazil has the highest deforestation rates, and Bolivia is also included among the top 10 countries in terms of deforestation area, despite its relatively small territory.

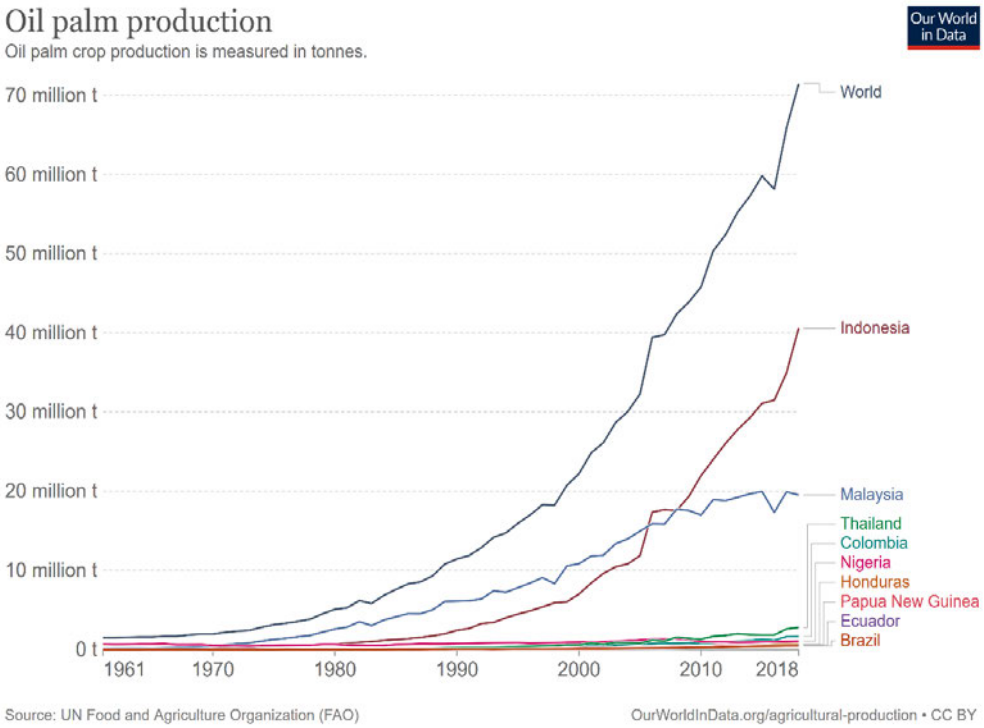
Country	Tons of soybeans
Brazil	121,797,712
USA	112,549,240
Argentina	48,796,661
China	19,604,447
India	11,226,000
Paraguay	11,024,460
Canada	6,358,500
Russia	4,307,593
Bolivia	2,829,356
Other countries	14,814,966
Global total	353,308,935

Source: FAOStats (2020)

Regarding palm oil, while "(s)*mall amounts of palm oil are grown in many countries, but the global market is dominated by only two: Indonesia and Malaysia. In 2018, the world produced 72 million tonnes of oil palm. Indonesia accounted for 57% of this (41 million tonnes), and Malaysia produced 27% (20 million tonnes). 84% of global palm oil production comes from Indonesia and Malaysia.*" [9] Other producers (included in the top ten) are Thailand, Nigeria, Brazil, Colombia, Ecuador, Guatemala, Honduras and Papua New Guinea – and all this palm oil is exported to food manufacturers all over the world, which illustrates the need to manage climate risks along all the value-chain (and certainly starting with the supply-chain).

It's interesting to observe that the deforestation linked to palm oil started to grow steadily in the 1980's. "*The story of palm oil is less about it as an isolated commodity, but more about the story of the rising demand for vegetable oils. Palm oil is a very productive crop; as we will see later, it produces 36% of the world's oil, but uses less than 9% of croplands devoted to oil production.*" [10]

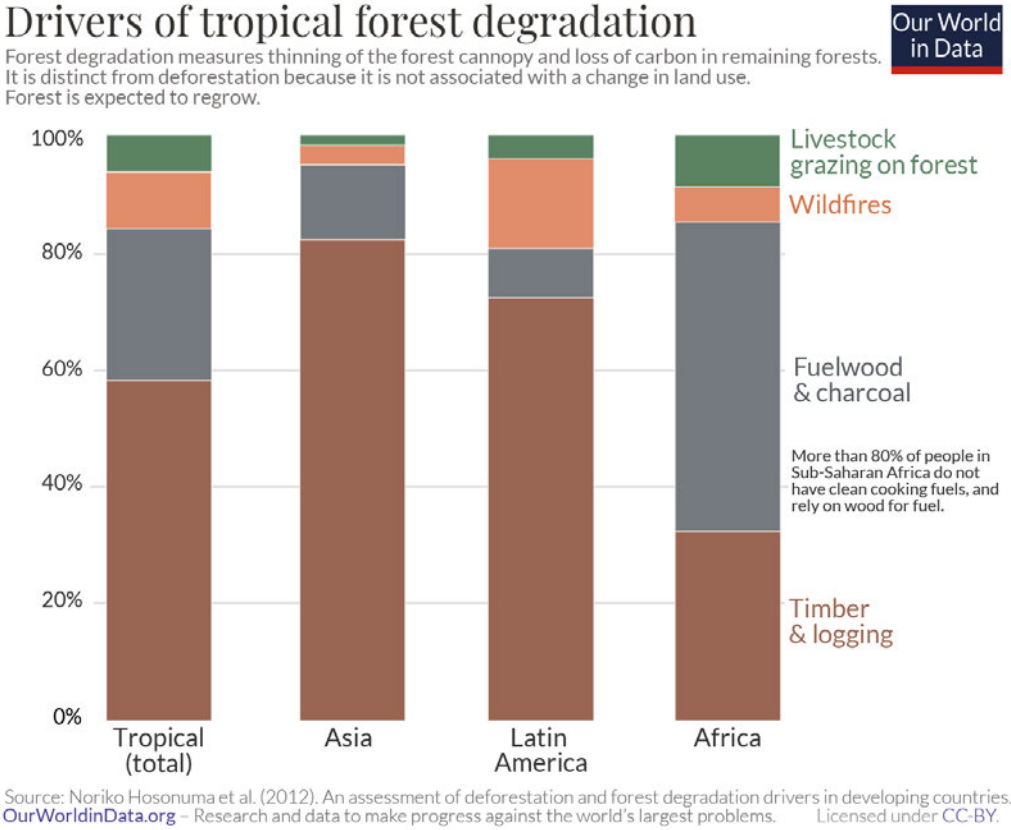
[9] https://ourworldindata.org/palm-oil
[10] https://ourworldindata.org/palm-oil



Moreover, regarding deforestation, it's relevant to point out too that wildfires and human-caused fires are responsible for 10 to 15% of GHG emissions globally [11] - and the frequency and scale of wildfires is increasing exactly because of climate change, in a spiral effect.

As for forest degradation (and sometimes also deforestation, when logging is followed by livestock grazing, for example, as it is common in the Amazon), another key commodity is **timber**, which is not accounted as a deforestation driver because the final use is not timber extraction, but it is the first commodity extracted from deforested areas.

[11] See, for example, this piece of researchers from the University of Houston: <https://www.uh.edu/news-events/stories/2022-news-articles/february-2022/02152022-deforestation-peatland-fires.php>



The global trade of **timber** is a multibillion-dollar industry that figures high in the forest degradation ratios much due to the large variety of uses for wood in the rough and processed wood products, such as in construction, paper, packaging, biomass and sold as furniture or textiles. The latest available Food and Agriculture Organization of the United Nations statistics[12] (FAO, 2020) presented below help to grasp the size and relevance of that commodity worldwide.

[12] Food and Agriculture Organization of the United Nations (FAO) statistics are displayed by material origins (from wood in the rough; from wood processing; from recovered wood), emphasizing the countries that most contribute to each category, by their share of the global year production. It's important to keep in mind that, if 3% might seem like a small share, it's in no way a small impact to the forests. Take, for example, the wood product with the smallest global production in the 2020 numbers presented, wood pallets and other agglomerates, 3% of the global 50 million tonnes produced mean, for instance, that Austria, Poland and Stonia each produced at least 1.500.000 tonnes during that year. As for industrial roundwood, by far the most produced wood product in the planet (only closely followed by wood fuel), totaling 1.984 million tonnes in 2020, Germany and Finland each produced 3% or 59.520.000 cubic meters in 2020. When it comes to climate or biodiversity impacts, total amounts are one aspect to be put into perspective with regards to other data and realities, which might mean, for example, that even an apparently s 3% of the global share production might result in a big impact both climate and biodiversity wise, if that yearly production happens in a country small in size and/or in forest cover, or rich in endemic biodiversity (native and restricted to a certain place), or is summed to other deforestation vectors locally present, and so forth.

Global production and trade in forestry products in 2020				
Forestry Product	**Unit**	**Global Production**	**Global Exports**	**Major Producers**
Roundwood	**million m³**	**3 912**	**140**	
Wood fuel	million m³	1 928	6	India (16%); China (8%); Brazil (6%); Ethiopia (6%); Dem. Republic of Congo (5%); Nigeria (3%); USA (3%).
Industrial roundwood	million m³	1 984	134	USA (19%); Russia (10%); China (9%); Brazil (7%); Canada (7%); Indonesia (4%); Sweden (4%); Germany (3%); Finland (3%).
Wood pellets and other agglomerates	**million tonnes**	**50**	**31**	USA (17%); Canada (8%); Germany (8%); Russia (7%); Vietnam (7%); Brazil (6%); Latvia (5%); Sweden (4%); France (3%); Poland (3%); Estonia (3%); Austria (3%).
Sawnwood	**million m³**	**473**	**153**	China (18%); USA (17%); Russia (9%); Canada (8%); Germany (6%); Sweden (4%).
Wood-based panels	**million m³**	**367**	**88**	China (44%); USA (9%); Russia (4%); Germany (3%); India (3%); Canada (3%); Brazil (3%); Poland (3%).
Wood pulp	**million tonnes**	**186**	**69**	USA (26%); Brazil (11%); China (9%); Canada (8%); Sweden (6%); Finland (5%); Russia (4%); Indonesia (4%); Japan (4%); India (3%); Chile (3%).
Recovered paper	**million tonnes**	**229**	**45**	China (24%); USA (18%); Japan (8%); Germany (7%); Republic of Korea (4%); United Kingdom (3%); France (3%).
Paper and paperboard	**million tonnes**	**401**	**111**	China (28%); USA (17%); Japan (6%); Germany (5%); India (4%); Republic of Korea (3%); Indonesia (3%); Brazil (3%).
Forest products value	**US$ billion**		**244**	

Source: FAOSTAT-Forestry database (2020)

Timber extraction, which is relevant in all the main three tropical forests basins (South America, Africa and Southeast Asia), is linked to very high rates of illegality, as described in the mentioned FAO report:

> "Ensuring the legality of timber production and trade, and strengthening forest governance, are crucial for tackling deforestation. The International Criminal Police Organization (INTERPOL) estimates that the value of illegal timber trade lies in the range of USD 51–152 billion per year. [59] The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) promotes the sustainable trade

of approximately 300 timber species that are at risk of overexploitation through sustainability and legality standards. Demand-side commitments to legality, such as those made by both producer and consumer countries within the framework of the FAO-EU Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan and associated bilateral Voluntary Partnership Agreements (VPA) processes, have shown that trade is an effective tool for incentivizing governance reforms to promote legal and sustainable forest management and economic development. Furthermore, demand-side legislation, including the European Union Timber Regulation (EUTR) and import regulation, the United States' Lacey Act Amendment, Japan's Clean Wood Act and the Republic of South Korea's Act on Sustainable Use of Timber, among others, shape a global trade environment where the legality of timber imports must be demonstrated.

Voluntary certification is also a valuable tool and already covers more than one third of industrial roundwood production.[60] Progress in addressing illegality requires continued commitments to transparency and to eliminating corruption, as well as adequate and predictable funding for enforcement. Effective law enforcement depends critically upon understanding and responding to the needs of indigenous peoples and local communities.[61]"

[Footnotes refer to Mitsugi, H. & Ikram Yaakob, M.S. 2018. Co-chairs summary report. Paper presented at CPF International Conference *Working across sectors to halt deforestation and increase forest area. From aspiration to action.* 14 March 2018, Rome, Collaborative Partnership on Forests]

Banks and institutional investors of course play a major role, since, without financing [13], large-scale forest exploitation operations wouldn't be commercially feasible, because they require capital to buy equipment and machinery and to pay the costs of harvesting, processing and transporting to the markets. Analysis published by

[13] *"[…] Banks serve as important players in the trade of products produced by forest-based industries. They provide, among other things, credit for trade, letters of credit to guarantee payment of trade, facilities for discounted trade credit and other short-term financing instruments. Without bank financing, forest-based industries could not work their way into the equity and bond markets that allow them access to long-term financing.*
One approach to reducing illegal deforestation and unsustainable forestry activities is to target the financial actors involved.
A review of data on issuances of securities (debt and equity) to companies in Southeast Asia between 2013 and 2021 found that the forest and pulp/paper sectors in China and Japan dominated financing activities. […]"
Source: SCOTT, George. Banking On Sustainable Timber: What Role Do Banks Play? UN-REDD Programme. <https://www.un-redd.org/multi-media-stories/banking-sustainable-timber-what-role-do-banks-play> 2021

the UN-REDD Programme points out that, given the extent of illegal logging and illegal conversion of forest lands, exposure to companies that operate within wood products supply-chains is a risk for banks and investors, as the underlying companies face potential operational risks from disruption to supply and price changes. These companies represent both credit and reputational risks, meanwhile banks themselves face reputational risks in a global market where customers value the integrity of their banks, not to mention legal risks resulting from banking regulations and anti-money laundering laws [14].

In the European Union, alongside the EU Legal Timber Regulation, the "Amsterdam Declaration" Towards Eliminating Deforestation from Agricultural Commodity Chains with European Countries, signed in December 2015 by major economies (UK, France and Germany) and also by some of the most advanced ones (Denmark, Netherlands and Norway) was the pioneer global initiative from governments. Nonetheless, the upcoming UK legislation on forest-risk commodities tackling illegal deforestation in supply-chains and the US-China Joint Statement on Enhancing Climate Action in the 2020s are clear signs of rising market risks for producers of these commodities, representing credit risk for banks and financial risks for investors who have them on their portfolios.

However, it is important to highlight, as pointed out by the research report of Our World in Data on Deforestation and Forest Loss, that only about 14% of deforestation is driven by consumption in rich countries (p. 11), once about **71% of deforestation-linked timber is for domestic production (p. 19), which makes clear that, with regards to credit, the involvement of banks from producing regions is relevant** to any initiative that aims to have a positive relevant impact on reducing deforestation and forest degradation.

At corporate-level, the "New York Declaration on Forests", that aimed to eliminate deforestation from relevant agricultural commodities (such as beef and leather, palm oil, soy, pulp and paper, cocoa and rubber) by 2020, fell short of achieving its targets [15], but new commitments have been made recently during COP 26, in order to pursue climate goals.

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[14] SCOTT, George. Banking On Sustainable Timber: What Role Do Banks Play? UN-REDD Programme. 2021: <https://www.un-redd.org/multi-media-stories/banking-sustainable-timber-what-role-do-banks-play>

[15] A five-year assessment report was published in September 2019 – its sub-title is self-explanatory: "A Story of Large Commitments yet Limited Progress".

Last but not least, it is interesting to observe the latest developments of the Network for Greening the Financial System (NGFS), which is expanding its focus from climate risks to biodiversity risks, making it very likely that deforestation risks will soon come to the top of banking regulators agenda.

3. Agriculture and GHG emissions from key operations

Although deforestation is one of the major key drivers of **climate change** arising from a few agriculture/forest commodities, it is important to emphasize that GHG emissions of the production of the same commodities also have other very relevant causes, such as:

- enteric fermentation (this is a part of cattle digestive process that emits methane, a GHG whose warming power is more than 20 times higher than CO_2 [16]) – in Brazil, the methane emissions caused by beef production are **equivalent to deforestation emissions**;
- use of nitrogen fertilizers – the use of these fertilizers emits nitrous oxide, a GHG with a warming power 296 times higher than CO_2 [17]; in Brazil, for example, the use of industrial fertilizers is responsible for about 3,5% of agriculture's emissions [18]; anywhere, this use is a key driver of freshwater and oceans pollution, increasing the risks of water scarcity, one of the most severe impacts of climate change;

[16] "The sector emits 37 percent of anthropogenic methane (with 23 times the global warming potential (GWP) of CO_2) most of that from enteric fermentation by ruminants." FAO, *Livestock's long shadow: environmental issues and options*, 2009, p. xxvii. According to the Environmental Defense Fund, actually, the warming power is 80 times bigger in the first 20 years after the emission, while the effects of carbon emissions last longer: https://www.edf.org/climate/methane-crucial-opportunity-climate-fight

[17] "It emits 65 percent of anthropogenic nitrous oxide (with 296 times the GWP of CO2), the great majority from manure. Livestock are also responsible for almost two-thirds (64 percent) of anthropogenic ammonia emissions, which contribute significantly to acid rain and acidification of ecosystems." FAO, *Livestock's long shadow: environmental issues and option***s**, 2009, p. xxvii. Nitrous oxide "is 296 times more effective than carbon dioxide in trapping heat and has a very long atmospheric lifetime (114 years)." FAO, *Livestock's long shadow: environmental issues and options*, 2009, p. 82.

[18] Source*: Modelagem setorial de opções de baixo carbono para Agricultura, Florestas e Uso do Solo (AFOLU): Opções de Mitigação de Emissão de Gases de Efeito Estufa em Setores-Chave do Brasil* (Sector modelling of low carbon options for Agriculture, Forests and Land Use). UNEP and Brazilian Ministry of Science, Technology and Innovation, Brasília, 2017, p. 253. https://www.lagesa.org/wp-content/uploads/documents/MCTIC%2017%20Setor%20AFOLU2o Opcoes .pdf (in Portuguese).

- animal waste management – even if not the most relevant in terms of GHG emissions, animal waste also affects freshwater quality and therefore increase water risks;
- some agriculture commodities cultivation and effluents/waste management, such as palm oil, whose cultivation has been growing for a few decades.

The same is true for palm oil, as pointed out in the life cycle assessment carried out by a Danish consultancy in 2019 for a major palm oil producer in Malaysia:

> "The contribution to global warming (not including iLUC) from 1 kg NBD palm oil produced in United Plantations in 2018 is 1.22 kg CO2-eq. **The major part of the contribution originates from the oil palm cultivation stage where the main contributors are field emissions of CO2 from oxidation of peat soils and N2O**. The major contribution in the oil mill stage is CH_4 from anaerobic digestion of palm oil mill effluents (POME).
>
> When iLUC is included, the total contribution to GHG emissions is 1.55 kg CO_2-eq. per kg NBD palm oil. iLUC is a significant contributor to GHG emissions" [19]. (our highlights)

A previous scientific article, with life-cycle analysis showing GHG emissions of palm oil production in two different models [20], identifies many other relevant sources of emissions, and also air pollution (with impacts on biodiversity):

> "The production of 1 t crude palm oil requires 5 t of fresh fruit bunches (FFB). On average processing of 1 t FFB in palm oil mills generates 0.23 t empty fruit bunches (EFB) and 0.65 t palm oil mill effluents (POME) as residues.
> […]
> The production and treatment of 1 t FFB causes more than 460 kg CO_{2eq} in the worst case scenario and 110 kg CO_{2eq} in the best case scenario. **The significant**

[19] The report clarifies the definition of "indirect land use change": "Since the cultivation of oil palm takes place on already cleared land, it is not associated with any direct land use changes, i.e. land use changes that take place in the oil palm field – except at replanting which is not associated with impacts because it involves conversion from oil palm to oil palm. However, the use of land for oil palm contributes to the general pressure on land, leading to land use changes somewhere else. This is referred to as indirect land use changes (iLUC). This study covers iLUC by means of a model documented in Schmidt et al. (2015) and Schmidt and Muñoz (2014). This model considers that demand for land leads to two main effects: conversion of land (land use changes) and intensification of land already in use – both effects are associated with GHG emissions." Available at: <https://lca-net.com/files/UPB-LCA-2019.pdf>

[20] STICHNOTHE, Heinz; SCHUCHARDT, Frank. Life cycle assessment of two palm oil production systems. *Biomass and Energy*. Vol. 35, Issue 9, Oct. 2011, p. 3976-3984, Elsevier. <https://doi.org/10.1016/j.biombioe.2011.06.001>

greenhouse gas (GHG) emission reduction is achieved by co-composting residues of the palm oil mill. Thus treating those residues appropriately is paramount for reducing environmental impacts particularly global warming potential (GWP) and eutrophication potential (EP).

Another important contributor to the EP but also to the human toxicity potential (HTP) is the biomass powered combined heat and power (CHP) plant of palm oil mills. Frequently CHP plants of palm oil mills operate without flue gas cleaning. The CHP plant emits heavy metals and nitrogen oxides and these account for 93% of the HTP of the advanced palm oil production system, of which heavy metal emissions to air are responsible for 79%." (our highlights)

4. Agriculture and biodiversity risks: further destruction of natural sources of climate regulation

In terms of **biodiversity/ecosystems integrity** (whose destruction is a key driver of climate change, as explained initially), there are other aspects (in addition to deforestation) that might be considered:

- fertilizers;
- use of water;
- use of antibiotics (for meat production);
- animal waste management (for meat production);
- use of pesticides;
- use of transgenic technologies (especially soy);
- use of limestone to adapt the Brazilian cerrado soil to the production of soy, leading to environmental degradation resulting from mineral extraction [21].

The use of industrial fertilizers causes severe impacts on biodiversity, especially freshwater and oceans. According to Rockström and others study on planetary boundaries, "[e]*utrophication due to human-induced influxes of nitrogen (N) and phosphorus (P) can push aquatic and marine systems across thresholds, generating*

[21] The Brazilian agency in charge of agriculture research (EMBRAPA) already identified potential alternatives to the use of limestone in this 1997 study: <https://www.embrapa.br/busca-de-publicacoes/-/publicacao/548579/avaliacao-dos-metodos-de-determinacao-da-necessidade-de-calcario-em-solos-de-cerrado>

abrupt non-linear change from, for example, a clear-water oligotrophic state to a turbid-water eutrophic state (Carpenter et al, 1999)" [22].

A comprehensive and deep study published by FAO in 2009 on the environmental risks posed by livestock (and options to mitigate them) demonstrated how high was the proportion of the total use of nitrogen fertilizers that was either for pastures (grassland) or for the production of animal feed, in countries that were large producers of beef (and this use was increasing, except only for Western European countries) [23]:

Chemical fertilizer N used for feed and pastures in selected countries

Country	*Share of total N consumption (percentage)*	*Absolute amount (1,000 tonnes/year)*
USA	*51*	*4,697*
China	*16*	*2,998*
*France**	*52*	*1,317*
*Germany**	*62*	*1,247*
Canada	*55*	*897*
*UK**	*70*	*887*
Brazil	*40*	*678*
Spain	*42*	*491*
Mexico	*20*	*263*
Turkey	*17*	*262*
Argentina	*29*	*126*

** Countries with a considerable amount of N fertilized grassland.*

Source: Based on FAO (2002; 2003)

It's crucial to mention the availability of a low-cost technology for soil fertilization, which is, at the same time, cheaper and do not cause environmental harm**:** **biological nitrogen fixation** (which is not even a recent technology anymore, but its use is not yet widespread).

[22] *Ecology and Society* 14(2): 32. p. 12. <http://www.ecologyandsociety.org/vol14/iss2/art32/>
[23] FAO, *Livestock's long shadow: environmental issues and options*, 2009, p. 87.

"*Nitrogen is an essential nutrient for plant growth and development but is unavailable in its most prevalent form as atmospheric nitrogen. Plants instead depend upon combined, or fixed, forms of nitrogen, such as ammonia and nitrate. Much of this nitrogen is provided to cropping systems in the form of industrially produced nitrogen fertilizers. Use of these fertilizers has led to worldwide, ecological problems, such as the formation of coastal dead zones. Biological nitrogen fixation, on the other hand, offers a natural means of providing nitrogen for plants. It is a critical component of many aquatic, as well as terrestrial ecosystems across our biosphere.*" [24]

With respect to water use, it's necessary to emphasize that **water scarcity is one of the most relevant effects of climate change in every region of the globe**. The latest IPCC report (Climate Change 2022 – Impacts, Adaptation and Vulnerability), a contribution of Working Group II to the 6th Assessment Report includes, in the summary for policymakers (p. 14):

"Risks in physical water availability and water-related hazards will continue to increase by the mid- to long-term in all assessed regions, with greater risk at higher global warming levels (high confidence)."

The topic gains relevance if we consider that agriculture uses 70% of freshwater globally (compared to 10% for domestic use and 20% for industrial use).

Moreover, livestock has a very relevant impact in water pollution, not only because of the use of fertilizers (already described), but also due to biological contamination (parasites in animals), use of pesticides for pastures, water waste of tanning, meat-processing, dairies and slaughterhouses' operations, heavy metals used in feed (such as copper, zinc, selenium, cobalt, arsenic, iron and manganese) and animal manure [25]. Other associated impact related to declining ecosystem health is the concentration of organic matter in water related to discharges of untreated sewage from large production facilities. The disturbance caused by these discharges can alter the biogeochemical composition of water bodies and cause declining indicators of quality for rivers, lakes and seas and cause large dead zones in marine ecosystems.

[24] Wagner, S. C.. (2011). Biological Nitrogen Fixation. *Nature Education Knowledge* 3(10):15 <https://www.nature.com/scitable/knowledge/library/biological-nitrogen-fixation-23570419/>

[25] FAO, *Livestock's long shadow: environmental issues and options*, 2009, Livestock's role in water depletion and pollution (p. 125-179). <https://www.fao.org/3/a0701e/a0701e00.htm>

Furthermore, the increasing use of antibiotics due to the expansion of intensive production in large processing facilities also has consequences on water quality and rising antibiotic resistance. The surge of superbacteria could lead to losses in the microbiota in soils, contamination in water and new diseases that could affect ecosystems' health. Castelo Branco, Albert and Romão (2021) [26] identified that there is a lack of information and monitoring related to antibiotic use by animal protein production facilities that could represent an emergent risk to public health.

Also, regarding biodiversity, pesticides are a factor of multiple and major concerns, negatively affecting:

a) soil [27] biota, leading to lower organic matter content and reduced water retention, the latter reducing yields in drought years, as well as reducing soil-dependent ecosystem services, such as carbon and nitrogen cycling, increasing codependence to fertilizers, in a negative feedback loop;
b) water pollution, eutrophication and degeneration of aquatic ecosystems, including coral reefs;
c) pest resistance and resurgence, this being true not only of fungicides, insecticides and bactericides, but also of herbicides, their many repeated applications requiring progressively increased amounts of chemicals, with decreasing efficiency to their usage.
d) crop vulnerability to change and stress, as key component of the simplified agricultural systems, resulting in much greater fluctuations in yield and creating liability to losses in production and food security;
e) biodiversity mortality and erosion, by causing the death of many non-target animals, vegetation and fish, including of plants in and around the agricultural production systems, having been linked to poor root hair development, shoot yellowing and reduced plant growth, landscape simplification and decrease in species diversity;

[26] "Emerging Pollutants: Antimicrobials in the environment, environmental education and the national and international regulatory aspect." <https://rsdjournal.org/index.php/rsd/article/view/17083>

[27] "Soil is a critical component of the natural environment – yet most people are totally unaware of, or underestimate, the vital role that soil biodiversity plays in the ecosystem services on which we depend. […] Soil hosts one of the largest reservoirs of biodiversity on Earth: up to 90% of living organisms in terrestrial ecosystems, including some pollinators, spend part of their life cycle in soil habitats…" WWF (2020) *Living Planet Report 2020 - Bending the curve of biodiversity loss.* Almond, R.E.A., Grooten M. and Petersen, T. (Eds). WWF, Gland, Switzerland. Available at: <https://www.zsl.org/sites/default/files/LPR%202020%20Full%20report.pdf>

f) pollination, for even the usage of very low levels of these chemicals have been found to cause orientation disorder and colony collapse disorder[28], a phenomenon that has been linked not only to decline in biodiversity, food yields, but also dietary deficiencies and related diseases.

With specific regards to pollination, it's noteworthy that this ecosystem service is essential to the production of approximately one third of global food supply, affecting the quantity, nutritional content, quality, and variety of foods available. According to a recent IPBES study, more than 75% of global food crop types, including fruits and vegetables and some of the most important cash crops, such as coffee, cocoa and almonds, rely on animal pollination[29]. The WHO and CBD study pointed out estimates that "*in 2005, the total economic value of pollination worldwide was €153 billion, equivalent to 9.5% of the value of the world agricultural production used for human consumption. In terms of welfare, the consumer surplus loss was estimated at between €190 and €310 billion (Gallia et al. 2009)".* The IPBES study evaluated that, by 2015, between US$235 billion and US$577 billion in annual global crop output was at risk as a result of pollinator loss. Beyond food, pollinators contribute directly to medicines, biofuels (e.g., canola and palm oil), fibers (e.g., cotton and linen), construction materials (timber) and cultural expressions [30]. The global decline of both pollinator species diversity and number of pollinators results from habitat loss, land conversion, intensive agricultural management, pesticides, environmental pollution, invasive species, pathogens and climate change.

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[28] "It has been estimated that farmers in the United States (US) lose at least $200 million a year from reduced crop pollination because pesticides applied to fields eliminate about a fifth of honeybee colonies in the US and harm an additional 15% (Tyler Miller 2004). Henry et al. (2012) found that, even with very low levels of the pesticide thiamethoxam, a neonicotinoid insecticide, in the bee's diet a high proportion of bees (more than one third) suffered from orientation disorder and were unable to come back to the hive, putting the colony at risk of collapse (colony collapse disorder) (see also Whitehorn et al. 2012). The pesticide concentration was much smaller than the lethal dose currently used, and its application, together with clothianidin and imidacloprid, was restricted by the European Union in April 2013 (Wall Street Journal 2013)." UNEP, CBD, WHO. *Connecting Global Priorities: Biodiversity and Human Health: a State of Knowledge Review.* 2015. Available at: <https://www.cbd.int/health/SOK-biodiversity-en.pdf>

[29] IPBES (2019): *Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. <https://ipbes.net/sites/default/files/inline/files/ipbes_global_assessment_report_summary_for_policymakers.pdf>

[30] IPBES (2016): *Summary for policymakers of the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production*. Available at: <https://zenodo.org/record/2616458#.YialjujMLIU>

Pesticides, nevertheless, have long been considered a major culprit in pollinators decline. The information gaps are particularly worrisome, because most pesticides disperse freely through the environment and potentially bioaccumulate, and other mentioned adverse environmental effects add up, creating negative synergistic and cascading effects.

The mentioned risks also connect directly to agricultural genetically modified organisms (GMO), like soy, corn, cotton, sugar cane, eucalyptus and others, since most of them are specifically engineered for pesticide tolerance or insect resistance. Studies [31] show that not only the intensive pesticide usage stimulated by their genetical modification, but also the toxins they are encoded to produce, have been connected to mass mortality of pollinators.

UN bodies have long recognized that the environmental crisis requires, amongst other needed fast paced actions, a green transition away from environmentally degrading pesticide intensive monocultures and towards safer, healthier and environmentally-friendly food and agricultural production systems [32]. Likewise goals are aimed by policy initiatives such as the European Green Deal's Farm to Fork Strategy, that expects to dramatically reduce pesticide use and ban any residue on food of pesticides not registered for use in the EU.

Nonetheless, the same pesticides that have been banned in EU and other developed countries, keep being heavily exported by European agrichemicals manufacturers to commodities producing developing countries. Moreover, reports [33] point out how EU-MERCOSUR commodities trade seems to be fundamentally at odds with global green goals, as interested players lobby in favor of pesticides and against legislation and policies that support more climate resilient agroecological practices in commodities exporting countries.

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[31] Besides the previously referenced studies, recent scientific literature abounds on this issue, as for instance: FAITA, Marcia Regina; CHAVES, Adriana; NODARI, Rubens Onofre. The expansion of agribusiness: harmful impacts of deforestation, pesticides and transgenics on bees. *Special issue - Agribusiness in times of planetary collapse: critical approaches*. Vol. 57, p. 79-105, jun. 2021. DOI: 10.5380/dma.v56i0.76157. e-ISSN 2176-9109. Available at: <https://www.researchgate.net/publication/353247427_The_expansion_of_agribusiness_harmful_impacts_of_deforestation_pesticides_and_transgenics_on_bees>

[32] "Report warns of catastrophic consequences and blames manufacturers for 'systematic denial of harms' and 'unethical marketing tactics'" The Guardian. UN experts denounce 'myth' pesticides are necessary to feed the world. Available at: <https://www.theguardian.com/environment/2017/mar/07/un-experts-denounce-myth-pesticides-are-necessary-to-feed-the-world>

[33] BOMBARDI, Larissa Mies, CHANGOE, Audrey. *Toxic trading: the EU pesticide lobby's offensive in Brazil*. Friends of the Earth Europe. S2B – Seattle to Brussels Network. April 2022.

5. Conclusions

In short, we require that SEC acknowledges the need to include, in addition to the topics mentioned in the draft, the following topics for disclosure, once they are extremely relevant for both climate change mitigation and adaptation:

a) for all sectors, the need to disclose the location of operations (including value-chain and, in case of banks, location of portfolio's companies and credit collaterals), in order to allow the assessment of climate physical risks, biodiversity risks (as a source of climate change mitigation and adaptation) and any strategy in place to mitigate those risks;
b) for all relevant sectors (at least, industrial fishing, coastal infrastructure, oil and gas off-shore production), risks to mangroves and ocean biodiversity – including the whole value chain;
c) for all relevant sectors (at least, agriculture and food production and commerce; mining and infrastructure), deforestation risks – including the whole value chain, especially if the company provides any source of finance for farmers; information to be disclosed must encompass the location of direct operations and value chain, risk assessment and mitigatory actions adopted;
d) for all relevant sectors (at least, agriculture and food/beverages production and commerce, mining and any other water-intensive industry), water efficiency (volumes used compared to production) and availability risks – including the whole value chain; information to be disclosed must encompass the location of direct operations and value chain, risk assessment and mitigatory actions adopted;
e) for the agriculture sector, the use of chemical fertilizers (absolute figures and volumes per production) – information to be disclosed must include a transition strategy for the replacement by biofertilizers;
f) for the agriculture/livestock sector, the use of chemical pesticides (absolute figures and volumes per production) – information to be disclosed must include a transition strategy for the replacement by biopesticides and if there is any strategy in place to mitigate the adverse impacts to pollination in all the areas of use;
g) for the livestock sector, the technologies to mitigate GHG emissions originated from enteric fermentation (for beef);

h) for both agriculture and livestock, the use of technologies to reduce GHG emissions of both any type of waste;

i) for the livestock sector, the current use (absolute figures and volumes per production and the technologies to reduce the use of antibiotics;

j) for the agriculture sector, the use of genetically modified organisms (absolute figures and volumes per production) – information to be disclosed must include a mitigation strategy and a robust comparison to available production technologies;

k) for the insurance sector, disclosure must include how all sorts of climate risks (including the risks to natural carbon sinks and climate regulators as well as providers of climate change adaptation) are incorporated both into risk subscription policies, premium pricing and investment policies, always considering the location of operations insured and/or invested in.

From Lisbon to Washington, D.C., May 13th 2022.

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