CHEMICAL INDUSTRY:

NATURE IS YOUR BUSINESS!

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1. DECLARATION OF DEPENDENCE[1]

The past decades have seen a rising global awareness on topics like climate change, biodiversity loss, deforestation, and pollution. The focus though, has largely been on climate change, which itself is mostly being equalled to CO2 or Green House Gas (GHG) emissions. Climate action is high on the agendas of the chemical sector, and industry in general. Rightfully so, since climate change mitigation is of utmost importance to reach the goals for 2050 of the Paris Agreement and the 2030 targets of the SDGs. However, this paper aims to highlight why and how the chemical sector should already start moving beyond the climate agenda (with its focus mostly on reducing GHG emissions) towards a carbon neutral and nature positive agenda. This paper provides arguments for this call to action, by showing **(a)** how climate change mitigation, -adaption and nature are very much interlinked, and **(b)** why going beyond CO2-reduction and striving for climate neutrality alone is necessary to reach the SDGs. And why move towards the new carbon neutral, circular and nature positive economy should be part of the strategic decisions of chemical companies.

Hopefully, by now, most of you are aware that it is not only our climate that is changing, but that life on our planet is in a dire state through a combined degrading effect of agriculture, clear cutting, over-fishing, pollutions, etc. The United Nation's *Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (IPBES) report for instance, published in May 2019, revealed an estimated staggering ***one million species*** being at risk of extinction, and that earth's life support systems are showing an accelerating decline. It is therefore not surprising that the *World Economic Forum*'s Global Risks Report 2020[2] shows that the top five risks to the world economy in terms of both likelihood and impact, are very strongly linked to environment, or in other words to natural capital[3].

Now you might wonder how these risks are all connected – and why is nature directly relevant to the chemical sector? We will dive deeper into this later, but the short answer is that nature, its richness in biodiversity, and the ecosystem services it provides to the economy (e.g. pollination, fossil and renewable resources, sufficient fresh and clean water, and most importantly: a stable habitable climate) – are interlinked and interdependent. So much so that they effectively *cannot* be seen as separate from each other.

Nature, and all the renewable resources it brings forth, is the cornerstone of our global economies and societies. We are all directly and completely dependent on it. Most of society has come far from being aware of this, although the recent COVID-pandemic has unexpectedly shed some (in a sense, well-deserved) light on the frailty and interdependency of both our natural and socioeconomical systems. So, when working on sustainability, the logical line of

[1] In the online newspaper The Correspondent an interesting perspective on dependencies was elaborated in 'the declaration of dependence'. See the articles (in Dutch): "De coronacrisis toont onze diepe verbondenheid wat als we die blik vasthouden" and "Hier werken we aan een afhankelijkheidsverklaring".

[2] Top five by **likelihood**: (1) Extreme weather (2) Biodiversity loss (3) Climate action failure (4) Natural disasters (5) Human-made environmental disasters. Top five by **impact**: (1) Biodiversity loss (2) Climate action failure (3) Water crises (4) Human-made environmental disasters (5). See The global risks report 2020.

[3] *Natural capital* is the term used to indicate all aspects of nature, such as biodiversity and ecosystems, as well as all natural (renewable) resources brought forth by it.

thinking is not 'People, Planet, Profit', as we are used to since John Elkington start publishing on corporate sustainability. We have to think in the order of *PLANET*, People, Profit. After all, there are no jobs on a dead planet. Realising how extremely interrelated climate and nature are, and how dependent we humans are on nature and its processes, is *key* to a *liveable* and hence – *sustainable* – future on our planet. It is key for establishing a new economy, an economy that is carbon neutral, nature positive, circular, inclusive and has fair division over the value chains of benefits and costs.[4]

The link between climate and biodiversity

Climate and nature in its enormous diversity of life forms are very much interlinked. Climate change is one of the most important causes of biodiversity loss. At the same time loss of biodiversity, for instance deforestration and its effects, can accelerate climate change. A staggering amount of biodiversity is nature's insurance against disturbing environmental and climatic changes. The more and more diverse sets of species are present that are able to deal with slightly different environmental specifics, food sources, niches, and so forth, the more resilient nature is. In doing so, nature ensures the long-term survival of the whole. Generally speaking, we could also say that the more tree and plant species are present and the richer the soils are, the cooler and more habitable the living environments are (relatively). The presence of nature has a general cooling, and (dynamically) stabilising effect on surroundings, while it spreads and slows the flow of water, storing it for use by all life forms. To put it simple, support of biodiversity and prevention of loss can contribute to climate mitigation in many different ways.

However, after decades of a continuous destabilising effect on ecosystems in the shape of harmful emissions, pollution, destructive forms of agriculture, deforestation, and all other harmful human (industrial) activities combined, earth's life support system has become more and more vulnerable. This effect only shows its true extent on the longer term, *especially* in the context of climate change.

A degraded piece of land with a minimum of biodiversity present, namely, is *most susceptible* to climate change. A less dense and layered green cover, for instance, results in a lower overall capacity to photosynthesise (which has a cooling effect on the environment) and retain water. Less water will then be available to existing life forms, and as a resource for communities and businesses. Such landscapes also experience greater sun and wind exposure, leading to (much) higher surface temperatures, and more extreme and sudden temperature changes. In its turn, that causes higher evaporation, transpiration (and oxidation) in soils, plants and animals – thereby also affecting cities and industries (e.g. droughts, more need for cooling and/or heating, going hand in hand with often huge increases in water and energy consumption). This sadly is increasingly the case for a great deal, if not most, of the lands presently managed by humans. Our intensively managed pastures and agricultural lands currently do not allow much biodiversity. Our infrastructure (roads, artificial waterways, built environment etc.) further limit the migratory movement of many species – hindering their ability to feed and procreate,

[4] MVO Netherlands has published the 'New Business Roadmap, the quickest way to the New Economy'. The New Business Roadmap uses seven roadmap items to guide companies towards the New Economy that show the quickest way to get there.

whilst our land management generally is aimed at disallowing natural and spontaneous regeneration.

Most life forms have evolved within rather narrow, relatively cool, climatic bandwidths, while having a high interdependency on other life forms (e.g. for food, nesting, pollination, seed dispersal, etc.). So bare landscapes, in an increasingly hotter and less predictable climate, in which top soils oxidise and wash away, have less capacity to hold water and nurture life. Thereby harbouring less and less (genetic) diversity of life forms, which leads to the survival of only the smallest subset of life forms with the capacity to deal with more degraded, acidified soils, and more extreme micro-climates. This process essentially is called desertification. It results in *even less* (diverse) green cover, capacity to hold water and ability to *nurture life*[5].

Whilst deserts cannot support our global society, *desertification can be turned around*. A loss of species however is ***irreversible***. So, cutting GHG emissions is important, but to actually achieve the climate goals ***and*** to survive as a global society on the longer run, we will need to actively work on the preservation of biodiversity first and foremost, combined with increasing global carbon storage (mostly in soils and other natural capital). It may come as no surprise that the most effective solutions to capture carbon all have to do directly with nature and regeneration thereof.[6]

Without biodiversity, a stable habitable climate that fully supports a global society, simply is an illusion.
The only way of doing this is by globally restoring soils and nature everywhere possible, and by using nature-positive principles in all industries, especially the chemical industry being such a key producer of resources.

Go beyond climate: nature is your chemical business

The interesting thing is that there is huge business potential for the chemical sector, acting as an enabler and catalyst of such a carbon neutral and nature positive economy, being the global supplier of raw materials for so many other sectors. The chemical sector realises this very well as we see reflected in the vision documents of the Dutch branch association VNCI 'Transition as an opportunity'[6] and of the European branch association CEFIC 'Molecule managers'[7]. In these visions climate change is very well addressed as well as circular economy, but the interrelatedness between climate change and biodiversity loss is overseen.

In this light, it is interesting to take a look at the conclusions of a report the Dutch Central Bank and PBL Netherlands Environmental Assessment Agency have published on the impact and dependency of the financial sector on biodiversity in June 2020.[8] They state that climate related risks and biodiversity risks are both significant for the financial sector and they are interlinked in a negative and positive way. Furthermore, it is important to realise that for both

[5] An interesting and often forgotten aspect of this story is that degrading (agricultural) lands actually often release enormous amounts of GHG (e.g. through oxidising of carbon in soils), next to losing its capacity to store water as described.
[6] See the list of carbon sinks at https://www.drawdown.org/solutions
[7] VNCI, 2020, 'Transitie als kans, Strategie VNCI 2020-2024' and CEFIC, 2019, 'Molecule managers, A journey into the Future of Europe with the European Chemical Industry'.
[8] DNB, PBL, 'Biodiversity and the financial sector: a cross pollination?' (in Dutch), June 2020.

climate and biodiversity historic data are not representative to forecast future developments. One of the findings of the report is that financial institutions run reputational and transition risks if they finance companies that have a large negative impact on biodiversity. For this reason, the financial sector should look at climate related risks and biodiversity risks in coherence.

This report of the Dutch Central Bank and PBL is not a stand-alone effort. It should be seen as an indication of growing awareness of the financial sector and their role in facilitating sustainable change. Generally, the financial sector aims at reducing the risks of their investments and increasingly at generating impact through SDG-aligned actions. The sector is more and more at the forefront of actively steering towards the reducing of climate change risks (e.g. water scarcity, resource scarcity, human rights controversies, etc.). This has led to international initiatives such as those by the *Taskforce on Climate-related Financial Disclosures* (TCFD), *Climate Action 100+, Sustainability Accountancy Standards Board* (SABS) specifically for the chemical industry, and the *EU-Directive on Non-Financial Disclosures*, or national initiatives like the studies on biodiversity of the *Dutch Central Bank* (DNB). This development clearly shows the growing awareness of the long-term risk companies face because of climate change and biodiversity loss, and thus, why companies should address these topics on the short term. In other words, if you do not look beyond the climate agenda and CO2-emissions as chemical company, you will overlook and underestimate risks for your company and value chain partners. Risks that are getting more and more in the picture for the financial institutions, your investors and stakeholders.

Mitigation of climate change will be successful only when having the richest possible biodiversity to be resilient enough to cope with more extreme climate change scenarios. We can therefore simply state that 'nature is your chemical business' if we look at the economy as a whole, and at the chemical industry specifically.

Dependency and impact of the chemical sector on nature

The impact and dependencies of the chemical sector on nature are very diverse, since the chemical sector is very diverse. However, in general you see that the chemical industry depends on nature for its natural resources (fossils, minerals and biobased resources) and its ecosystem services like water supply as solvent and process water, clean air as reactant and cooling agent, pollination and soil fertility for the growth of biobased resources, a stabile climate for general safety of production processes. Loss of biodiversity threathens the availability of the natural resources and ecosystem services the chemical industry uses. The negative impact of the chemical industry on nature ranges from air, soil and water emissions, loss of biodiversity due to these emissions, contribution to deforestration. Apart from that, it is also clear that the chemical industry also has an enormous potential to reduce the negative impact on nature by its products and processes that reduce the use of raw materials, energy, and replace fossils by renewables. Or even better, can have enlarge the positive impact.

Talking about dependencies, companies of course also have to take into account the people-side of sustainability for a sustainable or new economy. The dependency of and impact of the chemical industry on nature has a profound effect on the living environment, the well being

and the standard of living of people, both in a positive and negative way. Without an integrated and systemic approach to address global environmental, social and economic challenges, we will not catalyse the transformative change that is needed to ensure the health of the natural world, and to safeguard human health, wealth, happiness and identity.[9]

Readers' guide

The following chapters will provide more detail on why the stimulating and restoration nature and biodiversity especially is of the utmost importance. Important for better managing the sector's impacts and dependencies on nature as well as managing the risks for its overall performance deriving from it. And thus, important for becoming a more sustainable sector in general.

Using the SDG framework, we will explore which topics related to climate and nature should be on the sustainability agendas of chemical companies to serve this end. To this end we will firstly highlight the hierarchy of SDG's, and show which natural capital topics are present in the Key Performance Indicators for achieving the SDG's. Secondly, we analyse which of the SDGs are most relevant to the chemical sector, based on our analysis of roadmaps provided by VNCI, WBSCD, CEFIC and ICCA. After that, this paper will describe how working on minimising/neutralising your impact as a company on nature, using a nature based approach will help in achieving impact on all SDGs in which (chemical) companies play an important role. Finally, we will also highlight, and what next steps are to be taken by chemical companies.

[9] This systemic approach is embedded in the Capitals Coalition, which unites over 350 organizations, and engages many thousands more, who together represent all parts of society and span the global economy.

2. SDGs, NATURE, AND NATURAL CAPITAL

Before we analyse which SDGs are most important for the chemical industry in the next chapter, this chapter will give insight in the hierarchy of SDG's, the link between SDG's and natural capital. We will therefore provide a more practical perspective on how companies can contribute to the SDG's via their sustainability agenda's and where this is linked to natural capital topics. As such this chapter is **not** *chemical industry specific*, but relevant for all companies.

Background – a biosphere perspective

When striving for positive impact, companies take the SDGs as guidance. The main purpose of the SDGs as such is globally streamlining and facilitating sustainability actions. Currently, the 17 main goals[10] cover 169 individual goals, concretised into 231 unique *Key Performance Indicators* (KPIs). The SDGs appear, at first glance, to be separate from each other. A closer inspection will show you however, that all goals are *interconnected* and that they have an implicit hierarchy. Some SDGs thus could (and should) be seen as a prerequisite for achieving the others.

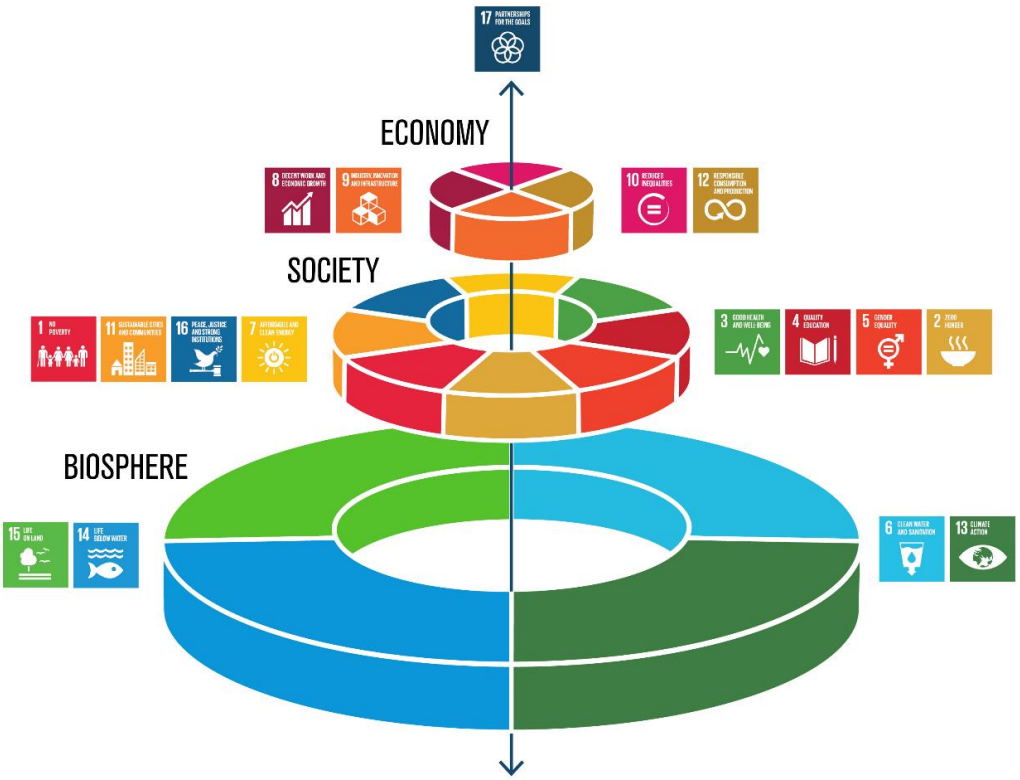

FIGURE 1 - THE WEDDING CAKE CLASSIFICATION OF THE SDGS BY THE STOCKHOLM RESILIENCE CENTRE

[10] See https://www.un.org/sustainabledevelopment/sustainable-development-goals/ **The goals**: (1) No poverty, (2) Zero hunger, (3) Good health and well-being, (4) Quality education, (5) Gender equality, (6) Clean water and sanitation, (7) Affordable and clean energy, (8) Decent work and economic growth, (9) Industry, innovation and infrastructure, (10) Reduced inequalities, (11) Sustainable cities and communities, (12) Responsible consumption and production, (13) Climate action, (14) Life below water, (15) Life on land, (16) Peace, justice and strong institutions, (17) Partnerships for the goals.

The *Stockholm Resilience Centre,* and the *Netherlands Environmental Assessment Agency* (PBL) are parties that have classified the SDGs based on an ecological perspective. In this paper we use the so called 'wedding cake' classification as proposed by the Stockholm Resilience Centre. Our global dependence on natural capital is clearly illustrated in it, see Figure 1. Or, to paraphrase George Orwell: "some SDG's are more equal than others", being the biosphere related SDG's.

It shows just how much our societies and global economy are built upon, and thus, are fully dependent on the foundation that is nature and its resources. The planet's ecosystems are the precondition for all societal and economical (sustainable) development: PLANET-People-Profit. Responsible use and management of natural capital thus is crucial for maintaining life (including non-human) and the way we live (and do business). Please do note that although this classification seems to imply that ***only*** the four so called 'biosphere SDGs' tie to nature and natural capital, many other SDGs do link to natural capital – just not as predominantly. We will show this in the following paragraphs.

Checking KPI's step I: 52 of 231 KPI's are related to natural capital

For the purpose of highlighting how nature is being accounted for in the SDG framework, we first have researched how many SDG KPIs link either directly or indirectly to nature and natural capital. The SDG KPIs have previously been conveniently arranged in the ***SDG Relevance Tracker*** issued by MVO Nederland. See Figure 2 and Figure 3 for an overview.

Out of a total of 231 KPIs[11], 52 (22%)[12] are related to natural capital. 37 of those KPIs are directly, and 15 indirectly linked to natural capital. *Direct relations*, as the name implies, are synonymous with natural capital, with the *indirect relations* being KPIs that are heavily *dependent* on it, such as is the case in income derived from food production (fertile soils, pollination, water availability etc.). See the Appendix for more details on the KPIs and our categorisation of them. See below for two examples of our categorisation:

6.3.2. - Proportions of bodies of water with good ambient water quality. ***Directly related***
2.3.2. - Average income of small-scale food producers, by sex and indigenous status. ***Indirectly related***

[11] The UN makes annual updates to the KPIs, so the numbers change from year to year (2019: 232 KPIs).
[12] A number of KPIs ***repeat*** under two or three different SDGs. Since our analysis was focussed on the specifics of the unique indicators, they have been counted only once under the most obvious respective target. For instance, SDG1.5.1 *"Number of deaths, missing persons and persons affected by [natural] disaster per 100,000 people"* – repeats as SDG13.1.2 and has been counted as such by us, considering SDG13 is about Climate action – as SDG1 is about Poverty.

Checking KPI's step II: 44 of 52 natural capital KPI's are relevant to companies in general

Not all natural capital SDG KPIs are directly relevant to companies, as some are only about governmental aspects such as legislation. KPIs dealing with such aspects, generally lie outside of the direct sphere of influence of companies – so we see them as non-relevant to companies. The *relevancy* for companies on the other hand, here means that corporate activities and value chains can either greatly *impact* the concerning natural capital topics, or that they are to a large extent *dependent* upon them.

44 of the SDG KPIs (19% of total) are linked to natural capital ***and*** are also relevant for companies. Of those, 36 are *directly* linked to natural capital, while 8 are *indirect* KPIs. See Figure 3 for an overview of the total and direct number of KPIs per goal.

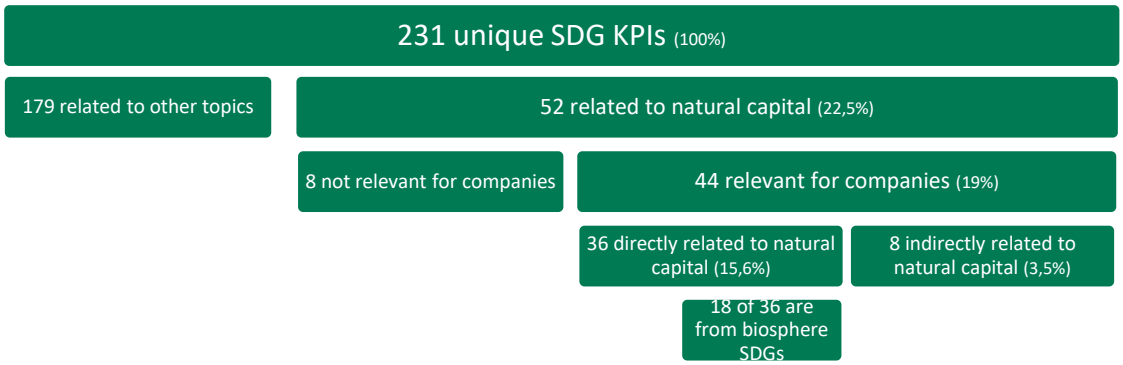

FIGURE 2 - DETAILS OF NATURAL CAPITAL RELATED SDG KPIS

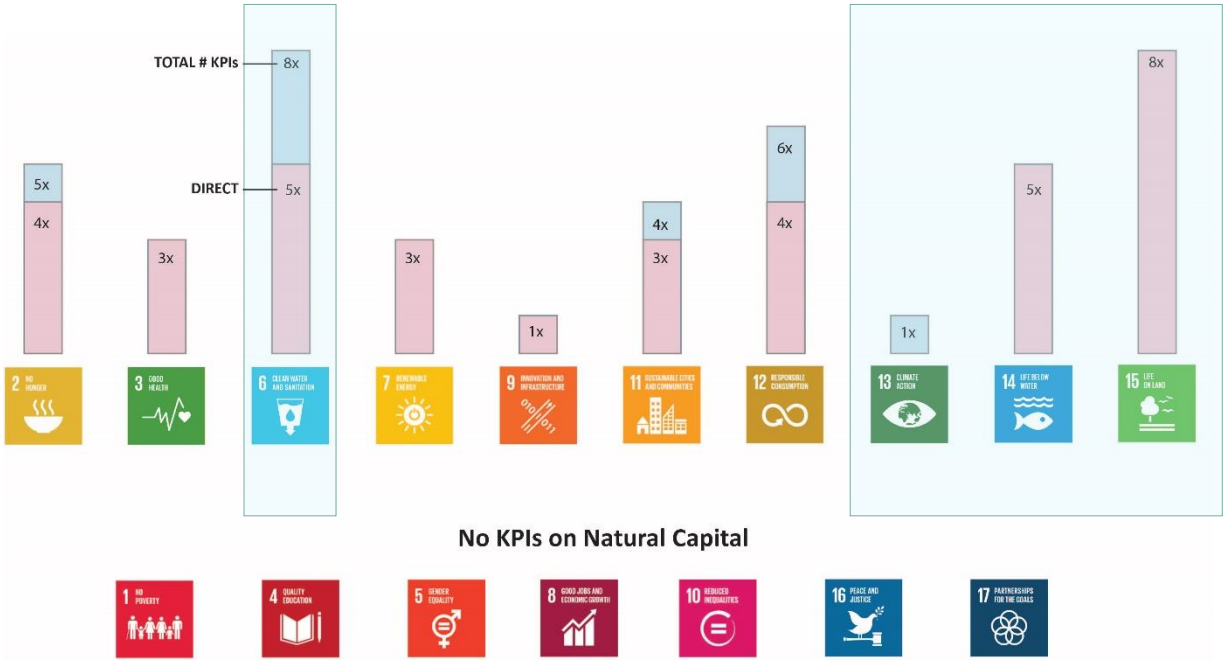

FIGURE 3 - OVERVIEW OF SDGS AND KPIS RELEVANT FOR COMPANIES SOURCE: SDG RELEVANCE TRACKER, MVO NEDERLAND

When direct focus is not on biosphere SDGs, companies can still work on natural capital
The four 'biosphere SDGs' (6, 13, 14, 15 – highlighted in figure 3) make up **half** of the company relevant *direct* nature KPIs. The other half of the direct KPIs then are logically found in the non-biosphere SDGs. 'Non-biosphere SDGs' with considerable *direct* nature related KPIs are SDG 2 (zero hunger) and 12 (responsible consumption and production) both with 4 *direct* KPIs, followed by SDG 3 (health and well-being), 7 (clean energy) and 11 (sustainable cities and communities) all with 3 *direct* natural capital KPIs. The above shows that even when a company's focus is not directly on the biosphere, there also is a very relevant biosphere related impact to be made on other SDGs.

3. SDGs RELEVANT TO CHEMICAL COMPANIES

This chapter will provide a general overview of relevant SDGs for chemical companies, without looking into the relationship with nature / natural capital. The information provided here is based on four reports or sustainability road maps for the chemical sector[13] that we have analysed. The following SDGs are mentioned as most important to the chemical industry in ***all five*** sources:

To help companies orient according to the themes/fields that are relevant to them, the sources formed thematical clusters, or fields of action, in which they showed what SDGs are most relevant therein. As they all use a slightly different, but comparable way of arranging, we group them similarly to highlight the most important SDGs relevant for the chemical industry in three areas. The bold numbers imply that respective SDGs repeat under two (SDG 3 and 8) or all three fields of action (SDG 12 and 13):

- "Energy + Low carbon economy" — SDG 7, **12** and **13**
- "People and Environment + Food" — SDG 2, **3**, 6, **8**, **12**, **13**, (14 + 15)[14]
- "City, Industry, Economy and Infra" — SDG **3**, **8**, 9, 11, **12** and **13**

The above shows that SDG 12 and 13 potentially provide the most relevant starting points for the chemical sector to look into for planning their sustainable action, as these SDGs are relevant in all three fields of action – followed by SDG 3 and 8. Interestingly enough, of the four SDG's that are most prominently biosphere-related (i.e. SDG 6, 13, 14, 15), only 13 is apparently seen as being one of the most important starting points for sustainable action in the

[13] Source reports were those by the ***VNCI*** (The Dutch branch organisation for chemical industry – "VNCI sustainable pathways" and "Transition as opportunity$_2$"), the ***WBCSD*** (Chemical Sector SDG Roadmap), ***CEFIC*** (Chemistry CAN: Accelerating Europe towards a sustainable future) and ***ICCA*** (Global Chemical Industry contributions to the SDGs).
[14] Here, SDG 14 and 15 are both listed by VNCI in the sustainable pathways presented in 2019, but not in the roadmap "Transition as opportunity$_2$", published in 2020; the WBCSD lists only SDG 14; CEFIC and ICCA neither mention SDG14 nor 15.

chemical industry right now. The focus in these roadmaps thus lies more on the societal and economic SDGs separately (thus disregarding the interconnected nature of the SDGs). While the listing of SDG13 is mostly based on a rather narrow *Green House Gas (GHG)-related approach* to climate action in the roadmaps and not linked to nature in a broader sense.

Implications
Industry and other economic activities greatly impact the biosphere in one way or another, while, most importantly, also being directly dependent on it. Apparently however, this is a ***blind spot*** in the sustainability road maps in the chemical sector internationally for both SDG 14 (life below water) and 15 (life on land). Even though, we showed earlier that in terms of risk management linking the climate agenda to biodiversity risks or a nature agenda is strategically wise and interesting. The reason for this is most likely a relatively simple one: every step of the economic process adds economic value, but it disregards almost completely the source of all value (natural capital). Also, it is often not seen as part of companies' *core business* to care for nature. So, because society is not yet (financially) valuing nature itself, we also do not really see nature or natural capital as prominently listed in action agendas and sustainability roadmaps of companies *as they should be. B*ut more on that later.

4. ANOTHER LOOK AT YOUR SUSTAINABILITY AGENDA

The chemical industry is a key transitional force towards a sustainable or new economy. As the ecological and thus financial risks of continuing business as usual, are on a steep increase and new – sustainable – markets and opportunities are opening up, this chapter will further detail some key natural capital aspects that are relevant to many chemical companies to reduce their risks, reduce their negative impact and increase their positive impact on the planet and society.

Most important natural capital topics covered in SDG KPIs
The greatest effect industry has on the biosphere are through the use of resources, and the subsequent effects. The most important *nature related SDG KPIs* are about:

- *usage and purification of water*;
- *sourcing, and usage of raw materials*;
- *effects on land, soil, air and water*;
- *nature conservation and biodiversity,* and lastly
- *energy efficiency*, as the amount of energy expended also has to come from natural resources (whether oil or bio based).

The following overview will provide basic starting points for companies to investigate, followed by a paragraph covering the interrelatedness of these topics.

- Raw materials (i.e. natural resources incl. [polluting] emissions) – **SDG3, SDG7, SDG12**

Generally speaking, we could say that the less raw materials we take from earth and its ecosystems, the lesser the impact is on the biosphere. Next to sheer quantity, the actual way of sourcing is also crucially important. In other words: how destructive are these processes, and does the sourcing destroy pristine ecosystems and their biodiversity? What is the water and energy consumption in that process, and what are the emissions to land, air and water? What happens downstream in the surroundings of the sourcing locations? These are all important aspects that contribute to the sustainability of raw material usage and sourcing.

So, regarding the use of raw materials and the sourcing thereof, the question is how to use *as little as possible*. Whilst ***also*** neutralising harmful effects on the greater surroundings of a source in order to sustain life and business on the long run. This requires active and unprecedented collaboration and communication across all industries – in which the chemical industry plays a key role. We simply cannot keep taking more and more, without facing the consequences. That is, a degraded planet that is unable to sustain life and thus, our economy.

- Water supply, use and purification – **SDG6, SDG14**[15]

Fresh, high quality water is an *extremely* scarce natural resource (and increasingly so), that is continuously being created in, and provided by, the more pristine ecosystems. As water is the most essential life-promoting substance on earth, and as such is an immensely important topic. All life is made out of, and completely dependent on water. Historically, the availability and quality of fresh water has too much been taken for granted. If, through industrial and economic activity, the quality and availability of fresh water is constantly decreased – one can imagine the result of these processes in the long run being a very much stressed biosphere and biodiversity, next to increasing challenges and costs for industry and society in securing this most essential natural resource.

For the chemical industry it is therefore crucially important to actively reduce the fresh water need by monitoring how much water is being used, make processes more water efficient and circulate water in the process via intermittent purification. Companies can actively prevent all unnatural emissions to ground-, waste-and cooling waters to such an extent that there is no detectable impact on marine and land based ecosystems. Any unnatural contamination can cause huge spill over effects on the long run.

[15] The analysis in the report 'Indebted by Nature, exploring biodiversity risks for the Dutch financial sector ' of the Dutch Central Bank and PBL (June 2020) shows that of investments by Dutch financial institutions, a total of EUR 510 billion is highly or very highly dependent on one or more ecosystem services. In the analysis only first order dependencies of the investments in companies were taken into account. The highest dependence is on the ecosystems that provide groundwater and surface water. Of every euro invested, approximately one-quarter is dependent on these ecosystems.

- Food/biomass – **SDG2, SDG12**

The sustainable production of biomass is seen as the one of the pillars for a sustainable chemical business. Right now, the production of biomass and food are however the largest drivers of global forest clearcutting and land use change. At the same time the overuse and/or wrong application of synthetic fertilisers and chemical pest-, fungi- and herbicides, have a tremendously negative impact on soil, soil life, and broader biodiversity. This domain is most direly in need of a change of our perception and direction, and as such deserves more than a paragraph. To be concise however we, in short, would like to say that we should work towards (agricultural) systems that nurture (soil) life, and increase the biodiversity that has been chased away and left to die in most of the lands the world over. Through the food we eat, we depend so much on pollination, fertile soils, and natural resilient ecosystems. Only dynamic and healthy ecosystems can provide us with a chance of survival in the long run. It is clear that the chemical industry has great voice and presence in this domain – and should therefore help to strive for a nature positive food and biomass production that does not convert existing (pristine) nature into production sites.

- Land Use and (indirect) Land-Use Change (LULUC) – **SDG2, SDG11, SDG15**

This topic is clearly related to food and biomass production, and less clearly perhaps to natural resources, water, and biodiversity – but land use and the change thereof is a crucial topic as the *type of land use*, and the increase in lands used for economic activities is a topic that in itself relates to the other important natural capital topics, as the impacts of land use / land use change, through the activities employed, determine to such a great extent how much of the biosphere is left undisturbed, and able to perform the natural dance of life called evolution and adaptation. The more land we use, and the more harmful the practices employed, the worse off nature is – and in the end, we are. A side note to this is that some highly fertile lands, can provide more and sustain production longer. Therefore, we advise to look at the carrying capacity, or 'richness' of the lands and use the land accordingly (i.e. not farming intensively on marginal lands – as these ecosystems are very brittle). The chemical industry perhaps has less direct control over these aspects, apart from changing their (way of) sourcing.

- Biodiversity – **SDG2, SDG3, SDG6, SDG11, SDG13, SDG14, SDG15**[16]

Biodiversity is under such extreme pressure that we are currently experiencing the sixth great mass extinction on Earth, caused by human activities. Whether it is through products (pesticides/herbicides or just plainly poisonous products to many life forms), the effects of agriculture and forestry, through sourcing by industry, or through the spill over effects of human induced climate change. All sectors should take their responsibility and help in bringing this unprecedented cause of mass extinction to a halt. Biodiversity is the web of life, and all that we do feeds back into that loop. One example of that is the link between climate change and biodiversity loss. The most important biodiversity-related facets and actions have been mentioned under the previous SDG topics and in chapter 1.

[16] There are many direct and indirect links to biodiversity within the SDG KPIs and targets. See Annex.

The interconnectedness of the topics

In the previous lines you may have discovered the interconnectedness of most of these topics. We would once more like to stress an integrated approach to sustainability is needed in which nature / natural capital should be the foundation. But at the same time an action approach on all individual topics themselves (as far as relevant to companies) is important. The topics mentioned above can provide simple starting points for a re-evaluation of your company's sustainability agenda.

Conclusion

By now, we have showed you that **(a)** climate, biodiversity and natural capital are the foundation of our socioeconomic system, but they are not (financially) valued and seen enough, **(b)** it is time for a change of perspective: 'move beyond climate' (in sense of just reducing GHG-emissions) by adjusting course towards a carbon neutral and nature positive economy, **(c)** the SDGs provide many opportunities to work on biodiversity and climate (beyond GHG) and that those opportunities can be found also in the non-biosphere SDGs.

The next chapter provides possible next steps for you as a company.

5. NEXT STEPS FOR CHEMICAL COMPANIES

Looking at our analysis and discussion in the previous chapters, developing an action agenda at sector-, chain-, and company level in the chemical sector is of great importance for the following topics:

- Water;
- Natural resources (raw materials);
- Soil quality.
- Biodiversity;
- Energy / air.

So, what to do next?

- As a company it is important to **start mapping your impacts and dependencies** on nature, people and society. To get a complete insight in the sustainability risks and impacts as a company this means looking inside out (the impact of your business on nature/environment and society) and looking outside in (the impact of nature and society on your business). See figure 4.

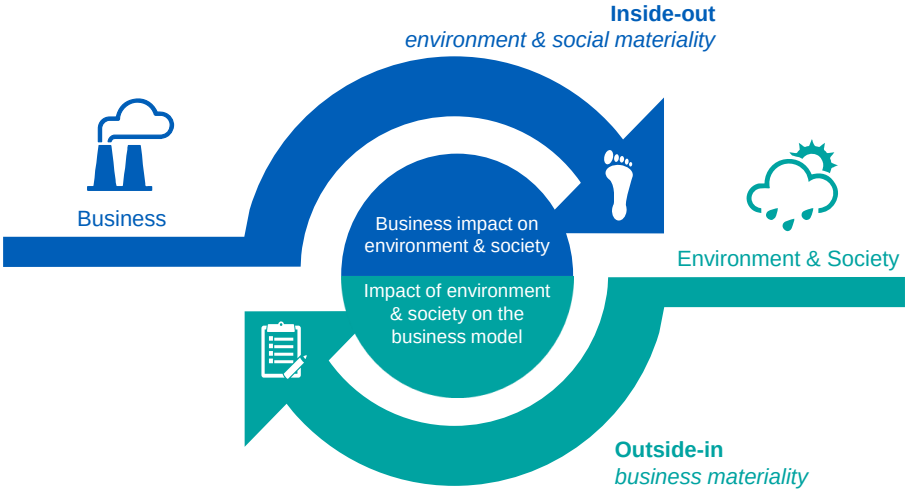

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FIGURE 4. DOUBLE MATERIALITY: TWO NECESSARY PERSPECTIVES TO CHECK AND BALANCE YOUR SUSTAINABILITY AGENDA (source: KPMG)

The list of topics mentioned at the begin of this paragraph can serve as checklist for mapping these impacts and dependencies if they are relevant for your company. For information about different tools on how to do the mapping, please look at the site of the Natural Capital Toolkit. This mapping of your impacts and dependencies on nature gives you a sensitivity check on the priorities you already have on your sustainability agenda.

- Based on the mapping of dependencies and impacts and the list of topics important for natural capital **evaluate your own sustainability and innovation agendas.** Prioritize at least three topics that you would like to take into account in all your business discussions and decisions. If you want to get inspired by what other businesses do, take a look at the website of Business4Nature https://www.businessfornature.org/act

- **Become a member of the MVO Nederland Network for Chemical Business**, and by doing so:
    - **Learn from other companies** that are further along the sustainability road to a carbon neutral and nature positive economy. Look at examples in and outside our network, like AkzoNobel, BASF and smaller companies;
    - **Develop nature-positive criteria and actions for climate measures together with other companies in the sector** and include these in your action plans and business decisions regarding climate adaptation and climate mitigation. MVO Nederland would like to facilitate this if there is a group of companies or, through its network, to bring companies into contact with parties that are able to do so.
    - **Look for investors** or banks who can think along with you in nature-positive and climate-neutral investments. MVO Nederland organises events where we bring together investors, banks and companies on this topic.
- **Participate in the National Action Agenda for Biodiversity** of the Ministry of Agriculture, Nature and Food Quality (Ministerie LNV) to start thinking about and acting with regard to biodiversity in your company.

Why wait?

In deciding your next steps, we hope the '*declaration of dependence*' we started this paper with is firmly in the back of your minds. And through that you can adjust course accordingly. As a company you can of course wait for disasters to occur, but then it will affect your business due to problems in resource supply, water, and/or energy. Or if you will no longer be able to receive loans or investments, you will have to change due to legislation or by a reduction of your license to operate (because the impacts of your business to environment and society is becoming increasingly visible because of more transparency, and clearer effects; and you can count on less and less tolerance). But why wait, if you can be an essential part of restoring our planet while having a renewed sense of purpose and contribution, whilst also being able to run a business because of the sustainable business potential. It is not by coincidence that the UN has declared the decade 2020-2030 as the decade of restoration: we have to start now!

APPENDIX: OVERVIEW OF SDG KPIs RELATED TO NATURAL CAPITAL

In this appendix you find an overview of the KPIs linked to the SDG- targets for 2030 that are related to natural capital topics. The KPIs are divided into KPIs that are company relevant and not company relevant. The overview is made with support of the SDG Relevance Tracker, a tool developed by MVO Nederland and the two chemical companies CRODA and Carbogen Amcis.

Note: *regarding the relevancy for chemical companies, we have just briefly noted a few general starting remarks or linked topics.*

Company relevant SDG KPIs

SDG KPI - first digit is SDG target number	**Direct/ Indirect**	**Related Natural capital Topics**	**Relevancy Chemical companies**
2.3.1 Volume of production per labour unit by classes of farming/pastoral/ forestry enterprise size	Direct	Soil fertility, water (use and storage), pollination, natural pest control, biodiversity	Agrochemicals and synthetic fertiliser
2.3.2 Average income of small-scale food producers, by sex and indigenous status	Indirect	Soil fertility, water (use and storage), pollination, natural pest control, biodiversity	Agrochemicals and synthetic fertiliser
2.4.1 Proportion of agricultural area under productive and sustainable agriculture	Direct	Soil fertility, water (use and storage), pollination, natural pest control, biodiversity	Agrochemicals and synthetic fertiliser
2.5.1 Number of plant and animal genetic resources for food and agriculture secured in either medium or long-term conservation facilities	Direct	Biodiversity	
2.5.2 Proportion of local breeds classified as being at risk, not-at-risk or at unknown level of risk of extinction	Direct	Biodiversity	Spin off effects of business
3.9.1 Mortality rate attributed to household and ambient air pollution	Direct	Emissions; Pollution; air quality; health ecosystems	Emission and pollution reduction chemical sector
3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services)	Direct	Emissions; Pollution; air quality; health ecosystems	Emission and pollution reduction chemical sector

SDG KPI - first digit is SDG target number	**Direct/ Indirect**	**Related Natural capital Topics**	**Relevancy Chemical companies**
3.9.3 Mortality rate attributed to unintentional poisoning	Direct	Pollution; health ecosystems	Safe storage chemicals (good housekeeping), waste management
6.1.1 Proportion of population using safely managed drinking water services	Indirect	Water quality, water purification	Decreasing water use and improving water purification chemical sector
6.3.1 Proportion of wastewater safely treated	Direct	Water quality, water purification	(Improving) water purification chemical sector
6.3.2 Proportion of bodies of water with good ambient water quality	Direct	Water quality, vegetation, biodiversity	Decreasing water use and improving water purification chemical sector
6.4.1 Change in water-use efficiency over time	Direct	Water (availability)	Water use chemical sector
6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	Direct	Water (availability)	Water use chemical sector
6.5.1 Degree of integrated water resources management implementation (0-100)	Indirect	Water (management)	Management systems
6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation	Indirect	Water (management)	'fair' water use
6.6.1 Change in the extent of water-related ecosystems over time	Direct	Water (management), Biodiversity (protection: marine ecosystems)	Emission reduction and water use (which sources)
7.1.2 Proportion of population with primary reliance on clean fuels and technology	Direct	Resource (demand), (bio)fuels, renewable resources, emissions/pollution	Use renewable sources, emission reduction (decoupling of economics and environmental effects)
7.2.1 Renewable energy share in the total final energy consumption	Direct	Resource (demand), (bio)fuels, renewable resources, emissions/pollution	Use renewable sources, emission reduction (decoupling of economics and environmental effects)

SDG KPI - first digit is SDG target number	**Direct/ Indirect**	**Related Natural capital Topics**	**Relevancy Chemical companies**
7.3.1 Energy intensity measured in terms of primary energy and GDP	Direct	Resource (demand), (bio)fuels, renewable resources, emissions/pollution	Use renewable sources, emission reduction (decoupling of economics and environmental effects)
9.4.1 CO2 emission per unit of value added	Direct	Emissions/pollution	Emission reduction, resource efficiency (decoupling of economics and environmental effects)
11.3.1 Ratio of land consumption rate to population growth rate	Direct	Ratio nature/built environment, resource demand, biodiversity loss, water demand	Resource efficiency, sustainable sourcing, water use, emission reduction
11.4.1 Total expenditure (public and private) per capita spent on the preservation, protection and conservation of all cultural and natural heritage, by type of heritage (cultural, natural, mixed and World Heritage Centre designation), level of government (national, regional and local/municipal), type of expenditure (operating expenditure/investment) and type of private funding (donations in kind, private non-profit sector and sponsorship)	Direct	Ratio nature/built environment	Companies can support nature conservancy and regeneration
11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities	Indirect	Ecosystem resilience and health	Reduction waste and emissions
11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)	Direct	Ecosystem resilience and health	Emission reduction chemical sector
12.2.1 Material footprint, material footprint per capita, and material footprint per GDP	Direct	Resource consumption, natural resources	Resource efficiency

SDG KPI - first digit is SDG target number	**Direct/ Indirect**	**Related Natural capital Topics**	**Relevancy Chemical companies**
12.2.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP	Direct	Resource consumption, natural resources	Resource efficiency
12.3.1 Global food loss index	Indirect	Food waste; Food loss; efficiency food chain	Improving food chain efficiency, food preservation.
12.4.1 Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement	Indirect	Health/pollution ecosystems	Reduction waste and emissions
12.4.2 Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment	Direct	Health/pollution ecosystems	Emission reduction, good housekeeping, waste management
12.5.1 National recycling rate, tons of material recycled	Direct	Resource consumption; health/pollution ecosystems; emissions & pollution	Each company contributes
13.1.2 Number of deaths, missing persons and persons affected by disaster per 100,000 people	Indirect	Biodiversity, soil carbon storage, water retention, ecosystem resilience	Climate action
14.1.1 Index of coastal eutrophication and floating plastic debris density	Direct	Biodiversity, pollution - water quality	Emission reduction chemical sector, design for recycling, waste collection and recycling
14.2.1 Proportion of national exclusive economic zones managed using ecosystem-based approaches	Direct	Biodiversity, resource consumption, ecosystem based approach	Ecosystems based approach possible in chemical sector? Positive impact chemical companies on ecosystems

SDG KPI - first digit is SDG target number	**Direct/ Indirect**	**Related Natural capital Topics**	**Relevancy Chemical companies**
14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations	Direct	Water quality	Emission reduction, water use
14.4.1 Proportion of fish stocks within biologically sustainable levels	Direct	Biodiversity, water quality, (over)fishing	Emission reduction, possible sourcing from fish
14.5.1 Coverage of protected areas in relation to marine areas	Direct	Nature protection; biodiversity	Not directly relevant
15.1.1 Forest area as a proportion of total land area	Direct	Percentage forest cover by land area; biodiversity	Sourcing (ILUC, biomass production), Emission reduction chemical sector (tree planting)
15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	Direct	Biodiversity, nature protection, Conservation and health ecosystems	Sourcing (ILUC, biomass production), Emission reduction chemical sector, water use
15.2.1 Progress towards sustainable forest management	Direct	Forest management	Sourcing (ILUC, biomass production), Emission reduction chemical sector
15.3.1 Proportion of land that is degraded over total land area	Direct	Land degradation	Emission reduction chemical sector
15.4.1 Coverage by protected areas of important sites for mountain biodiversity	Direct	Nature protection; biodiversity	Emission reduction chemical sector
15.4.2 Mountain Green Cover Index	Direct	Percentage forest cover by land area; biodiversity	Sourcing, emission reduction chemical sector
15.5.1 Red List Index	Direct	Biodiversity	Emission reduction chemical sector, use agrochemicals, contribution to biodiversity
15.7.1 Proportion of traded wildlife that was poached or illicitly trafficked	Direct	Biodiversity, hunting/poaching management	Link with chemical sector only when sourced from wildlife.

SDG KPI - first digit is SDG target number	**Direct/ Indirect**	**Related Natural capital Topics**	**Relevancy Chemical companies**
TOTAL: 44 SDG Natural capital KPIs			

Non-company relevant SDG KPIs

SDG KPIs - first digit is SDG number	**Direct / Indirect**	**Related Natural capital Topics**	**Relevancy Chemical companies**
11.5.2 Direct disaster economic loss in relation to global GDP, including disaster damage to critical infrastructure and disruption of basic services	Indirect	Biodiversity, water retention, ecosystem resilience	Climate action
12.6.1 Number of companies publishing sustainability reports	Indirect	Company activities in relation with resource use, emissions etc.	Transparency companies concerning non-financial disclosures
12.7.1 Number of countries implementing sustainable public procurement policies and action plans	Indirect	Sustainable procurement, resource consumption	-
12.8.1 Extent to which (i) global citizenship education and (ii) education for sustainable development (including climate change education) are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment	Indirect	Climate adaptiveness	-
12.a.1 Amount of support to developing countries on research and development for sustainable consumption and production and environmentally sound technologies	Indirect	Resource consumption, emissions and pollution, climate adaptiveness	-

13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)	Direct	Resource consumption, emissions and pollution, climate adaptiveness	-
13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula	Indirect	Resource consumption, emissions and pollution, climate adaptiveness	-
13.3.2 Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions	Indirect	Resource consumption, emissions and pollution, climate adaptiveness	-
TOTAL: 8 non-company SDG Natural capital KPIs			