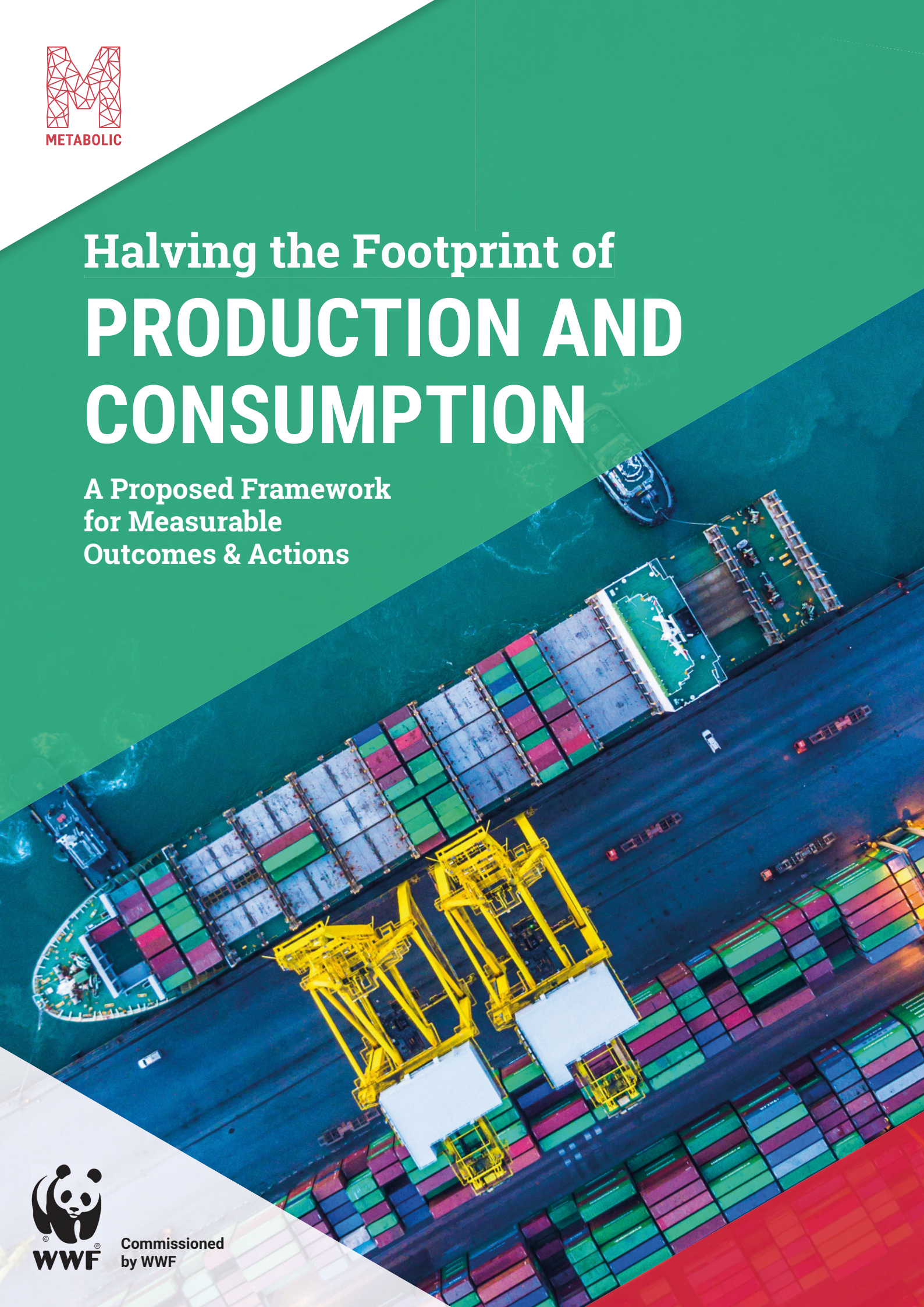
METABOLIC

# Halving the Footprint of PRODUCTION AND CONSUMPTION

## A Proposed Framework for Measurable Outcomes & Actions



WWF

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# EXECUTIVE SUMMARY

Urgent action is needed to avoid irreversible biodiversity loss and build resilience world-wide. Mitigating our biodiversity crisis, while still meeting human needs and promoting equity, entails a major shift in how we produce and consume materials and products. With all of this in mind, one of the main goals of WWF's New Deal for Nature and People is "Halving the Footprint of Production and Consumption" (together with: "Protect and restore natural habitats" and "Safeguard diversity of life"). The "Footprint" includes all of the ways that people degrade or put pressure on natural systems and there is no single measure of what the "footprint" means. However, existing footprint measures, such as the planetary boundaries, the share of net primary productivity appropriated by humans (eHANPP), the ecological footprint, the material footprint, etc, all indicate that we have already significantly surpassed acceptable levels of impact. The goal is to bring these impacts within safe boundaries by 2030.

The Zero Draft of the post-2020 Global Biodiversity Framework (GBF) establishes sufficient goals and targets for reducing biodiversity **Impacts**. In translating the goal of "Halving the Footprint of Production and Consumption" into actionable targets and metrics, we have taken an approach of defining key outcome-based targets for **Drivers, Pressures**, and **States**, related to production and consumption for the years 2020-2030, which are also necessary to reach the CBD targets. These are coupled with action-based targets (or **Responses**) that are ambitious enough to achieve the outcomes. Part of this framework expands on what is already covered in biodiversity and conservation frameworks such as the GBF, as described here:

As biodiversity loss is driven predominantly by production systems, it is crucial to begin by the **drivers**, e.g. resource consumption levels. Biomass consumption and regional extraction of marine resources beyond a sustainable level (a level that can be maintained long term) are essential leverage points and must be included in a comprehensive framework.

- **Example outcome-based target:** Consumption of biomass is reduced by around 35% per capita to bring it within sustainable levels, while ensuring there is enough nutritious food for current and future generations
- **Example action-based target:** Consumption reduction of 10% is achieved through lifespan extension of products, eliminating planned obsolescence, product-as-a-service models, expanded lending models, building renovation

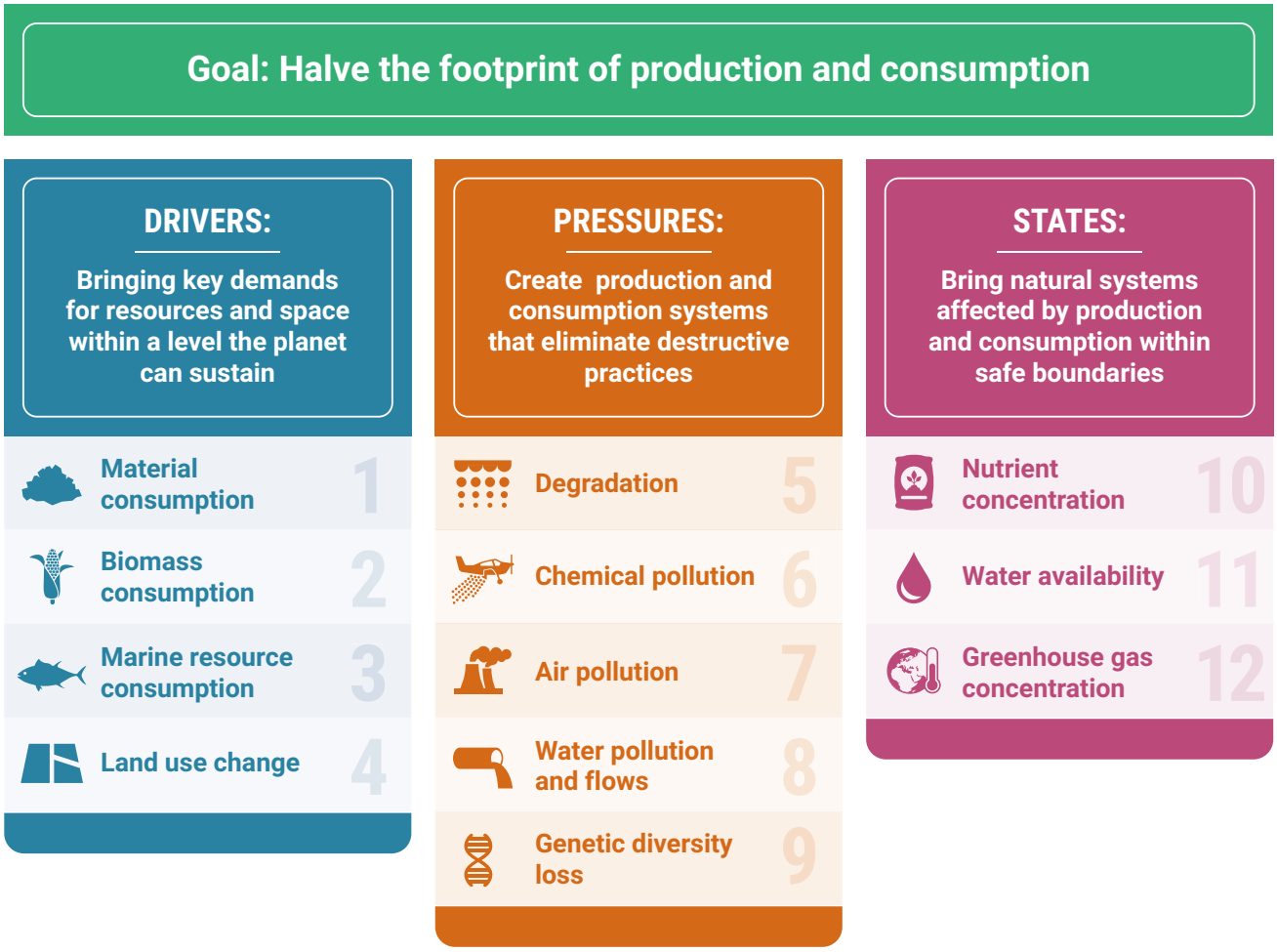
Looking beyond these drivers, how we produce and consume is also essential. **Pressures** from production and consumption systems have been organized into categories focused on direct degradation (e.g. destructive fishing gear or agricultural practices), chemical pollution (plastics, pesticides), air pollution, water pollution, and loss of genetic diversity. Some of these, such as invasive species transfer, coincide well with existing frameworks. Other pressures, such as mining practices and regulations are gaps in these frameworks that are covered here.

- **Example outcome-based target:** Key sources of chemical pollution, for which the risk is high or unknown, are prevented
- **Example action-based target:** Strict environmental requirements on mining practices in all regions of the world are applied through both legal and economic pressures and all closed mines are rehabilitated

Finally, the **States** of environmental systems are imperative to cover in a comprehensive framework addressing biodiversity impacts from production and consumption. This framework covers states for nutrients, water, and greenhouse gas emissions. Compared to existing frameworks, these are not novel topics, although there are some new actions and metrics.

- **Example outcome-based target:** Net nutrient emissions from production converge to within sustainable levels (56% reduction for P & 41% for N - taking into account spatial excess and deficiencies)
- **Example action-based target:** Proper manure management and utilization reduces nutrient emissions from livestock by 60%, reducing overall nutrients emissions by 9% for N and 16% for P

In this document, we describe what "footprint" means and how we can set targets and actions at a level that rises to meet the challenge of "Halving the Footprint of Production and Consumption". In setting these targets, we have looked for evidence on where we stand compared to where we need to be, which sectors and consumption and production behaviors are the main contributors to the "footprint", and what types of actions can be taken to reduce impacts to an acceptable level




in line with the outcome targets. This provides a much more comprehensive picture of the production and consumption footprint and what we can do to "halve the footprint", though there are certainly still some gaps that could be addressed with further research. While we have defined actions that could achieve the targets, these actions are not the only ones possible, nor the optimal option in every context globally.

Within this framework, we have identified where there are overlaps with the indicators that other organizations and networks are using, or key gaps. To address some of these gaps, we have proposed additional indicators that are not yet covered by these existing frameworks. A few examples include:

- **Material consumption inequality:** While existing indicators cover the material footprint per person, there is a high degree of material consumption inequality. For some regions in the world, material consumption should actually increase, while being decreased in high-income countries. For this reason, we propose a GINI coefficient for material consumption to track the convergence of consumption levels between countries.
- **Average lifespan of products:** Many products and assets in the economy are discarded while still having functional value, which further drives demand for new products. The lifespan of products should be increased, except where there are fast developments in resource efficiency (e.g. energy efficiency). For this reason, the average lifespan of different product categories should be tracked.
- **Industrial and intentional biological fixation of N:** Reactive nitrogen is emitted in large quantities every year. Only about half of the emissions are due to human activities but the additional emissions provided by human activities stress the global nitrogen cycle. Although local ecosystems are already under pressure due to high nitrogen concentration, it is ultimately most important to avoid a high global concentration because this would prevent low ecosystems from recovering through diffusion.

# INTRODUCTION

Biodiversity supports everything that humans need to survive: food, clean water, clean air, and materials that we can make everything from medicines to buildings with. Biodiversity includes all the different kinds of life — the variety of animals, plants, fungi, and microorganisms like bacteria that make up our natural world — as well as how these species and organisms work together in ecosystems, like an intricate web, to maintain balance and support life.

This balance, and the human systems that rely on it are under threat, driven almost entirely by economic activity. Overconsumption, unsustainable extraction rates, land-use change, and the methods we use to produce and consume all contribute to environmental degradation and biodiversity loss, which in turn put the health, wellbeing, and livelihoods of people at risk.

Urgent action is needed to avoid irreversible biodiversity loss and build resilience world-wide. Mitigating our current biodiversity crisis, while still meeting human needs, entails a major shift in how we produce and consume materials and products. Within this, we also need to recognize and address global inequalities - high-income countries are responsible for a much larger share of global consumption (consuming around 27 tons of materials/person/year, compared to 2 tons/person/year in developing countries (Oberle et al., 2019)). Not only does consumption and its related impacts need to be brought within sustainable levels, but there also needs to be a convergence of impact footprint across and within regions and income groups.

Policymakers have a key role to play, as they set the boundary conditions driving land use, consumption, and production practices. Levers such as regulation, fiscal measures, taxes and subsidies, capacity building and awareness raising, etc can all be used to address the root causes of further degradation. WWF's New Deal for Nature and People framework and the recommendations it makes for inclusion in the Convention on Biological Diversity's post-2020 Global Biodiversity Framework sets out 10-year ecological targets that go across key impact areas and that collectively strengthen biodiversity. This framework includes suggestions on how policy can support the realization of targets across three goal areas.

# HALVING THE FOOTPRINT

The second goal of WWF's New Deal for Nature and People is "Halving the Footprint of Production and Consumption". From the science, it is clear that human impacts on the Earth exceed a sustainable level, or one that can continue to support biodiversity and maintain the key services upon which society depends. We need to reduce the footprint of our economy (or: the degree of impact that our economy has on the natural environment) to ensure that future generations have access to the same resources we do currently, as well as to preserve biodiversity for its own intrinsic value. In order to do this, we need to address the root causes of biodiversity loss (such as total consumption or the methods of production) to reduce the footprint to an acceptable level.

Concepts such as the Planetary Boundaries, the Ecological Footprint, Material Footprint, embodied human appropriation of net primary productivity (eHANPP), and the Water Footprint attempt to establish safe boundaries for environmental impacts. However, none of these are a comprehensive measure of all of the "footprint" of production and consumption. Impacts on biodiversity represent a complex web of interactions between key drivers, pressures, and states, which makes it difficult to establish a sound single measure of the "footprint".

While imperfect, these collectively do provide an indication of how far we need to go to address different problems. From these various footprinting methods, we can see that a target of "halving the footprint" is more or less in line with the science, though we need to be slightly more or less ambitious in addressing certain drivers or states.


**Figure 1:** Difference between annual per capita footprint boundaries and current state

**References:**

- All values except for those listed below: O'Neill, D. W., Fanning, A. L., Lamb, W. F., & Steinberger, J. K. (2018). A good life for all within planetary boundaries. Nature sustainability, 1(2), 88-95.
- Current material footprint: Oberle, B., Bringezu, S., Hatfield-Dodds, S., Hellweg, S., Schandl, H., & Clement, J. (2019). Global Resources Outlook: 2019. International Resource Panel, United Nations Envio.
- Current nitrogen footprint: https://ourworldindata.org/grapher/nitrogen-fertilizer-consumption. Current carbon footprint: https://data.worldbank.org/indicator/EN.ATM.CO2E.PC

## Rationale behind the approach

- Targets should be set using a science-based approach. Biodiversity is affected both directly and indirectly by a range of drivers, pressures, and states. While there is no suitable "limit" defined for a safe footprint, we should use the existing science to evaluate footprints related to key drivers and states that are well defined, including $CO_2$ emissions, land use and biomass appropriation, nutrient cycles, and fresh water use. Our targets are based on footprint limits which have been quantified where possible (as shown on the previous page).
- Targets should be time-based. For key drivers and states where we have already exceeded safe levels of impact, urgent action is required to bring us within a safe boundary by 2030. In other areas where impacts pose a future risk, we have to consider feasibility, political will, and building up capacity for addressing impacts on the longer term.
- Targets should be linked to outcomes. There are multiple ways to achieve an outcome and we need to be aware that some actions can result in negative tradeoffs.
- Targets should be actionable and give clear guidance on what policymakers should do in the coming decade. We have roughly quantified actions that could get us as far as the targets if implemented, though we recognize that these are not the only actions, nor always the best ones in every context.
- Targets must be contextually aware. Global environmental boundaries and our current status compared to these boundaries differ geographically. The actions that make sense in one context might not be suitable in another.
- Finally, both outcomes and actions should work to address the key causes of the footprint of production and consumption, which varies by sector and impact, as illustrated in the "hotspot" graphic below.

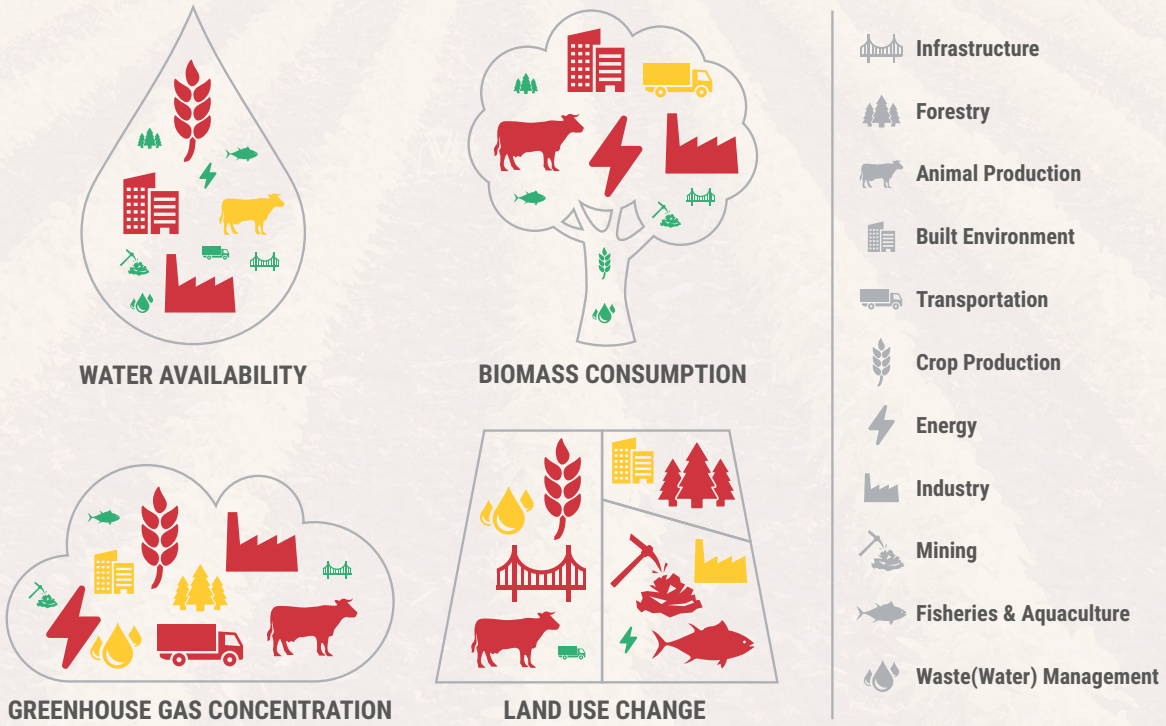



**Figure 2:** Hotspots - key sectors contributing to different types of impacts. The contribution from key economic sectors to different impact areas was assessed as part of the framework development. The results above show the specific sectors and actions that will be most important in reaching the individual targets. Red shows the sectors that are most crucial for each impact area, while green shows the sectors that are least important for each impact area.

# TARGETS FRAMEWORK

The CBD Zero Draft establishes sufficient goals and targets for reducing biodiversity impacts. However, there are additional key drivers, pressures, and states related to production and consumption systems that play a role in biodiversity loss, which is why a focus on these issues is a necessary consideration.

WWF has set a goal of "Halving the Footprint of Production and Consumption". In translating that goal into targets and metrics, this framework outlines 12 topic areas (shown below), which are arranged into three categories from the DPSIR approach (Kristensen, 2004). For each topic area, targets are defined for the period 2020 - 2030, which together provide a more comprehensive picture of the "footprint". Some of these topics, targets, and metrics are new compared to existing frameworks, and could be considered necessary preconditions for achieving existing goals, while others correspond to what is covered already.

1. **DRIVERS** are needs, processes or activities that drive a certain development or impact. In this case, the consumption of materials and products is a core driver of multiple environmental impacts.
2. **PRESSURES** are changes in the biophysical environment that affect ecosystems. In this case, production practices are the main pressures.
3. **STATES** are stocks in the biophysical environment that describe the state of an essential parameter, such as the concentration of atmospheric $CO_2$ (note: this differs from the CBD definition).

Beyond these three categories, the DPSIR framework also includes IMPACTS and RESPONSES. IMPACTS are the final outcome (e.g. biodiversity loss), which are already well covered under the current CBD framework and other WWF goals. RESPONSES are covered in our framework by linking action-based targets to each of the outcomes defined under drivers, pressures, and states.

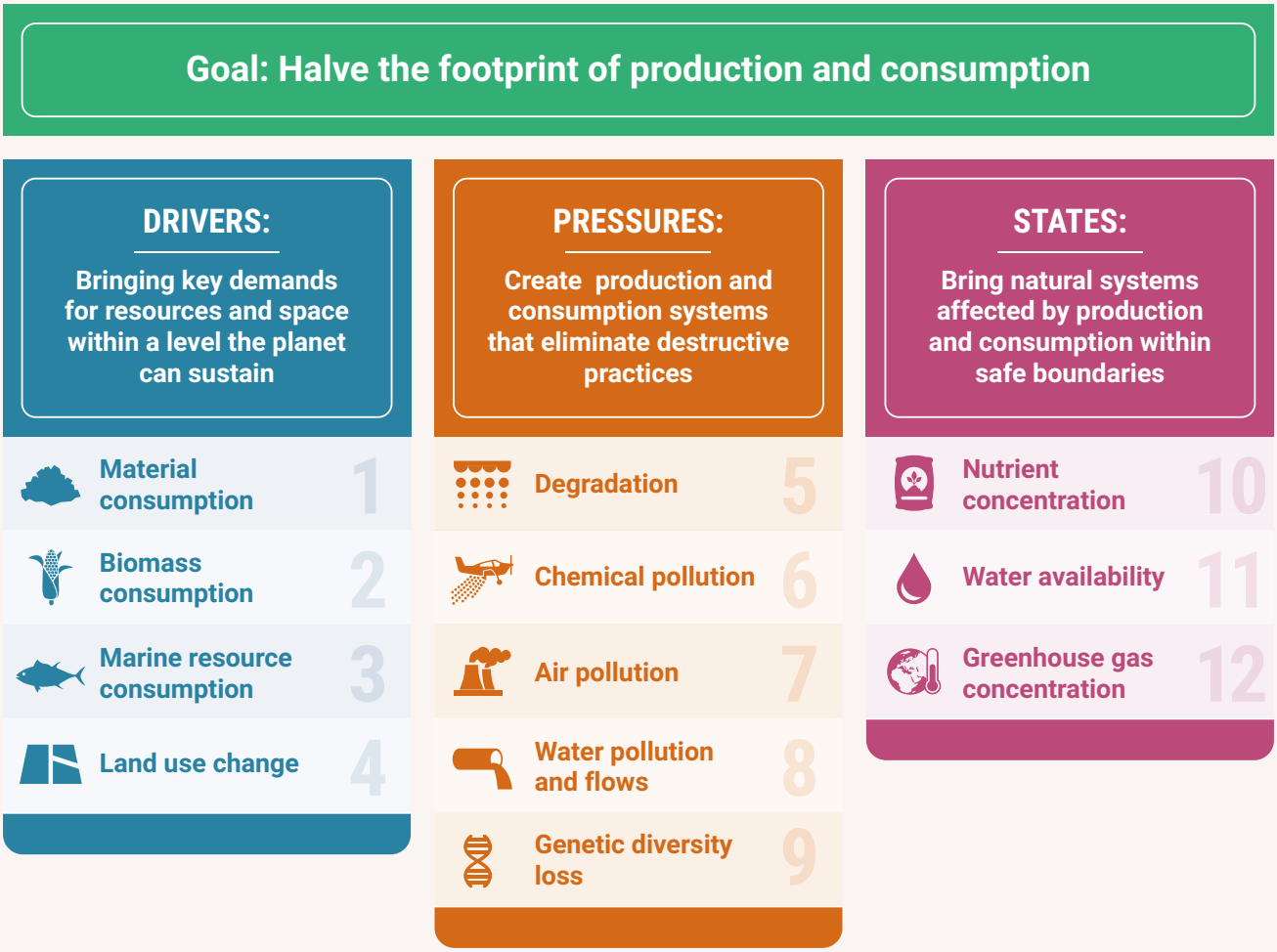



**Figure 3:** Targets framework at a glance

# DRIVER TARGETS:

## Bringing key demands for resources and space within a level the planet can sustain

## 1. MATERIAL CONSUMPTION

### Outcome Target

**Net consumption of all materials is reduced by roughly 40% to bring the material footprint within sustainable levels, while global consumption levels converge to a more equitable state**

### Action-based Targets

- Consumption reduction is achieved through increased footprint awareness and conscious consumption, decreasing material demand by 10%
- Resource efficiency of products is increased by 5%, for example through a tax on products for final consumption that is based on embodied resource use or through technological innovations
- Consumption reduction of 10% is achieved through lifespan extension of products, eliminating planned obsolescence, product-as-a-service models, expanded lending models, building renovation, etc
- Increased recycling rates for key materials (such as building materials) and use of recycled materials in products decreases material demand by 15% (similarly covered by the SDG framework)

## 2. BIOMASS CONSUMPTION

### Outcome Target

**Consumption of biomass is reduced by around 35% per capita to bring it within sustainable levels, while ensuring there is enough nutritious food for current and future generations**

### Action-based Targets

- A transition to more sustainable diets (for example by reducing overall animal product consumption by 15%, which could reduce overall crop consumption by around 5%)
- Silvopastoralism, waste-based feed, and other techniques to reduce meat's demand for primary crops by around 5%
- Halving food waste along the entire value chain, including post-harvest losses, reducing overall crop demands by around 10%
- Circular economy actions (e.g. textiles recycling, wood recycling, biomass cascading), reducing overall non-food crop & forestry demands by 15% and overall biomass consumption by around 5%
- Use of primary biomass sources (wood and crops) for energy production is reduced by 50%, bringing the overall biomass demand down by 15.5%

## 3. MARINE RESOURCE CONSUMPTION

### Outcome Target

**Extraction of marine resources is brought within a sustainable level in all marine and coastal environments**

### Action-based Targets

- Overall demand for fish is reduced by avoiding the use of fish as animal feed (or only fish not suitable for human consumption is used as animal feed — currently 27% of landings are used as feed)
- Total allowable catch is set and applied using precautionary reference points under an ecosystem approach to fisheries framework (Building on Aichi target 6)
- Recovery plans and measures are in place and fully implemented for all declining stocks so they can rebuild to healthy levels (similarly covered by the Aichi framework)

## 4. LAND USE CHANGE

### Outcome Target

**Net expansion of human land uses globally is halted, while recognizing the right of developing countries to achieve economic security**

### Action-based Targets

- Yield increases, especially in developing countries, account for the majority of production increases to prevent further agricultural expansion and deforestation
- Sustainable soil management practices (such as no-till and conservation tillage) and rehabilitation are widely applied to prevent degradation that necessitates expansion of agricultural land
- Nature-based solutions (for example wetlands for water management) are widely applied instead of further gray infrastructure development, wherever possible
- Compensation for further development ensures that there is no net expansion (with consideration of the right to develop by developing nations)
- No-go areas declared by Indigenous Peoples and Local Communities are respected

### Example indicators (see appendix for full list):

| Outcome Indicators | Action Indicators |
|---|---|
| • Material consumption inequality | • Recycling rate |
| • Land footprint per kg protein | • Food waste/ food loss indices |
| • Fish stock status | • Proportion of depleted stocks with rebuilding plans in place |
| • Land footprint per capita | • Share of sustainable soil management practices (e.g. no till) |

# PRESSURE TARGETS:

## Create production and consumption systems that eliminate destructive practices

### 5. DEGRADATION

**Outcome Target**

**The main sources of direct degradation of environments from productive systems are halted by 2030**

**Action-based Targets**

- Regenerative farming/agroecological practices are incentivized and widely adopted (also covered by Aichi and SDG indicators)
- Sustainable forest management practices are universally applied (as in the SDGs and CBD framework)
- Legal and economic pressures ensure that strict environmental requirements on mining practices are adopted world-wide (e.g. water and air pollution standards) and that all closed mines are rehabilitated
- A 50% reduction is achieved in fishing vessels / gears that (a) remove all or most species they encounter, or (b) damage habitats; or (C) cause unsustainable mortality of non-target species
- Fisheries that operate illegally are eliminated (as in the SDG and CBD frameworks)
- All coastal, marine, and freshwater areas are sustainably managed by applying integrated ecosystem-based approaches, prioritizing key habitats and keystone species (as in the SDGs)
- Multiple uses of the ocean are managed in a way that limits their impact as well as cumulative impacts on the ecosystem functions and ecosystem services (consistent with CBD guidance on the ecosystem approach as noted in decisions V/6 & VII/11)

### 6. CHEMICAL POLLUTION

**Outcome Target**

**Key sources of chemical pollution, for which the risk is high or unknown, are prevented**

**Action-based Targets**

- Reduction of pesticide use through practices such as intercropping and banning the most harmful pesticides
- Preventing losses of plastics and other wastes into the environment is achieved through litter prevention and better waste-management practices (touched upon by the SDGs and the CBD framework)

## 7. AIR POLLUTION

### Outcome Target

**The main sources of air pollutants with an adverse effect on nature and people are prevented**

### Action-based Targets

- Stricter air quality standards halve loss of life and DALYs caused by air quality (corresponds with the SDGs)
- Air pollution capture technologies and other interventions (e.g. urban vegetation) are widely applied in highly populated settings

## 8. WATER POLLUTION AND FLOWS

### Outcome Target

**Critical water pollutants and disruptions to water flows with an adverse effect on nature and people are prevented**

### Action-based Targets

- Emissions of insufficiently treated wastewater are prevented globally
- Incidences of oil spills are reduced to near zero
- Mercury emissions from the two largest sources: coal combustion and gold mining are halted, preventing more than half of the current mercury emissions (partly addressed by the Aichi framework)
- No new large dams are constructed in protected areas or on free-flowing /high/good ecological status rivers
- Environmental flows and river connectivity are required to be implemented with new water infrastructure projects

## 9. GENETIC DIVERSITY LOSS

### Outcome Target

**Key pressures of the production system that result in the loss of genetic diversity are addressed**

### Action-based Targets

- Invasive species transfer from shipping and aquaculture is halved
- Crop and livestock diversity is preserved through programs that increase demand for traditional varieties

### Example indicators (see appendix for full list):

| Outcome Indicators | Action Indicators |
|---|---|
| • Wild Bird Index for farmland birds<br>• Plastic debris density<br>• PM2.5 air pollution, population exposed to levels exceeding WHO guideline value (% of total) | • Proportion of area of forest production under FSC and PEFC certification<br>• Areas of agricultural land under organic production<br>• Air pollution regulation standard levels |

# STATE TARGETS:

## Bring natural systems affected by production and consumption within safe boundaries

## 10. NUTRIENT CONCENTRATION

### Outcome Target

**Net nutrient emissions from production converge to within sustainable levels (56% reduction for P & 41% for N - taking into account spatial excess and deficiencies)***

### Action-based Targets

- Precision agriculture, intercropping with N-fixing species, closed-system agricultural production, and other techniques are widely applied to reduce nutrient leakage from agriculture by 50% and overall nutrient emissions by around 26% for N and 28% for P
- Proper manure management and utilization reduces nutrient emissions from livestock by 60%, reducing overall nutrients emissions by 9% for N and 16% for P.
- All regions have proper wastewater treatment to prevent nutrient leakage, reducing overall nutrient emissions by 6% for N and 9% for P
- N emissions from fossil fuel incineration is reduced by 20%, reducing global N emissions by 3%

## 11. WATER AVAILABILITY

### Outcome Target

**Groundwater reservoirs are maintained and replenished where necessary**

### Action-based Targets

- Crops with low water demands (e.g. drought-resistant crop varieties) and efficient methods of irrigation are used in areas experiencing water stress
- Water consumption is reduced in the built environment to create a balance in regions of low water availability and rain, gray, and wastewater are cascaded and cycled

**Note: The metrics for nutrients are arguably similar to Pressures. However, because they express the total pressure and because the needed reduction is incorporated in the goal, it provides an appropriate proxy for the state.*

## 12. GREENHOUSE GAS CONCENTRATION

### Outcome Target

**The cumulative emission of greenhouse gasses starting from 2018 stay below 420 $GtCO_2$-eq for a two-thirds chance of limiting warming to 1.5°C (IPCC, 2018: SR15)**

### Action-based Targets

- Reducing final energy demand by 5%
- Increasing share of renewable energy by 60%
- Reducing agricultural emissions of $CH_4$ by 48%
- Reducing agricultural emissions of $N_2O$ by 26%
- Drastically increasing natural capacity to capture carbon through afforestation and other land restoration (related to share of forest land included in in the SDGs, CBD, and Aichi targets)

### Example indicators (see appendix for full list):

| Outcome Indicators | Action Indicators |
|---|---|
| • Industrial and intentional biological fixation of N<br>• Total phosphorus flow from freshwater systems into ocean<br>• Percentage of global crop production by water risk<br>• Net change in groundwater reservoirs<br>• Net $CO_2$ emissions (metric tons per capita) | • Sustainable Nitrogen Management Index<br>• Agricultural irrigated land (% of total agricultural land)<br>• Renewable energy share in the total final energy consumption |

# NEW INDICATORS FOR MEASURING THE FOOTPRINT OF PRODUCTION AND CONSUMPTION

Many of the indicators identified as suitable for measuring progress towards the "Halving the Footprint of Production and Consumption" goal align well with existing frameworks, such as those used in the Sustainable Development Goals (SDGs), the Aichi Biodiversity Targets framework, and those used by the CBD. Other indicators that were included in this framework are already measured by organizations such as the World Bank, FAO, WRI, or included in Yale's Environmental Performance Index.

Beyond these existing indicators, there are a number of gaps in the scope of "Halving the Footprint of Production and Consumption" that were identified. New indicators are proposed to fills these gaps, which include:

| Outcomes | |
|---|---|
| **DRIVERS** | **STATES** |
| • **Material consumption inequality:** While existing indicators cover the material footprint per person, there is a high degree of material consumption inequality. For some regions, material consumption should increase, while decreasing in high-income countries. For this reason, we propose a GINI coefficient for material consumption to track the convergence of consumption between countries (and within countries, where data is available). | • **Industrial and intentional biological fixation of N:** Reactive nitrogen is emitted in large quantities every year. Only about half of these emissions are due to human activities, but the additional emissions from human activities stress the global nitrogen cycle. Local ecosystems are already under pressure due to high nitrogen concentration, but a high global concentration prevents ecosystems from recovering through diffusion. |
| • **Biomass footprint per capita:** In addition to the overall material footprint, it also makes sense to track the biomass footprint per capita, since biomass consumption is most directly linked to environmental footprint. | • **Total phosphorus flows from freshwater systems into the ocean:** Phosphorus is, like nitrogen, driving eutrophication. Similar to nitrogen, it is crucial to avoid a global concentration so high that it will undermine marine ecosystems and prevent recovery of freshwater systems through diffusion. |
| • **Land footprint per capita:** The general consensus is that humans have appropriated too large a share of global land to continue supporting biodiversity, so land use should be tracked using a land footprint per capita metric. | • **$CO_2$ emissions per level of happiness:** $CO_2$ emissions are often compared against GDP, but GDP is a poor measure of human wellbeing. On the longer-term it makes sense to shift towards other measures as proxies for wellbeing. As happiness levels are measured globally, it would be possible to create a $CO_2$ intensity versus happiness metric that better captures this aspect. |
| • **People nourished per ha agricultural land:** A more specific way to measure the effectiveness of the land we are using is to look at the amount of people who can be nourished per area of agricultural land. This incorporates various issues, such as dietary choices and yield, into a single indicator. | |
| • **Total harmful pesticide emissions:** Total pesticide use is tracked, but not the share of those pesticides with known risks to nature and people. This should be tracked as a separate metric, though data availability will be a challenge. | |

| Actions | |
|---|---|
| **DRIVERS** | **STATES** |
| • **Average lifespan of products:** Many products and assets in the economy are discarded while still having functional value, which further drives demand for new products. The lifespan of products should be increased, except where there are fast developments in resource efficiency (e.g. energy efficiency). For this reason, the average lifespan of different product categories should be tracked. | • **Total $CO_2$ capture by afforestation and land restoration:** Most scenarios for a global economy that keeps climate change below 1.5 - 2 degrees, assume a significant amount of carbon dioxide removal through carbon capture, afforestation, and other nature-based solutions. These efforts however are not well-monitored and strategically supported to the extent necessary. Monitoring the total capacity to capture carbon and the annual change in this capacity is pivotal for ensuring the future stability of sensitive ecosystems. |
| • **Biobased material cascading rate:** Biobased materials should be cascaded through as many cycles as possible before recapturing the chemical composition (e.g. nutrients) of the materials. Tracking biobased cascading rates is important as it can result in decreased demand for primary biomass resources. | • **Total emissions from agriculture:** Agriculture is a major contributors to the emission of nutrients (especially nitrogen). Understanding which share is coming from food production can help shape priorities and interventions. The metric will cover what share of the two metrics above are coming from agricultural activities. |
| • **Percentage primary biomass used in energy production:** Biomass is still a major source of global energy, which is a key driver of environmental pressures. At the same time, demands for bioenergy are increasing, though there is a push to switch to secondary sources of biomass, which can alleviate this pressure. For this reason, the share of primary biomass versus crop residues or other wastes should be tracked. | |

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# APPENDIX

# FULL LIST OF INDICATORS

**bold are new indicators*

| DRIVERS | | |
|---|---|---|
| | **Outcome Indicators** | **Action Indicators** |
| **1. MATERIAL CONSUMPTION** | • Material footprint per capita<br>• **Material consumption inequality** | • Recycling rate<br>• **Average lifespan of products (by product type)**<br>• Number of countries developing, adopting or implementing policy instruments aimed at supporting the shift to sustainable consumption and production |
| **2. BIOMASS CONSUMPTION** | • **Biomass footprint per capita**<br>• Food loss index<br>• **Land footprint per kg protein** | • Number of countries developing, adopting or implementing policy instruments aimed at supporting the shift to sustainable consumption and production<br>• Food waste/ food loss indices<br>• **Percentage primary biomass used in energy production**<br>• **Biobased material recycling rates** |
| **3. MARINE RESOURCE CONSUMPTION** | • Fish stock status | • Proportion of depleted stocks with rebuilding plans in place<br>• Coverage of fisheries with management measures to reduce bycatch and discards<br>• Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the United Nations Convention on the Law of the Sea, for the conservation and sustainable use of the oceans and their resources<br>• Number of countries using ecosystem-based approaches to managing marine areas |
| **4. LAND USE CHANGE** | • **Land footprint per capita** | • **People nourished per ha agricultural land**<br>• Share of sustainable soil management practices (e.g. no till) |

| PRESSURES | | |
|---|---|---|
| | **Outcome Indicators** | **Action Indicators** |
| **5. DEGRADATION** | • Trends in population of non-target species affected by fisheries<br>• Wild Bird Index for farmland birds<br>• Living planet index | • Proportion of agricultural area under productive and sustainable agriculture<br>• Trends in fisheries certified by the Marine Stewardship Council<br>• Number of countries with policies that make adequate provisions to minimize the impacts of fisheries on threatened species<br>• Proportion of area of forest production under FSC and PEFC certification |
| **6. CHEMICAL POLLUTION** | • Total harmful pesticide emissions<br>• Plastic debris density | • Areas of agricultural land under organic production<br>• Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities |
| **7. AIR POLLUTION** | • PM2.5 air pollution, population exposed to levels exceeding WHO guideline value (% of total) | • Air pollution regulation standard levels |
| **8. WATER POLLUTION** | • Proportion of bodies of water with good ambient water quality<br>• Ocean Health Index | • Proportion of domestic and industrial wastewater flows safely treated |
| **9. GENETIC DIVERSITY LOSS** | • Percentage of plant genetic resources for food and agriculture threatened out of those surveyed/ inventoried<br>• Trends in the numbers of invasive alien species introduction events | • Level of implementation of global plan of actions on genetic resources for food and agriculture<br>• Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species |

| STATES | | |
|---|---|---|
| | **Outcome Indicators** | **Action Indicators** |
| **10. NUTRIENT CONCENTRATION** | • **Industrial and intentional biological fixation of N**<br>• **Total phosphorus flows from freshwater systems into the ocean** | • Sustainable Nitrogen Management Index |
| **11. WATER AVAILABILITY** | • **Human appropriation of fresh water (water footprint)**<br>• Percentage of global crop production by water risk | • Water productivity, total (constant 2010 US$ GDP per cubic meter of total freshwater withdrawal)<br>• Agricultural irrigated land (% of total agricultural land) |
| **12. GREENHOUSE GAS CONCENTRATION** | • Net $CO_2$ emissions (metric tons per capita)<br>• **$CO_2$ emissions per level of happiness** | • Renewable energy share in the total final energy consumption<br>• **Total emissions from agriculture**<br>• **Total $CO_2$ capture by afforestation and land restoration** |

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