NATURAL CAPITAL PROTOCOL

FOOD AND BEVERAGE SECTOR GUIDE

NATURAL CAPITAL COALITION

Contents

Foreword by Mark Gough, Executive Director, Natural Capital Coalition

This sector guide was developed to accompany the Natural Capital Protocol (hereafter, the Protocol). The guide is intended as a supplement to the Protocol and, as such, you will need to have a copy of the Protocol with you as you read this.

The Protocol and sector guides form a suite of work that has been produced by the Natural Capital Coalition, to harmonize approaches and simplify the sometimes confusing landscape of natural capital initiatives.

It has been produced through collaboration, and proves that by working together we can create widely accepted outputs that are robust and accessible and that recognize the needs of the many different stakeholders involved.

Continuing this collaboration at the sector level allows for a greater understanding of common challenges and the ability to develop system-wide solutions that will benefit not just the sector as a whole, but society and nature as well.

I would like to thank all of the people who have been involved in developing this sector guide. This is a significant step forward and provides a strong platform for future integration of natural capital into the way that we think and work.

Orientation

Introducing natural capital, the Protocol, and the sector guides

The Protocol is a standardized framework to help businesses identify, measure, and value their impacts and dependences on natural capital. However, natural capital impacts and dependencies are often specific to the sector in which a business operates. In 2013, the Natural Capital Coalition (hereafter the "Coalition") valued the unpriced natural capital consumed by primary production (including agriculture, forestry, fisheries, and mining) and some primary processing (including cement, steel, pulp, and paper) sectors at USD 7.3 trillion. Moreover, most of these sectors did not generate sufficient profit to cover their environmental impacts, with consumer sectors amongst those most exposed (Natural Capital Coalition 2013). Recognizing the sector specificity of natural capital impacts and dependencies, the Protocol is supported by sector guides that provide additional guidance for businesses applying the Protocol in specific sectors. The first guides, produced in 2016, were for the food and beverage and apparel sectors, with additional sector guides to follow.

The appetite amongst business for a standardized framework to help assess impacts and dependencies on nature was evidenced in an extensive business review conducted by the Coalition in the summer of 2015. The review provided insight into the opinions of a broad range of businesses representing 15 sectors (including consumer products, construction, food and beverage, apparel, and financial institutions) across all geographic regions. Businesses said that any measure of success in the uptake of a protocol would be evidenced in improved risk management, increased competitive advantage, and enhanced corporate reporting (Natural Capital Coalition 2015). Ultimately, these benefits are encapsulated in more informed business decision making.

Responding to this call to action, the sector guides help demonstrate the manner in which natural capital assessments can help businesses in specific sectors achieve these benefits through applications of the Protocol.

Glossary

Natural capital
The stock of renewable and non-renewable natural resources (for example, plants, animals, air, water, soils, and minerals) that combine to yield a flow of benefits to people (adapted from Atkinson and Pearce 1995; Jansson et al. 1994).

Natural Capital Protocol
A standardized framework to identify, measure, and value direct and indirect impacts (positive and negative) and/or dependencies on natural capital.

Sector guide
Additional, sector-specific guidance to be used alongside the Protocol by businesses in a relevant sector conducting a natural capital assessment.

How do the sector guides support the Protocol?

The sector guides support the Protocol by providing additional guidance and sector-specific business insights. The sector guides do not provide additional methodologies, but assist in the implementation of the Protocol. Like the Protocol itself, the sector guides have been developed for business, aimed primarily at managers from sustainability, environmental, health and safety, and operations departments to help them integrate natural capital into existing business processes.

More specifically, the sector guides:

- Provide context on why natural capital is relevant to your business and how your business benefits from it
- Develop the business case for natural capital assessments
- Identify natural capital impacts and dependencies relevant to your business
- Use practical examples to demonstrate sector-specific business applications of the Protocol

Principles

The sector guides are underpinned by the same principles as the Protocol to help guide your natural capital assessment.

Relevance
Ensure that you consider the most relevant issues throughout your natural capital assessment including the impacts and/or dependencies that are most material for the business and its stakeholders *(Adapted from original in CDSB 2015 and WRI and WBCSD 2004).*
Rigor
Use technically robust (from a scientific and economic perspective) information, data, and methods that are also fit for purpose.
Replicability
Ensure that all assumptions, data, caveats, and methods used are transparent, traceable, fully documented, and repeatable. This allows for eventual verification or audit, as required *(Adapted from GRI, 2013).*
Consistency
Ensure the data and methods used for an assessment are compatible with each other and with the scope of analysis, which depends on the overall objective and expected application *(Adapted from WRI and WBCSD, 2004; and IIRC, 2013).*

Note: Whereas **Relevance** is a principle to adhere to throughout the application of the Protocol, **Materiality** is covered in Step 04, "Determine the impacts and/or dependencies".

Although it is recommended that the principle of **Consistency** is adhered to throughout your assessment, the Protocol does not propose that outputs will be consistent and comparable between companies, as they are context specific. Comparability of results is something that will be addressed at a later date.

The Protocol Framework, Stages, and Steps and their relevance in the sector guides

The Protocol Framework covers the four stages of a standard decision-making process, "Why", "What", "How", and "What Next". These Stages are further broken down into nine Steps, which contain specific questions to be answered when carrying out a natural capital assessment (Figure 0.1).

The Stages and Steps are iterative, and you should expect to revisit previous Steps as necessary. For example, after identifying your most material impacts and dependencies in Step 04, you may need to go back and change the objective or scope of your assessment in Steps 02 and 03.

Each Step in the Protocol follows the same structure. Steps begin with a statement of the overarching question to be addressed and a brief introduction, followed by a detailed description of the actions required to complete the Step, together with guidance on how to proceed, and a template for outputs.

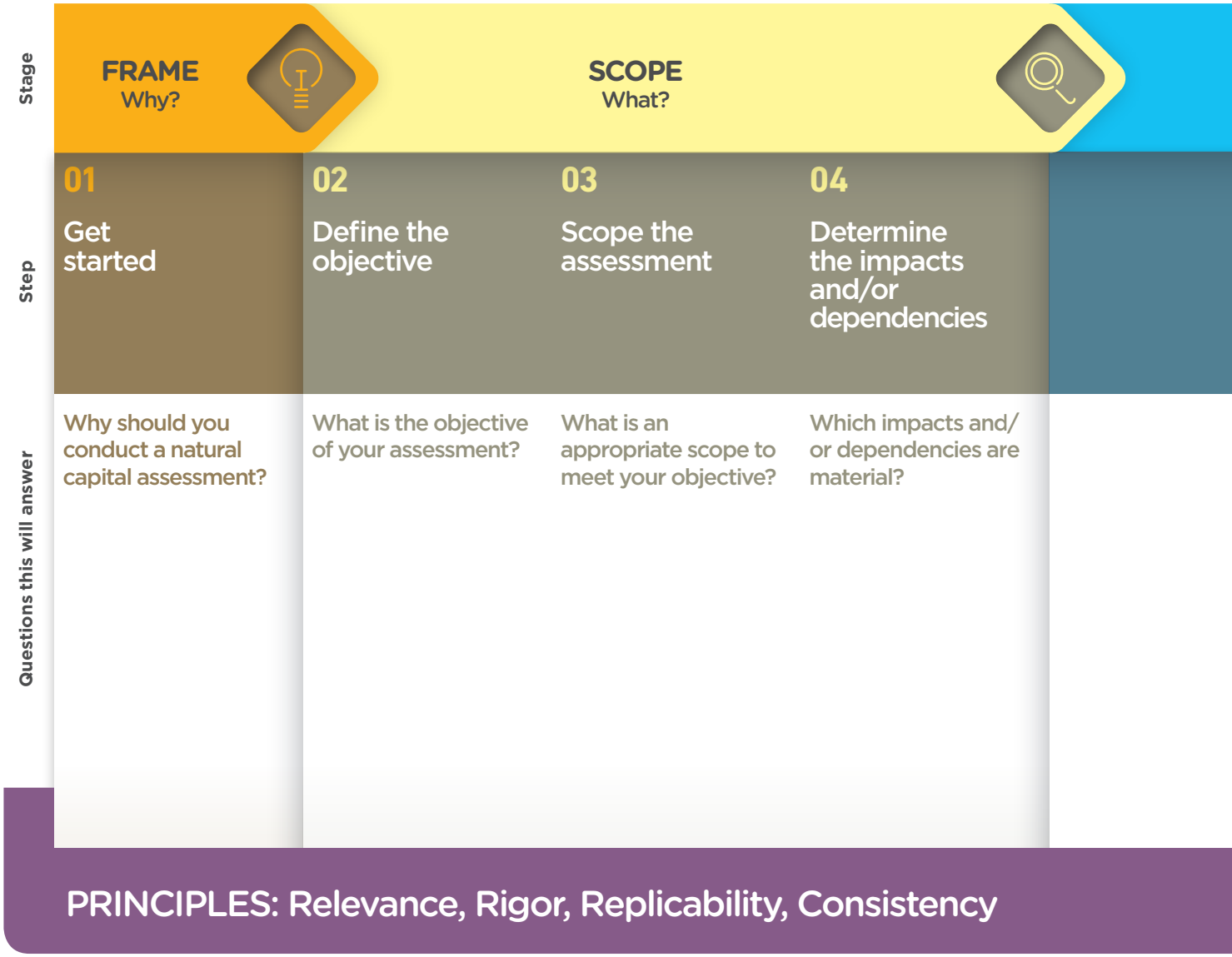

Figure 0.1
The Natural Capital Protocol Framework

MEASURE AND VALUE
How?

APPLY
What next?

05
Measure impact drivers and/or dependencies

How can your impact drivers and/or dependencies be measured?

06
Measure changes in the state of natural capital

What are the changes in the state and trends of natural capital related to your business impacts and/or dependencies?

07
Value impacts and/or dependencies

What is the value of your natural capital impacts and/or dependencies?

08
Interpret and test the results

How can you interpret, validate and verify your assessment process and results?

09
Take action

How will you apply your results and integrate natural capital into existing processes?

The sector guides follow the overarching Protocol Framework exactly and do not introduce any additional Stages or Steps. Each Step in the sector guides contains additional guidance that will help your business complete the actions within that Step and navigate through the Protocol Framework.

For some actions, additional sector-specific guidance may not be appropriate. At the beginning of each Stage and Step, the sector guides outline the actions that have been extended to provide additional sector-specific guidance.

Businesses implementing the Protocol should follow all Stages and Steps as described in the Protocol Framework. The sector guides should be used together with the Protocol rather than in isolation. To help bring sector-specific business applications to life, the sector guides include hypothetical examples that summarize how a business would complete all actions outlined in the Protocol.

Useful definitions of key terms are provided when they are first introduced. For a complete glossary, please refer to the Protocol.

Definition of the food and beverage sector and its value chain

This sector guide defines the food and beverage sector to encompass all businesses operating in the production, processing, or retailing of food and beverage products, excluding the hospitality/foodservice sector which is beyond the scope of this guide. Farmers, traders, wholesalers, food manufacturing companies, and retailers together make up the world's largest sector, generating an approximate global value of around USD 12.5 trillion based on revenue, or 17% of world GDP in 2013 (KPMG 2013; calculated from MarketLine 2013a,b,c,d,e). These businesses also span different tiers of production, and are reliant on international trade and complex supply chains. Though industry participants have differing degrees of vertical integration into agricultural products, with some companies operating farms, processing facilities, and storage and distribution networks, the basic stages are represented in Figure 0.2.

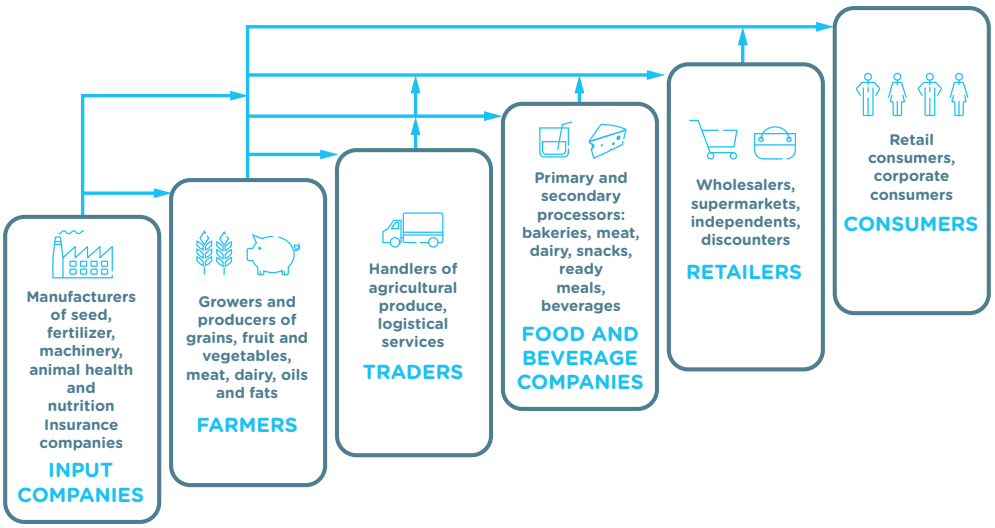

Figure 0.2
The food and beverage value chain (Trucost 2016)

The Traders stage of the value chain includes all intermediary stages, such as sourcing, logistics, and trading, that are not covered elsewhere.

This sector guide considers the natural capital impacts and dependencies of businesses operating across the food and beverage value chain including the consumer use and end-of-use stages, as well as input companies throughout the value chain. However, certain sub-sectors are prioritized based on their relevance.

Recycling, reuse, and other end-of-life options are considered within every stage of the value chain and can be a critical mechanism for reducing impacts and dependencies.

Hypothetical examples running through the food and beverage sector guide

To help your business navigate through each Step of the Protocol Framework, the food and beverage sector guide contains three hypothetical examples that help bring sector-specific business applications to life. Although purely illustrative, the examples demonstrate how businesses operating in the food and beverage sector can use the Protocol to frame, scope, measure, value, and apply a natural capital assessment to inform business decision making. The hypothetical examples will appear at the end of each Step to provide a summary of what was concluded. Table 0.1 introduces these examples, the context for each organization's engagement with the Protocol, the benefit that was obtained, and the decision that was informed.

Table 0.1
Sector-specific hypothetical examples

	Bright & Wholesome	Maison Chocolat	Sugar Estates Ltd.
Organization	Large diversified food and beverage retailer	Small chocolate brand	Medium-sized sugar farm
Context	A large diversified food and beverage retailer sells multiple brands as well as its own-brand product line, where it has been investing in sustainability improvements on an ad hoc basis. It would like to communicate to its customers how its own-brand product line outperforms other brands in sustainability terms.	A small chocolate brand has experienced a significant decline in profit due to increased costs of key raw materials in its supply chain. It would like to identify the best sites for sourcing materials to mitigate potential future risk.	A medium-sized sugar farm is receiving financial assistance to transition towards more sustainable farming systems that prevent toxic runoff into fragile coastal ecosystems. To encourage a further round of investment, it would like to assess and report to its funders on the significant natural capital benefits delivered as a result of their funding.
Natural capital assessment undertaken (Business application)	The company conducted a monetary assessment to communicate to its customers the net natural capital benefits delivered to society from the reduction of negative impacts of its own-brand products. *(Communicate internally and/or externally—see Step 02)*	The company conducted a quantitative and qualitative assessment of its raw material suppliers to mitigate the risks of natural capital dependency on fresh water provision across its supply chain. *(Compare options – see Step 02)*	The sugar farm conducted a monetary assessment to report back to its funders the net impact delivered by their investments from the reduction of agrochemical use polluting soil and coastal water ecosystems. *(Estimate total value and/or net impact — see Step 02)*
Business benefit	Effective communication with external stakeholders in monetary terms generated reputational benefits from own-brand differentiation.	Simultaneously assessing the water footprint of each raw material and related regulatory risk enabled improved decision making and potential long-term increase in competitiveness.	Sugar Estates Ltd.'s effective communication with its funders on the net benefit returned on their investment allowed the farm to receive a further round of funding and diversify its investor base.
Business decision	Bright & Wholesome decided to extend its external reporting and communication efforts into a comprehensive own-brand portfolio EP&L to enable comparison of financial performance with impact reduction achievements.	The environmental team engaged senior management with the results of the analysis providing the business case for risk reduction. This allowed the business to make more informed procurement decisions and improve the overall long-term sustainability of its raw material sourcing.	Following the success it had with its funders, Sugar Estates Ltd. used the results of the monetary assessment to differentiate itself to buyers and secure longer-term purchase agreements.

FRAME STAGE
Why?

What is the Frame Stage?

The Frame Stage of the Protocol helps you to frame why you would undertake a natural capital assessment and to consider the benefits this could deliver.

How does the sector guide map to the Protocol?

Table F.1 provides an overview of the questions and actions of the Frame Stage in the Protocol and an outline of the actions for which the sector guide provides additional guidance.

Table F.1:
Mapping between the Protocol and the sector guide

Step	Question that this Step will answer	Actions	Additional guidance included in the sector guide?
01 Get started	**Why should you conduct a natural capital assessment?**	1.2.1 Familiarize yourself with the basic concepts of natural capital	**No**
		1.2.2 Apply the basic concepts of natural capital to your business context	**Yes**
		1.2.3 Prepare for your natural capital assessment	**No**

Additional notes
Businesses operating in the food and beverage sector should address all of the actions associated with Step 01 in the Frame Stage. The sector guide provides additional guidance for some actions, where most appropriate, but it is important that you familiarize yourself with the foundational concepts and terms introduced in Step 01 of the Protocol as you use the sector guide.

01 Get started

This section of the sector guide provides additional guidance for answering the following question:
Why should you conduct a natural capital assessment?

In particular, the sector guide will help you undertake the following action:
1.2.2 Apply the basic concepts of natural capital to your business context

Apply the basic concepts of natural capital to your business context

In this section, the sector guide builds on the basic concepts of natural capital that are outlined in Step 01 of the Protocol and demonstrates how they relate to your business. In undertaking this action, you will consider the potential natural capital impacts and/or dependencies and explore the potential risks and opportunities that are relevant to your business and its stakeholders.

Whilst strong underlying growth factors such as population, urbanization, and the rise of the middle class translate into strong demand for food and beverage products, the supply side of the equation shows increasing vulnerability (KPMG 2013). The food and beverage sector is embedded within ecosystems, where crop and livestock systems form the basis of an entire downstream economy. Food and beverage companies depend on natural capital for raw materials, energy, land, water, and a stable climate as a base for their businesses. This dependency can be direct, in the case of agricultural producers, or indirect, for all those who depend on agricultural products in their value chain. Further to this, biodiversity is critical to the health and stability of natural capital and to flows of ecosystem services; it underlies resilience to shocks like floods and droughts, and supports fundamental processes such as the carbon and water cycles as well as soil formation. Over-exploitation of natural resources, particularly when they are sourced from areas with high water scarcity or where the level of production and therefore land use is also high, presents a financial risk to companies. For example, the FAO (2015a) estimated that industrialized farming practices cost the environment some USD 3 trillion per year, more than the UK's annual GDP in 2015.

In turn, agricultural practices, food and beverage production, and their distribution, consumption, and disposal patterns have profound impacts on ecosystems and societal well-being. More than 60% of critical ecosystem services (including fresh water provision, climate regulation, and soil fertility) are currently being degraded or used up faster than they can be replenished (MA 2005). Agriculture and seafood, sitting at the top of the sector's supply chain, are among the segments of business activity that pose the greatest threat to critical ecosystems through impacts such as soil erosion, air, land, and water pollution, deforestation of habitats, and species reduction (WWF 2012). Not only do these impacts threaten ecosystems on which food and beverage companies depend for continuous supply, but there is increasing risk of financial costs. In addition, as much as USD 11.2 trillion in agricultural assets, including processing plants and transportation and distribution networks, could be stranded annually because of environmental risks including climate change and water scarcity (Oxford University 2013). Conversely, well-managed natural capital can provide positive opportunities. Agricultural practices can be optimized to protect and enhance the vital ecosystem services on which businesses depend, while the use of recycled materials can reduce the negative impacts associated with landfill and incineration practices.

Before considering some of the potential natural capital impacts and dependencies that are relevant to your business, Figure 1.1 outlines the main risk categories that have a direct link to business performance: higher resource costs, new government regulations, reputational damage, reduced market share, and fewer financing options. These types of risks are already affecting corporate income statements and balance sheets. In contrast, businesses that already manage natural capital create for themselves a range of opportunities from new products, services, and technology that positively affect their bottom lines. For more examples of risks and opportunities, please refer to the Protocol.

Glossary

Natural capital impact
The negative or positive effect of business activity on natural capital.

Impact driver
In the Protocol, an impact driver is a measurable quantity of a natural resource that is used as an input to production (for example, volume of sand and gravel used in construction) or a measurable non-product output of business activity (for example, a kilogram of NOx emissions released into the atmosphere by a manufacturing facility).

Ecosystem
A dynamic complex of plants, animals, and microorganisms, and their non-living environment, interacting as a functional unit. Examples include deserts, coral reefs, wetlands, and rainforests (MA 2005). Ecosystems are a component of natural capital.

Ecosystem services
The most widely used definition of ecosystem services is from the Millennium Ecosystem Assessment: "the benefits people obtain from ecosystems". The MA further categorized ecosystem services into four categories: Provisioning, Regulating, Cultural, and Supporting (MA 2005).

Biodiversity
The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems (UN 1992).

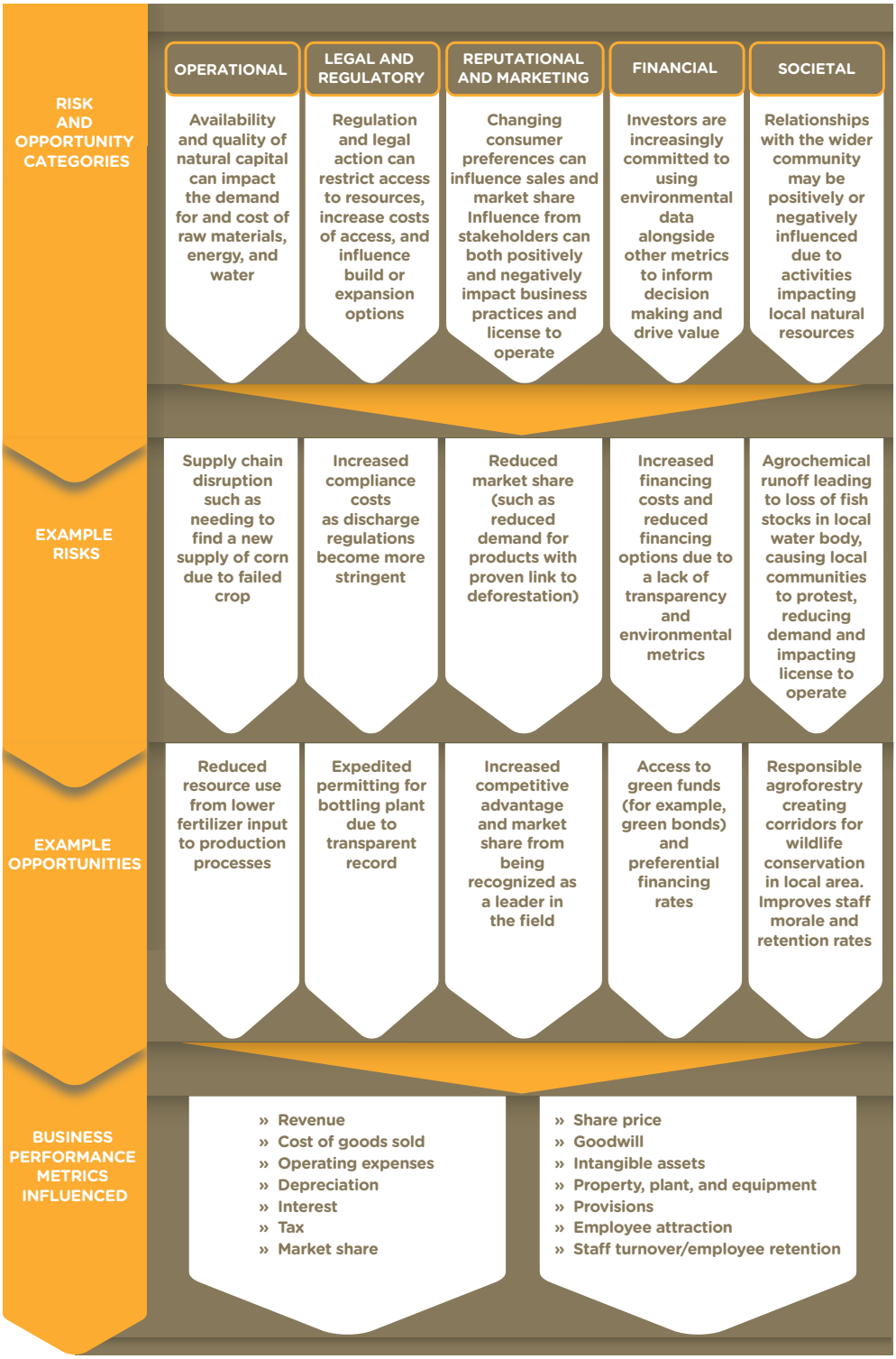

Figure 1.1:
Examples of business implications from key natural capital risks and opportunities

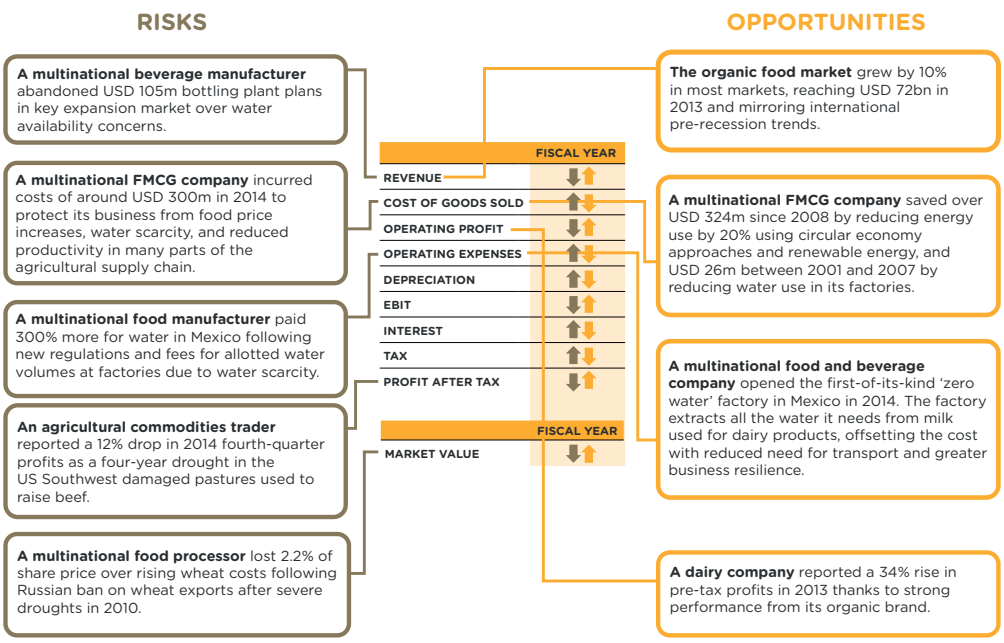

Figure 1.2:
Case study of business implications from some key natural capital risks and opportunities as experienced by real food and beverage sector stakeholders

Figure 1.2 translates theoretical risk and opportunity categories into practice through a growing list of real world examples where business implications have been realized. The examples have been anonymized.

Natural capital risks are typically intertwined and often appear at the same time. For example, a multinational beverage manufacturer's Indian operations have recently faced a mix of operational, reputational, and regulatory challenges from its water consumption (Financial Times 2015a). Over the course of one year, it was forced to abandon plans worth USD 105 million for two bottling plants after failing to gain permission from water authorities amid strong resistance from local farmers who feared a fall in the water table. Other large manufacturers face similar operational concerns. A fast-moving consumer goods (FMCG) company that already incurs costs of around USD 300 million to protect itself from climate-change-related impacts reported a strong business case for implementing a responsible sourcing policy (Business Insider 2014). Where direct supply is not interrupted, it is at risk of regulatory cost increases. A multinational food manufacturer paid 300% more for water in Mexico following new regulations at food manufacturing plants due to water scarcity (CDP 2015b).

Natural capital management can also provide opportunities and financial benefits. A food and beverage company capitalized on existing opportunities by investing USD 7 million to transform its California milk factory to a zero water operation to avoid the use of local freshwater resources (Financial Times 2014a). The project was a result of the company's phased approach to water reduction resulting in the deployment of innovative methods to extract water from raw materials and then recycle it. This followed a pioneering initiative in Mexico during the previous year, where a facility deployed a first-of-its-kind process to extract all its water requirements from milk used for dairy products in order to produce some of its most valuable brands. This initiative helped increase business resilience.

What underpins all of the real world examples identified above is the way a business interacts with natural capital through impacts and dependencies across its value chain. Business activity across the food and beverage value chain can impact upon natural capital and its ability to continue to supply goods and services. There are, however, some examples of positive impacts including ecological recovery due to site remediation, improved quality of rivers and lakes due to pollution abatement, and improved soil fertility due to organic farming practices.

Table 1.1 provides a small selection of some of the relevant impact drivers for the food and beverage sector. The table also provides examples of risks and opportunities relating to each impact driver and business performance metrics than can be influenced. Other important impact drivers to consider include freshwater and marine ecosystem use, water use, non-GHG air pollutants, soil pollutants, solid waste, disturbances, and other resource use.

Table 1.1:
A selection of natural capital impact drivers in the food and beverage sector

	GHG emissions	Water pollutants	Terrestrial ecosystem use
Overview	The cultivation of crops and livestock accounts for 10-12% of global GHG emissions (Smith et al., 2014). Of this, livestock production represents over two-thirds (from enteric fermentation and manure), while the remainder is related to inorganic fertilizer applications, rice cultivation, biomass burning. Land-use change and deforestation release an additional 10% of global GHG emissions in the atmosphere, with agriculture activities responsible for up to 80% of this. Energy use in agricultural fields also emits GHGs, but represents less than 2% of global emissions. Downstream, energy use from manufacturing, transportation, and refrigeration at the retail level are an important source of GHG emissions. Finally, food loss and waste contributed an estimated 8% of global GHG emissions in 2011 (FAO, 2015c).	Agriculture is the largest user of chemicals and the largest source of water pollution worldwide (WWF 2012). The run-off of fertilizers from fields causes dead zones, harming fisheries, affecting human health, and raising water treatment costs. For example, in corn farming in China, the use of fertilizers represents around 30% of the impacts caused by a typical corn farm (FAO 2015a).	Terrestrial ecosystems include all land-based natural systems. Agriculture is the single largest driver of forest loss, responsible for 85% of all deforestation. Some 40% of forest loss occurs in Brazil and Indonesia alone, primarily due to the production of beef and palm oil. Deforestation poses a serious threat to biodiversity (80% of the world's documented species can be found in tropical rainforests); it causes the disruption of local water cycles (as trees no longer evaporate water, causing the local climate to be much drier); and it can lead to land desertification and increasing sedimentation into watercourses as exposed topsoil becomes extremely vulnerable to wind and water erosion (WWF 2015b). Beyond forestry, the conversion of grasslands (the most human-altered biome with the highest risk of biome extinction) and associated wetlands attractive for agricultural production leads to loss of crucial ecosystem services and biodiversity. For example, the Brazilian Cerrado is estimated to be disappearing twice as fast as the Amazon rainforest, with 2 million hectares destroyed annually between 2002 and 2008 (Mongabay 2013).
Risk and opportunity category	– Operational – Legal and regulatory – Reputational and marketing – Financial – Societal	– Operational – Legal and regulatory – Reputational and marketing – Financial – Societal	– Operational – Legal and regulatory – Reputational and marketing – Societal
Example risk	Energy and fertilizer use is one of the most significant drivers of GHG emissions from the sector. Regulations such as carbon taxes may become material, particularly to input companies supplying farmers.	Potential implications for water availability if pollution occurs in a water basin used for own sourcing. Mitigation costs if deemed to have breached local regulations.	Illegal deforestation in supply chains or changes in legislation to protect vulnerable or ancient forests could result in supply chain disruption. Media and NGO campaigns are also a risk to reputation and could result in pressure to improve business practices.
Example opportunity	Managing energy use through resource efficiency and energy efficient equipment can provide significant cost savings.	Recapturing chemicals before discharge can potentially allow for recycling, reducing operational costs, and reducing wastewater treatment costs.	Potential to meet sustainable procurement specifications of eco-labelling if forestry standards adhered to and certifications achieved.
Significant value chain stage	Throughout value chain	Agricultural practices in raw material acquisition, as well as processing stages	Most critical at raw material stage
Geographical relevance	Global	Local	Local
Business performance metrics influenced	– Increased cost of goods sold due to compliance costs – Decreased operational costs from reduction of inputs and energy consumption – Improved customer loyalty and market share through reputational benefits of good management	– Increased cost of goods sold due to compliance costs – Increased resource costs such as higher water charges – Fines and compensation increasing operating costs – Decreased operational costs through recovery of chemicals and internal reuse – Increased costs related to payments for ecosystem services (PES), where the company needs to safeguard water quality against an external party causing water pollution (for example, bottling water companies and pig farming in Brittany, France) (IIED 2006; Guardian 2011)	– Increased cost of goods sold due to compliance costs – Fines and compensation increasing operating costs – Revenue losses from negative publicity or consumer demand for better sourcing – Increased cost from business relocation due to loss of land and soil

Natural capital dependencies for the food and beverage sector span all categories of ecosystem service, including provisioning services, regulating services, and cultural services. Table 1.2 focuses upon some of the critical dependencies relevant to the sector. The raw material stage in a value chain typically interacts with nature directly through agricultural or extraction activities. As such, this stage tends to have the most significant dependency on natural capital. However, in many stages of the food and beverage value chain, business activities depend on energy and water.

Table 1.2:
A selection of natural capital dependencies in the food and beverage sector

	Consumptive: Water	**Consumptive: Materials**	**Non-consumptive: Regulation of physical and living environment, and waste and emissions**
Overview	From farm to factory, producing food is the most water-intensive business on earth. The majority of water consumption is concentrated in agricultural activities, where irrigating crops and raising animals alone abstracts over 70% of the world's dwindling freshwater resources, more than twice the use of industrial sectors (FAO 2011). In agriculture, practices vary from efficient irrigation (for example, drip feed) to wasteful irrigation techniques, poor field application methods, and cultivation of thirsty crops not suited to the environment in places such as California's Imperial Valley (WWF 2015a).	Agricultural crop and livestock commodities form the basis of the entire downstream economy. Studies modeling climate change impacts on agricultural productivity predict that the global agricultural system as a whole will have difficulty supplying adequate quantities of food at constant real prices (IFPRI 2010). Commodities have already been subject to considerable price fluctuations which expose food companies to a number of risks. Commodity price volatility can cut severely into profits and impact pricing strategy. It can present serious supply chain management issues and make forecasting difficult, increasing the overall cost and risk of doing business and making hedging strategies more complex (EY 2015). Industry responses to existing volatility range from product price hikes to supplier acquisitions (Financial Times 2014b).	These services are required to maintain systems for provisioning services and to directly mitigate risks. Animal pollination, for example, is an ecosystem service mainly provided by insects but also by some birds and bats. Globally around 70% of the crops grown for human consumption are directly dependent on insect pollinators, especially bees. The economic value of insect pollination was estimated at €153 billion (Oxford University 2013). Management of pests and disease is critical to the success of all crop production.
Risk and opportunity category	– Operational – Financial – Legal and regulatory – Reputational and marketing – Societal	– Operational – Financial – Reputational and marketing – Societal	– Operational – Legal and regulatory – Reputational and marketing – Societal
Example risk	Currently, one-third of total food production is in areas of high or extremely high water stress or competition. Water shortages are likely to affect almost half of the global population in the coming decades and all countries in the longer term, with serious repercussions for food security (FAO 2011).	Land-use change, increased competition for materials, and climate events (such as droughts and floods) can lead to reduced supply of crop and livestock products.	Land-use change, climate events (such as droughts and floods), and anthropogenic activities can damage an ecosystem's ability to provide these services, which underpin all goods provided by them. Efforts to replace these services introduce significant operational costs, such as water purification normally done by wetlands or regenerating soils with compost and land engineering such as terracing.
Example opportunity	Sourcing raw materials from regions with a plentiful water supply means that the acquisition of key inputs is less likely to be impacted by water shortages and reduced yields.	Responsibly managed lands can produce higher yields and improve revenue.	Responsible farm management can regulate pests and minimize crop damage, improving quality of produce.
Significant value chain stage	Raw material acquisition, and in food processing as an ingredient, for cleaning and moving raw materials, and as the principal agent used in sanitizing plant machinery (Ceres 2015)	Raw material acquisition.	Raw material acquisition.
Geographical relevance	Local	Local	Local

Glossary

Natural capital dependency
A business reliance on or use of natural capital.

Business performance metrics influenced	– Increased operating costs to source alternative materials – Revenue implications due to constraints on production – Reduced operating costs if onsite management allows internal recycling of water	– Revenue implications due to constraints on production – Increased operating costs to source alternative materials – Stability of supply chain if managed – Market share increase through marketed use of sustainable materials	– Supply chain disruption leading to increased operating costs to source an alternative supply – Potential loss of revenue to farmers due to low crop quality – Increased operating costs due to artificial replacement of services provided by ecosystems (such as higher agrochemical input costs)

Step 01 of the food and beverage sector guide has provided additional guidance to help you explore potential risks and opportunities and understand your relationship with natural capital. Table 1.3 illustrates the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required in the Protocol for this Step.

Table 1.3
Sector-specific hypothetical examples – Step 01

	Bright & Wholesome	**Maison Chocolat**	**Sugar Estates Ltd.**
Context	A large diversified food and beverage retailer sells multiple brands as well as its own-brand product line, where it has been investing in sustainability improvements on an ad hoc basis. It would like to communicate to its customers how its own-brand product line outperforms other brands in sustainability terms.	A small chocolate brand has experienced a significant decline in profit due to increased costs of key raw materials in its supply chain. It would like to identify the best sites for sourcing materials to mitigate potential future risk.	A medium-sized sugar farm is receiving financial assistance to transition towards more sustainable farming systems that prevent toxic runoff into fragile coastal ecosystems. To encourage a further round of investment, it would like to assess and report to its funders on the significant natural capital benefits delivered as a result of their funding.
Which risks and opportunities might a natural capital assessment help to address?	Reputational opportunities such as increased competitive advantage over other brands and market share from being recognized as a leader in the field.	Financial and operational opportunity from supply chain stability and potential cost reduction.	Financial opportunity from better access to funding.

SCOPE STAGE
What?

What is the Scope Stage?

The Scope Stage of the Protocol sets out what you will need to consider in order to set the specific objective for your natural capital assessment.

How does the sector guide map to the Protocol?

Table S.1 provides an overview of the questions and actions of the Scope Stage in the Protocol and an outline of the actions for which the sector guide provides additional guidance.

Table S.1:
Mapping between the Protocol and the sector guide

Step	Questions each Step will answer	Actions	Additional guidance included in the sector guide?
02 Define the objective	**What is the objective of your assessment?**	2.2.1 Identify the target audience	**No**
		2.2.2 Identify stakeholders and the appropriate level of engagement	**No**
		2.2.3 Articulate the objective of your assessment	**Yes**
03 Scope the assessment	**What is an appropriate scope to meet the objective?**	3.2.1 Determine the organizational focus	**No**
		3.2.2 Determine the value-chain boundary	**No**
		3.2.3 Specify whose value perspective	**No**
		3.2.4 Decide on assessing impacts and/or dependencies	**No**
		3.2.5 Decide which type of values you will consider	**No**
		3.2.6 Consider other technical issues (i.e., baselines, scenarios, spatial boundaries, and time horizons)	**Yes**
		3.2.7 Address key planning issues	**No**
04 Determine impacts and/or dependencies	**Which impacts and/or dependencies are material?**	4.2.1 List potentially material natural capital impacts and/or dependencies	**Yes**
		4.2.2 Identify the criteria for your materiality assessment	**No**
		4.2.3 Gather relevant information	**No**
		4.2.4 Complete the materiality assessment	**No**

Additional notes
Businesses operating in the food and beverage sector should address all of the actions associated with each Step in the Scope Stage. The sector guide provides additional guidance for some of the actions where it is most appropriate.

02 Define the objective

This section of the sector guide provides additional guidance for answering the following question:
What is the objective of your assessment?

In particular, the sector guide will help you undertake the following action:
2.2.3 Articulate the objective of your assessment

Articulate the objective of your assessment

In Step 01 of the Protocol, you have already started to think about how you intend to use the results of your natural capital assessment—your potential business application. In Step 02, you develop and articulate the objective, or why you are doing it. In addition, it is important to articulate the anticipated benefits that your business stands to gain from undertaking an assessment. Table 2.1 sets out a list of potential business applications alongside example objectives and benefits for the food and beverage sector. The list is not exhaustive and you may use different terms within your company.

Glossary

Business application
In the Protocol, the intended use of the results of your natural capital assessment to inform decision making.

Table 2.1
Examples of business applications, objectives, and business benefits of natural capital assessments in the food and beverage sector

Business application (Intended use)	Example business decisions	Example outputs
Assess risks and opportunities	An overarching assessment is often a good starting point to understand the implications of your company's impacts and dependencies, informing decisions regarding strategy development and risk mitigation. For example, a food and beverage company that has never previously measured natural capital may choose to assess its entire value chain to identify and value areas of potential natural capital risk to determine where targeted improvements can be made.	Improved decision making; improved risk management
Compare options	Option appraisals can help compare the trade-offs of alternative options in natural capital terms, when presented with various scenarios. This can be used to inform business decisions relating to procurement such as new technologies or processes, or for prioritization. For example, a landowner may choose to compare the consequences of different cropping systems to inform their land use. In addition, option appraisals can be used to inform investment decisions by identifying potential solutions which yield the greatest natural capital return.	Improved decision making; increased competitive advantage; enhanced reporting and communication
Assess impacts on stakeholders	Ascertain which stakeholders are affected by a change in natural capital due to your business activity, such as a chemical discharge from sugarcane farming into a water system used by local communities.	Improved decision making; improved risk management
Estimate total value and/or net impact	A means to assess the total value of natural capital generated by a system. For example, a property owner with assets across many land types can maximize the value of differing coffee plantations in its land portfolio by assessing them in relation to their proximity to pollination services provided by nearby forests. Coffee yields have been shown to increase by 20% in proximity to forest edges, where access to pollinators is higher (Ricketts 2004). This analysis would inform strategic planning and decisions on capital investment and land management.	Improved decision making; increased competitive advantage
Communicate internally and/or externally	Reporting of natural capital assessments, such as the publication of Environmental Profit and Loss accounts (EP&Ls), can help inform communication strategies with internal and external stakeholders. Natural capital valuation in particular can be integrated within conventional financial accounting for a comprehensive understanding of business activities. This can help inform business decisions on communications strategies and context-based target setting across the food and beverage sector.	Increased competitive advantage; enhanced reporting and communication

Step 02 of the food and beverage sector guide has provided additional guidance to help you develop and articulate the objective of your assessment. Table 2.2 illustrates the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required in the Protocol for this Step.

Table 2.2
Sector-specific hypothetical examples – Step 02

	Bright & Wholesome	Maison Chocolat	Sugar Estates Ltd.
Context	A large diversified food and beverage retailer sells multiple brands as well as its own-brand product line, where it has been investing in sustainability improvements on an ad hoc basis. It would like to communicate to its customers how its own-brand product line outperforms other brands in sustainability terms.	A small chocolate brand has experienced a significant decline in profit due to increased costs of key raw materials in its supply chain. It would like to identify the best sites for sourcing materials to mitigate potential future risk.	A medium-sized sugar farm is receiving financial assistance to transition towards more sustainable farming systems that prevent toxic runoff into fragile coastal ecosystems. To encourage a further round of investment, it would like to assess and report to its funders on the significant natural capital benefits delivered as a result of their funding.
What is the intended business application?	Communicate internally and/or externally	Compare options	Estimate total value and/or net impact
Who is the targeted audience?	Customers	Procurement team	Investors
Who are the right stakeholders and what is the appropriate level of engagement?	No external stakeholders initially, though potentially in the future	First-tier suppliers	No external stakeholders
What specific benefits do you anticipate from the assessment?	Effective communication with external stakeholders in monetary terms will generate reputational benefits from own-brand differentiation.	Simultaneously assessing the water footprint of each raw material and related regulatory risk will enable improved decision making and potential long-term increase in competitiveness.	Sugar Estates Ltd.'s effective communication with its funders on the net benefit returned on their investment will allow the farm to receive a further round of funding and diversify its investor base.
What is the specified objective?	To measure the extent to which products within own-brand portfolio impact and depend on natural capital. This will inform a corporate strategy of reducing future impacts and risk associated with volatile supply.	To prioritize certain suppliers over others and to provide a basis for supplier engagement over water availability and use.	To quantify the net impact of improved practices and communicate this to current and future funders.

03 Scope the assessment

This section of the sector guide provides additional guidance for answering the following question:
What is an appropriate scope to meet the objective?

In particular, the sector guide will help you undertake the following action:
3.2.6 Consider other technical issues (i.e., baselines, scenarios, spatial boundaries, and time horizons)

Consider other technical issues (i.e., baselines, scenarios, spatial boundaries, and time horizons)

There are several details to consider during the Scope Stage in terms of the technical specifications of the assessment. If the assessment includes a comparison, appropriate baselines, scenarios, spatial boundaries, and time horizons need to be defined. Consideration of these technical issues will be dependent on the results of Step 01 and Step 02, in particular the identification of potential business applications. Table 3.1 provides some considerations on baselines, scenarios, spatial boundaries, and time horizons for the food and beverage sector specifically.

Table 3.1
Consideration of technical issues in the food and beverage sector

Technical issue	Considerations for the sector
Baselines	When selecting a baseline for an assessment, it is important to consider the unit of comparison. In the food and beverage sector, comparisons are often undertaken on different food and beverage processed products or at the commodity level. Baseline commodities and processed products can be selected based on a number of metrics including weight (for like-for-like commodities), calorific contribution, or economic contribution. Comparisons can also be undertaken at the sector level where an industry benchmark is considered an acceptable baseline. For example, the Food and Agriculture Organization of the United Nations (FAO) compared conventional cattle grazing and rice, soybean, and wheat farming to improved agricultural management practices and assessed the resulting net environmental benefits (FAO 2015a). Baselines will be influenced by the objective of the assessment, alongside other scoping decisions, and may also involve spatial boundaries and time horizon considerations (for example, if assessing a brewery technology that will be in place for 25 years, consider how the baseline would change over the same time period).
Scenarios	In addition to the baseline, comparisons may involve scenarios for potential future outcomes. In the food and beverage sector, scenarios may include "intervention" scenarios which may be selected if your company wishes to determine how an activity or business decision may impact current practice. This could include the use of improved production techniques or the results of achieving sustainability targets (such as moving to organic or certified suppliers). "Vision" scenarios are also used in the sector, for example, identifying the implications on the supply of a particular key ingredient should water availability decrease.
Spatial boundaries	Many food and beverage companies have distinctive and often fragmented supply chains, as well as a huge variety within each crop in terms of how and where it is produced and by whom (KPMG 2013). As such, consideration should be given to the spatial boundaries used in an assessment and particularly if collecting primary data. Your direct operational impacts on natural capital may extend beyond your operational boundaries, for example air pollutants from a factory being dispersed over a wide area. Some considerations are given below: – Impacts: It is important to consider the geographical range of an impact. For example, how far will the impact driver cause change in natural capital. Is it localized, regional, or global? – Dependencies: Where possible, spatial boundaries for specific sourcing regions should be set according to the objective—for example, the specific field of crop production or livestock farm. If this level of detail is unavailable, the country of origin should be used.
Time horizons	Food and beverage is a non-cyclical sector expected to provide consistent and predictable levels of output to satisfy relatively inelastic and stable demand. However, as climate change intensifies we can expect more weather-driven volatility in the future as average temperatures and rainfall increase. Despite the extent of this volatility, assessing the timing of climate change impacts on agriculture is still very much a developing field (KPMG 2013). Any corporate-level assessment should use a carefully selected, appropriate temporal boundary to provide accurate findings. Depending on the objective of the assessment, it may be appropriate to focus on a historic, current, or future time horizon. For example, the company may consider changes in natural capital relative to some original "pristine" state, or relative to conditions when the company took effective control. Some considerations are given below: – Impacts: It is important to consider how persistent the impact driver is in the environment, to assess whether it will create long- or short-term natural capital changes. For example, releases of GHGs today are likely to result in persistent GHGs in the atmosphere over many hundreds of years (US EPA 2016) – Dependencies: Where possible, spatial boundaries for specific sourcing regions should be set according to the objective of the assessment — ideally as granular as the field where crop production takes place or the livestock farm. If this level of detail is unavailable, the country of origin should be used.

Step 03 of the food and beverage sector guide has provided additional guidance to help you consider other technical issues of your assessment. Table 3.2 illustrates the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required in the Protocol for this Step.

Table 3.2
Sector-specific hypothetical examples – Step 03

	Bright & Wholesome	Maison Chocolat	Sugar Estates Ltd.
Context	A large diversified food and beverage retailer sells multiple brands as well as its own-brand product line, where it has been investing in sustainability improvements on an ad hoc basis. It would like to communicate to its customers how its own-brand product line outperforms other brands in sustainability terms.	A small chocolate brand has experienced a significant decline in profit due to increased costs of key raw materials in its supply chain. It would like to identify the best sites for sourcing materials to mitigate potential future risk.	A medium-sized sugar farm is receiving financial assistance to transition towards more sustainable farming systems that prevent toxic runoff into fragile coastal ecosystems. To encourage a further round of investment, it would like to assess and report to its funders on the significant natural capital benefits delivered as a result of their funding.
What organizational focus?	Product	Corporate	**Project**
Which value-chain boundary?	Whole value chain (upstream, operational, and downstream)	Upstream	**Operational at farm level**
Will the assessment cover impacts and/or dependencies?	Impacts	Dependencies	**Impacts**
Which value perspective?	Society	Business	**Society**
What types of value?	Monetary	Qualitative and quantitative	**Monetary**
Other technical issues to consider			
a) Baselines	a) Competitor product range	a) Current practice	a) Typical impacts of sugarcane in coastal areas of country of operation
b) Scenarios	b) No additional scenarios were considered	b) Four individual scenarios of installation and use of different technology options were assessed	b) The two scenarios were the baseline of standard sugar production and the impacts of production under the new agriculturally improved system.
c) Spatial boundaries	c) A single product line	c) Operations of supply chain	c) Owned farmland and potential areas of influence
d) Time horizons	d) Most recent full financial year	d) Most recent full financial year	d) From point of intervention until full implications of farming practice changes evidenced, estimated to be three years
Key planning issues to consider (for example, resource and time constraints)	Resources were assembled internally within the sustainability department, with assistance from buyers.	The chocolate brand appreciates that its suppliers are largely smallholders with limited resources and awareness of their dependencies. A third-party consultant was sought to assist in data gathering and secondary data modeling.	The farm has detailed data collection and can quantify the impact drivers in physical terms. A third-party consultant was sought to assist in determining how these translate into impacts (Step 06 and 07).

04 Determine the impacts and/or dependencies

This section of the sector guide provides additional guidance for answering the following question:
Which impacts and/or dependencies are material?

In particular, the sector guide will help you undertake the following action:
4.2.1 List potentially material natural capital impacts and/or dependencies

List potentially material natural capital impacts and/or dependencies

The first activity in a materiality assessment is to consider all potentially relevant impacts and dependencies for the chosen objective and scope. At this point, the Protocol introduces the concepts of impact pathways and dependency pathways. Understanding these terms is fundamental to conducting a natural capital assessment. Impact pathways describe how, as a result a specific business activity, a particular impact driver results in changes in natural capital and how these changes affect different stakeholders. Figure 4.1, provides an example of an impact pathway for water pollution from a pork processing factory. A dependency pathway shows how a particular business activity depends upon specific features of natural capital, or associated natural processes which are often external to your business. Figure 4.2, provides an example dependency pathway for the water dependency of a sugarcane plantation.

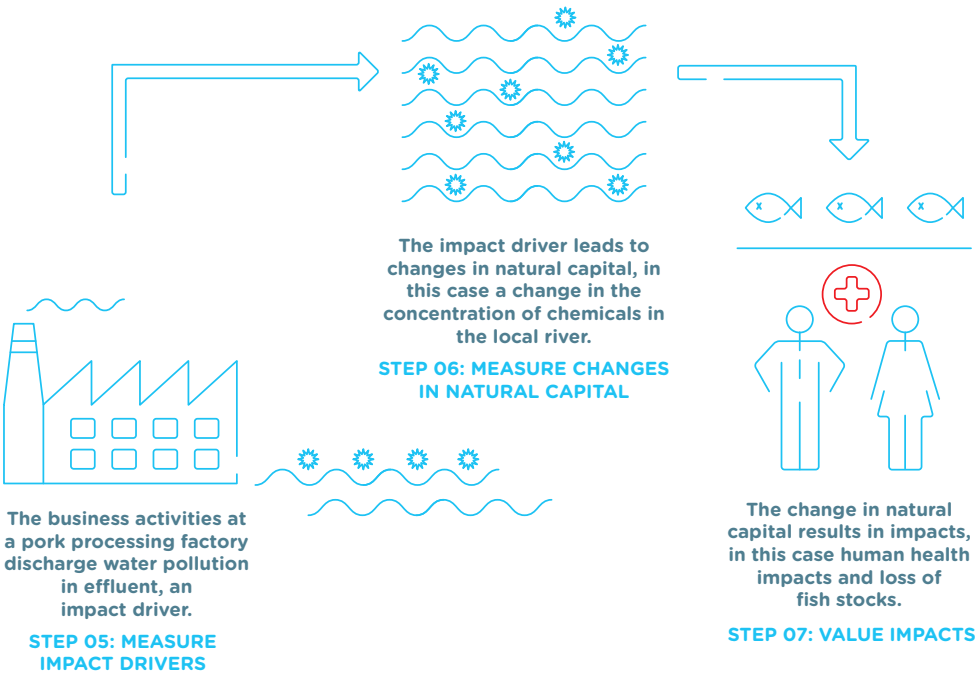

Figure 4.1
Example impact pathway for water pollution from a pork processing factory

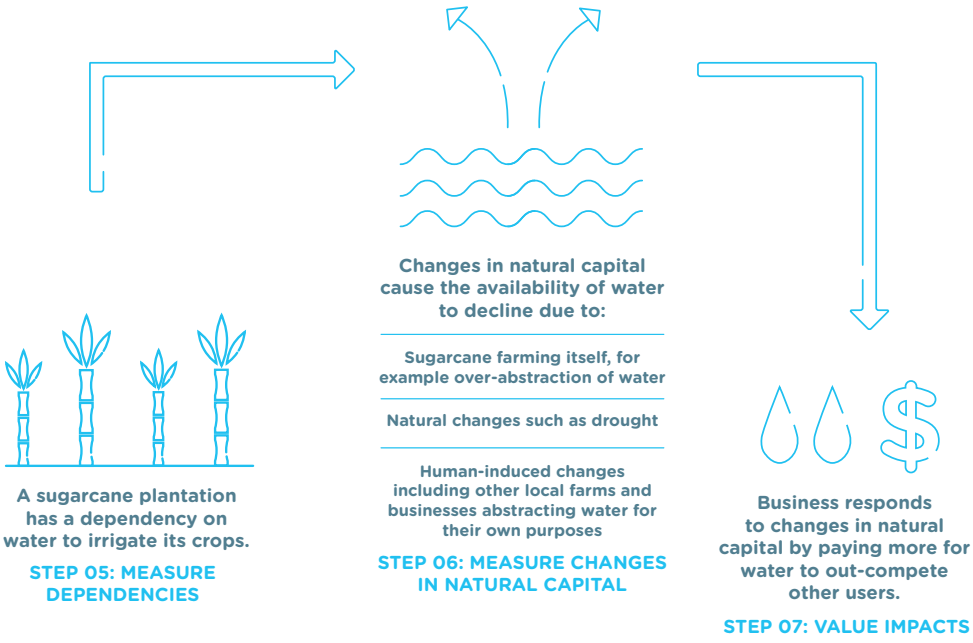

Figure 4.2
Example dependency pathway for the water dependency of a sugarcane plantation

There are many different approaches to assessing the materiality of issues affecting a business. Most companies have experience with at least one approach often through their risk, governance, finance, or strategy functions.

The Protocol does not specify one particular method for assessing materiality, but instead sets out the importance of carrying out an assessment through a generic, systematic, and transparent process. This process includes the following four activities:

- List potentially material natural capital impacts and/or dependencies
- Identify the criteria for your materiality assessment
- Gather relevant information
- Complete the materiality assessment

This section of the sector guide supports your business in completing the first step of the process by providing a narrowed list of potentially material impact drivers and dependencies relevant to the food and beverage sector. The narrowed lists are presented in materiality matrices conducted across four different food and beverage value chains:

- Barley used to produce beer
- Fresh pork
- Sugarcane used to produce soft drinks
- Rice

These raw materials and products have been selected via a stakeholder engagement process to ensure they are relevant to a wide audience of food and beverage sector stakeholders and reflect a diverse range of geographies and business practices.

The materiality matrices can be used as a building block to complete your own materiality assessment when you are assessing similar raw materials and products. However, even if this is the case, it is still important that you identify the criteria for a materiality assessment that are relevant to your objectives and complete all Steps outlined in the Protocol. Large companies with many different products should undertake an initial screening to determine which products are the most important to consider.

Glossary

Materiality
In the Protocol, an impact or dependency on natural capital is material if consideration of its value, as part of the set of information used for decision making, has the potential to alter that decision (Adapted from OECD 2015 and IIRC 2013).

Materiality assessment
In the Protocol, the process that involves identifying what is (or is potentially) material in relation to the natural capital assessment's objective and application.

The materiality matrices

The example materiality matrices can be used to identify the likely most significant natural capital impact drivers and dependencies of different raw materials and products.

The color of the cells represents the materiality across the whole value chain. If you are only assessing direct operational materiality (such as a food processor attempting to understand site-specific impacts and dependencies), the cells marked with an 'O' reflect materiality at that particular stage of the value chain. As such, the materiality matrices can be applied at a corporate, project, and site level.

The materiality of a natural capital impact driver or dependency was initially determined through a literature review of business and academic literature that considered the three criteria listed below. These criteria are derived from groupings of the key materiality criteria recommended in the Protocol.

Materiality matrix criteria	Key materiality criteria groupings recommended in Protocol
Business financial implications — evidence of financial implications relating to the interaction of food and beverage businesses with natural capital	Financial; Operational; and Legal and regulatory criteria
Potential environmental and societal consequences — evidence of environmental and social consequences relating to the interaction of food and beverage businesses with natural capital	Reputational and marketing; and social criteria
Business stakeholder interest — evidence of food and beverage sector stakeholder interest in natural capital impacts and dependencies	Reputational and marketing criteria

If all three criteria were evidenced within the literature review then the materiality of the impact drivers and dependencies were qualitatively appraised as "High". If only two criteria were met, they were appraised as "Medium" and if only one criterion was met they were appraised as "Low". If none of the criteria were met, they were appraised as "Not material". For example, if a food and beverage company disclosed that it had experienced increases in the cost of goods sold due to water scarcity in its agricultural supply chain, this would meet the "Business financial implications" criteria for water dependency. Similarly, if there was evidence in the literature of the societal cost of water pollution emanating from the food processing stage for a particular product then this would meet the "Potential environmental and societal consequences" criteria for the water pollutants impact driver. The materiality matrices were then verified by food and beverage sector stakeholders and other experts to ensure that they reflect the current state and interests of the food and beverage sector. The sources used for the initial literature review are summarized in References. For an explanation of the different impact drivers and dependencies, please refer to the Protocol.

Important note regarding disclosure

Materiality is both a general and legal concept (Corporate Reporting Dialogue 2016). Materiality within the Natural Capital Protocol does not necessarily equate to the legal concept of materiality which applies to formal corporate reporting in many jurisdictions (for example, as defined in the US by the Supreme Court). Many companies around the world regularly disclose information about their impacts and dependencies on natural capital. However, if you have concerns about the potential interpretation of disclosures you plan to make on natural capital impacts or dependencies (for example by investors, regulators, or other stakeholders), you are advised to seek independent legal advice relevant to your industry and jurisdiction.

Barley used to produce beer

Barley has the fourth highest global production value of any cereal grain after rice, corn, and wheat (FAOSTAT 2013). It is principally used for malt production and for human consumption (75%) as well as for animal feed (25%). Malt barley is one of the main ingredients in the manufacture of beer. Before barley grain can be used to make beer, it must undergo a process known as malting, in which moisture stimulates the natural germination process inside the grain. Barley's role in beer making is equivalent to grapes' role in winemaking. Malted barley gives beer its color, malty sweet flavor, protein, and the natural sugars needed for fermentation.

Barley factsheet	
Commodity value	USD 34 billion (FAOSTAT 2013)
Main countries of production	EU-27 (the EU malting industry accounts for more than 60% of the world malt trade), Russia, Ukraine, Australia (FAOSTAT 2013)
Main countries of consumption	Major importing nations: Belgium, Netherlands, China, Japan, Germany, Brazil (FAOSTAT 2013)
Typical product use	Animal feed (66%) and beer consumption (24%) (FAOSTAT 2013)
Additional notes	Worldwide the largest limitation on barley production is water and significant research is being undertaken in drought adaptation in wheat and barley (University of Queensland 2015). The materiality matrix is based on the conventional production of barley and beer.

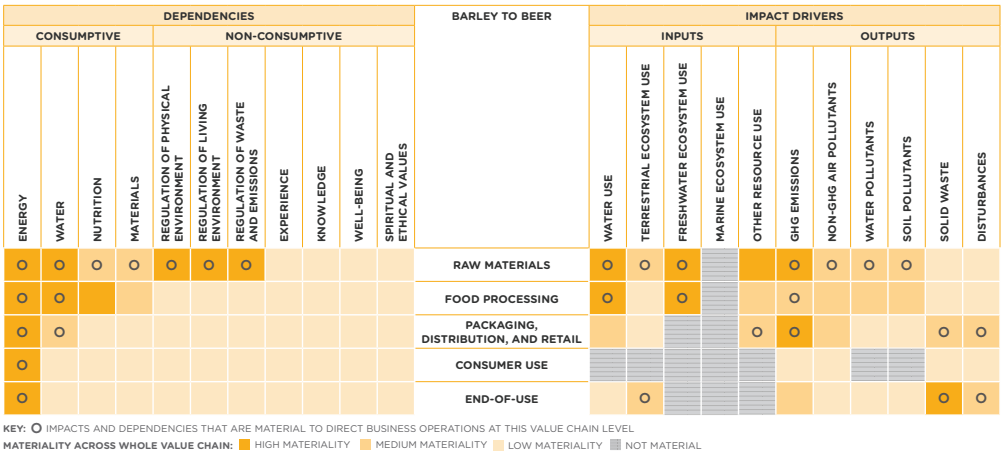

Figure 4.3
Indicative materiality matrix for the value chain of barley used to produce beer

	Description	Examples of material operational impacts and dependencies	Variation in size of impact and dependency
Raw materials	Barley farming	Energy and fertilizer-related emissions are responsible for 30% of the lifecycle GHG impacts of barley growing (Product Sustainability Forum 2013). Water use is also a significant impact (Bowe and van der Horst 2015).	Type of energy and fertilizer used in operations, irrigation efficiency, water source and scarcity in region.
Food processing	Beer production including malting, processing, fermentation	The energy used in mashing, boiling and cooking, fermentation, and filtration are responsible for up to 10% of GHG emissions over the lifecycle of beer production (Product Sustainability Forum 2013). Water use for cleaning as well as disposal of wastewater are other significant impacts.	Type of energy used, water efficiency and recapture rates, water source and scarcity in region.
Packaging, distribution and retail	Production of glass and bottles	The extraction and processing of glass, aluminum, and steel is a principal source of GHG emissions across the value chain (Product Sustainability Forum 2013). Refrigeration, the most important utility in food and drink manufacturing and retail operations, is also responsible for significant GHG emissions (WRAP 2012).	Packaging material used, refrigeration management (for example, cooling demand and efficiency).
Consumer use	Beer consumption	GHG emissions and other air emissions from energy used in refrigeration of beer can be significant (WRAP 2012).	Efficiency of refrigeration systems. Assumptions made on consumer behavior can be significant.
End-of-use	Consumer food waste and disposal or recovery of packaging material	Beer is the alcoholic drink thrown away in the greatest quantity in the UK and its waste is classified as mostly avoidable (WRAP 2009). Landfilling waste is associated with significant GHG emissions, water use, and terrestrial ecosystem use impacts (FAO 2013).	Consumer waste management, such as recycling behavior, can be highly varied.

Fresh pork

Pig meat or pork is the most widely consumed meat, accounting for over 36% of the world meat intake. The sector is also the fastest growing livestock sub-sector as a result of changing consumption patterns associated with increases in income in developing countries (FAO 2015b). Livestock production (including feed production) causes just under one-fifth of global GHG emissions and is the key land user and source of nutrient water pollution (Eshel et al. 2014). Pork products can be broadly categorized as fresh meat and processed meat.

Pork factsheet	
Commodity value	US$452.5 billion (FAOSTAT, 2013)
Main countries of production	China, EU-27, United States, Brazil, Russia (FAOSTAT, 2013)
Main countries of consumption	China, EU-27, Vietnam, Korea (OECD, 2014)
Typical product use	Pork products are broadly categorized as fresh meat and processed meat
Additional notes	For livestock, an important indicator of environmental performance is animal feed. Concentrate feed uses human-edible grains and has a high impact on the environment. The materiality matrix is based on the conventional production of pork.

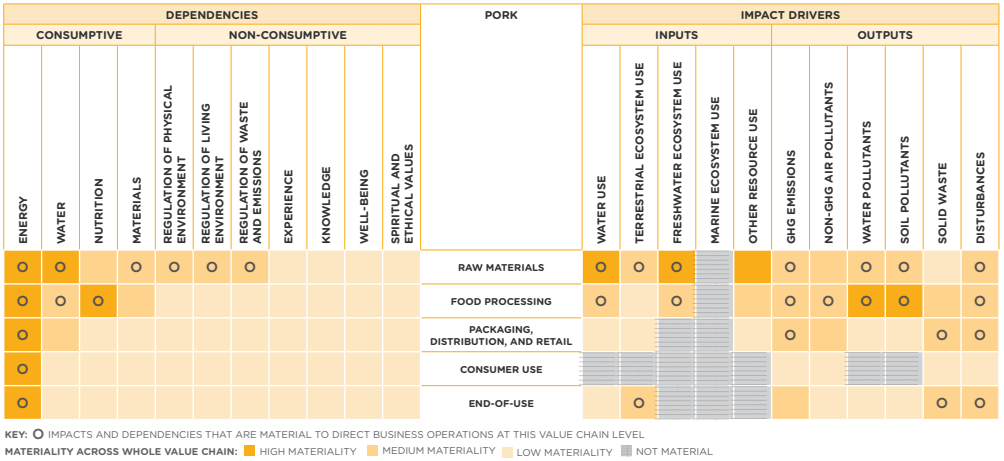

Figure 4.4
Indicative materiality matrix for the value chain of fresh pork

	Description	Examples of material operational impacts and dependencies	Variation in size of impact and dependency
Raw materials	Pig farming including pig feeding, breeding and farrowing, manure management	In spite of favorable feed conversion efficiencies, pigs have relatively large fractions of cereals and oil meal in their feed (FAO 2014a). The use of grains and other cereals in livestock farming is so significant that the OECD and FAO predict livestock feed will drive demand for these in the next decade (Financial Times 2015d). Feed production has considerable natural capital impacts; for example, the livestock feed required for US-reared livestock is associated with 40% of all US cropland, 7% of the total national irrigation use, and half of national fertilizer use (Eshel et al. 2014).	Type of feed, feeding practice, animal rearing and manure management practices (for example, organic farming practices or free of human-edible grains).
Food processing	Meat processing including slaughtering, meat cutting and processing, refrigeration, handling and transport	Factory farming is associated with significant natural capital impacts related to the provision of energy and water, as well as toxic waste discharges to water and soil (PETA 2014).	Techniques in slaughtering and meat handling, efficiency of equipment used in meat cutting, techniques used in meat processing.
Packaging, distribution, and retail	Meat packaging, distribution, and retail	Refrigeration, the most important utility in food and drink manufacturing and retail operations, is responsible for significant GHG emissions (WRAP 2012).	Type of technology used for packaging, packaging material, mode and distance of transport, and efficiency of retail refrigeration systems.
Consumer use	Meat consumption	GHG emissions and other non-GHG air pollutants from energy used in refrigeration and preparation of chilled meat can be significant (WRAP 2012).	Efficiency of refrigeration systems. Assumptions made on consumer behavior can be significant.
End-of-use	Consumer food waste and disposal or recovery of packaging material	Landfilling waste is associated with significant GHG emissions, water use, and terrestrial ecosystem use impacts (FAO 2013).	Consumer waste management, such as recycling behavior, can be highly varied.

Sugarcane used to produce soft drinks

There is a strong and growing global market for sugarcane derivatives driven by the prevalence of sugar in modern diets and its increasing use in biofuels and bioplastics (WWF 2015d). Soft drinks, a global market worth over USD 0.5 trillion, typically contain carbonated water, sweeteners, and flavorings (Reuters 2014). Three different sugar types are typically used in soft drinks. These are sugar beet, sugarcane, and high-fructose corn syrup (Water Footprint Network 2011). According to the USDA, sugarcane's share of combined sweetener production rose from more than 70% in 2000 to nearly 79% in 2009 (AgMRC 2012).

Sugarcane factsheet	
Commodity value	US$81.5 billion (FAOSTAT, 2013)
Main countries of production	Brazil, India, China, Thailand, Pakistan, Mexico, Colombia (FAOSTAT, 2013)
Main countries of consumption	United States, EU-27, Mexico, Canada, New Zealand, Saudi Arabia (Washington Post, 2015)
Typical product use	Sugar is extracted from the sweet, juicy stems of sugar cane, and is used worldwide as a sweetener, for example, as a syrup (a traditional sweetener in soft drinks), a preservative and in the cosmetics industry (Kew, 2015).
Additional notes	One of the most prominent initiatives in the sector is Bonsucro established by WWF. In cooperation with retailers, investors, traders, producers and other non-governmental organizations, the initiative seeks to reduce the social and environmental impact of sugarcane production by establishing global standards to certify sustainable production (WWF, 2015d). The materiality matrix is based on the conventional production of sugarcane and soft drinks.

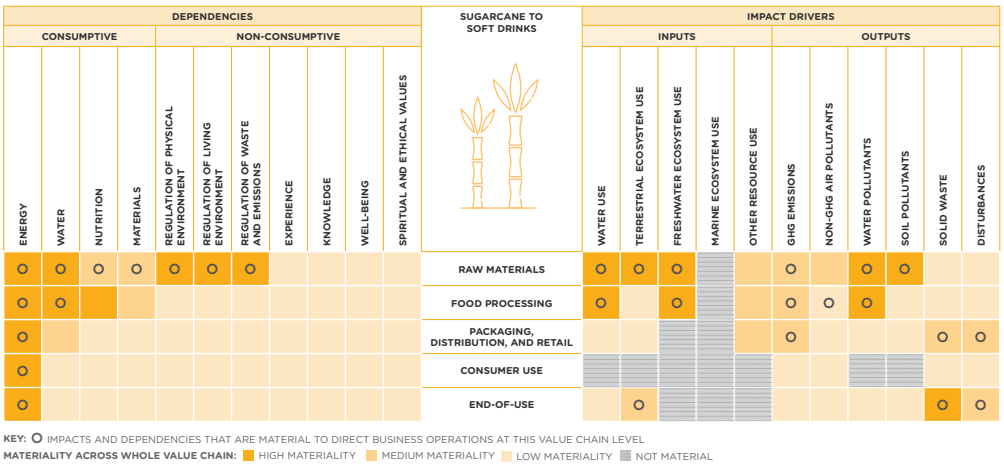

Figure 4.5
Indicative materiality matrix for the value chain of sugarcane used to produce soft drinks

	Description	Examples of material operational impacts and dependencies	Variation in size of impact and dependency
Raw materials	Sugarcane farming	Sugarcane is a highly water-intensive crop. Some of the most biodiverse regions on the planet have been cleared for sugarcane production. Soils typically dry out in preparation for cane planting whilst the continual removal of cane from the fields gradually reduces fertility and forces growers to rely on fertilizers (WWF 2015d). Silt from eroded soils and nutrients from applied fertilizers also often foul water supplies.	Type of energy and fertilizer used in operations, irrigation efficiency, water source and scarcity in region, growing location and previous land use.
Food processing	Sugarcane processing produces cane sugar (sucrose) from sugarcane; sugar refining further purifies the raw sugar	Sugar mills produce wastewater, air pollutants, and solid waste that impact the environment (WWF 2015d). Significant quantities of plant matter and sludge typically washed from mills decompose in freshwater bodies, absorbing available oxygen and depleting fish stocks.	Wastewater treatment systems, water source and scarcity in region.
Packaging, distribution, and retail	Production of plastic and bottles, distribution, and retail	Beverages are by far the dominant application for PET-plastic packaging globally, especially in soft drink manufacturing (Euromonitor 2015). The use of plastic packaging yields significant benefits such as reducing waste and extending the shelf-life of items. A 2014 UNEP report assessing plastic use in the consumer goods industry quantified upstream impacts from GHGs and land and water pollutants (UNEP 2014).	Packaging material used, refrigeration management (for example, cooling demand and efficiency).
Consumer use	Soft drinks consumption	GHG emissions and other non-GHG air pollutants from energy used in refrigeration of chilled drinks can be significant (WRAP 2012).	Efficiency of refrigeration systems. Assumptions made on consumer behavior can be significant.
End-of-use	Consumer drinks waste and disposal or recovery of packaging material	Landfilling waste is associated with significant GHG emissions, water use, and terrestrial ecosystem use impacts (FAO 2013). A 2014 UNEP report assessing plastic use in the consumer goods industry quantified and valued the major downstream impacts of plastic use (chemical additives, land disamenity, and marine litter) at around USD 3 billion (UNEP 2014).	Consumer waste management, such as recycling behavior, can be highly varied.

Rice

Rice is a staple food for more than half of the world's population and 90% of the world's rice is produced and consumed in Asia (WWF 2015e). Rice is produced primarily for domestic consumption, with less than 6% of global rice production traded internationally. It is the only cereal that can withstand water submergence, though it survives rather than thrives. The main benefit of flooding rice fields is that it mitigates the proliferation of weeds, saving labor costs, and reducing the purchase of inorganic herbicides that might otherwise be used. Paddy rice consumes more water than any other crop, but much of this water is recycled and put to other uses (FAO 2004).

Rice factsheet	
Commodity value	USD $328.2 billion (FAOSTAT 2013)
Main countries of production	China, India, Indonesia, Bangladesh, Vietnam, Thailand (FAOSTAT 2013)
Main countries of consumption	China, India, Indonesia, Bangladesh, Vietnam, Philippines (Statista 2015)
Typical product use	Staple food
Additional notes	Worldwide, new rice cultivation practices are being experimented with at the field level, motivated by the need to save water in the face of increasing shortages. One of the most prominent is SRI (WWF 2015e). The materiality matrix is based on the conventional production of rice in paddy fields.

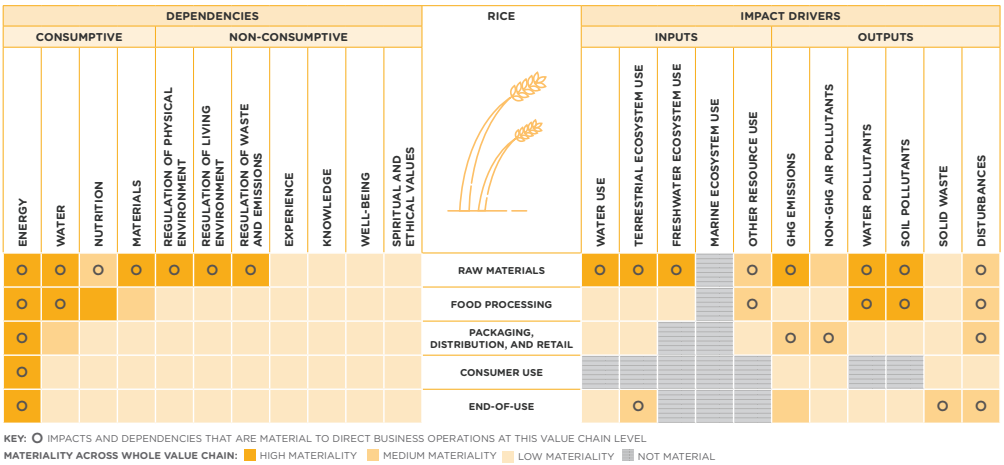

Figure 4.6
Indicative materiality matrix for the value chain of rice

	Description	Examples of material operational impacts and dependencies	Variation in size of impact and dependency
Raw materials	Growing, harvesting	Conventional production of rice involves the use of continuous flooding, a highly water-intensive practice. Flooded rice fields also produce significant methane emissions from the decomposition of organic matter in flooded paddy fields. Water pollutants are another significant impact. Not only can they directly impact the quality of water used for irrigation on the farm, and subsequently affect the quality of the rice produced (thus potentially harming trade), but they can also affect downstream water users, including impacting the health of the local labor force (Bloomberg News 2013).	Irrigation efficiency, water source and scarcity in region, wastewater treatment systems.
Food processing	Drying, storage, milling	Wastewater from rice mills typically contains high concentrations of organic and inorganic substance causing significant pollution (Paul et al. 2015).	Wastewater treatment systems, water source and scarcity in region.
Packaging, distribution, and retail	Rice packaging, distribution, and retail	GHG emissions and other non-GHG air pollutants from energy used in rice distribution (Binh and Tuan 2016).	Efficiency of distribution method.
Consumer use	Rice consumption	GHG emissions and other non-GHG air pollutants from energy used in rice preparation (WRAP 2012).	Efficiency of preparation method.

Step 04 of the food and beverage sector guide has provided additional guidance to help you identify material natural capital impacts and dependencies relevant to the sector. Table 4.1 illustrates the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required in the Protocol for this Step.

Table 4.1
Sector-specific hypothetical examples – Step 04

	Bright & Wholesome	Maison Chocolat	Sugar Estates Ltd.
Context	A large diversified food and beverage retailer sells multiple brands as well as its own-brand product line, where it has been investing in sustainability improvements on an ad hoc basis. It would like to communicate to its customers how its own-brand product line outperforms other brands in sustainability terms.	A small chocolate brand has experienced a significant decline in profit due to increased costs of key raw materials in its supply chain. It would like to identify the best sites for sourcing materials to mitigate potential future risk.	A medium-sized sugar farm is receiving financial assistance to transition towards more sustainable farming systems that prevent toxic runoff into fragile coastal ecosystems. To encourage a further round of investment, it would like to assess and report to its funders on the significant natural capital benefits delivered as a result of their funding.
Summarize the key decisions on the materiality process, including who was involved	**What stakeholder engagement was carried out?** No external consultation was undertaken, though internal CSR executives were interviewed owing to their significant expertise. **What criteria were used to compare relative materiality?** Societal materiality to understand and communicate the extent of positive impact delivered by own-brand product line. **What data were gathered?** An external consultant was hired to provide high-level appraisal of impacts and dependencies over the lifecycle of the own-brand product range.	**What stakeholder engagement was carried out?** Environmental specialists were consulted to better understand the dependencies associated with raw materials used in the supply chain. **What criteria were used to compare relative materiality?** Financial and operational materiality of the dependencies were incorporated to best understand how these may impact the company bottom line. **What data were gathered?** First-tier supplier location data were reviewed and compared against publicly available water risk tools and vulnerable ecosystem mapping analyses.	**What stakeholder engagement was carried out?** Internal experts were consulted to advise on practices to significantly reduce the amount of nitrogen, phosphorous, herbicide, and other pollutants flowing into fragile soil and water ecosystems such as the Great Barrier Reef. **What criteria were used to compare relative materiality?** Societal materiality to best incorporate wider implications of natural capital costs and benefits. **What data were gathered?** Operational input data were received from staff and associated LCAs of inputs were gathered from an online database.
List the material impact drivers and/or dependencies that will be brought forward to the Measure and Value Stage	Upstream and downstream GHG emissions and other non-GHG air pollutants from growing, manufacturing, transportation, and retail of the product, as well as water use from growing and manufacturing and solid waste by consumers.	The provision of water was determined to be the most material dependency.	Agrochemical use (chemical herbicides, pesticides, and fertilizers) leading to water and soil pollution.

MEASURE AND VALUE STAGE
How?

What is the Measure and Value Stage?

The Measure and Value Stage of the Protocol introduces guidance on how impacts and/or dependencies can be measured and valued.

How does the sector guide map to the Protocol?

Table MV.1 provides an overview of the questions and actions of the Measure and Value Stage in the Protocol and an outline of the actions for which the sector guide provides additional guidance.

Table MV.1:
Mapping between the Protocol and the sector guide

Step	Questions each Step will answer	Actions	Additional guidance included in the sector guide?
05 Measure impact drivers and/or dependencies	**How can your impact drivers and/or dependencies be measured?**	5.2.1 Map your activities against impact drivers and/or dependencies	**Yes**
		5.2.2 Define which impact drivers and/or dependencies you will measure	**No**
		5.2.3 Identify how you will measure impact drivers and/or dependencies	**Yes**
		5.2.4 Collect data	**No**
06 Measure changes in the state of natural capital	**What are the changes in the state and trends of natural capital related to your business impacts and/or dependencies?**	6.2.1 Identify changes in natural capital associated with your business activities and impact drivers	**Yes**
		6.2.2 Identify changes in natural capital associated with external factors	**Yes**
		6.2.3 Assess trends affecting the state of natural capital	**No**
		6.2.4 Select methods for measuring changes	**No**
		6.2.5 Undertake or commission measurement	**No**
07 Value impacts and/or dependencies	**What is the value of your natural capital impacts and/or dependencies?**	7.2.1 Define the consequences of impacts and/or dependencies	**Yes**
		7.2.2 Determine the relative significance of associated costs and/or benefits	**No**
		7.2.3 Select appropriate valuation technique(s)	**No**
		7.2.4 Undertake or commission valuation	**No**

Additional notes
Businesses operating in the food and beverage sector should address all of the actions associated with each Step in the Measure and Value Stage. The sector guide provides additional guidance for some of the actions where it is most appropriate. For a detailed appraisal of the suitability and potential accuracy of different methods of measurement and valuation please refer to the Protocol.

Before you get started with the Measure and Value Stage

Before you get started with the measurement and valuation steps of your assessment, it is important to consider any planning requirements. The Protocol, for example, identifies some of the resource needs that should be considered for each Component of the assessment. For impacts on your business, fewer external resources are typically needed, as some data may be available in your company or in published literature. However, for your impacts on society and your business dependencies, more resources are typically needed and they may require specialist environmental/natural resource modeling expertise.

The availability of existing data and the ability to leverage existing sector-specific published literature are important planning considerations not only for measurement and valuation but also in scoping your natural capital assessment. In the food and beverage sector, there are a number of important examples of published literature including sector-specific frameworks, initiatives, and datasets. Table MV.2 summarizes some of these and illustrates how they may be useful for your assessment. Once again, the list is not exhaustive.

Table MV.2:
Examples of sector-specific published literature

Author	Name	Type	Description	How could it be used in natural capital assessments conducted using the Protocol?	Relevant steps
Food and Agriculture Organization of the United Nations (FAO)	FAOSTAT	Datasets and assessment tools	Country- and time-specific agricultural production and trade, food security, agri-environmental indicators, food balance sheets, and other relevant information.	FAO data could be used to identify material natural capital impacts associated within certain agricultural commodities, products, and growing practices, as well as measure and estimate certain impacts and dependencies.	03, 04, 05
	Natural capital impacts in agriculture: Supporting better decision making (FAO 2015a)	Assessment framework and dataset	Framework to measure the net environmental benefits associated with different agricultural management practices. Dataset of natural capital costs per crop/ livestock per country and tier of the value chain.		04, 05, 06, 07
	System of Environmental-Economic Accounting for Agriculture, Forestry and Fisheries (SEEA Agriculture)	Standard	A standardized framework for structuring information on environmental stocks and flows relevant to these sectors, linked to standard measures of economic activity such as GDP and national wealth.	The standards and structures of SEEA Agriculture should directly complement corporate-level natural capital accounting work. In the first instance, datasets compiled using the SEEA should provide much relevant contextual, and benchmarking, information for corporations, particularly for the agriculture, forestry, and fisheries sectors.	05, 06, 07
Sustainable Agriculture Initiative (SAI) Platform	A number of different tools and guidance documents	Assessment tools	Tools and guidance to support global and local sustainable sourcing and agriculture practices	Tools and guidance material provided by SAI can support food and beverage companies in many areas particularly in the framing of a natural capital assessment and scoping considerations.	03, 04, 05
The Cool Farm Alliance	Cool Farm Tool	Assessment tool	Tool for growers to measure the carbon footprint of crop and livestock products.	The tool can feed into the measurement and estimation of impacts related to crop and livestock products.	05
The Economics of Ecosystems and Biodiversity (TEEB)	TEEB for Agriculture & Food (TEEBAgFood)	Assessment framework	A draft framework being developed for comprehensive economic evaluation of the "eco-agri-food systems" complex, road tested in externalities-heavy agricultural sectors (livestock, palm oil, inland fisheries, agro-forestry, rice, and corn).	TEEBAgriFood's framework to review the economically invisible interdependencies between human, agriculture, and food systems, and biodiversity in ecosystems, can be leveraged at all stages of the Protocol but particularly in measurement and valuation.	05, 06, 07
Accreditation/ certification schemes	Varied – includes Fairtrade, RSPO, Rainforest Alliance	Varied	The most widely established and adopted certification schemes are in agriculture, though they vary in target adopters, geographical diffusion, and emphasis on natural capital issues.	The quantitative data collected by companies to achieve accreditation and certification to these types of schemes could be leveraged in natural capital assessments using the Protocol.	05
Sustainability Accounting Standards Board (SASB)	Varied—Agricultural products, Alcoholic and Non-alcoholic beverages, Meat, Poultry, Dairy, and Processed food	Standard	Disclosure guidance and accounting standard.	While the Protocol is not a reporting framework, natural capital assessments can be informed by these types of reporting standards in areas such as materiality, sector-relevant issues, and scoping.	03, 04
Cambridge Institute for Sustainable Leadership (CISL)	E.Valu.a.te: The practical guide	Assessment framework and tools	Evidential support around the process of valuation using a step-wise, bottom-up approach.	Practical examples and real case studies from food and beverage companies.	All steps

05 Measure impact drivers and/or dependencies

This section of the sector guide provides additional guidance for answering the following question:
How can your impact drivers and/or dependencies be measured?

In particular, the sector guide will help you undertake the following actions:

5.2.1 Map your activities against impact drivers and/or dependencies

5.2.3 Identify how you will measure impact drivers and/or dependencies

Map your activities against impact drivers and/or dependencies

In order to complete this action in the Protocol, you will need to identify all of the relevant activities associated with your assessment and map these against material natural capital impacts drivers and/or dependencies. The materiality matrices presented in Step 04 of the sector guide can assist you with this process as they identify relevant business activities across the food and beverage value chain and the material natural capital impacts and dependencies associated with them. Table 5.1 revisits the materiality matrices to provide some simplified examples of how you might start to map business activities to material impacts and dependencies for your assessment.

Table 5.1
Examples of sector-specific activity mapping

Company undertaking assessment	Organizational focus	Value chain element	Material natural capital impacts and dependencies
Pork producer	**Product**	Operational (pig farming including pig feeding, breeding and farrowing, manure management)	**Impact drivers:** Water use, GHG emissions, non-GHG air pollutants, water pollutants, soil pollutants **Dependencies:** Consumptive (energy, water, materials)
Beer brewery	**Corporate**	Upstream (raw materials)	**Impact drivers:** Water use, terrestrial ecosystem use, GHG emissions, non-GHG air pollutants, water pollutants, soil pollutants **Dependencies:** Consumptive (energy, water, materials), non-consumptive (regulation of physical environment – including soil regulation, regulation of living environment – including pollination, regulation of waste and emissions); biodiversity
		Operational (beer production including malting, processing, fermentation)	**Impact drivers:** Water use, GHG emissions **Dependencies:** Consumptive (energy and water)
Soft drinks retailer	**Product**	Upstream (raw materials, food processing, packaging, distribution)	**Impact drivers:** Water use, terrestrial ecosystem use, GHG emissions, water pollutants, soil pollutants **Dependencies:** Consumptive (energy, water, nutrition, materials), non-consumptive (regulation of physical environment, regulation of living environment, regulation of waste and emissions)
		Operational (retail)	**Impacts:** GHG emissions, solid waste, disturbances **Dependencies:** Consumptive (energy)
		Downstream (consumer use and end-of-use)	**Impacts:** Solid waste, disturbances, terrestrial ecosystem use **Dependencies:** Consumptive (energy and water)
Rice mill	**Project**	Operational (drying, storage, milling)	**Impact drivers:** Water pollutants, soil pollutants **Dependencies:** Consumptive (energy and water)

Identify how you will measure impact drivers and/or dependencies

To complete this action in the Protocol, you need to determine how you will obtain the data needed to quantitatively or qualitatively measure your impact drivers and/or dependencies. There are many potential sources of available data (for further detail on primary and secondary data options, please see the Protocol), including:

Primary data:

- Internal business data collected for the assessment being undertaken
- Data collected from suppliers or customers for the assessment being undertaken

Secondary data:

- Published, peer-reviewed, and grey literature (for example, life-cycle impact assessment (LCIA) databases; industry, government, or internal reports)
- Past assessments
- Estimates derived using modeling techniques (for example, EEIO models, productivity models, mass balance)

Table 5.2 provides some sector-specific considerations for the use of primary and secondary data. Once again, for a detailed appraisal of the suitability and potential accuracy of different methods of measurement please refer to the Protocol.

Table 5.2
Sector-specific considerations for primary and secondary data approaches

Type of data	Sector-specific considerations
Primary data	The food and beverage sector is characterized by relatively high primary data disclosure when compared to other sectors. The Carbon Disclosure Project's 2015 Global Water Report found that the consumer staples sector had a high water disclosure rate at 47% in 2015 (compared to an average of 38%) (CDP 2015d). However, companies with low disclosure may still have good primary data available for internal decision making. In 2015, 40% of companies in the food, beverage, and tobacco sectors responded to CDP, most reporting on their own operations with less than a quarter accounting for agricultural emissions from their supply chains. This is likely to improve in the future as more than 75% of food, beverage, and tobacco companies already engage with their suppliers (CDP 2015e). Disclosure on other impact drivers beyond water use and GHG emissions is currently scarce.
Secondary data	Due to the complex nature of food and beverage supply chains and the difficulty of accounting for emissions from supply chain activities, less than a quarter of CDP respondents account for emissions in their supply chains (CDP 2015e). In addition, engagement with suppliers can be costly, challenging, and time consuming. Secondary data sources are often used in these instances and are discussed within the Protocol. Secondary data are often used in the end-of-use stages for similar reasons. Some useful examples of sector-specific secondary data sources are presented in table MV.2.

Step 05 of the food and beverage sector guide has provided additional guidance to help you map your activities against impact drivers and/or dependencies and identify how you will measure them. Tables 5.3, 5.4 and 5.5 illustrate the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required in the Protocol for the Step. All values provided in the tables are for illustrative purposes only.

Glossary

Primary data
Data collected specifically for the assessment being undertaken.

Secondary data
Data that were originally collected and published for another purpose or a different assessment.

Table 5.3
Sector-specific hypothetical examples:
Step 05 – Bright & Wholesome

Intended business application: Communicate internally and/or externally
Organizational focus: Product
Value-chain boundary: Whole value chain (upstream, operational and downstream)
Impacts or dependencies: Impacts
Value perspective: Societal
Type of value: Monetary

	Specific impact/ dependency	Quantitative/ qualitative indicator	Data sources	Data gaps
Impacts	GHG emissions	Metric tons of GHGs	External consultant conducting own-brand LCIAs	No downstream data available
	Non-GHG air pollutants	Kg emission of CO, NH_3, SO_2, NO_x, VOCs and PM		
	Water use	m^3 of water		
	Solid waste	Metric tons of solid waste		

Table 5.4
Sector-specific hypothetical examples:
Step 05 – Maison Chocolat

Intended business application: Compare options
Organizational focus: Corporate
Value-chain boundary: Upstream
Impacts or dependencies: Dependencies
Value perspective: Business
Type of value: Qualitative and quantitative

	Specific impact/ dependency	Quantitative/ qualitative indicator	Data sources	Data gaps
Dependencies	Provision of water	m^3 of water	Quantitative: EEIO model supplemented with primary data collected from first-tier suppliers Qualitative: Appraisal of regulatory water risk (based on location-specific water scarcity maps and the likelihood of increased water regulation in a country in the short to medium term)	Practice-specific data unavailable

Table 5.5
Sector-specific hypothetical examples: Step 05 – Sugar Estates Ltd.

Intended business application: Estimate total value and/or net impact
Organizational focus: Project
Value-chain boundary: Operational at farm level
Impacts or dependencies: Impacts
Value perspective: Societal
Type of value: Monetary

	Specific impact/ dependency	Quantitative/ qualitative indicator	Data sources	Data gaps
Impacts	Water pollutants	Kilograms of N,P,K fertilizer input and other chemical inputs to water	Internal agrochemical use data combined with LCIA database/ secondary academic literature	Regionally-specific data on distribution pathways unavailable
	Soil pollutants	Kilograms of N,P,K and other chemical inputs to soil		

06 Measure changes in the state of natural capital

This section of the sector guide provides additional guidance for answering the following question:
What are the changes in the state and trends of natural capital related to your business impacts and/or dependencies?

In particular, the sector guide will help you undertake the following actions:

6.2.1 Identify changes in natural capital associated with your business activities and impact drivers

6.2.2 Identify changes in natural capital associated with external factors

Identify changes in natural capital associated with your business activities and impact drivers

This action considers the changes in natural capital that are likely to result from the impact drivers measured or estimated in Step 05. The Protocol presents some generic examples of changes in natural capital for a range of impact drivers. Table 6.1 presents some sector-specific examples for the impact drivers that were introduced in Step 01 of the sector guide. In addition to providing examples of changes in natural capital, the table also presents some examples of how the changes may vary according to location-specific factors.

Table 6.1
Sector-specific examples of relevant changes in natural capital for different impact drivers

	GHG emissions	Water pollutants	Terrestrial ecosystem use
Example indicator	Metric tons of GHGs	Kilograms of N,P,K fertilizer input and other chemical inputs to water	Hectares of land
Example changes in natural capital	GHG emissions are a global impact driver that cause an increase in global GHG concentrations, resulting in climate change.	Nutrients entering waterways through the process of leaching lead to a change in eutrophication levels and affect ecosystems through the reduction in species (for example, fish).	Natural capital change can occur in biodiversity and the availability of ecosystem services (provisioning services such as stocks of timber and non-timber forest products and regulating services such as flood protection, pollination, erosion control, and carbon sequestration).
Examples of variation in changes in natural capital	Climate change leads to many natural capital changes around the world – in the atmosphere, on land, and in the oceans. Quantifying these requires an understanding of atmospheric chemistry, meteorology, and forecasting the consequences of climate change on rainfall patterns, ocean acidity, storm frequency and intensity, and sea level amongst others. The impacts of these changes is geographically specific, with some regions of crop production, for example, more vulnerable to effects such as the variability of rainfall and shifts in temperatures (IPCC 2014).	Water pollution is primarily a local impact driver because it has a direct and traceable impact on local ecosystems and the quality of the water into which it is discharged. As such, understanding the change in natural capital from the emission of water pollutants requires a consideration of location-specific factors such as the type of water body they are discharged into and the background concentrations of the pollutants. For example, the overuse of fertilizers can be the source of significant natural capital changes, as is the case for wheat farming in Germany. The European Environmental Agency (EEA) identifies Germany as one of the countries in Europe with the greatest exceedance of critical nutrient loads (EEA 2009).	Terrestrial ecosystem use is an impact driver with local, regional, and global implications (for example, through the emission of GHGs). The greater the difference between the values of ecosystem services lost due to the conversion of land from its natural ecosystem and the ecosystem services "gained" from the converted land, the bigger the change in natural capital. For example, the conversion of natural ecosystems to pastureland for cattle production in Brazil, one of the most biodiverse countries in the world, results in a natural capital cost of over USD 473 million per year (FAO 2015a).

Identify changes in natural capital associated with external factors

You should also identify any external factors that could result in major changes in the state of natural capital, as these may directly or indirectly affect the significance of impacts on your business, your impacts on society, and/or your business dependencies. External factors potentially leading to changes in natural capital include both natural changes and human-induced changes. The Protocol provides a definition of these and some examples of changes in natural capital influencing dependencies. Table 6.2, presents some sector-specific examples of changes in natural capital influencing the dependencies that were introduced in Step 01. Once again, the table also presents some examples of how the change in natural capital may vary according to location-specific external factors.

Table 6.2
Sector-specific examples of relevant changes in natural capital for different dependencies

	Consumptive: Water	Consumptive: Materials	Non-consumptive: Regulation of living environment
Example indicator	Cubic meters of water (m^3)	Metric tons of raw materials supplies	Pollinator density
Example changes in natural capital	Diversion or desiccation of a freshwater body that provided a source of process water.	Wildfires destroying grain harvests.	Loss of pollinators such as bees resulting in decreased crop yields.
Examples of variation in changes in natural capital	External factors that could impact the state and trends of fresh water provision include economic and population growth driving the demand for resources, as well as background environmental change such as climate change. A well-reported example of human-induced change is the Colorado River in the United States, where agriculture uses approximately 80% of its water to irrigate nearly 4 million acres, providing 15% of Unites States crop and 13% of its livestock production. Going forward, rising temperatures are expected to reduce the Colorado's average flow after 2050 by 5–35%, even if rainfall remains the same—and most studies predict that rains will diminish (New York Times 2014; Economist 2014).	Location-specific external factors such as propensity to drought or flooding, and soil quality, and human-induced factors such as legal and illegal deforestation, all create pressures on the ability of an ecosystem to provide materials. For example, Russia faced drought and wildfire losses on a quarter of its grain with subsequent global implications for food security and food riots in many locations around the world. Subsequent analyses of this and other significant extreme weather events between 2010–2013 (such as flooding in Pakistan, a drought in East Africa, and a typhoon in the Philippines) concluded that the impacts of these events were spatially variable and determined by local conditions including socio-economic factors (Oxfam 2014).	External pressure on pollinators, a key regulating service, is accelerating in many regions of the globe. For example, the White House recently estimated honey bees in the United States have declined from 6 million to just 2.5 million in 60 years due to loss of natural forage and inadequate diets, mite infestations and diseases, loss of genetic diversity, and exposure to pesticides (White House 2014). Given the heavy dependence of certain crops on commercial pollination, reduced honey bee populations pose a real threat to United States agriculture. Pollinator plantations can also increase as a response of location-specific practices.

Step 06 of the food and beverage sector guide has provided additional guidance to help you identify changes in natural capital associated with your business activities, impact drivers, and external factors. Tables 6.3, 6.4, and 6.5 illustrate the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required in the Protocol for the Step. All values provided in the tables are for illustrative purposes only.

Table 6.3
Sector-specific hypothetical examples:
Step 06 – Bright & Wholesome

Intended business application: Communicate internally and/or externally

	Specific impact/ dependency	Quantitative/ qualitative indicator	Approach for estimating natural capital change
Impacts	GHG emissions	Concentration of CO_2e in atmosphere	LCIA used provided characterization factors which account for the change in natural capital.
	Non-GHG air pollutants	Concentration of non-GHG air pollutants in local air	
	Water use	Change in available water source	
	Solid waste	Assessed through disamenity	

Table 6.4
Sector-specific hypothetical examples:
Step 06 – Maison Chocolat

Intended business application: Compare options

		Quantitative/ qualitative indicator	Approach for estimating natural capital change
Dependencies	Supplier A: Provision of water	Changed availability of water (average over 15 years) due to long term changes in precipitation	Published hydrological models used to estimate availability of water.
	Supplier B: Provision of water		
	Supplier C: Provision of water		
	Supplier D: Provision of water		

Table 6.5
Sector-specific hypothetical examples:
Step 06 – Sugar Estates Ltd.

Intended business application: Estimate total value and/or net impact

		Quantitative/ qualitative indicator	Approach for estimating natural capital change
Impacts	Water pollutants	Chemical concentration in water systems and increase in ecotoxicity	LCIA used provided characterization factors which account for the change in natural capital.
	Soil pollutants		

07 Value impacts and/or dependencies

This section of the sector guide will provide additional guidance to allow you to answer the following question:
What is the value of your natural capital impacts and/or dependencies?

In particular, the sector guide will help you undertake the following action:
7.2.1 Define the consequences of impacts and/or dependencies

Define the consequences of impacts and/or dependencies

Based on the impact drivers and dependencies, and associated changes in natural capital identified in Step 04 and (as appropriate) measured in Steps 05 and 06, you should now be able to identify the consequences—or the types of business and societal costs and benefits—that may arise under one or more relevant scenarios. The Protocol provides some useful examples of the consequences of natural capital impacts on business and society as well as the consequences of natural capital dependencies. In this section, the sector guide provides some examples for the food and beverage sector specifically.

Consequences of natural capital impacts on your business

Food and beverage businesses may be impacted directly by the natural capital impacts of their activities. These business impacts include any financial costs or benefits that directly affect your bottom line. Some of these were introduced in Step 01 of the sector guide in the discussion of business performance metrics influenced by different risks and opportunities relating to natural capital. They also include less tangible impacts that may affect the bottom line indirectly, such as reputational damages (or benefits), delays in permitting, and employee attraction and retention. Business impacts may relate to the cost of production inputs (for example, the purchase costs of raw materials, water, or energy), as well as the costs or benefits of outputs (for example, increased compliance costs as water regulations become more stringent, or increased revenue from waste recovery and recycling initiatives).

Environmental market mechanisms are being introduced in many jurisdictions, whereby companies increasingly need to pay for their use of or impacts on natural capital, or get paid for environmental enhancements they provide. While a global carbon market remains elusive, a report published by the World Bank (2015) showed that 40 nations and over 20 cities, states, and regions now have a price on CO_2 emissions, covering around 12% of annual global GHG emissions, or the equivalent of nearly 7 billion tons of CO_2. The proliferation of environmental mechanisms such as these may create new costs and/or benefits for food and beverage companies and these are often scaled according to the amount of emissions generated or resources used.

Conversely, fines or legal claims for environmental damages (or revenues from payments for ecosystem services) may be linked to measured changes in natural capital. In payments for ecosystem services (PES) schemes, people managing and using natural resources, typically forest owners or farmers, are paid to manage their resources to protect watersheds, conserve biodiversity, or capture CO_2 (carbon sequestration) through, for example, replanting trees or keeping living trees standing, or by using different agricultural techniques.

If the scope of your assessment extends over several years, you will need to consider not only potential future direct business impacts, but also the possibility that future business impacts may arise indirectly through your company's impacts on society. While assessing your company's impacts on society is more demanding than assessing impacts on your business, it is more likely to capture the risk and opportunity associated with your impacts being internalized at some point in the future.

Consequences of natural capital impacts on society

The natural capital impacts of your business may also affect society. Societal impacts include all costs or benefits accruing to individuals, communities, or organizations that are not captured through current market systems and are external to your business—these are often referred to as "externalities". Societal impacts arise from changes in natural capital resulting from the impact drivers of your business. Again, some of these were introduced in Step 01 in the discussion of risks and opportunities and how they may indirectly influence business performance metrics. Societal impacts will vary depending on the "receptors" that are affected (for example, people, buildings, agriculture).

At the agricultural and food production level, societal consequences can be significant. For example, recent FAO research found that industrialized farming practices cost the environment some USD 3 trillion per year (FAO 2015a). These costs often fall disproportionately on the poor and on women in particular (TEEBAgriFood 2014). This is because smallholders and communities may be situated in remote locations in fragile environments, with limited access to agrochemicals and irrigation systems and no means to relocate, nor invest in rehabilitation or mitigation. As such, they may be reliant on local ecosystem provisioning services for welfare and income, with little alternative when ecosystems are degraded.

Negative externalities from agriculture and food production typically affect human well-being directly and include, for example, loss of livelihoods from natural resource degradation and health impacts arising from the use of agro-chemicals. In the European Union alone, exposure to endocrine-disrupting chemicals (mainly found in pesticides) is costing approximately USD 174 billion per year from direct medical costs, as well as indirect costs from lost worker productivity, early death and disability, and loss of intellectual abilities caused by prenatal exposure (Trasande et al. 2015). Other externalities affect humans indirectly, such as nutrient runoff from farmland affecting the quality of water, and in turn recreational activities. On the other hand, most positive externalities (outputs) from agriculture and food production are visible and generally marketed, such as food and raw materials. Less economically visible positive externalities include enhanced ecosystem services (such as pollination, predation, water purification, and soil formation) and cultural and aesthetic amenities of traditionally farmed landscapes and the provision of habitats for plant and animal species (TEEBAgriFood 2014).

Further down the food and beverage value chain, food processing, marketing, consumption, and disposal have important societal externalities. In a 2015 analysis, the FAO estimated that in terms of GHG emissions, food wastage ranks as the third top emitter after the United States and China, whilst globally its water footprint is about three times the volume of Lake Geneva (FAO 2015c). Produced but uneaten food also accounts for close to 30% of the world's agricultural land area. These losses represent USD 2.6 trillion in costs to society because food wastage represents a missed opportunity to improve global food security and to mitigate environmental impacts generated by agriculture (FAO 2014c).

Consequences of natural capital dependencies

The dependence of your business on natural capital primarily affects the business itself. Potential costs and benefits associated with business dependencies fall into two categories: consumptive—or goods that you rely upon for your business (for example, water and timber)—and non-consumptive—goods or services nature provides that are often unseen and unpriced (for example, natural flood and erosion control). Once again, some of these costs and benefits were introduced in Step 01 in the discussion of risks and opportunities.

Table 7.1, presents some sector-specific examples of the consequences associated with the natural capital impacts that were introduced in Step 01 and Step 06. These natural capital impacts are presented in terms of their consequences for business and for society. Table 7.2 presents some sector-specific examples of the consequences associated with natural capital dependencies. These dependencies are presented in terms of their consequences for business.

Table 7.1
Examples of the consequences of natural capital impacts

	GHG emissions	Water pollutants	Terrestrial ecosystem use
Example changes in natural capital	GHG emissions are a global impact driver that cause an increase in global GHG concentration, resulting in climate change.	Nutrients entering waterways through the process of leaching lead to a change in eutrophication levels and affect ecosystems through the reduction in species (for example, fish).	Natural capital change can occur in biodiversity and the availability of ecosystem services (provisioning services such as stocks of timber and non-timber forest products and regulating services such as flood protection, pollination, erosion control, and carbon sequestration).
Consequence of impact to business	Operating cost increases due to carbon tax levied by national environmental market mechanisms.	Potential legal costs depending on local environmental regulations. Operational cost of clean-up, or treatment of water for use in operations.	Cost of land conversion. If deforestation is illegal, there could be an associated risk of legal costs, and implications for brand reputation.
Consequence of impact to society	Global implications of climate change including the impact of climate change on agricultural productivity, forestry, water resources, energy consumption, property damages from increased flood risk, and human health.	Water pollution from the excessive use of fertilizer creates a cost for communities that then have to pay to treat the water so they can safely use it, alongside finding an alternative source of food if fish stocks have been depleted.	Loss of culturally and economically important lands will negatively impact local populations.

Table 7.2
Examples of the consequences of natural capital dependencies

	Consumptive: Water	Consumptive: Materials	Non-consumptive: Regulation of living environment
Example changes in natural capital	Diversion or desiccation of a freshwater body that provided a source of process water.	Wildfires destroying grain harvests.	Loss of pollinators such as bees resulting in decreased crop yields.
Consequence of dependency to business	Increased operational costs associated with securing alternative fresh water. Loss of revenue from crop failure.	Increased operating costs associated with alternative sourcing of raw materials.	Increased operational costs from mechanical pollination and reduced revenue from low yields.

Step 07 of the food and beverage sector guide has provided additional guidance to help you define the consequences of natural capital impacts and dependencies. Tables 7.3, 7.4, and 7.5 illustrate the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required in the Protocol for the Step. All values provided in the tables are for illustrative purposes only.

Table 7.3
Sector-specific hypothetical examples
Step 07 – Bright & Wholesome

Intended business application: Communicate internally and/or externally

	Specific impact/ dependency	Valuation approach	Value (per product)
Impacts	GHG emissions	Monetary valuation: Social cost of carbon (SCC)	US$50
	Non-GHG air pollutants	Monetary valuation: Stated preference – Willingness-to-pay	US$20
	Water use		US$75
	Solid waste	Monetary valuation: Revealed preference – Hedonic pricing	US$12

Table 7.4
Sector-specific hypothetical examples
Step 07 – Maison Chocolat

Intended business application: Compare options

	Specific impact/ dependency	Valuation approach	Value (per kg chocolate)
Dependencies	Supplier A: Provision of water	No additional valuation required as the quantitative data collected in Step 05 is sufficient.	3,500 m^3/kg chocolate and ranking according to regulatory risk index
	Supplier B: Provision of water		1,510 m^3/kg chocolate and ranking according to regulatory risk index
	Supplier C: Provision of water		3,650 m^3/kg chocolate and ranking according to regulatory risk index
	Supplier D: Provision of water		2,500 m^3/kg chocolate and ranking according to regulatory risk index

Table 7.5
Sector-specific hypothetical examples
Step 07 – Sugar Estates Ltd.

Intended business application: Estimate total value and/or net impact

	Specific impact/ dependency	Valuation approach	Value (per technology)
Impacts	Water pollutants	Value transfer approach adjusted for regional water body	USD 8
	Soil pollutants	Value transfer approach adjusted for ecosystem type	USD 4.5

APPLY STAGE
What next?

What is the Apply Stage?

The Apply stage of the Protocol summarizes the natural capital assessment process by helping you interpret and apply your results in your business. It also encourages you to consider how to optimize the value from this and future assessments.

How does the sector guide map to the Protocol?

Table A.1 provides an overview of the questions and actions of the Apply Stage in the Protocol and an outline of the actions for which the sector guide provides additional guidance.

Table A.1:
Mapping between the Protocol and the sector guide

Step	Questions each Step will answer	Actions	Additional guidance included in the sector guide?
08 Interpret and test the results	How can you interpret, validate, and verify your assessment process and results?	8.2.1 Test key assumptions	Yes
		8.2.2 Identify who is affected	No
		8.2.3 Collate results	No
		8.2.4 Validate and verify the assessment process and results	No
		8.2.5 Review the strengths and weaknesses of the assessment	No
09 Take action	How will you apply your results and integrate natural capital into existing processes?	9.2.1 Apply and act upon the results	Yes
		9.2.2 Communicate internally and externally	No
		9.2.3 Make natural capital assessments part of how you do business	Yes

Additional notes
Businesses operating in the food and beverage sector should address all of the actions associated with each Step in the Apply Stage. The sector guide provides additional guidance for some of the actions where it is most appropriate.

08 Interpret and test the results

This section of the sector guide provides additional guidance for answering the following question:
How can you interpret, validate, and verify your assessment process and results?

In particular, the sector guide will help you undertake the following action:
8.2.1 Test key assumptions

Test key assumptions

There will always be some estimation or approximation involved in a natural capital assessment. You should therefore avoid spurious precision and instead present any numbers in a range or rounded and document your decision to do this.

To understand what level of confidence you can have in your results, you will need to carry out a sensitivity analysis. This involves testing how changes in assumptions or key variables affect the results of an assessment. The Protocol provides an outline of some of the different methods of carrying out a sensitivity analysis as well as some generic assumptions that you can test.

Any natural capital assessment in the food and beverage sector will involve some estimation and it is important to understand the significance of any assumptions made, especially as many food and beverage companies have their own distinctive and often fragmented supply chains (KPMG 2013). Natural capital assessments that involve upstream or downstream boundaries are often more challenging because of the potential lack of data availability in areas where businesses have less direct operational control or influence. In these situations, testing the sensitivity of key assumptions is even more important.

Some examples of sector-specific assumptions that you can test as part of a sensitivity analysis are listed in Table 8.1.

Table 8.1
Sector-specific examples of assumptions that can be tested in a sensitivity analysis

Assumptions you can test:	How do my results change if...
Quantity of commodity used within a processed product	The quantity of cocoa used to produce a chocolate bar increased by 10%.
Sourcing location of key raw materials	The sourcing location changed from one country to another.
Magnitude of change in natural capital	Water availability at the sourcing location for barley is halved.
Processing techniques	The commodity processing technique changed.
Changes in prices	The price of water used by a brewery increased from USD 1 to USD 5 per m^3.

Step 08 of the food and beverage sector guide has provided additional guidance to help you test the key assumptions of your natural capital assessment. Table 8.2 illustrates the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required in the Protocol for this Step.

Table 8.2
Sector-specific hypothetical examples – Step 08

	Bright & Wholesome	Maison Chocolat	Sugar Estates Ltd.
Context	A large diversified food and beverage retailer sells multiple brands as well as its own-brand product line, where it has been investing in sustainability improvements on an ad hoc basis. It would like to communicate to its customers how its own-brand product line outperforms other brands in sustainability terms.	A small chocolate brand has experienced a significant decline in profit due to increased costs of key raw materials in its supply chain. It would like to identify the best sites for sourcing materials to mitigate potential future risk.	A medium-sized sugar farm is receiving financial assistance to transition towards more sustainable farming systems that prevent toxic runoff into fragile coastal ecosystems. To encourage a further round of investment, it would like to assess and report to its funders on the significant natural capital benefits delivered as a result of their funding.
Natural capital assessment undertaken (Business application)	The company conducted a monetary assessment to communicate to its customers the net natural capital benefits delivered to society from the reduction of negative impacts of its own-brand products. *(Communicate internally and/or externally)*	The company conducted a quantitative and qualitative assessment of its raw material suppliers to mitigate the risks of natural capital dependency on fresh water provision across its supply chain. *(Compare options)*	The sugar farm conducted a monetary assessment to report back to its funders the net impact delivered by their investments from the reduction of agrochemical use polluting soil and coastal water ecosystems. *(Estimate total value and/or net impact)*
What key assumptions were tested?	The assumptions behind the monetization coefficients were tested with varying discount rates to ensure monetization results remain within the same order of magnitude.	Sensitivity analysis was carried out to assess the implications on results with varying levels of water scarcity.	Sensitivity analysis was carried out on the model used to calculate the dispersion of toxic runoff from soil to water ecosystems.
Who is affected by the results of the assessment?	The assessment is designed to inform external stakeholders to help strengthen company communication on sustainability and differentiate its own-brand product portfolio from competitors.	The assessment is designed to inform internal procurement decisions in order to mitigate supply chain risk from water scarcity. Furthermore, potential suppliers of raw materials are also affected.	The assessment is designed to inform current and potential funders on the impact of their investment. Furthermore, potential sugar buyers are also affected.
Validation/ Verification	External: The review identified that sources of data, methodology, and assumptions made were "fit for purpose".	Internal: The review identified that sources of data, methodology, and assumptions made were "fit for purpose".	Internal: The review identified that sources of data, methodology, and assumptions made were "fit for purpose".
Strengths and weaknesses of assessment	Due to the wide scope across its product range, the majority of the data used within the assessment were taken from secondary sources and LCIAs, and the work could be strengthened using more primary data.	The strength of the assessment is through its usefulness in decision making and value in driving actual purchasing decisions. While undertaking the review, it became apparent that expanding the scope of the analysis to other material natural capital impacts and dependencies would have strengthened the results.	The assessment's ability to demonstrate net impact of investment is highly valued by investors, who can in turn report on these metrics to their fiduciaries. However, some co-benefits delivered by the investment were left outside the scope of this pioneering assessment and should be included in future iterations.

09 Take action

This section of the sector guide will provide additional guidance to allow you to answer the following question:
How will you apply your results and integrate natural capital into existing processes?

In particular, the sector guide will help you undertake the following actions:

9.2.1 Apply and act upon the results

9.2.3 Make natural capital assessments part of how you do business

Apply and act upon the results

At this stage in the process, you have framed and scoped your assessment, measured and valued your interaction with natural capital according to a specific objective, and interpreted the results. The next step is to apply the results to inform business decision making processes using new information. The application of the results is the real measure of success for your assessment and a crucial step in the Protocol Framework.

This section of the sector guide provides some practical examples of how the results of a natural capital assessment could be applied by businesses operating in the food and beverage sector. In each example, the sector guide refers back to the relevant business applications (explained in Step 02) that would help your business achieve each outcome.

Practical example 1: Shadow pricing

Shadow pricing is one way to account for risk and the cost of natural capital impacts. A shadow price is an estimated monetary value that is used internally to account for risk or profitability. A natural capital shadow price or valuation might be factored into actual operational costs in a profit and loss statement, included in a discounted cash flow statement for a capital investment, or considered alongside a capital asset on a balance sheet.

In 2015, more than one thousand companies across the globe disclosed to their key stakeholders that they currently price their CO_2 emissions—or intend to in the next two years—to try to manage their climate change risks (CDP 2015a). Companies across many sectors, including consumer discretionary and consumer staples, are using internal carbon pricing to offset the costs and risks of GHG production, and to finance the transition to secure sources of low-carbon energy. This demonstrates the ongoing mainstreaming of carbon pricing as a high priority for business and an essential component of the corporate strategy toolkit (CDP 2015a).

Relevant business applications: Compare options, Estimate total value and/or net impact

Practical example 2: Sourcing, procurement, and supply chain management

For many businesses operating in the food and beverage sector, a significant proportion of their natural capital risks and opportunities reside in their supply chains rather than in their direct operations. This is evidenced in the materiality matrices introduced in Step 04 for a number of important raw materials and products across the food and beverage value chain.

Practical ways to apply natural capital assessments include supply chain risk assessments, strategic sourcing or hedging of commodities, supplier relationship management, and sustainable procurement strategies and guidelines for buyers and suppliers.

The starting point for any company is a supply chain risk assessment that identifies which natural capital impacts and dependencies are material to the business and where they occur. This could involve measuring impacts and dependencies in physical terms or applying monetary valuations so that they can be compared in a common metric and prioritized.

Armed with this information, food and beverage companies can begin to build a more risk-resilient supply chain and identify opportunities for increased competitive advantage. On water scarcity risks in particular, Ceres (2015) concludes that as water supplies are increasingly depleted and polluted in major agricultural regions across the world, traditional risk management approaches such as hedging and geographic diversification are becoming less effective. Companies can achieve more by engaging directly with their supply chain to strengthen farmer practices and protect watersheds. Key strategies could include setting sustainable agriculture policies and time-bound sourcing goals, purchasing certified sustainable commodities where relevant, and collecting data from farmers on their practices while providing assistance and incentives for improvement.

Relevant business applications: Assess risks and opportunities, Compare options, Assess impacts on stakeholders

Practical example 3: Product design

Another way to operationalize natural capital assessments is in the product development and design process. Many forward-thinking companies already use life-cycle impact assessments (LCIAs) to quantify and reduce impacts associated with sourcing, manufacturing, use, and disposal of products.

Natural capital valuation can enhance LCIAs by converting physical impacts into monetary values, which are more readily understood by a business audience. A business also can understand the impact in relation to the amount of the resource actually available, as its value reflects its scarcity. Water, for instance, will be more valuable in an arid region of the world compared to a region which is water abundant.

There are many opportunities for businesses to transition to a more circular business model; one which is less dependent on primary energy and material inputs. Sustainable product design can play an important role in unlocking new revenue streams, particularly in the fast-moving consumer goods sector. In the UK, for example, costs of packaging, processing, and distributing beer could be reduced by 20% by shifting to reusable glass bottles. In addition, a profit of USD 1.90 per hectoliter of beer produced can be captured by selling the spent grains produced by breweries (Ellen MacArthur Foundation 2015).

Relevant business applications: Compare options, Estimate total value and/or net impact, Assess risks and opportunities

Practical example 4: Scenario planning

Businesses in the food and beverage sector can use natural capital assessments to inform decisions such as where to grow and invest capital, or withdraw and divest assets, or how to weigh environmental constraints for new or different business models.

A large soft drinks manufacturer, for example, may want to expand production in cities where it already has a number of factories and where population growth is increasing rapidly, but where water scarcity is an increasing problem. By assessing the future natural capital value of water, the company may gain insight into where best to expand, and can feed valuation data into other calculations such as site-development costs. Another business might value natural capital to consider the feasibility of vertically integrating operations as a way to source alternative agro-materials, or to compare the costs of different technologies.

When using scenario planning to manage natural capital risks, companies should use forward-looking models or scenarios to identify the likelihood and severity of future risks, and use robust datasets to support this analysis (Ceres 2015).

Relevant business applications: Compare options, Estimate total value and/or net impact, Assess risks and opportunities

Practical example 5: Disclosure

Although the Protocol is not a reporting framework, businesses may choose to report the findings of their natural capital assessments. Sustainability reporting, on the whole, can provide investors with an insight into the stewardship of natural resources, and into which companies are most transparent about performance. For companies, better disclosure can lead to better stewardship, which in turn can help increase efficiency and operational performance, and mitigate risks that might have material financial impacts on their business (KPMG 2014).

Relevant business applications: Communicate internally and/or externally

What future natural capital assessments are worthwhile?

Natural capital assessment can and should lead to new ways of thinking about how your business relates to the natural environment. For example, it may flag significant dependencies on ecosystem services that you were not aware of, or reveal previously unrecognized risks or opportunities associated with the indirect impacts of your business on society. In extreme cases, a natural capital assessment may fundamentally challenge or support your existing business model. In general, as you begin to include natural capital more systematically in your decisions, more and more of your business will be affected.

Applying the results of your assessment for one specific business application may have already generated ideas about additional business decisions that could be improved by a natural capital assessment. These ideas could be based upon what is most material (as identified in Step 04) or it might focus on new and unexpected natural capital impacts and dependencies that were revealed in your first assessment. Table 9.1 provides some ideas for undertaking further assessments in the food and beverage sector, including exploring new business opportunities, expanding the scope of your assessment, or broadening your assessment to include different types of value.

Table 9.1
Example of future assessments in the food and beverage sector

If you've already considered...	Could you now consider...?
Your direct operations	Impacts and dependencies of upstream (such as the supply chain of your products) or downstream (such as consumer use phase including cooking, storage of food, and end-of-life) activities.
A qualitative assessment	Quantifying impacts and dependencies, and/or applying monetization.
A technological improvement in a particular factory	Rolling out the technology across all production sites.
A particular key ingredient	All ingredients included within your food range.
Business impacts	Considering the wider social implications, such as health impacts to neighboring communities at site of impact.
One environmental indicator	Expanding the assessment to incorporate all the material impacts and dependencies of your assessment scope.

Make natural capital assessments part of how you do business

Any measure of success in the uptake of a protocol would be evidenced in improved risk management, increased competitive advantage, and enhanced corporate reporting (Natural Capital Coalition 2015). Step 01 to Step 09 of the sector guide thus help demonstrate how these outcomes can be achieved through applications of the Protocol in the food and beverage sector. However, in order to truly unlock the value associated with more informed decision making, it is important that your natural capital assessment is not a one-off exercise, and that the results become embedded in the way you do business.

This poses a challenge as a radical shift in mind-set is needed if businesses are to adapt to the risks and opportunities that natural capital presents. In 2010, for example, a United Nations Principles of Responsible Investment (UNPRI) report revealed that the annual economic costs of natural resource depletion and pollution impacts linked to business activity equated to USD 6.6 trillion or 11% of global GDP. In addition, the research calculated that more than 50% of company earnings were at risk from environmental costs in an equity portfolio weighted according to the MSCI All Country World Index (UNPRI 2010). Economy-wide, these risks are sufficiently large that the World Economic Forum's Global Risks report (2015) cites water crises, failure of climate-change adaptation, energy price shocks, biodiversity loss, and ecosystem collapse within its top ten global risks over the next ten years as measured by likelihood and scale of global impact.

However, where there is risk, there is opportunity. Businesses using traditional decision-making processes to cope with the uncertainty posed by these economic, social, and environmental issues may find themselves playing catch-up with more forward-thinking competitors in the future (Bain & Company 2015).

Ultimately, we need new corporate thinking that:

- Identifies the material impacts and dependencies that businesses have on nature and society;
- Makes the connection between financial capital, natural capital, commercial opportunities, and business risk; and
- Integrates this information into decision making, strategies, business models, and reporting.

This section of the sector guide concludes with some key recommendations on how food and beverage companies can ensure natural capital becomes embedded in business decision making so that they can respond to the opportunities and risks that it may pose.

Continue to strengthen the business case for natural capital

- Corporate board members have a fiduciary duty for risk management oversight. As such, board charters should be strengthened to explicitly mention natural capital to increase board oversight and understanding of material natural capital risks (Ceres 2015).
- Traditional approaches to strategy (analyzing trends, making forecasts, and committing to an appropriate course of action) are not calibrated to the uncertainty of a resource-constrained world (Bain & Company 2015). Engage board members by facilitating debate about how natural capital relates to your strategy, business model, performance, and social license to operate.

Continue to measure and value

- Continue to explore the most appropriate methodologies and help shape evolving standards for measuring and valuing your natural capital impacts and dependencies.
- Engage with suppliers, customers, and other important stakeholders to better understand how your business is impacting on critical natural resources and continue to identify risk "hotspots" across the value chain.
- Ensure that you continue to identify ways to expand your measurement and understanding of material natural capital impacts and dependencies and associated risks and opportunities.

Explore linkages with new and existing business processes

- Ensure that information on natural capital is integrated with other business management systems, including financial and management accounting, to help prioritize where natural capital will drive management action.
- Consider how material natural capital issues could be integrated into reporting to external stakeholders including investors.

Continue to develop knowledge and strengthen collaboration

- Develop the relevant skills internally to enable natural capital assessments to be conducted and communicated with the same rigor as for financial and business accounts.
- Collaborate with stakeholders, relevant experts, and specialists in the sector to increase your awareness of natural capital impacts and dependencies and their relationship with your business.
- Influence the global debate through links with international and professional organizations.

Step 09 of the food and beverage sector guide has provided additional guidance and recommendations to help you take action and embed the results of your natural capital assessment in business decision making. Table 9.2 illustrates the completion of this Step for each of the sector-specific hypothetical examples, including the completion of all actions required in the Protocol for this Step.

Table 9.2
Sector-specific hypothetical examples – Step 09

	Bright & Wholesome	Maison Chocolat	Sugar Estates Ltd.
Context	A large diversified food and beverage retailer sells multiple brands as well as its own-brand product line, where it has been investing in sustainability improvements on an ad hoc basis. It would like to communicate to its customers how its own-brand product line outperforms other brands in sustainability terms.	A small chocolate brand has experienced a significant decline in profit due to increased costs of key raw materials in its supply chain. It would like to identify the best sites for sourcing materials to mitigate potential future risk.	A medium-sized sugar farm is receiving financial assistance to transition towards more sustainable farming systems that prevent toxic runoff into fragile coastal ecosystems. To encourage a further round of investment, it would like to assess and report to its funders on the significant natural capital benefits delivered as a result of their funding.
Natural capital assessment undertaken *(Business application)*	The company conducted a monetary assessment to communicate to its customers the net natural capital benefits delivered to society from the reduction of negative impacts of its own-brand products. *(Communicate internally and/or externally)*	The company conducted a quantitative and qualitative assessment of its raw material suppliers to mitigate the risks of natural capital dependency on fresh water provision across its supply chain. *(Compare options)*	The sugar farm conducted a monetary assessment to report back to its funders the net impact delivered by their investments from the reduction of agrochemical use polluting soil and coastal water ecosystems. *(Estimate total value and/or net impact)*
Business benefit	Effective communication with external stakeholders in monetary terms generated reputational benefits from own-brand differentiation.	Simultaneously assessing the water footprint of each raw material and related regulatory risk enabled improved decision making and potential long-term increase in competitiveness.	Sugar Estates Ltd.'s effective communication with its funders on the net benefit returned on their investment allowed the farm to receive a further round of funding and diversify its investor base.
Business decision	Bright & Wholesome decided to extend its external reporting and communication efforts into a comprehensive own-brand portfolio EP&L to enable comparison of financial performance with impact reduction achievements.	The environmental team engaged senior management with the results of the analysis providing the business case for risk reduction. This allowed the business to make more informed procurement decisions and improve the overall long-term sustainability of its raw material sourcing.	Following the success it had with its funders, Sugar Estates Ltd. used the results of the monetary assessment to differentiate itself to buyers and secure longer-term purchase agreements.
Potential future assessments	**Environmental Profit and Loss accounting** The company can extend its external reporting and communication efforts into a comprehensive own-brand portfolio EP&L to enable comparison of financial performance with impact reduction achievements.	**Other environmental impacts** The assessment could be expanded to include other environmental impacts Monetization of risk reduction from certification Maison Chocolat is considering gaining certification from environmental labelling organizations, a costly endeavor that it would like to justify by monetizing the potential benefits that this would deliver to its business.	**Other environmental impacts** With the help of this assessment, funding can be effectively sought to reduce and communicate the reduction of other environmental impacts. **Certification** Eventually the assessment can feed into a formal certification of the plantation.
Further embedding opportunities	Natural capital impact metrics could be incorporated into a structured framework for prioritizing product improvement and investments.	The new supplier screening approach could be implemented more widely across multiple locations. The associated results could then be publicly reported upon to improve company reputation, customer loyalty, and potential market share gain.	Natural capital impact metrics could be incorporated into a structured framework for prioritizing further areas for improvement and investment.

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Notes

Notes continued

About The Natural Capital Coalition

The Natural Capital Coalition brings together the different initiatives and organizations working in natural capital to find solutions and create opportunities through collaboration. Its membership is global and includes research, science, academia, business, advisory, membership, accountancy, reporting, standard setting, finance, investment, policy and governments, conservation bodies, and civil society. Its strength comes from this diversity, which is brought together through a common vision of a world where business conserves and enhances natural capital to create thriving societies and prosperous economies.

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