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## Scenario Analysis Techniques

Scenario analysis techniques are strategic planning tools that originated in military applications and future thinking, but which have also been applied in corporate settings (the most well-known being the Royal Dutch Shell scenario work). Scenarios are also central to how we anticipate global environmental change will evolve with the Intergovernmental Panel on Climate Change (IPCC) developing scenarios that examined how technological change and economic policies driven by climate change concerns would affect business operations (transition risks). These scenarios also model how the climate system itself is likely to evolve as climate change progressed (physical risks). Scenario analysis is also emerging as a technique for business to understand biodiversity and nature change. Given the nature of the Earth system, we anticipate that climate and nature scenarios may be developed together (with some companies starting to product integrated nature-climate reports).

The **purpose of scenario analysis** is to explore uncertainties and identify knowledge gaps as well as the potential consequences of decisions over a range of possible future paths (including both ‘better’ and ‘worse’ outcomes), as determined by the values of the group creating the scenarios. Key characteristics of scenarios are that they are not definitive predictions or forecasts: rather, they focus on describing possible futures that challenge existing assumptions and expand perspectives. **Environmental scenario analysis** differs from business focused scenario analysis in that it places environmental problems and issues at the heart of the analysis.

**Table 1: Types of scenario approaches**

Type of scenario	Definition
<b>Predictive scenarios</b>	Attempt to predict what is going to happen in the future.
<b>Explorative scenarios</b> (also known as <b>descriptive</b> or <b>exploratory</b> scenarios)	Start in the present (i.e. with an initial situation) and a set of assumptions on policies, measures and key drivers to explore plausible future developments.
<b>Normative scenarios</b> (also known as <b>anticipatory</b> or <b>target-seeking</b> scenarios)	Are constructed to lead to a future that is desired by the scenario builders.
<b>Quantitative scenarios</b>	Describe possible futures in numerical form such as graphs or tables of numbers, commonly produced using a model or models.
<b>Qualitative scenarios</b>	Describe possible futures in primarily non-numerical form, for example as outlines, phrases or complete text, or visually as diagrams or pictures.
<b>Reference scenarios</b> (also known as <b>baseline</b> , <b>benchmark</b> or <b>non-intervention</b> scenarios)	Describe the future state of society and the environment in the absence of additional, new, and focused environmental policies.
<b>Policy scenarios</b> (also known as <b>pollution control</b> , <b>mitigation</b> , or <b>intervention</b> scenarios)	Consider new policies or measures additional to those already adopted or agreed upon.

## Corporate Biodiversity Scenarios

Corporate biodiversity scenarios are an element in the Taskforce for Nature-related Financial Disclosures (TNFD) guidance where they are described as hypothetical but plausible narratives that organisations can use to assess their exposure to nature-related risks and opportunities. Several nature-related risks are noted in the guidance, split by physical and transition risk.

**Table 2: Categories of nature-related risks**

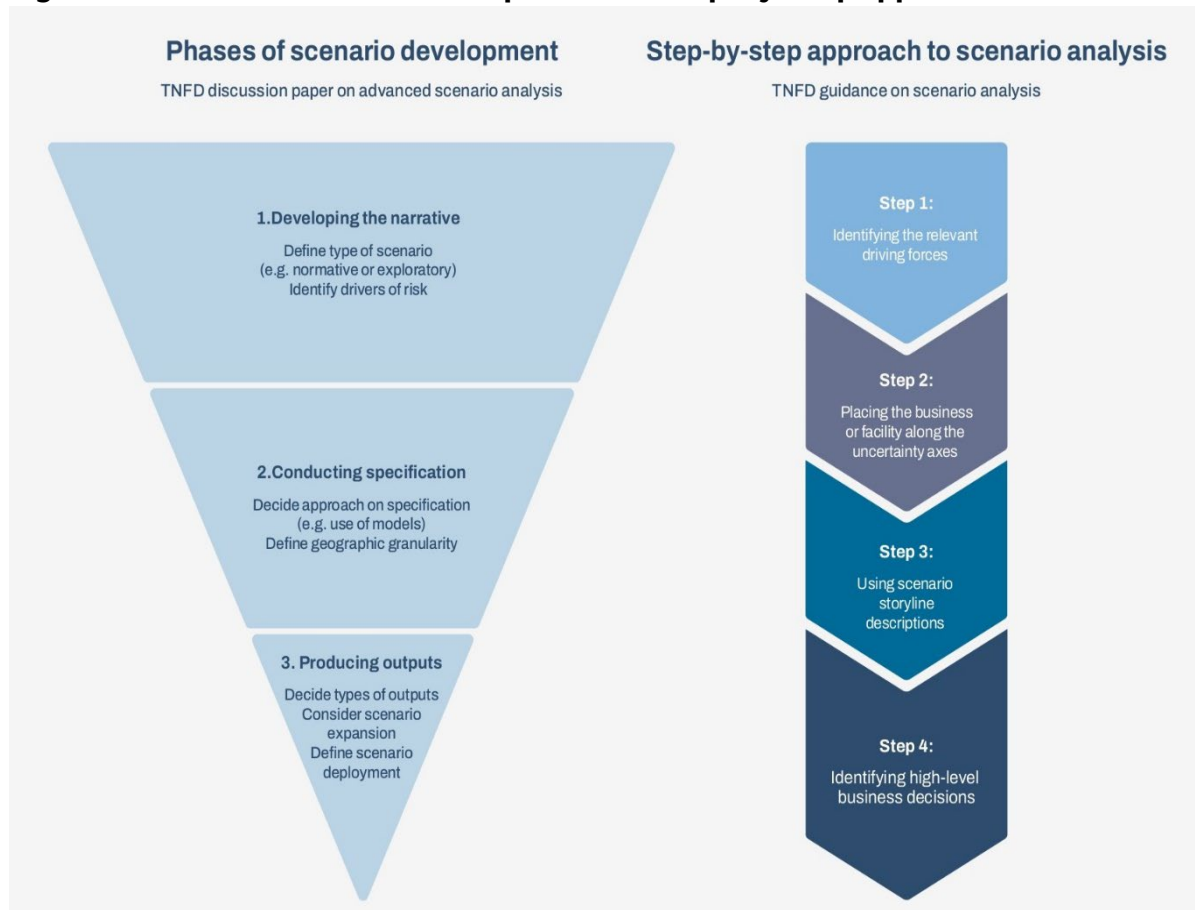
Risk type	Category	Description
Physical risk	Acute risks	Occurrence of short-term, specific events that change the state of nature. For example, oil spills, forest fires or pests affecting a harvest.
	Chronic risks	Chronic risks Gradual changes to the state of nature. For example, pollution stemming from pesticide use or climate change.
Transition risk	Policy	Changes in the policy context due to new (or enforcement of existing) policies associated with creating positive impacts on nature or mitigating negative impacts on nature.
	Market	Changing dynamics in overall markets, including changes in consumer preferences, which arise from other risk categories because of changing physical, regulatory, technological and reputational conditions and stakeholder dynamics. For example, the market value of a company is affected by assets that have decreased in value because there is insufficient freshwater for the production process, or the value of the business production process is reduced by the emergence of new technologies that require less water to operate.
	Technology	Substitution of products or services with a reduced impact on nature and/or reduced dependency on nature. For example, the replacement of plastics with biodegradable containers.
	Reputational	Changes in perception concerning an organisation’s actual or perceived nature impacts, including at the local, economic and societal level. This can result from direct company impacts, industry impacts and/or impacts of activities upstream and/or downstream in a value chain.
	Liability	Liability risks arising directly or indirectly from legal claims. As laws, regulations and case law related to an organisation’s preparedness for nature action evolves, the incident or probability of contingent liabilities arising from an organisation may increase.

Source: TNFD Discussion Paper on conducting advanced scenario analysis (TNFD, 2023).

The TNFD guidance identifies two different types of scenarios, namely **exploratory scenarios** and **normative scenarios** and they recommend the application of exploratory scenarios. Normative approaches for biodiversity are harder to realise in the absence of global targets. In addition, the place-based specificity of biodiversity also inhibits the development of globally relevant objectives. This also implies that an exploratory approach to developing nature scenarios would be most valuable in the first instance. Exploratory scenarios, guided by "what if?" questions, allow for the identification and aggregation of research and data to assess risks and opportunities related to nature loss in particular locations.

The phases of scenario development are summarised below, drawing from the TNFD paper on conducting advanced scenarios analysis (TNFD, 2023). In addition, an outline of the step-by-step approach to scenario analysis is drawn from the same document.

**Figure 1: Phases of scenario development and step-by-step approach to scenario analysis**



Source: TNFD Discussion paper on conducting advanced scenario analysis (TNFD, 2023b).

**Developing the narrative (phase 1):** Scenario narratives describe potential future developments encompassing social, political, macroeconomic, and environmental changes/trends. These narratives do not predict the future; instead, they present plausible events, outlined in storylines to facilitate communication about the explored core aspects.

**Conducting specification (phase 2):** The subsequent stage involves transforming biodiversity scenario narratives into outputs that are valuable for decision-making in corporations risk assessment by using related tools, models and methods.

**Producing outputs (phase 3):** This phase focused on ensuring scenarios are decision useful. There could be several different types of outputs. Qualitative outputs could be directional trends that follow from a scenario’s narrative. In contrast, quantitative outputs could be a range of different metrics, including physical units, such as ecosystem quality or crop yield, or economic and financial units, such as amount of production, consumer demand or price of a commodity.

The questions that need to be addressed in each phase (outlined above) are summarised below.

**Table 3: Scenarios questions across the TNFD phases**

Scenario component	Theme	Scenario characteristics
Narrative (phase 1)	Type of scenario	Does the scenario describe what could happen or what should happen?  <ul style="list-style-type: none"> <li>• Is the scenario normative or exploratory?</li> <li>• How is the scenario aligned with the Kunming-Montreal GBF?</li> </ul>
	Drivers of risk	What creates risk in the scenario?  <ul style="list-style-type: none"> <li>• Which drivers of risk does the scenario incorporate? Are there multiple sources of risk? Are they relevant to the organisation?</li> <li>• How does the scenario reflect changes in the state of nature? How are the IPBES drivers of nature change accounted for?</li> <li>• How does the scenario incorporate climate-related drivers of risk, if at all?</li> <li>• Are low-probability events incorporated in the narrative? Are tipping points, tail events or systemic risks accounted for?</li> </ul>
Specification (phase 2)	Approach to specification	Is the scenario going to produce qualitative and/or quantitative outputs?  <ul style="list-style-type: none"> <li>• Which tools are used to create the scenario? (e.g. models, assumptions)</li> </ul> <p>How does the scenario treat different risks?</p> <ul style="list-style-type: none"> <li>• How are physical risks incorporated? Do the scenario’s physical risks overlap with climate?</li> <li>• How are transition risks incorporated? Do the scenario’s transition risks overlap with climate?</li> <li>• How are low-probability events treated?</li> <li>• How does the scenario account for opportunities?</li> </ul> <p>Which assumptions are used to link narratives to outputs? How are these formulated?</p>
	Geographic granularity	Which locations is the scenario relevant for? What is the geographic granularity of the scenario? (e.g. global, country, local)
Outputs (phase 3)	Type of outputs	Are the scenario outputs qualitative or quantitative? Which kinds of variables are produced?
	Scenario expansion	Are the outputs at the right level of geographic granularity or do they need to be expanded?  Do the outputs capture all of the driving forces that the organisation cares about?
	Scenario deployment	What is the scenario’s time horizon? Are multiple years considered?

Source: TNFD Discussion paper on conducting advanced scenario analysis (TNFD, 2023).

TNFD’s guidance maps **transition risk** (the degree of alignment of market and non-market forces with biodiversity preservation responsiveness) and **physical risk** (degree of ecosystem service degradation) to create four biodiversity scenarios. Companies might also use existing scenario narratives developed within the climate change domain, such as the Shared Socio-economic Pathways (SSPs) approach, as a basis from which to develop their nature scenarios within a TNFD

approach. The SSP creates five potential scenarios (see below) and has been used by the [Kao Corporation](#) to inform their TNFD report.

**Table 4: The summary of five SSP narratives**

SSP1	<p><b>Sustainability – Taking the Green Road (<i>Low challenges to mitigation and adaptation</i>)</b></p> <p>The world shifts gradually, but pervasively, toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries. Management of the global commons slowly improves, educational and health investments accelerate the demographic transition, and the emphasis on economic growth shifts toward a broader emphasis on human well-being. Driven by an increasing commitment to achieving development goals, inequality is reduced both across and within countries. Consumption is oriented toward low material growth and lower resource and energy intensity.</p>
SSP2	<p><b>Middle of the Road (<i>Medium challenges to mitigation and adaptation</i>)</b></p> <p>The world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns. Development and income growth proceeds unevenly, with some countries making relatively good progress while others fall short of expectations. Global and national institutions work toward but make slow progress in achieving sustainable development goals. Environmental systems experience degradation, although there are some improvements and overall the intensity of resource and energy use declines. Global population growth is moderate and levels off in the second half of the century. Income inequality persists or improves only slowly and challenges to reducing vulnerability to societal and environmental changes remain.</p>
SSP3	<p><b>Regional Rivalry – A Rocky Road (<i>High challenges to mitigation and adaptation</i>)</b></p> <p>A resurgent nationalism, concerns about competitiveness and security, and regional conflicts push countries to increasingly focus on domestic or, at most, regional issues. Policies shift over time to become increasingly oriented toward national and regional security issues. Countries focus on achieving energy and food security goals within their own regions at the expense of broader-based development. Investments in education and technological development decline. Economic development is slow, consumption is material-intensive, and inequalities persist or worsen over time. Population growth is low in industrialized and high in developing countries. A low international priority for addressing environmental concerns leads to strong environmental degradation in some regions.</p>
SSP4	<p><b>Inequality – A Road Divided (<i>Low challenges to mitigation, high challenges to adaptation</i>)</b></p> <p>Highly unequal investments in human capital, combined with increasing disparities in economic opportunity and political power, lead to increasing inequalities and stratification both across and within countries. Over time, a gap widens between an internationally connected society that contributes to knowledge- and capital-intensive sectors of the global economy, and a fragmented collection of lower-income, poorly educated societies that work in a labour-intensive, low-tech economy. Social cohesion degrades and conflict and unrest become increasingly common. Technology development is high in the high-tech economy and sectors. The globally connected energy sector diversifies, with investments in both carbon-intensive fuels like coal and unconventional oil, but also low-carbon energy sources. Environmental policies focus on local issues around middle and high-income areas.</p>
SSP5	<p><b>Fossil-fuelled Development – Taking the Highway (<i>High challenges to mitigation, low challenges to adaptation</i>)</b></p> <p>This world places increasing faith in competitive markets, innovation and participatory societies to produce rapid technological progress and development of human capital as the path to sustainable development. Global markets are increasingly integrated. There are also strong investments in health, education, and institutions to enhance human and social capital. At the same time, the push for economic and social development is coupled with the exploitation of abundant fossil fuel resources and the adoption of resource and energy-intensive lifestyles around the world. All these factors lead to rapid growth of the global economy, while the global population peaks and declines in the 21st century. Local environmental problems like air pollution are successfully managed. There is faith in the ability to effectively manage social and ecological systems, including by geo-engineering if necessary.</p>

Source: Riahi et al. (2017).

## **Summary**

Scenario analysis is a longstanding technique that is used to provide a sense of a range of outcomes that might arise in the future. These potential outcomes are generated from combining (in a manner suitable to scenario developers' needs and context) pressures/drivers/trends that will impact future outcomes. Scenario analysis is not a singular activity. Rather, there are several forms of scenario analysis ranging from exploratory-narrative scenarios to more quantitative modelling of potential future operating environments. Scenarios have been developed with a variety of foci, including socio-economic conditions and climatic regimes. They have also been developed to inform thinking about nature conditions and biodiversity outcomes. To date there has been relatively few TNFD reports with scenario analysis: Kao Corporation is an early innovator in this area, using SSP scenarios as a basis to develop their biodiversity scenarios.

## References

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