



## Full Length Article

# The role of ecosystem services in the doughnut economy – The example of whale ecosystem services in Disko Bay, Greenland

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## ABSTRACT

The doughnut economy framework has been increasingly advocated by academics, governance institutions and policy-makers as a tool for delivering economies that provide a social foundation for all people, are safe and socially just, and respect planetary boundaries. Thus far, the role of ecosystem services (ES) in contributing to the doughnut economy's ambitions has been underexplored. This is surprising considering the wealth of ES literature addressing the theoretical components of 'a good life' and relationships between social-ecological systems (SES), resource use and human well-being. Two contributions to the literature are made by this study: (1) a generalised model is outlined linking natural capital to ES to the ecological ceilings and human needs of the doughnut economy's framework, and (2) an illustrative case study of whale ES in Disko Bay, Greenland is provided to demonstrate linkages between ES and the doughnut economy's framework. The findings are based on 19 interviews with representative stakeholders in August 2019 and observational data gathered by the researchers. Although the case study is a simplification of the complexity of SES, it nevertheless reveals several of the key contributions made by whale ES to a mixed economy, especially reduced pressures on the ecological ceilings linked to biodiversity loss and climate change, and a positive contribution to the human needs of food, health, income and work, and social equity. The case study stimulates a discussion that reflects on the limited recognition of the role of cultural ES in the doughnut economy's conceptualisation, evidence of social-ecological trade-offs and complexities. These include some increased pressures caused by whale ES on ecological ceilings and tensions between the human needs, and multi-level governance challenges in operationalising the doughnut economy.

## 1. Introduction

Over the last few years, the conceptual framework of the doughnut economy has received increasing attention from academics and policy-makers as a modern means of envisioning and applying the concept of sustainable development (Costanza, 2022; Turner and Wills, 2022). In contrast to approaches to economic development, such as the "foundational economy" (Bentham et al., 2013), which concentrate mostly on economic output linked to the supply and consumption of goods and services, Raworth's redraws the economy as a doughnut, and rather than fixating on growth in Gross Domestic Product (GDP), social and environmental underpinnings are prioritised (Raworth, 2017). Originating in Raworth's work at Oxfam, the unification of the concepts of planetary boundaries with a strong social foundation, and social and just spaces,

reinforces the imperative for economies to be designed in ways that are fair to all and sustain human well-being over time, while respecting planetary boundaries (Fioramonti et al., 2022; Raworth, 2013; Wahlund and Hansen, 2022). Drawing on the Sustainable Development Goals (SDGs), the doughnut economy's conceptualisation of social foundations identifies the fulfilment of fundamental human needs to be an objective of modern, sustainable economies (Turner and Wills, 2022).

The planetary boundaries concept in the outer ring of the doughnut economy's conceptual framework includes nine ecological ceilings. These constitute the boundaries of the ecosphere that must not be breached in order to ensure safe operating spaces for mankind (Biermann and Kim, 2020; Rockström et al., 2009). If breached, there is the risk of significant and irreversible environmental perturbations, leading to severe harm to human well-being (Rockström, 2015). Whilst the

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negative impacts of breaching planetary boundaries were being widely modelled and discussed, the ecosystem services (ES) field concurrently focused largely on the contribution of the quality and quantity of natural capital to sustaining human well-being through international endeavours such as the Millennium Ecosystem Assessment (MEA), The Economics of Ecosystems and Biodiversity, and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) (Jonas et al., 2014; Torres et al., 2021). The MEA depicted the contribution of supporting, provisioning, regulating and cultural ES to human well-being in terms of the fulfilment of security, basic materials for a good life, health, social relations, and freedom of choice and action (MEA, 2005). The more recent IPBES framework used the broader term of nature's benefits to people to depict how ES and nature's gifts contribute to humanity living in harmony and balance with nature (Díaz et al., 2015). Additionally, in recent times there has been a growing recognition of the importance of notions of justice in ES research (Chaudhary et al., 2018; Langemeyer and Connolly, 2020).

Within systems- and capital-based research initiatives, such as The Economics of Ecosystems and Biodiversity for Agriculture and Food Programme (TEEB, 2018), it is evident that there is considerable overlap between the focal points of ES research and the core components of the doughnut economy's framework of not breaching ecological ceilings, human need fulfilment, and delivery of safe and just spaces, and a regenerative and distributive economy. Given this, it is perhaps surprising that very little attention has been paid to specifying the critical role that ES may play in the doughnut economy, ensuring that planetary boundaries are not breached and sustaining social foundations at the local level, where the benefits of natural capital are supplied and demanded. This paper sets out to demonstrate the potentially significant role of ES in the fulfilment of the doughnut economy's ambitions. It does so firstly by outlining a theoretical framework which ties together the concepts of natural capital, the ES cascade framework, impacts to ecological ceilings and human needs, and governance/management responses targeting the sustainability of interrelationships. Secondly, based on interviews and fieldwork observations, an illustrative case study is provided concerning the contribution of whale ES in Disko Bay, Greenland to the doughnut economy's fulfilment, focused specifically on ecological ceilings and social foundations. The topic of whale ES has received burgeoning attention in recent years (Roman et al., 2014; Cook et al., 2020; Malinauskaitė et al., 2021a; 2021b). The Arctic has been a focal point of this research, not least due to the historical importance of whale ES to the sustaining of diets, culture and traditions, and new economic opportunities, including whale watching (Malinauskaitė et al., 2021; 2022). Disko Bay's small mixed economy and considerable dependency on marine resources (Malinauskaitė et al., 2021b) represents a useful lens for exploring the various interactions between natural capital, ES, human well-being, and the doughnut economy's core components.

This paper is structured as follows. Section 2 discusses in more detail the components of the doughnut economy's framework and presents an enlarged conceptual model inclusive of natural capital, ES, the doughnut economy, and related interactions. Section 3 briefly outlines details about the paper's illustrative case study example and the materials and methods that were used by the researchers. Section 4 presents a combined results and discussion, describing examples of whale ES and how they contribute to preventing the breaching of ecological ceilings and fulfilment of social foundations. Underlying social trade-offs and governance complexities are reflected upon. Section 5 concludes and considers avenues for future research.

## 2. Conceptual background

### 2.1. Doughnut economy framework

The doughnut economy consists of two concentric rings. The outer ring represents ecological ceilings tied to nine planetary boundaries of

climate change; ocean acidification; chemical pollution; nitrogen and phosphorous loading; freshwater withdrawals; land conversion; biodiversity loss; air pollution; and ozone layer depletion (Rockström, 2015). The inner ring constitutes the social foundation, where twelve fundamental human needs are met and form the foundation of thriving. These include water; food; health; education; income and work; peace and justice; political voice; social equity; gender equality; housing; networks; and energy. The human needs are derived from the agreed social priorities set out in the United Nations' Sustainable Development Goals (UN, 2015). A doughnut-shaped space that is ecologically safe and socially just sits between the two rings of the framework, wherein human needs are met without overstraining the ecological infrastructure of the planet (Dillman et al., 2021; Wahlund and Hansen, 2022). Thus, the doughnut economy framework is an envisioning of economy-in-society-in-nature (Raworth, 2017).

In a sense, the framework represents a visually amenable synthesis of many components in the environmental and economic development discourse over the last few decades (Luukkanen et al., 2021). The framework itself is agnostic when it comes to the subject of economic growth, preferring to shift the political mindset by prioritising the fulfilment of ecological and socio-economic objectives (OG and EEB, 2021). Therefore, rather than focusing on macroeconomic target-setting, doughnut economics implies the quantification of indicators with sustainable thresholds for ecological ceilings and basic human needs (Luukkanen et al., 2021; Saunders and Luukkanen, 2022). In addition, many, including Raworth herself, contend that the doughnut economy framework leans on Elinor Ostrom's work on the commons, in particular the notion that humanity has the capacity to self-organise and facilitate common ownership of resources rather than the failed neoliberal promises of relying entirely on markets to deliver prosperity (Ostrom, 1990; Raworth, 2017; Waddock, 2020).

### 2.2. Conceptual framework

Fig. 1 depicts a generalised theoretical framework linking the formations and flows of ES supply and demand, with benefits for the doughnut economy's human needs and ecological ceilings. Implicit in the model is the role of co-production in ES supply from natural capital in a social-ecological system (SES), with both natural and non-natural capital inputs necessary for the formation of most ES (Costanza et al., 2014; Palomo et al., 2016). The Common International Classification for Ecosystem Services (CICES) and the notion of the ES cascade from supply to demand by Haines-Young and Potschin (2018) is also integrated into the conceptualisation.

The supply side in the model constitutes the biosphere. This is inclusive of natural capital and the ecological infrastructure – biophysical structure, processes, and functions (Haines-Young and Potschin, 2018). Natural capital produces a flow of ecosystem services, which are typically co-produced and require inputs of non-natural capital and cognitive interpretations by human beings in the anthroposphere, the demand side (Malinauskaitė et al., 2021a). Ecosystem services cause pressures to either be reduced on the ecological ceilings, generating benefits to human well-being and helping to fulfil human needs in the doughnut economy framework, or increased via various SES dynamics and trade-offs, leading to disbenefits and undermining the fulfilment of those human needs. Regardless of the direction of impact, feedback is generated from the ecosystem services back to natural capital, influencing its quality and quantity, and in turn, the supply of future ecosystem services. The model also shows the importance of establishing performance indicators (monetary, biophysical, or socio-cultural), inclusive of sustainable thresholds, for the respective ecological ceilings and human needs, which can then be used to inform management interventions and policy-making by governance institutions and agents. This information generates a feedback loop in the framework from the demand back to the supply side.

Table 1 uses version 5.1 of the CICES technical guidance (Haines-

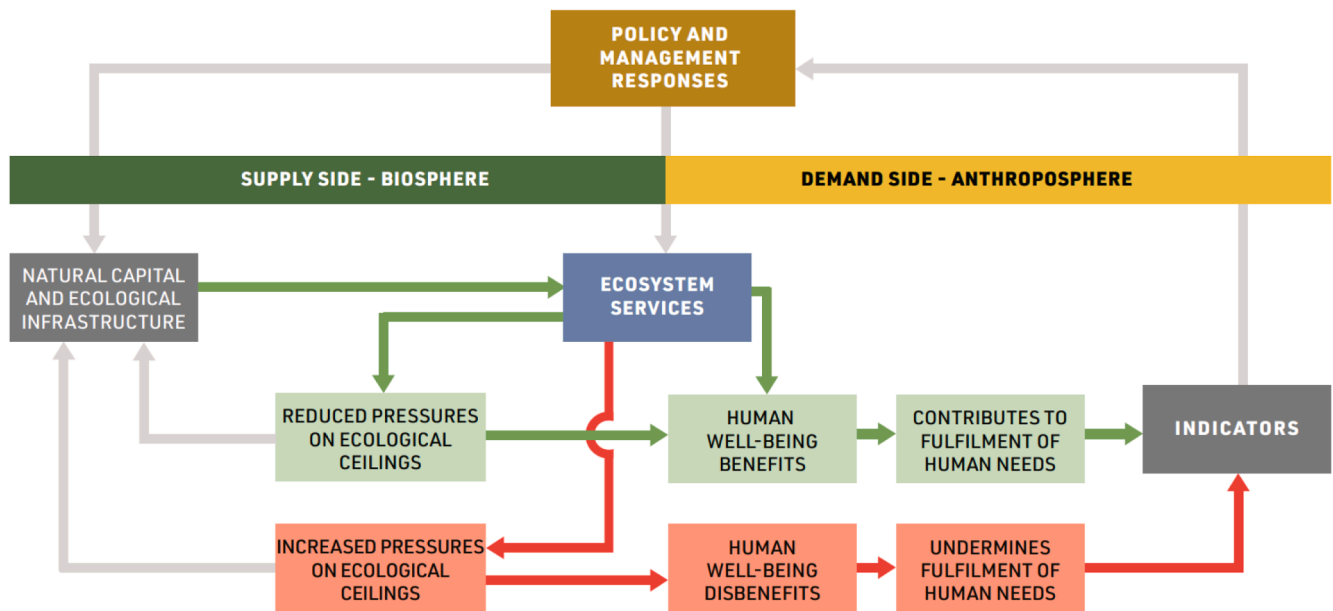


Fig. 1. Conceptual framework linking ES supply and demand with the foundations of the doughnut economy. (Adapted with permission from Malinauskaite et al. (2021a)).

Young and Potschin, 2018) to construct a set of generalised examples whereby ES contribute to diminishing pressures on ecological ceilings and fulfilment of human needs. The ES examples are not specific to any particular SES or ecosystem context, they are illustrative and not exhaustive, and have been extracted from the list provided in the Appendix tables of Haines-Young and Potschin (2018). ES are grouped according to the categorisation of the CICES framework, and the table differentiates between likely direct and indirect effects on the doughnut economy's core components of ecological ceilings and human needs.

In terms of determining linkages between the ES and ecological ceilings and the human needs, Table 1 distinguishes between direct and indirect effects, both positive and negative in the case of the ecological ceilings. The indirect effects were determined to be secondary, consequential impacts – for example, the provision of cultivated crops provides a direct contribution to fulfilling the human need of food, and a secondary benefit in terms of sustaining good health. The example of cultivated crops also illustrates well some of the potentially negative impacts to ecological ceilings and human well-being associated with the supply of an ES. In satisfying the sustenance needs of peoples, there are frequently increased pressures to convert lands to agricultural use. This can undermine biodiversity and given that crop production is typically a fossil fuel intensive activity, leads to secondary negative pressures being placed on the ecological ceilings linked to climate change and air pollution.

### 3. Materials and methods

#### 3.1. Case study description

Disko Bay is the largest open bay in western Greenland, measuring 150 km from south to north and 100 km west to east. For many centuries, indigenous peoples and European settlers have shown interest in Disko Bay due to its abundant marine resources, including seals, walrus, whales and fish (Poulsen, 2018). Despite its size, Disko Bay has only eight settlements and remains very sparsely populated. Today, the main population centre is Ilulissat, formerly known as Jakobshavn. Ilulissat is the third largest city in Greenland and had a population of 4,670 in 2020 (Statistics Greenland, 2020). The city is the most popular tourism destination in Greenland, predominantly due to its pristine

marine and coastal environment, which includes the nearby Ilulissat Icefjord, a UNESCO World Heritage Site (Smed, 2014). Whale watching is a popular tourism activity in Disko Bay, with common sightings of bowhead, humpback, minke, beluga and narwhal (Malinauskaite et al., 2021a). In Ilulissat and other small towns in Disko Bay, such as Aasiaat (population of 3,069) and Qeqertarsuaq, Disko Island (population of 839), licensed Greenlandic hunters engage in indigenous whaling, which has been important for food security and cultural identity (Goldhar and Ford, 2010; Malinauskaite et al., 2021a; Statistics Greenland, 2020).

#### 3.2 Research methods

Several research methods were applied. An initial literature review informed stakeholder mapping. Stakeholders were grouped into those with an economic, non-economic, regulatory, and non-regulatory interest in whales in Disko Bay (Malinauskaite et al., 2021a; Malinauskaite, 2022). A total of 19 semi-structured interviews were conducted across a two-week period in August 2019 in accordance with the best practice guidelines for qualitative research set out by Hennink et al. (2020). These were conducted in Ilulissat, Qeqertarsuaq and Aasiaat, and included stakeholders involved in the tourism industry, indigenous hunters, museum managers, and former and current governance officials from the municipalities of Avannaata and Qeqertalik (Malinauskaite et al., 2021a; Malinauskaite, 2022). Thus, they represented a broad array of the private and public sector institutions, NGOs, and communities in Disko Bay that had been identified in the stakeholder map (Malinauskaite et al., 2021a; Malinauskaite, 2022)). Participant and non-participant observation was also undertaken by the researchers parallel to the interviews, including activities such as going on whale watching trips with local tourism operators in Ilulissat, museum visits in Ilulissat, Qeqertarsuaq and Aasiaat, and a hunting boat trip in Aasiaat (Malinauskaite et al., 2021a; Malinauskaite, 2022). The observational parts of the research were akin to the ethnographic methods used previously in ES research (Maestre-Andrés et al., 2016; Kaltenborn et al. 2017).

The main aim of the interviews was to gain greater understanding of the different ways in which people benefit from whales in Disko Bay, the various values inhabitants attach to such benefits, and the relative

**Table 1**  
Generalised examples of ES contributions to the doughnut economy’s ecological ceilings and human needs.

ES Category	ES	Reduced pressures on ecological ceilings		Increased pressures on ecological ceilings			Related human needs		
		Direct	Indirect	Direct	Indirect	Direct	Indirect		
<b>Provisioning (biotic)</b>	Cultivated crops			Biodiversity loss Land conversion	Climate change Air pollution	Food Income and work	Health Social equity Networks		
<b>Provisioning (abiotic)</b>	Surface water for drinking			Biodiversity loss Land conversion		Water Income and work	Health Social equity		
	Surface water for energy	Climate change Air pollution	Ocean acidification	Biodiversity loss Land conversion		Energy Income and work	Health Social equity		
<b>Regulating and maintenance (biotic)</b>	Bio-remediation by micro-organisms, algae, plants, and animals	Chemical pollution	Land conversion Biodiversity loss Ozone layer depletion				Health Food Water		
	Filtration/sequestration/storage/accumulation by micro-organisms and algae	Climate change Chemical pollution Air pollution	Ozone layer depletion Ocean acidification				Health Food Water		
	Storm protection		Biodiversity loss				Housing Social equity		
	Pollination and seed dispersal Micro and regional climate regulation	Biodiversity loss Climate change	Ocean acidification			Food	Health Food Energy Health Social equity		
	Nutrient cycling	Biodiversity loss Nitrogen and phosphorus loading		Biodiversity loss Chemical pollution		Food	Health Social equity		
<b>Cultural (biotic)</b>	Scientific	Biodiversity loss Climate change Ocean acidification Chemical pollution Nitrogen and phosphorous loading Freshwater withdrawals Biodiversity loss Air pollution Ozone layer depletion				Education Income and work	Networks Gender equality Social equity Political voice		
		Educational	Biodiversity loss Climate change Ocean acidification Chemical pollution Nitrogen and phosphorous loading Freshwater withdrawals Land conversion Biodiversity loss Air pollution Ozone layer depletion				Education Income and work	Networks Gender equality Social equity Political voice	
			Aesthetic		Biodiversity loss				Peace and justice
			Symbolic		Biodiversity loss				Peace and justice
			Sacred and/or religious		Biodiversity loss				Peace and justice
	Existence			Biodiversity loss				Peace and justice	
	Bequest		Biodiversity loss				Peace and justice		

importance of the respective whale ES, especially given the ongoing physical changes in Disko Bay that are driven by climate change and increased globalisation (Malinauskaite et al., 2022). An interview guide was developed prior to the Greenlandic fieldwork, with specific sections focused on ES, values, and management practices and needs. The interviews lasted between 30 and 75 min (Malinauskaite et al., 2021a; Malinauskaite, 2022). They were mostly conducted in the offices of the interviewees, but other locations were also used, such as the homes of three indigenous hunters and a quiet space in a local guesthouse (Malinauskaite et al., 2021a; Malinauskaite, 2022). The researchers adhered to standard ethical practices in qualitative research set out by Esterberg (2002) and Yin (2017), ensuring the anonymity of the participants and incorporating opportunities for them to opt out of answering questions (Malinauskaite et al., 2021a; Malinauskaite, 2022). A Greenlandic-English translator was hired for the interviews held with three indigenous hunters in Qeqertarsuaq (Malinauskaite et al., 2021a; Malinauskaite, 2022).

Each interview was recorded, transcribed, and coded deductively (Malinauskaite et al., 2021a; Malinauskaite, 2022). In deductive coding, the codes are predetermined to facilitate the key ideas of a theory on which it is based (Elo and Kyngäs; Yin, 2017). Since the aim of this study was to explore the relevance of whale ES in the context of the doughnut economy framework, the deductive coding approach was ideal. MAXQDA software was used for coding and analysis of the interview data (Malinauskaite et al., 2021a; Malinauskaite, 2022). In terms of determining linkages between the whale ES and planetary boundaries/ecological ceilings and the human needs, the researchers distinguished between direct and indirect effects as per the approach exemplified in Table 1.

#### 4. Results and discussion

The results briefly describe the main ES applicable to the Disko Bay case study. In sections 4.2 to 4.4, relevant interview extracts are added as exemplifications of the discussed content regarding relevance to the doughnut economy framework, social-ecological trade-offs and complexities, and governance issues.

##### 4.1. Whale ES in Disko Bay

Based on the content of the interviews and researcher observations, a total of thirteen whale ES were identified. These are described as follows, in what constitutes a summary of the content reported in Malinauskaite et al. (2021a) and Malinauskaite (2022).

**Provisioning services** included harvested whale meat and *mattak*, which consists of whale blubber and skin, remains central to the way of life in Disko Bay. Traditional foods continue to form a significant component of the local diet, with internationally established quotas limiting the numbers caught. Whale products, such as bones, teeth and baleen, form part of whale artefacts and pieces of art.

**Regulating and maintenance services** included the contribution of whales to nutrient cycling through releases of iron via whale faeces and nitrogen from urine and faecal plumes. This leads to enhanced primary production and phytoplankton blooms, which, in turn, tends to lead to more biodiverse and species-rich marine environments (Cook et al., 2020; Roman et al., 2014). Whales also provide a form of carbon sequestration and therefore climate regulation. Species accumulate large quantities of carbon in their bodies which, after death, fall and lock organic carbon content into the seafloor (Cook et al., 2020; Roman et al., 2014).

Whales provide several **cultural** benefits to Disko Bay. Whale watching is a popular tourist activity, often carried out by tour operators as a part of boat trips from Ilulissat to the Ice Fjord. In Qeqertarsuaq and Aasiaat, the researchers also witnessed whale watching trips conducted in small boats used by licensed hunters. Some cultural benefits occurred in a bundle with the whale watching experience, including appreciation

of the aesthetics of whales and education by trained guides. Education about whales also accrued via exhibits in the museums of Ilulissat, Qeqertarsuaq and Aasiaat and also in other pieces of art and sculpture dotted around these settlements. Music – whale songs – and art with a whale theme was also available for purchase in various gift shops. There was also a sense of reverence for the whale and recognition of its place in the identity of people within these communities, not least due to the centuries-old tradition of hunting.

As such, the whale constitutes a sacred animal for many people in Disko Bay and a source of spiritual enrichment. The importance of the whale as a source of sustenance and income via whale watching was reflected in recognition of the existence and bequest values of whales to people in Disko Bay, even more so given the context of climate change that was reducing the capacity to conduct some cultural practices, such as dog sledding in winter.

##### 4.2. Relevance of whale ES to the doughnut economy's framework

Table 2 sets out the identified links, both positive and negative, between whale ES with the planetary boundaries and human needs of the social foundation. The whale ES are categorised in accordance with the categories of the Common International Classification for Ecosystem Services of Haines-Young and Potschin (2018).

The most commonly occurring direct links between whale ES and the doughnut economy related to the provision of food via whale meat and whale products, an important source of sustenance in remote Disko Bay, yet their harvesting directly contributed to biodiversity loss. Indirect benefits of food consumption contributed to the health and vitality of locals, and most of the time the resources appeared to be distributed equitably among locals. The dominance of cultural whale ES in the set of thirteen led to very few direct links being forged with the human needs, outside of those relating to the market-based touristic activity of whale watching. The intangible qualities of whales – their aesthetics, sacred, bequest and existence values – were a significant component of local community identity and therefore cohesiveness, indirectly contributing to some extent to peaceful coexistence in Disko Bay. Two regulating and maintenance whale ES reduced pressures on ecological ceilings linked to biodiversity loss and climate change, however, the abundance of whales in Disko Bay was also reported to undermine biodiversity via their consumption of fish. The activities of whale watching and whaling were also fossil fuel dependent, offsetting to some extent the reduced pressures on climate change supplied via the carbon sequestration capacities of whales.

##### 4.3. Underlying social-ecological trade-offs and complexities

The case study revealed complex dynamics in the SES. At the same time as whale ES were contributing to enhanced primary production and thus boosting biodiversity, countervailing effects were evident. Occasionally, indigenous hunters would shoot at whales from the coastline, trying to scare them away from consuming the polar cod, which is important bait for the lucrative Greenland halibut.

*“There are so many whales now, they’re getting too close for the fishermen. They try to frighten them by shooting with rifles. (.) Not to hit them, of course, but they’re trying to frighten with the sound of those big rifles.”*  
(AJ)

The act of whaling increased pressure on the ecological ceiling linked to biodiversity, necessitating quotas. In addition, fuel consumption by whaling and whale watching vessels leads to emissions of greenhouse gas emissions and other pollutants, potentially undermining the sustainability of marine resources, locally and further afield, and atmospheric purity. The close presence of whale watching vessels oftentimes cause disturbances to whales, and in the opinion of interviewees, this would alter their behaviour.



**Table 2**  
Impacts of whale ES on core components of the doughnut economy’s framework.

Whale ES Category	Whale ES	Reduced pressures on ecological ceilings		Increased pressures on ecological ceilings		Positive contributions to social foundations		Negative contributions to social foundations	
		Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
Provisioning (biotic)	Food products		Climate change	Biodiversity loss	Climate change Ocean acidification Air pollution	Food Income and work	Health Social equity Networks	Food Income and work	Health Social equity Networks Political voice Gender equality
	Bones, teeth and baleen			Biodiversity loss	Climate change Ocean acidification Air pollution	Income and work	Networks	Income and work	Social equity Networks Political voice Gender equality
	Blubber products			Biodiversity loss	Climate change Ocean acidification Air pollution	Food Income and work	Health Social equity Networks	Food Income and work	Health Social equity Networks Political voice Gender equality
Regulation and maintenance (biotic)	Enhanced biodiversity / evolutionary potential	Biodiversity loss	Nitrogen and phosphorous loading	Biodiversity loss					
	Climate regulation	Climate change	Ocean acidification Biodiversity loss				Food Health Social equity Networks		
Cultural (biotic)	Tourism (whale watching)		Biodiversity loss	Biodiversity loss	Climate change Ocean acidification Air pollution	Education Income and work	Networks		Gender equality Social equity
	Music and arts		Biodiversity loss			Income and work	Peace and justice Networks		
	Education	Biodiversity loss				Education Income and work	Social equity Gender equality Political voice		
	Sacred and/or religious		Biodiversity loss				Peace and justice Networks Social equity		
	Aesthetic		Biodiversity loss				Peace and justice		
	Community cohesiveness and cultural identity		Biodiversity loss				Peace and justice Networks Social equity		
	Existence		Biodiversity loss				Peace and justice Social equity		
	Bequest		Biodiversity loss				Peace and justice Social equity		

“I’ve seen some of the operators here sailing with tourists, observing a sleeping whale and they’d be very, very close to that whale. And finally, being maybe 20–40 m away from it, it’ll wake up and then dive down. And this is bad behavior, very bad behavior. [...] There should be a better

conduct, maybe you should stop at a bigger distance from the whale.” (CH)

Gaining understanding concerning the nuanced interrelationships between the doughnut economy’s environmental and social domains is a challenge for forging its safe and just space (Krauss, 2018; Lade et al.,

2020). The interviews and observational data gathered by the researchers revealed possible trade-offs in the doughnut economy's human needs. Whilst the role of whale ES in providing food, and thereby sustaining health and resilience, was recognised by all interviewees, negative connotations were observed for other human needs tied to the social foundation. These largely related to how whaling was managed and conducted. Indigenous whalers believe they had insufficient political voice, with their needs, values and observational knowledge about whale populations largely unrepresented by national and international decision-making bodies responsible for setting quotas and collating scientific knowledge, for example, the International Whaling Commission (IWC).

*"We [local hunters] feel that our suggestions on the [hunting] rules are not listened to, the new rules just come and nobody listens to our opinion. We have some opinions and knowledge, and we don't feel that we are listened to."* (PM)

The number of licensed hunters had more than halved over the last decade. There was growing concern at how reduced whaling quotas in recent years were diminishing the local food supply and reducing the capacity of hunters to sustain livelihoods, which demonstrates the dynamics and tensions between the need to reduce pressure on the ecological ceiling linked to biodiversity and the human needs for sustenance, income, and work. There is a feeling among the locals of historical injustice in foreign parties depleting the whale stocks, which resulted in strict whaling quotas for Greenlanders:

*"Overhunting in the 1600 s – 1700 s from Europe, they came here with many hundreds of ships, and they overhunt them. The Greenlandic culture in hunting, they do not overhunt, they can feel when something changes."* (PM)

Diminished whale harvests had also increased the reliance of Greenlanders on imported, non-traditional foods, which some interviewees claimed made them feel less Greenlandic and led to much increased greenhouse gas emissions and air pollutants via transportation. SES dynamics such as climate change were discussed as likely further negative future impacts on the availability of traditional foods in the future, not limited to whales.

In terms of community resilience and voice, elders talked of a diminishment in adherence to the so-called 'unwritten rules' by the younger generation of whalers. These concerned when and where to hunt, and how to collectively arrive at this decision following a review of the tides and sea conditions. Consequently, due to a less structured approach to decision-making, there was a fragmentation in trust and cohesiveness among the hunting fraternity.

*"Before all this, structures and rules were in use, [older hunters] made sure how to do it, what we going to do tomorrow morning, when we are going to go out, who will be the first. Today, it is like a competition, there are many conflicts and they [younger hunters] just shoot above their [older hunters'] heads."* (LG)

Technological advancements had led to more efficient whaling practices, but also seemingly to some declining traditions, such as meat and mattak sharing. Despite this, the interviewees asserted that teamwork skills remained essential to hunting practices – boat coordination and collective driving of the whales – but there were sometimes disputes among the hunting community about how to share the harvested resources in a socially equitable manner at the flensing sites.

Social challenges were also evident in tourism. There was local resentment at the seasonality of employment, the limited corporation taxes that were paid by foreign-owned tourism companies, and the lack of integration of foreign tourism works into local communities in Disko Bay, especially in Ilulissat. Equally, there was recognition by some interviewees that Greenlandic workers were often either poorly skilled for or lacked interest in working in the tourism sector, which had working hours that were not family friendly, and thus the challenges of matching

labour supply and demand could only be satisfied via temporary inward migration. Foreign workers in tourism were typically young, adventurous, and seasonal, speaking several languages and not having family commitments.

*"Because for the big companies here it is better for them to employ young foreigners. [...] Because if you are a young Danish girl coming here, you do not have your family [with you], you come here to work 24 h a day. And the young Greenlandic people have families here and they don't work 24 h per day."* (OM)

The limited attractiveness of the tourism sector, the male-dominated arena of hunting, and relative lack of alternative sources of employment was contributing to many women seeking to leave the Disko Bay area to acquire further education. Men, on the other hand, were less likely to seek further education – or be able to seek – and find a new identity other than that of a hunter. Such trends were felt to be contributing to the gradual loss of traditional customs, afflicting community identity and resilience, and cultivating an increasing sense of marginalisation. Some interviewees also called for the development of a regional tourism strategy for the Disko Bay area that was more inclusive of local viewpoints concerning physical and human capital needs.

#### 4.4. Governance implications of the case study

Another issue evident in the implementation of the doughnut economy concerns the necessity of downscaled governance to deliver sustainable development (Turner and Wills, 2022). This case study illustrated how the benefits attached to whale ES are supplied and received across multiple spatial scales. Regulating and maintaining whale ES, which reduce pressures on ecological ceilings, may provide global benefits, whilst provisioning and cultural whale ES are predominantly experienced in a local community setting. The case study therefore highlighted important spatial jurisdictional issues concerning governance for the delivery of sustainable outcomes via adoption of the doughnut economy's framework. Multilevel governance and recognition of connectivity across scales is likely to be essential (Sterner et al., 2019; Turner and Wills, 2022). On the one hand, political action is likely to be necessary at the national and regional level for sustaining the provisioning, carbon sequestration and biodiversity benefits of whales, such as using whaling quotas, recognising the greenhouse gas emissions offsets of whales in agreements such as the Paris Agreement, and the establishment of Marine Protected Areas using ecosystem-based management principles. On the other hand, local action and bottom-up processes are likely to be needed to instil a 'mobilising narrative' (Galaz et al., 2016; Turner and Wills, 2022) to ensure that the cultural and provisioning benefits of whales are recognised and preserved intact by current and future generations.

The recent research of Malinauskaite et al. (2022) integrated ES and interactive governance theories to evaluate whale ES governance potentials and deficiencies with regards to sustainable management in Disko Bay. An interactive governance framework identifies the web of multi-layered interactions between co-evolving components of SES, which include formal and informal institutions, ecosystems, and human actors. Recognition of the governance of whale ES and related SES as a complex, co-evolving, multi-actor, multi-scale process facilitates a systematic assessment of governability, which can guide marine resource management towards sustainability (Chuenpagdee, 2011; Chuenpagdee and Jentoft, 2013). A major conclusion of the research by Malinauskaite et al. (2022) was that whale ES in Disko Bay are governed by multiple actors with different ES preferences and values, and that much of its governance occurs outside of formal institutions. Informal interest groups were commonplace, including hunters, fishermen, researchers, whale watching guides, as well as regional tourism representatives and economic development offices, agencies and environmental organisations, municipalities, national ministries, and international organisations focused on whale management and quota determination, such as

the IWC. Although national and international governance was in place for provisioning whale ES, a lack of stakeholder consultation was still evident in terms of the integration of traditional indigenous knowledge when setting whaling quotas. In addition, interviews with local hunters discussed the underreporting of catch, indicative of disconnection from the regulations which they believe does not reflect their reality.

*“Sometimes, you shoot a whale, it gets hurt but doesn’t get killed, it escapes and probably dies from wounds. This does not get reported. You only report whatever you bring to land. (.) And I’ve heard estimations saying that you actually only bring 30% into land.” (CH)*

There was thus a mismatch between the national and international setting of rules and the local playing out of the whaling activity that sources food and sustains health. Additionally, at the local level, commonly applied approaches elsewhere, such as national whale watching codes of conduct (Blankenstein, 2021), were not adopted, an activity which was self-managed by the respective operators in Disko Bay (Malinauskaite et al., 2022).

The scale and actor complexities of whale ES governance revealed by Malinauskaite et al. (2022) intimated parallel intricacies in the practical implementation of the doughnut economy. Key challenges are likely to relate to the determination of downscaled boundaries, including methodologies for this endeavour, and sub-global biophysical thresholds (Dao et al., McClaughlin, 2018). These may vary greatly across socio-economic and socio-cultural contexts, including in terms of historical social justice issues. To date, the academic discourse concerning the governance of the doughnut economy has largely been drawn from the existing literature on earth system governance (ESG), which integrates the notion of global scale SES with theories of governance (Biermann, 2014; Turner and Wills, 2022). ESG has been implemented across multiple spatial scales, but its main focus has been on global governance rather than localisation (Biermann, 2021). The identification of appropriate thresholds for human needs (social floors) is likely to be most effective if these are determined following stakeholder engagement, including local governance institutions, civil society organisations and the public on a local level (Turner and Wills, 2022). Irrespective of its whale ES focus, the interactive governance approach of Malinauskaite et al. (2022) could be useful for the doughnut economy in identifying and integrating relevant stakeholders on different governance levels and reconciling social and ecological trade-offs. This is due to its multilevel, multi-actor lens that recognises the importance of participation and collaboration in relation to the sustainable governance of a co-evolving SES, as well as recognition that much of ES governance happens outside of formal institutions. This is likely to be essential for the doughnut economy to not only represent a powerful visual tool that can motivate political action, such as has already been evident at the national, regional and city scale (DEAL, 2020; Swaffield and Egan, 2020; Turner et al., 2020), but a practical tool for governance across multiple, connected spatial scales.

#### 4.5. Broader reflections on the utility of the doughnut economy framework

The tying of the human needs of the doughnut economy to social dimensions in the SDGs restricts the capacity of its conceptualisation to reflect aspects of thriving and prosperity. They represent fulfilment of fundamental needs, those located at the base of Maslow’s pyramidal hierarchy concerning physiology and safety (Maslow, 1970), and admittedly as intended, represent foundational floors on which the realisation of needs higher up the pyramid can be satisfied. These can include aspects of subjective well-being tied to psychology, the quality and diversity of the lived experience, and collective benefits associated with tradition and culture. For a mixed economy such as Greenland’s, which is reliant on its maritime natural resources for subsistence, whale ES are highly relevant to the doughnut economy in terms of the direct provision of food, health, and work, and, less directly, social networks.

Equally, modern industries such as whale watching in Disko Bay are market-based and make direct contributions to the human needs of income and work, and formation of networks.

It is harder to link the cultural whale ES to the fulfilment of human needs in the doughnut economy framework. Thus, in Disko Bay, aspects of aesthetics directly tied to the beauty, spirituality, existence, and bequest values of whales, plus contributions to community identity via whaling’s role in the traditional way of life, are overlooked. Frameworks such as the MEA (2005), TEEB (2010) and IPBES (Díaz et al., 2015) acknowledge the contribution of cultural ES to social cohesion and good social relations, as well as the well-being dimensions of health, security, and the basic materials for a good life. Kaltenborn et al. (2017) also discussed the role of cultural ES as part of the building blocks of a good life in the Lofoten Islands, Norway. In similarity with this study’s case of Disko Bay, the authors found that contributions of natural and social capital to human well-being were hard to separate, and moreover that well-being was associated with the maintenance of identity through the traditional harvesting of natural resources (including whales), nurturing of skills, social cohesion, and acting meaningfully in the local area.

A criticism of the doughnut economy framework that emerges from this research is thus that its conceptualisation fails to capture deeper intricacies of well-being inherent in the cultural experience, as was evidenced in Disko Bay via the community benefits from the intangible qualities of whales. This is potentially due to its emergence from poverty-themed research at Oxfam and the tying of the human needs to the social dimensions in the SDGs, which were mostly categories of the Millennium Development Goals (Cook et al., 2023). Despite this, there is empirical evidence that integration of the norms, values and beliefs underlying cultural benefits are essential for SDG compliance – they were found to be relevant to 79% of the SDG targets in the study by Zheng et al. (2021). Other challenges in operationalising the doughnut economy relate to the selection of appropriate scales of analysis. These could be spatially defined – national, regional or local – or economic sectors could be the focal point, such as in the sustainable corridors approach of Dillman et al. (2021). Determining suitable ecological and social thresholds is a complex yet important endeavour which necessitates considerable stakeholder engagement, and further practical challenges are likely to relate to the acquisition of timely data and capacity to disaggregate to accord with the spatial or sectoral focus of the study (Sayers and Trebeck, 2015). It is only when suitable thresholds are met in their entirety that a system can perhaps be said to be sustainable. In addition, regarding the missing cultural aspects in the doughnut economy’s social foundation, as were identified in this study, the doughnut economy framework could be expanded through integration of related indicator data collected in monitoring the well-being economy. Over the last few years, the well-being economy paradigm has been embraced by several progressive national governments via the WEGo partnership, including those of New Zealand, Scotland, Wales, Iceland and Finland (WEA, 2021). The well-being economy’s approach recognises the importance of quality-of-life outcomes and intertwining of economies with sustainability (Cook et al., 2023; McGregor and Pouw, 2016; Costanza et al., 2018), and in so doing, incorporates the contributions of natural capital to the quality of the human experience through the receipt of ecosystem services (Cook and Davíðsdóttir, 2021).

Looking more deeply at its foundations, the doughnut economy’s recognition of planetary boundaries and ecological ceilings accords with a constraints-based approach to economic management and thus reinforces arguments against the placing of political emphasis on macro-economic expansion (Raworth, 2017). However, context is key. Whilst highly developed nations may have largely fulfilled minimum social objectives tied to basic human needs, convergence (likely equating to economic degrowth) will be necessary to ensure that ecological thresholds are met (Raworth, 2017). The same approach cannot be followed in less developed nations, whereby economic expansion is necessary to ensure that minimum social needs are met, which may



entail the trade-off of deteriorating performance in terms of the ecological thresholds. Pursuit of economic growth has up until now come with several pitfalls that undermine the pursuit of sustainable development (Hickel et al., 2019; Hoekstra, 2019), including but not limited to the depletion of non-renewable resources, increased inequality, and an accelerating climate crisis (Costanza et al., 2018; De Neve and Sachs, 2020). Thus, through the notion of growth agnosticism (Raworth, 2017), the doughnut economy framework likely facilitates, at the global scale, a halfway house between a growth-based future and a post-growth one that simultaneously acknowledges limits to growth and prioritises human and ecological well-being (Coscieme et al., 2019; Coscieme et al., 2020; Fioramonti et al., 2022).

#### 4.6. Study limitations

Although the study followed best-practice guidelines in terms of stakeholder mapping, interview design and analysis, and therefore revealed general insights into the phenomena under study in Disko Bay, like any other qualitative appraisal, it could have been subject to researcher bias with respect to interviewee selection, coding, and analysis (Gerring, 2004; Yin, 2017). This was especially the case with regards to the need to appoint a Greenlandic-English translator for interviews with local hunters in Qeqertarsuaq, and the fact that other interviews conducted in English were not held in the participant's native tongue. Furthermore, the illustrative case study of Disko Bay very much represented a snapshot in time.

### 5. Conclusion

This study communicated a generalised, CICES-based model of potential linkages between the supply and demand of ecosystem services, and potential implications for the doughnut economy's ecological ceilings and array of human needs. Based on nineteen semi-structured interviews and observational data, an illustrative case study of thirteen whale ES in Disko Bay was provided to demonstrate examples of overlap in a real-world setting. The greatest overlap in terms of the human needs related to the provisioning of sustenance to satisfy the nutritional needs of Greenlandic communities. Whale ES both reduced pressures on biodiversity loss and climate change, countervailing effects were evident due to resource harvesting and fossil fuel consumption by whaling and whale watching vessels. Apart from the market-based activity of whale watching, it was difficult to link cultural whale ES to the satisfaction of human needs, as these are depicted in the doughnut economy's framework. This pitfall was equally evident in the preceding generalised model of potential linkages between ES and human needs. In addition to this case study revealing limitations in terms of the capacity of the doughnut economy to capture the richer dimensions of well-being flowing from cultural ES, considerable governance and data-related challenges remain in terms of its practical operationalisation. Its foundational approach reflects the fulfilment of largely physiological and safety-related needs, which are likely essential issues to be addressed in a developing world context, whereas, for developed nations, the issue of convergence to a sustainable and socially just state is of greater importance.

Future work should give more detailed consideration to how ecosystem service or other indicators could be utilised in accordance with this study's proposed framework. Consideration needs to be given to their potential usefulness for quantifying doughnut economy performance on local, regional, and national scales, and the likely necessity to disaggregate data to suit the spatial and temporal focus of any such analysis. In addition, since August 2019, when the interviews and observational data were gathered, the COVID-19 pandemic has had severe ramifications for the Greenlandic economy, including the near cessation of the tourism industry in 2020 and 2021 (Cook and Jóhannsdóttir, 2021). The effects of such shocks to SES, and their capacity to be resilient and rebound thereafter, have yet to be fully

evaluated. However, at the very least, the COVID-19 pandemic reinforces the imperative to consider not just spatial but also temporal dynamics in ES and doughnut economy analysis. The changes that were unleashed have further implications for the issues of trade-offs, complexity, and governance that this study discussed.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

Data will be made available on request.

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### References

- Biermann, F., 2014. Earth system governance: World politics in the Anthropocene. MIT Press.
- Biermann, F., 2021. The future of 'environmental' policy in the Anthropocene: time for a paradigm shift. *Environmental Politics* 30 (1–2), 61–80.
- Biermann, F., Kim, R.E., 2020. The boundaries of the planetary boundary framework: a critical appraisal of approaches to define a "safe operating space" for humanity. *Annu. Rev. Env. Resour.* 45 (1), 497–521.
- Blankenstein, R., 2021. *The Effectiveness and Potential Improvements of a Voluntary Code of Conduct for Whale-Watching in Iceland*. Master's thesis, University of Iceland. Retrieved from: <https://skemman.is/handle/1946/39961> (accessed 31st August 2022).
- Chaudhary, S., McGregor, A., Houston, D., Chettri, N., 2018. Environmental justice and ecosystem services: A disaggregated analysis of community access to forest benefits in Nepal. *Ecosyst. Serv.* 29, 99–115.
- Chuenpagdee, R., 2011. Interactive governance for marine conservation: an illustration. *Bull. Mar. Sci.* 87 (2), 197–211.
- Chuenpagdee, R., Jentoft, S., 2013. Assessing governability—What's next. In: *Governability of Fisheries and Aquaculture*. Springer, Dordrecht, pp. 335–349.
- Cook, D., Davíðsdóttir, B., 2021. An appraisal of interlinkages between macro-economic indicators of economic well-being and the sustainable development goals. *Ecol. Econ.* 184, 106996.
- Cook, D., Jóhannsdóttir, L., 2021. Impacts, systemic risk and national response measures concerning COVID-19—The Island case studies of Iceland and Greenland. *Sustainability* 13 (15), 8470.
- Cook, D., Malinauskaite, L., Davíðsdóttir, B., Ögmundardóttir, H., Roman, J., 2020. Reflections on the ecosystem services of whales and valuing their contribution to human well-being. *Ocean Coast. Manag.* 186, 105100.
- Cook, D., Kaji, T.B., Davíðsdóttir, B., 2023. An assessment of the scope and comprehensiveness of well-being economy indicator sets: The cases of Iceland, Scotland and New Zealand. *Ecol. Econ.* 205, 107728.
- Coscieme, L., Sutton, P., Mortensen, L.F., Kubiszewski, I., Costanza, R., Trebeck, K., Pulselli, F.M., Giannetti, B.F., Fioramonti, L., 2019. Overcoming the myths of mainstream economics to enable a new wellbeing economy. *Sustainability* 11 (16), 4374.
- Coscieme, L., Mortensen, L.F., Anderson, S., Ward, J., Donohue, I., Sutton, P.C., 2020. Going beyond gross domestic product as an indicator to bring coherence to the sustainable development goals. *J. Clean. Prod.* 248, 119232.
- Costanza, R., 2022. Creating a sustainable and desirable future. In: *Global Ecological Governance and Ecological Economy*. Springer, Singapore, pp. 1–18.
- Costanza, R., de Groot, R., Sutton, P., van der Ploeg, S., Anderson, S.J., Kubiszewski, I., Farber, S., Turner, R.K., 2014. Changes in the global value of ecosystem services. *Glob. Environ. Chang.* 26, 152–158.
- Costanza, R., Caniglia, B., Fioramonti, L., Kubiszewski, I., Lewis, H., Hunter Lovins, L., McGlade, J., Mortensen, L.F., Philippen, D., Pickett, K.E., Ragnarsdóttir, K.V., Roberts, D., Sutton, P., Trebeck, K., Wallis, S., Ward, J., Weatherhead, M., Wilkinson, R., 2018. Towards a sustainable wellbeing economy. *Solutions* J. 9.
- De Neve, J.E., Sachs, J.D., 2020. The SDGs and human well-being: a global analysis of synergies, trade-offs, and regional differences. *Sci. Rep.* 10 (1), 1–12.
- DEAL (Doughnut Economics Action Lab), 2020. The Amsterdam City Doughnut: A tool for transformative action. Retrieved from: <https://www.circle-economy.com/resources/the-amsterdam-city-doughnut-a-tool-for-transformative-action> (accessed 31st August 2022).

- Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., Larigauderie, A., Adhikari, J.R., Arico, S., Báldi, A., Bartuska, A., Baste, I.A., Bilgin, A., Brondizio, E., Chan, K.M.A., Figueroa, V.E., Duraipapp, A., Fischer, M., Hill, R., Koetz, T., Leadley, P., Lyver, P., Mace, G.M., Martin-Lopez, B., Okumura, M., Pacheco, D., Pascual, U., Pérez, E.S., Reyers, B., Roth, E., Saito, O., Scholes, R.J., Sharma, N., Tallis, H., Thaman, R., Watson, R., Yahara, T., Hamid, Z.A., Akosim, C., Al-Hafedh, Y., Allahverdiyev, R., Amankwah, E., Asah, S.T., Asfaw, Z., Bartus, G., Brooks, L.A., Caillaux, J., Dalle, G., Darnaedi, D., Driver, A., Erpul, G., Escobar-Eyzaguirre, P., Failler, P., Fouda, A.M.M., Fu, B., Gundimeda, H., Hashimoto, S., Homer, F., Lavorel, S., Lichtenstein, G., Mala, W.A., Mandivenyi, W., Matczak, P., Mbizvo, C., Mehrdadi, M., Metzger, J.P., Mikissa, J.B., Moller, H., Mooney, H.A., Mummy, P., Nagendra, H., Nesshover, C., Oteng-Yeboah, A.A., Pataki, G., Roué, M., Rubis, J., Schultz, M., Smith, P., Sumaila, R., Takeuchi, K., Thomas, S., Verma, M., Yeo-Chang, Y., Zlatanova, D., 2015. The IPBES Conceptual Framework—connecting nature and people. *Curr. Opin. Environ. Sustain.* 14, 1–16.
- Dillman, K.J., Czepkiewicz, M., Heinonen, J., Davíðsdóttir, B., 2021. A safe and just space for urban mobility: a framework for sector-based sustainable consumption corridor development. *Global Sustainability* 4.
- Esterberg, K.G., 2002. Qualitative methods in social research. McGraw-Hill Higher Education, New York, New York, USA.
- Fioramonti, L., Coscieme, L., Costanza, R., Kubiszewski, I., Trebeck, K., Wallis, S., Roberts, D., Mortensen, L.F., Pickett, K.E., Wilkinson, R., Ragnarsdóttir, K.V., McGlade, J., Lovins, H., De Vogli, R., 2022. Wellbeing economy: An effective paradigm to mainstream post-growth policies? *Ecol. Econ.* 192, 107261.
- Gerring, J., 2004. What is a case study and what is it good for? *Am. Polit. Sci. Rev.* 98 (2), 341–354.
- Goldhar, C., Ford, J.D., 2010. Climate change vulnerability and food security in Qeqertarsuaq, Greenland. In *Community adaptation and vulnerability in arctic regions*. In: Hovelsrud, G.K., Smit, B. (Eds.), Community Adaptation and Vulnerability in Arctic Regions. Springer Netherlands, Dordrecht, pp. 263–283.
- Haines-Young, R., Potschin, M., 2018. Common International Classification of Ecosystem Services (CICES) V5. 1 and guidance on the application of the revised structure. Retrieved from <https://cices.eu/> (accessed 5<sup>th</sup> September 2022).
- Haines-Young, R., Potschin, M., 2018a. Revision of the common international classification for ecosystem services (CICES V5. 1): a policy brief. *One Ecosystem* 3, e27108.
- Hennink, M., Hutter, I., Bailey, A., 2020. Qualitative research methods. Sage Publications Limited, London.
- Hickel, J., 2019. The contradiction of the sustainable development goals: Growth versus ecology on a finite planet. *Sustain. Dev.* 27 (5), 873–884.
- Hoekstra, R., 2019. Replacing GDP by 2030. Cambridge University Press, Cambridge, UK.
- Jonas, M., Ometto, J.P., Batistella, M., Franklin, O., Hall, M., Lapola, D.M., Moran, E.F., Tramberend, S., Queiroz, B.L., Schaffartzik, A., Shvidenko, A., Nilsson, S.B., Nobre, C.A., 2014. Sustaining ecosystem services: Overcoming the dilemma posed by local actions and planetary boundaries. *Earth's Future* 2 (8), 407–420.
- Kaltenborn, B.P., Linnell, J.D., Baggethun, E.G., Lindhjem, H., Thomassen, J., Chan, K.M., 2017. Ecosystem services and cultural values as building blocks for the 'good life'. A case study in the community of Røst, Lofoten Islands, Norway. *Ecol. Econ.* 140, 166–176.
- Krauss, J., 2018. Review of Doughnut Economics: 7 Ways to Think Like a 21st Century Economist by Kate Raworth. 2017. White River Junction, VT: Chelsea Green Publishing. *J. World-Syst. Res.* 24 (2), 452–457.
- Lade, S.J., Steffen, W., de Vries, W., Carpenter, S.R., Donges, J.F., Gerten, D., Hoff, H., Newbold, T., Richardson, K., Rockström, J., 2020. Human impacts on planetary boundaries amplified by Earth system interactions. *Nat. Sustainability* 3 (2), 119–128.
- Langemeyer, J., Connolly, J.J., 2020. Weaving notions of justice into urban ecosystem services research and practice. *Environ. Sci. Policy* 109, 1–14.
- Luukkanen, J., Vehmas, J., Kaivo-oja, J., 2021. Quantification of doughnut economy with the sustainability window method: Analysis of development in Thailand. *Sustainability* 13 (2), 847.
- Maestre-Andrés, S., Calvet-Mir, L., van den Bergh, J.C., 2016. Sociocultural valuation of ecosystem services to improve protected area management: a multi-method approach applied to Catalonia, Spain. *Regional Environ. Change* 16 (3), 717–731.
- Malinauskaitė, L., 2022. Ecosystem services of whales in the Arctic: co-production, valuation and governance. University of Iceland, Iceland. PhD Thesis.
- Malinauskaitė, L., Cook, D., Davíðsdóttir, B., Ögmundardóttir, H., 2021a. Whale ecosystem services and co-production processes underpinning human wellbeing in the Arctic: case studies from Greenland, Iceland and Norway. In: *Nordic Perspectives on the Responsible Development of the Arctic: Pathways to Action*. Springer, Cham, pp. 181–202.
- Malinauskaitė, L., Cook, D., Davíðsdóttir, B., Ögmundardóttir, H., 2021b. Socio-cultural valuation of whale ecosystem services in Skjalfandi Bay. Iceland. *Ecological Economics* 180, 106867.
- Malinauskaitė, L., Cook, D., Ariza, E., Davíðsdóttir, B., Ögmundardóttir, H., 2022. Interactive governance of whale ecosystem services: governability assessment of three case studies in the Arctic. *Ecol. Soc.* 27 (2).
- Maslow, A.H., 1970. Motivation and personality. Harper & Row, New York.
- McGregor, J.A., Pouw, N., 2016. Towards an economics of well-being. *Camb. J. Econ.* 41 (4), 1123–1142.
- MEA (Millennium Ecosystem Assessment), 2005. *Ecosystems and human well-being: wetlands and water*. World Resources Institute. Retrieved from: <https://www.millenniumassessment.org/en/index.html> (accessed 11th October 2022).
- OG and EEB (Oxfam Germany and European Environmental Bureau), 2021. Towards a wellbeing economy that serves people and nature. Retrieved from: <https://climateofchange.info/wellbeingeconomyreport.pdf> (accessed 2nd September 2022).
- Ostrom, E., 1990. Governing the commons: The evolution of institutions for collective action. Cambridge University Press.
- Palomo, I., Felipe-Lucia, M.R., Bennett, E.M., Martín-López, B., Pascual, U., 2016. Disentangling the pathways and effects of ecosystem service co-production. In: *Advances in ecological research*, Vol. 54. Academic Press, pp. 245–283.
- Poulsen, M.K., 2018. 9. Disko Bay. *Biodiversity and ecosystem services in Nordic coastal ecosystems: an IPBES-like assessment Volume 2 The geographical*, 229.
- Raworth, K., 2013. Defining a safe and just space for humanity. In: *State of the World 2013*. Island Press, Washington, DC, pp. 28–38.
- Raworth, K., 2017. Doughnut Economics: Seven Ways to Think like a 21st-Century Economist. Random House, London.
- Rockström, J., 2015. Bounding the planetary future: why we need a great transition. *Great Transition Initiative* 9, 1–13.
- Rockström, J., Steffen, W., Noone, K., Persson, A., Chapin III, F.S., Lambin, E.F., Foley, J.A., 2009. A safe operating space for humanity: identifying and quantifying planetary boundaries that must not be transgressed could help prevent human activities from causing unacceptable environmental change, argue Johan Rockstrom and colleagues. *Nature* 461 (7263), 472–476.
- Roman, J., Estes, J.A., Morissette, L., Smith, C., Costa, D., McCarthy, J., Nation, J.B., Nicol, S., Pershing, A., Smetacek, V., 2014. Whales as marine ecosystem engineers. *Front. Ecol. Environ.* 12 (7), 377–385.
- Saunders, A., Luukkanen, J., 2022. Sustainable development in Cuba assessed with sustainability window and doughnut economy approaches. *Int. J. Sust. Dev. World* 29 (2), 176–186.
- Sayers, M., Trebeck, K., 2015. The UK Doughnut – a framework for environmental sustainability and social justice. Oxfam Research Report. Retrieved from: <https://oxfamlibrary.openrepository.com/bitstream/handle/10546/344550/rr-uk-doughnut-environmental-sustainability-social-justice-190215-en.pdf;jsessionid=0A64190D021D578986C9327E82CF2D7F?sequence=7> (accessed 2<sup>nd</sup> September 2022).
- Smed, K.M., 2014. The culture of nature: destination visitability in Ilulissat, Greenland. *Northern Review* 38.
- Statistics Greenland, 2020. Population by Localities. Retrieved from: [https://bank.stat.gl/pwweb/en/Greenland/Greenland\\_BE\\_BE01\\_BE0120/BEXST4.PX/?rxid=27d6ab46-03f8-43bd-868c-24a2a5a0a8e0](https://bank.stat.gl/pwweb/en/Greenland/Greenland_BE_BE01_BE0120/BEXST4.PX/?rxid=27d6ab46-03f8-43bd-868c-24a2a5a0a8e0) (accessed 31<sup>st</sup> August 2022).
- Sterner, T., Barbier, E.B., Bateman, I., van den Bijgaart, I., Crépin, A.-S., Edenhofer, O., Fischer, C., Habla, W., Hassler, J., Johansson-Stenman, O., Lange, A., Polasky, S., Rockström, J., Smith, H.G., Steffen, W., Wagner, G., Wilen, J.E., Alpizar, F., Azar, C., Carless, D., Chávez, C., Coria, J., Engström, G., Jagers, S.C., Köhlin, G., Löfgren, Å., Pleijel, H., Robinson, A., 2019. Policy design for the Anthropocene. *Nat. Sustainability* 2 (1), 14–21.
- Swaffield, L., Egan, D., 2020. The Welsh Doughnut 2020: A framework for environmental sustainability and social justice. Available online: <https://policy-practice.oxfam.org/resources/the-welsh-doughnut-2020-a-framework-for-environmental-sustainability-and-social-620979/> (accessed 31<sup>st</sup> August 2022).
- TEEB (The Economics of Ecosystems and Biodiversity), 2018. The Economics of Ecosystems and Biodiversity for Agriculture and Food Programme. Available online: <https://teebweb.org/our-work/agrifood/> (accessed 10<sup>th</sup> August 2023).
- Torres, A.V., Tiwari, C., Atkinson, S.F., 2021. Progress in ecosystem services research: A guide for scholars and practitioners. *Ecosyst. Serv.* 49, 101267.
- Turner, R., Poznansky, F., Smirthwaite, N., Blundell, A., Benson, D., Gaston, K., Yan, X., 2020. Towards a sustainable Cornwall: state of the Doughnut.
- Turner, R.A., Wills, J., 2022. Downscaling doughnut economics for sustainability governance. *Curr. Opin. Environ. Sustain.* 56, 101180.
- UN (United Nations), 2015. Transforming Our World: The 2030 Agenda for Sustainable Development. UN Publishing: New York. Retrieved from: <https://sustainabledevelopment.un.org/post2015/transformingourworld> (accessed 29th August 2022).
- Waddock, S., 2020. Reframing and transforming economics around life. *Sustainability* 12 (18), 7553.
- Wahlund, M., Hansen, T., 2022. Exploring alternative economic pathways: a comparison of foundational economy and Doughnut economics. *Sustain.: Sci., Practice Policy* 18 (1), 171–186.
- WEA (Wellbeing Economy Alliance), 2021. Our vision for a movement to bring about economic system change: Bold, vital—And entirely possible. Wellbeing Economy Alliance. Available online: [https://wellbeingeconomy.org/wp-content/uploads/WEAll-brochure\\_2021Update\\_FINAL\\_Feb17.pdf](https://wellbeingeconomy.org/wp-content/uploads/WEAll-brochure_2021Update_FINAL_Feb17.pdf) (retrieved 29th August 2022).
- Yin, R.K., 2017. Case study research and applications: Design and methods. Sage Publications Limited, Los Angeles, California.
- Zheng, X., Wang, R., Hoekstra, A.Y., Krol, M.S., Zhang, Y., Guo, K., Sanwal, M., Sun, Z., Zhu, J., Zhang, J., Lounsbury, A., Pan, X., Guan, D., Hertwich, E.G., Wang, C., 2021. Consideration of culture is vital if we are to achieve the Sustainable Development Goals. *One Earth* 4 (2), 307–319.