frontiers | Frontiers in Environmental Science

ORIGINAL RESEARCH
published: 19 April 2022
doi: 10.3389/fenvs.2022.782229

A Novel Approach to Identify and Prioritize the Connections Between Nature and People's Well-Being in New Zealand

Anne-Gaëlle Elsa Ausseil[1,2]*, *Suzie Greenhalgh*[3], *Pam Booth*[1], *Sandra Lavorel*[4] and *Alison Collins*[2]

[1]Manaaki Whenua – Landcare Research, Wellington, New Zealand, [2]Ministry for the Environment, Wellington, New Zealand, [3]Manaaki Whenua – Landcare Research, Auckland, New Zealand, [4]CNRS, Laboratoire d'Ecologie Alpine, Université Savoie-Mont Blanc, CNRS, Université Grenoble Alpes, Grenoble, France

Human well-being depends on the Earth's natural system. While there is awareness of the impact of human activities on the environment, the reverse – nature's role in human well-being – is usually not as clear. For decision makers and people to recognize the role of nature in human well-being, we need scientific evidence and ways to monitor trends that will ensure environmental policies are well designed and on track for long-term sustainability. We present a participative process to relate nature to human well-being and identify the important contributions from nature to different aspects of well-being. Our process is irrespective of classification systems for nature's contributions and can use either ecosystem services or nature's contributions to people (ES/NCP) concepts. Two criteria, impact and substitutability, have been used to rank the importance of the ES/NCP for well-being. We applied our approach in New Zealand, where the government has pioneered a well-being framework to measure wealth beyond GDP. The framework defines current well-being based on twelve domains, with intergenerational well-being dependent on four capitals (social, built, human and natural capital). By using a participative process, we designed a process to identify the important ES/NCP and well-being relationships. Our results showed that regulating ES/NCP contributed to the six broader categories of well-being, with non-material ES/NCP contributing to health, social relations, material well-being, and environmental quality categories. Material ES/NCP, such as food, energy, and timber, contributed mainly to material well-being, with small contributions to social relations and environmental quality well-being categories. This process can raise awareness and help stakeholders recognize the value of nature-based solutions for human well-being. It provides a structured approach to underpin fit-for-purpose indicators for monitoring and reporting the relationship between nature and well-being, target policy initiatives and identify potential trade-offs, and prioritize investment decisions across multiple outcomes.

Keywords: nature's contributions to people, ecosystem services, quality of life, policy decision, nature-human well-being relationship

OPEN ACCESS

Edited by:
Robert Costanza, Australian National University, Australia

Reviewed by:
Cathleen Maria Waters, New South Wales Department of Primary Industries, Australia
Zebensui Morales-Reyes, Institute for Advanced Social Studies (IESA-CSIC), Spain

***Correspondence:**
Anne-Gaëlle Elsa Ausseil
anne-gaelle.ausseil@mfe.govt.nz

Specialty section:
This article was submitted to Conservation and Restoration Ecology, a section of the journal Frontiers in Environmental Science

Received: *24 September 2021*
Accepted: *25 March 2022*
Published: *19 April 2022*

Citation:
Ausseil A-GE, Greenhalgh S, Booth P, Lavorel S and Collins A (2022) A Novel Approach to Identify and Prioritize the Connections Between Nature and People's Well-Being in New Zealand. Front. Environ. Sci. 10:782229. doi: 10.3389/fenvs.2022.782229

INTRODUCTION

Current global environmental crises of climate and biodiversity highlight that the integration of nature's values for people's good quality of life is deficient (Harmsworth and Awatere, 2013; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [IPBES], 2019; Pörtner et al., 2021). Yet, there is solid evidence that ecosystems and their biodiversity contribute significantly to human well-being (IPBES, 2019), and the conservation or restoration of the state of nature stands at the core of the Sustainable Development Goals agenda (Geijzendorffer et al., 2017; Nilsson et al., 2018). The concept of ecosystem services (ES) has gained considerable traction since the Millennium Ecosystem Assessment. Recently, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem services (IPBES) has broadened the concept of ES by assessing Nature's Contributions to People (NCP) in recognition of diverse sources of knowledge and different worldviews from indigenous and local communities (Díaz et al., 2018). NCP are defined as "all the positive contributions, losses or detriments, that people obtain from nature" to capture both beneficial and harmful effects of nature on people's quality of life (Pascual et al., 2017) (*see* **Supplementary Table S1** in Suppl. Mat. for the classification and definitions), thus broadening the ES definition of only "benefits people obtain from ecosystems". ES or NCP can be linked to multiple dimensions of a good quality of life to assess how the state, trends, and future scenarios are expected to impact people (IPBES, 2018b). This framing can be operationalized to compare alternative pathways to sustainability (IPBES, 2018b; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) 2018a), and evaluate existing or planned interventions and policies (Maes et al., 2016; Akinsete et al., 2019). Scientists are also starting to develop decision-support tools for directly linking NCP maps to political indicators like the Sustainable Development Goals based on stakeholder-elicited relationships between NCP and well-being indicators (Johnson et al., 2019).

While the understanding and policy integration of ecosystems' contributions to people have progressed tremendously in the last two decades, quantifiable evidence and detailed understanding for resulting benefits and costs to people's quality of life remain incomplete (Mastrangelo et al., 2019). Leviston et al. (2018) argued that the need to better articulate relationships between ecosystem, ES, and human well-being was a key gap in the research agenda. Connecting the state of nature to well-being is a long-standing public policy problem that has both conceptual and methodological roots. Reviewing these conceptual underpinnings is beyond the focus of this paper, as there are already recent literature reviews highlighting current state of knowledge and gaps (e.g. Brauman et al., 2020; Mandle et al., 2020). Instead, we consider the latest advances relevant to better integrating ES or NCP into policy. Typically, scientific bottom-up frameworks seek to develop systematic relationships between indicators of ES/NCP and well-being criteria. For instance, a systematic review of research on mountain ecosystems worldwide showed that over the past two decades an increasing number of publications document linkages between biodiversity, ES/NCP, and good quality of life (Martín-López et al., 2019). Those publications have addressed the interlinkages between material and regulating NCP and basic material well-being, along with increasing evidence for security and health. Another review in Latin America, Asia, and Africa pointed out that, in general, relationships between ES/NCP and well-being are assumed by default rather than explicitly explored (Cruz-Garcia et al., 2017).

Economics, social sciences, and humanities provide a toolbox of methods that can be combined in participatory processes to quantify the multiple values of nature to well-being (Jacobs et al., 2018). Several studies have linked self-reported indicators of well-being with indicators of ES/NCP. In European mountains, stakeholders often relate aggregate well-being targets like economic livelihoods from agriculture, identity, and social relations to multiple, co-occurring material, non-material, and regulating NCP (Zoderer et al., 2019; Bruley et al., 2021; Bergeret and Lavorel, 2022). While subjective perceptions of well-being derived from nature can be clustered to broader categories (e.g., access to services, tranquility and social capital, health and nature, cultural landscapes, and place attachment), detailed relationships between biophysical attributes and specific aspects of well-being are multi-faceted and often context specific (Fagerholm et al., 2020). For example, Akinsete et al. (2019) used a multi-stage expert-based participatory process across four river basins for assessing how measures from the European Water Framework Directive benefited well-being based on their amelioration of ecosystem services. Other studies have used semi-structured interviews or surveys to assess the relative influence of ES/NCP on various aspects of well-being based on people's preferences and profiles (Ciftcioglu, 2017; Huang et al., 2020; Zhang et al., 2021). While these studies help understand the importance of the social context and diversity of values, they do not provide a rationale or process to prioritize where policy decisions should focus first or what the key ES/NCP related to human well-being are for any given policy context.

This paper aims to demonstrate a process to help identify key relationships between nature and well-being. Our aim is to provide a participative approach that is systematic, structured, and transparent, thus helping practitioners make sound policy decisions based on greater consistency and transparency. The process, by identifying and being able to prioritize the more important relationships between nature and well-being, enables greater focus and judicious financial and time investment to support policy development and evaluation. Our process was tested in New Zealand, where the Parliamentary Commissioner for the Environment (Parliamentary Commissioner for the Environment, 2019) identified a gap in knowledge on how changes in the environment relate to people's well-being. This is despite the legal obligation to report on the state of the Environment since 2015, and the focus of the current government on "well-being" budgetary decisions that includes natural capital (New Zealand Treasury, 2019b). The following sections describe our method, report on our findings from a workshop with key stakeholders and our own evaluation and discuss potential applications for practitioners.

METHODS

Prioritization Process

A process was developed to provide a systematic, structured, and transparent approach to identify the key relationships between nature and well-being, and thus where to focus effort. These key relationships may be used for the subsequent identification of fit-for-purpose indicators or where decision makers should focus policy development. This process was designed to facilitate discussions between people (e.g., decision makers, scientists and/or stakeholders), ensure that multiple perspectives were heard in the process, and create buy-in to the process. This participatory process was aimed at ensuring the process outcome would support the needs of stakeholders and be usable for multiple purposes. The research process was given Manaaki Whenua – Landcare Research social ethics approval (number 2122/8), which is based on the New Zealand Association of Social Science Research code of ethics.

The two-step process involves:

1 Framing: Framing the conceptual basis of the relationship between well-being and nature. Exploring the relationship between people and nature relies on using frameworks that are systematic, easy to communicate and/or commonly used. Using a structured and transparent approach helps ensure important relationships between people and nature are not inadvertently overlooked. In this step, ES/NCP and well-being frameworks are chosen to ensure terminology is well understood, and all aspects of both well-being and ES/NCP are well represented. The process we outline could use any well-being framework or ES/NCP framework.

2 Prioritizing: Assessing if (and how) each ES/NCP impacts (positively or negatively) on each well-being domain and if (and how) each well-being domain depends on each ES/NCP. This rapid assessment aims to identify which ES/NCP are (most) relevant to consider for each well-being domain. This reduces the potential list of nature–well-being relationships for further consideration to those of greatest relevance to a particular decision or context. This also reduces the time and cost of the effort needed to characterise the relationship between nature and well-being. It may also mean a broader set of relationships are included, not just those relationships where information already exists and to which assessment or decisions often default.

This prioritized set of nature–well-being relationships for the given context can then be used for any number of decision-making purposes. These purposes may include, but are not limited to, engaging appropriate groups to take action to improve nature and thus well-being, targeting regulatory or non-regulatory policy initiatives, determining budget allocations, identifying fit-for-purpose indicators to evaluate actions/policies aimed to improve nature or the nature–well-being relationship, identifying additional research or knowledge gathering areas or identifying what potential trade-offs may arise from policy signals or actions being undertaken.

This paper mainly focuses on the second step of the process and discusses how it could be used in decision-making to improve human well-being. A similar process could also be used for other forms of capital that underpin well-being.

Prioritizing ES/NCP–Well-Being Relationships

The purpose of the prioritization step is to narrow the number of ES/NCP–well-being relationships to those that are most relevant for the context and decision(s) being undertaken.

Two criteria were used as the basis of a scoring framework to determine the level of relevance of each ES/NCP–well-being relationship. These criteria build on the impacts and dependency criteria used and tested in the ecosystem service assessment literature (e.g., Ranganathan and Lucas, 2008; World Resources Institute, 2012). These types of criteria have been used to prioritize the services of most importance to a business and have been applied to different policy decision contexts in New Zealand and the Pacific (e.g., Greenhalgh and Hart, 2015). The aim of the criteria was to stimulate discussions on the attributes of the relationship between nature and well-being, including type of impact, how well-being is affected, and alternative options for how an ES/NCP is supplied. These criteria were:

- The **Impact (I)** of an ES/NCP on a well-being domain. The impact is assessed for each ES/NCP–well-being domain relationship in two ways. First is the **type (T)** of impact, where T describes how a change in an ES/NCP (negatively or positively) affects groups of people or sectors and the size of that affect. The impact type may be direct (e.g., food production on jobs and earnings) or indirect (e.g., the regulation of natural hazard is indirectly linked to our work-life balance through access to walking tracks). The size of the change may be small or large. Second is **Extent (E)**, which refers to the scale of this change. Extent can be assessed as either the proportion of the population (P) or the spatial geographical range (G) affected. The appropriate extent criteria to use will depend on context. Type and extent scores can then be combined using a scoring approach based on the average or maximum value. We used the average value to assess impact.
- The **Substitutability (S)** of an ES/NCP for a well-being domain. A substitute may either be a cost-effective fix or provide an alternative option for the same (or similar) ES/NCP supplied for the well-being domain. Substitutability has been suggested by others to understand the influence of, or, if it is possible, to mediate the importance of, an ES/NCP to a well-being domain (Garibaldi et al., 2019; Keeler et al., 2019; Mandle et al., 2020). Substitutability was also a criterion used to prioritize ecosystem services for further investigation for business and government decisions (Ranganathan and Lucas, 2008; World Resources Institute, 2012; Greenhalgh and Hart, 2015).

The impact and substitutability criteria were then used as the basis for a scoring system to facilitate the prioritization of ES/NCP in terms of their importance for each well-being domain

TABLE 1 | Scoring system for prioritizing the importance of each ES/NCP for each well-being domain based on the impact of an ES/NCP on a well-being domain and the substitutability of that ES/NCP for the well-being domain.

Score	Impact I = f(T,E)			Substitutability S = C or A depending on context	
	Type of relationship (T)	Extent of impact (E = G or P depending on context)		Cost-effective substitutes – how hard and costly is it to fix? (C)	Alternative options – similarity and how easily accessed (A)?
		Spatial geographical range of impact (G)	Proportion (%) of population affected per region (P)		
1	No importance	<10% of the regional territories	<10	Yes, low cost and affordable for individuals	Many alternative options available of similar quality (or experience) that are easily accessed
2	Indirect and small	10–30% of the regional territories	10–30	Yes, affordable for communities or user groups	Some alternative options available of differing quality (or experience) within proximity
3	Indirect and big	30–50% of the regional territories	30–50	Yes, but needs local government intervention	Some alternative options available of similar quality some distance away
4	Direct and small	50–75% of the regional territories	50–75	Yes, but needs national government intervention	Some alternative options available but of different quality (or experience) some distance away
5	Direct and big compared with national	>75% of the regional territories	>75	No substitutes	No alternative options available

TABLE 2 | Summary of the process and questions used to apply the impact and substitutability criteria to each ES/NCP–well-being domain.

	Step		Action
Framing	**Identify ES/NCP and well-being frameworks to be used**		**Process outlined in this article uses NCP from IPBES to represent nature and the NZ living Standards Framework for defining well-being**
Go through prioritizing step for each ES/NCP–well-being domain			
Prioritization	Nature of the impact (I)	Type of relationship (T)	Does the [ES/NCP] impact on people's [well-being domain] directly or indirectly and what is the size of that impact (small/large)?
		Extent (E)	What is the extent of that impact or how many people are affected based on geographic units (G) or proportion of population (P)?
		Impact (I)	I-score is the average of T and E scores
	Substitutability (S)		Is there a substitute for the [ES/NCP] important for [well-being domain]? If yes, is there a cost-effective substitute (C) or a similar alternative option (A)?
	Final priority score		Identify final score in matrix using I and S scores

(**Table 1**). A series of questions (**Table 2**) was used to aid the scoring process and guide discussions. The scoring system was ordinal with corresponding scores from no/weak (1) to strong (5) interaction for each criterion and was applied to each ES/NCP–well-being domain. While the ordinal categories covered the full range of possible interactions the description of the categories was arbitrary. While the authors experience in assessing ES/NCP flows was used to develop these arbitrary categories, this is an area that could be further refined over time to improve the robustness of the categories.

The score for the impact criterion consists of the average (or maximum if preferred) of the T and E values. The substitutability criterion, however, is a single score. These two scores are then used to prioritize the ES/NCP–well-being domain.

To prioritize ES/NCP–well-being domain relationships, a ranking matrix was developed to rank each relationship as low, medium, or high (**Table 3**). For example, if an ES/NCP scores a 5 for impact and a 5 for substitutability then it would be ranked high and given a higher priority for further consideration in any subsequent decision. If the impact scored a 3 and

TABLE 3 | Guide for assigning scores (with quantitative number in bracket) to determine the prioritization of an ES/NCP–well-being relationship.

SI	1	2	3	4	5
1	Low (0)	Low (0)	Medium (1)	Medium (1)	High (2)
2	Low (0)	Low (0)	Medium (1)	Medium (1)	High (2)
3	Low (0)	Low (0)	High (2)	High (2)	High (2)
4	Low (0)	Low (0)	High (2)	High (2)	High (2)
5	Medium (1)	Medium (1)	High (2)	High (2)	High (2)

The scores are based on impact (I) and substitutability (S). Low (0): implies no further consideration; medium (1) implies further expert input and inclusion depending on context, and high (2) implies this relationship should be considered in the decision making.

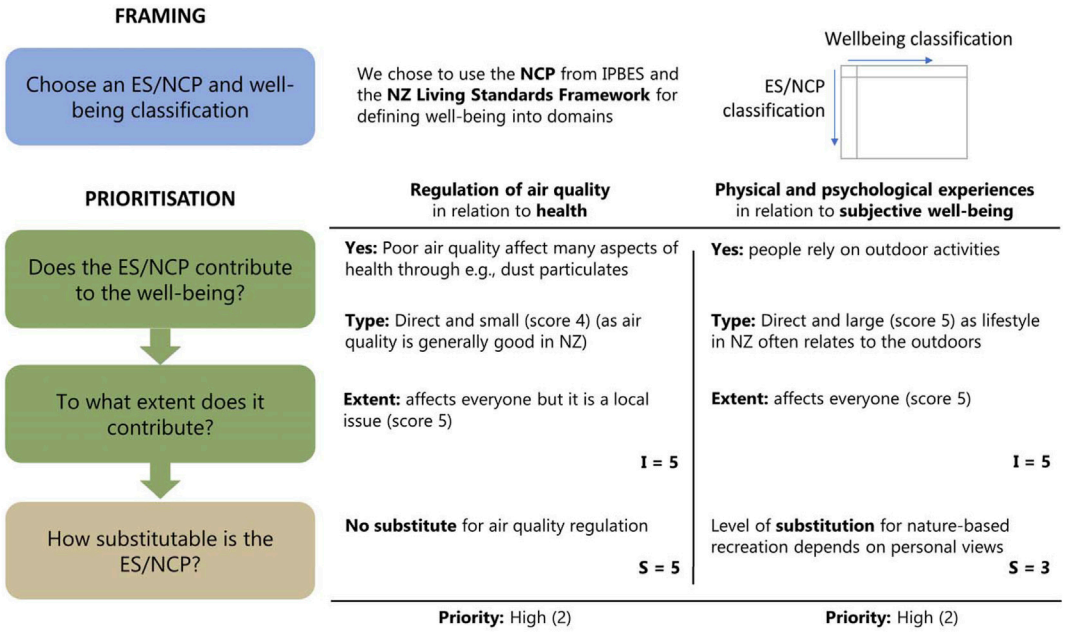

FIGURE 1 | A schematic diagram showing how the prioritization process is applied to relate ES/NCP to well-being domains.

substitutability a 1, then it would be ranked low and not considered important for subsequent decisions. In the final determination of what ES/NCP–well-being domain relationships to consider further, each rank (Low, Medium, High) was expressed numerically (0, 1 or 2, respectively) for quantitative analysis. The aim of using this type of scoring system was to quickly identify those relationships to include (high) and those to exclude (low). Those relationships scored as medium can then be more closely scrutinized and included or excluded based on expert opinion, stakeholder input, and/or after additional information had been collated on the relationship. The scorings (0, 1 or 2) can be reported into a table of ES/NCP against well-being domains. This adjacency matrix describing the strength of the relations can be visualized with, for example, a chord diagram showing proportional strength of relations through width of links. A simplified example of how the process was applied is outlined in **Figure 1**.

Demonstrating the Prioritization Process Design

The New Zealand Context

New Zealand, alongside Scotland, Iceland, Finland, and Wales, was a founding member of the Well-being Economy Governments (Scottish Government, 2019) initiative launched in 2019. These governments define national success by the quality of life of its citizens rather than national Gross Domestic Product (GDP). This led to New Zealand releasing its first well-being budget in 2019 stating that the budget "signals a new approach to the way governments work, by placing the well-being of New Zealanders at the heart of what we do" (New Zealand Treasury, 2019b). The New Zealand Treasury, since 2011, has been developing and evolving the Living Standards Framework (LSF) to help inform economic policy advice to government and provide a measure of wealth beyond GDP. It is based on the OECD well-being framework and reflects people's well-being or the "capability of people to live lives that they have reason to value" (New Zealand Treasury, 2019a). The LSF is divided into 12 domains of current well-being to reflect the range of outcomes that matter to New Zealanders and four capitals to reflect future well-being (social, built, human and natural capital) (*see* **Supplementary Table S2** in Suppl. Mat. for the definitions of well-being domains). However, the relationship between natural capital and well-being is not explicit and these relationships have not been consistently explored or assessed.

For this paper, we used the latest IPBES classification to describe the contributions coming from "natural capital" (**Figure 2**).[1] The IPBES classification includes material, non-material, and regulating ES/NCP, noting that these broad categories are common across different classification systems (Czúcz et al., 2018). To describe well-being, we used the 12 LSF domains. These have been grouped into six broad categories: five – freedom of choice, security, health, material, and social relations – are aligned with the Millennium Ecosystem Assessment (MEA) well-being categories, with one additional category separating the environmental quality domain (**Figure 2**).

[1]NCP18 "Maintenance of options" from the IPBES classification cuts across regulating, material and non-material NCP. It reflects a longer term and fundamental contribution of nature and people through ecological resilience and transformability (e.g., through evolutionary processes, dispersal, and reconfiguration). We did not include this NCP in the analysis as a stand-alone NCP as the impact on well-being was captured by the other NCP flowing through NCP18.

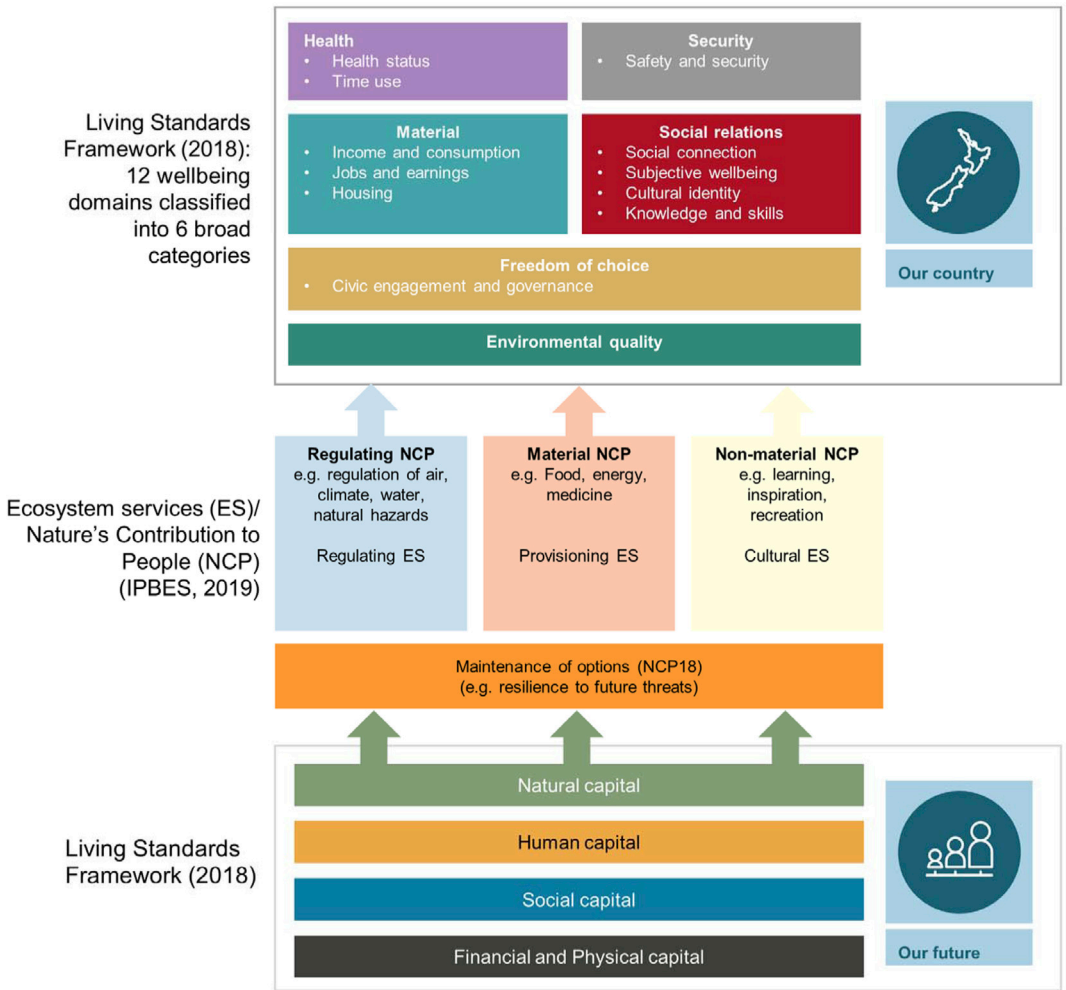

FIGURE 2 | Linking natural capital (from "Our Future") and current well-being domains ("Our Country") from the New Zealand Living Standards Framework (Source: New Zealand Treasury 2019a) with the ecosystem services (ES) and Nature's Contributions to People (NCP) (IPBES, 2019). The ES/NCP are an intermediate concept connecting natural capital and well-being.

The latter category, added as "environmental quality," is described in the LSF as "the natural and physical environment and how it impacts people today" which wasn't reflected in any of the five categories of well-being from the MEA.

Applying the Prioritization Process

The prioritization criteria and process outlined above was tested in a workshop setting with 20 stakeholders from New Zealand's central government agencies. The aim of the 1-day workshop was to see if the criteria resonated with practitioners or potential users of this process and to identify ways to further refine the application of the process. The process was tested using two well-being domains (subjective well-being and health status) that differed in their level of objectivity and three ES/NCP, one from each main IPBES category of material, regulating, and non-material. There were 14 staff from central government agencies, including the Ministry for the Environment (multiple departments), Ministry for Primary Industries, Department of Conservation, Treasury and Statistics New Zealand, one from a Local and Territorial Authority, two from the Parliamentary Commissioner for the Environment's office, plus three from a research institute. All participants had backgrounds in environmental management, with expertise in policy, environmental sciences, conservation, agriculture, or economics. We did not have any representatives from an indigenous knowledge perspective, which is a gap that should be filled through future research. The process could also be undertaken in workshop settings with a wider group of stakeholders, and this would be recommended especially where decisions are likely to be contentious with stakeholders having different viewpoints.

The workshop tested the process, which resulted in small refinements, but no material changes were suggested for or made to the scoring system. Given the limited availability of central government staff, the workshop focused on testing the process for only two well-being domains and three ES/NCP. After the

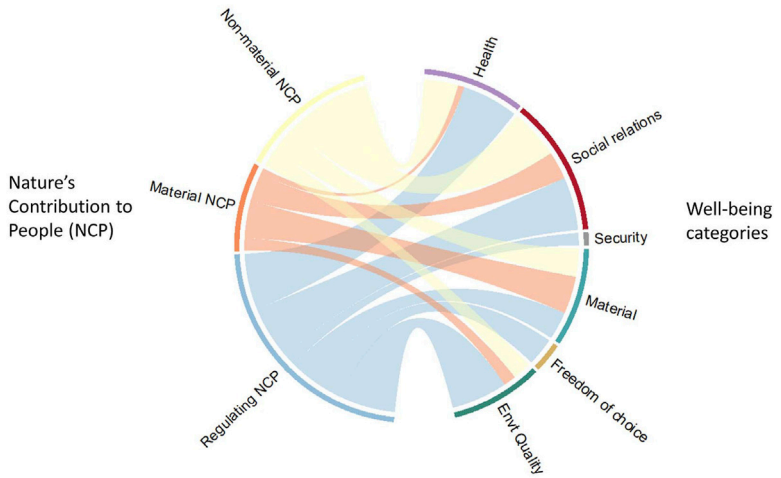

FIGURE 3 | Illustrative diagram showing relative contribution of NCP to the six broad well-being categories. These results are illustrative as they are based on a small sample size of government agency employees and are not intended to be representative of New Zealand population. The width of the chords is representative of the number of NCP-well-being relationships that scored high in the prioritization process. *See* **Table 4** for exact numbers.

refinements had been integrated, three of the authors subsequently applied the prioritization process to the remaining ES/NCP–well-being domain relationships. These results were then provided to the Ministry for the Environment for their review and feedback. To ensure consistency in the application of the process, each ES/NCP–well-being domain relationship was individually scored by two people. The scoring for each relationship was then compared and discussed by all three authors to resolve any discrepancies between the individual scores. The discrepancies and resolutions were recorded to provide transparency, explanation and documentation should it be needed later to show why a choice was made (Ausseil et al., 2021). Where possible, the scoring of each criterion was supported by evidence in the literature, in particular the review from Roberts et al. (2015).

RESULTS AND DISCUSSION

Overview of the Prioritization Findings

Overall, regulating NCP contributed to all six broad groupings of well-being (**Figure 3**). Non-material NCP contributed to the well-being categories health, social relations, material well-being, and environmental quality. Material NCP, such as food, energy and timber contributed mainly to the material well-being category, with smaller contributions to social relations and environmental quality categories (**Figure 3**).

Health Well-Being Category

All broad categories of NCP are important for the "health status" domain. This reflects basic needs provided by the material ES/NCP (e.g. food NCP) as well as the subjective and cognitive experiences that are important to mental health and the value of regulating NCP that, for example, reduce the physical harm to people by mitigating natural hazards or provide clean drinking water (**Table 4**).

The "time use" domain related to work-life balance is mostly affected by the non-material NCP (*see* **Table 4**). For instance, nature-based recreation (i.e., physical and psychological experiences NCP) is an important leisure pastime for many New Zealanders whether it be hiking in forests, gathering seashells, or boating or fishing in lakes/rivers or around the coastline. Learning and inspiration can also affect the quality of people's leisure time, e.g., arts and crafts that draw on nature or the learning by children during outdoor leisure activities.

Material Well-Being Category

With the Material well-being category, material NCP were most important, followed by non-material NCP (**Table 4**). Livestock production, fruit production, and Mānuka honey (i.e., food and feed NCP) and the timber industry (i.e., materials and assistance NCP) were strong contributors to "income and consumption," and "jobs and earnings" domains. Recreation (physical and psychological experiences) is important for New Zealand's tourism and screen industries, thus also contributing to "income and consumption," and "jobs and earnings" domains (StatsNZ, 2021; NZIER, 2017). The "housing" domain, as expected, depended on, or was impacted by the materials and assistance NCP through timber availability. However, the regulation of hazards and extreme events, and air quality were also considered important for the quality, suitability, and affordability of the homes through the role ecosystems have in mitigating natural hazards and improving air quality. Proximity to recreational areas that provide physical and psychological experiences were also considered important for well-being related to housing.

TABLE 4 | Final prioritizations scores of 17 NCP against the 12 LSF well-being domains and their six broad categories.

	Well-being categories/domains	Health		Security	Material			Social relations				Freedom of choice	Environmental quality
	IPBES NCP	Health status	Time use	Safety and security	Income and consumption	Jobs and earnings	Housing	Knowledge and skills	Social connection	Subjective well-being	Cultural identity	Civic Engagement and governance	Environmental quality
Regulating NCP	Habitat creation and maintenance	2	0	0	1	1	0	1	0	2	2	2	2
	Pollination and dispersal of seeds	0	0	0	0	0	0	0	0	0	0	0	2
	Regulation of air quality	2	0	0	0	0	2	0	0	1	2	0	0
	Regulation of climate	2	0	2	1	0	0	0	0	2	2	1	2
	Regulation of ocean acidification	1	0	0	0	0	0	0	0	0	0	0	2
	Regulation of freshwater quantity, location, and timing	2	2	0	0	0	0	0	0	0	2	1	2
	Regulation of freshwater and coastal water quality	2	0	0	0	0	0	0	0	1	1	2	2
	Formation, protection, and decontamination of soils	0	0	0	0	0	0	0	0	0	0	1	2
	Regulation of hazards and extreme events	2	1	2	1	1	2	0	0	0	1	2	2
	Regulation of organisms detrimental to humans	1	1	0	0	0	0	0	0	0	0	0	2
Material NCP	Energy	0	0	0	1	0	0	0	0	0	0	0	0
	Food and feed	2	0	0	2	2	0	2	0	2	2	0	2
	Materials and assistance	0	0	0	2	2	2	0	0	0	2	0	2
	Medicinal, biochemical, and genetic resources	0	0	0	1	0	0	0	0	0	1	0	0
Non-material NCP	Learning and inspiration	2	2	0	0	1	0	2	0	0	2	0	2
	Physical and psychological experiences	1	2	0	2	2	2	1	0	1	2	0	2
	Supporting identities	2	2	0	0	0	2	2	2	2	2	0	2

Final prioritization scores of 17 CP against the 12 LSF well-being domains and their six broad categories. The scores are based on impact (I) and substitutability (S). Low (0): implies no further consideration; medium (1) implies further expert input and inclusion depending on context, and high (2) implies this relationship should be considered in the decision making. These results are illustrative as they are based on a small sample size of government agency employees and are not intended to be representative of New Zealand population.

Social Relations Well-Being Category

In terms of the social relations well-being category, supporting identities is the most important NCP for the "social connection" domain. This comes through the connections and networks people obtain *via* their sense of place and social relations that people derive from ecosystems. The non-material NCP contribute most to the "knowledge and skills" domain, as does wild foods from the food and feed NCP.

In the New Zealand context, Mātauranga Māori (indigenous knowledge) is a holistic worldview that encompasses knowledge of natural flora and fauna relationships, thus contributing to learning and inspiration (Hikuroa, 2017). Mātauranga Māori is also closely tied to "place," which influences a person's identity (from the supporting identities NCP). The "subjective well-being" domain, a person's overall life satisfaction and sense of meaning and self, is affected by the supporting identities NCP. This is through religious, spiritual, and social-cohesion experiences and a person's sense of place, purpose, belonging, rootedness, or connectedness, associated with different entities of the living world, as well as knowing New Zealand's iconic ecosystems exist. Climate anxiety, related to climate regulation, also affects subjective well-being, as does the poor provision of food.

The "cultural identity" domain (having a strong sense of identity, belonging and ability to be oneself, and the existence value of cultural taonga or treasures) is influenced by several NCP. Regulating NCP such as regulation of hazards and extreme events; climate; freshwater quantity, location, and timing; and air quality have potential to affect cultural sites, experiences, and practices, which in turn affect cultural identity, particularly for Māori, New Zealand's indigenous people. All New Zealanders' cultural identity is influenced by non-material NCP, as outdoor recreation, relaxation, and aesthetic enjoyment (physical and psychological experiences and supporting identities NCP) are integral components of New Zealand's lifestyle. Similarly, youth learning experiences (learning and inspiration NCP) come through school outdoor camps (annually from age 9–15 years) and Māori youth cultural learning, which all influence emerging personal cultural identities. New Zealand's treasured species and habitats (habitat maintenance NCP), like kiwi or the ancient kauri forests, form part of New Zealand's cultural identity.

Security Well-Being Category

The "safety and security" domain (people's safety and security, both real and perceived, and their freedom from risk of harm and lack of fear) is influenced by the regulating NCP, regulation of hazards and extreme events, and climate (**Table 4**). The impacts of hazards and natural disasters are becoming more frequent, increasing people's fear of the potential consequences of expected or unexpected events such as property damage, displacement, or financial impacts of floods/drought. There is also increasing evidence that climate is affecting safety and security, for instance, injuries related to high winds or increases in violent crimes and assaults with changes in temperature (Stevens et al., 2019).

Freedom of Choice Well-Being Category

The "civic engagement and governance" domain relates to people's engagement in the governance of their country and their civic responsibilities, how "good" New Zealand's governance is perceived to be, and the procedural fairness of society. Regulation of hazards and extreme events is becoming an increasingly important governance issue, with conversations about climate adaptation and the implications of climate risk assessments. Recent issues about pathogen contamination of drinking water (regulation of freshwater and coastal water quality NCP) have impacted on civic engagement and governance, leading to a government inquiry into drinking water in New Zealand (Government Inquiry into Havelock North Drinking Water, 2017a; b) and the subsequent "Three waters reforms" (DIA, 2021). Water quality degradation led to national conversations on and action for reforms in national and regional freshwater policy and increased involvement by communities and citizens in those decisions. This subsequently resulted in collaborative processes in many parts of New Zealand to identify and set freshwater goals and implementation pathways (Cradock-Henry et al., 2017). Habitat creation and maintenance is another growing concern that has resulted in national debates (Biodiversity (land and freshwater) Stakeholder Trust, 2018) and a proposed national direction for biodiversity protection and restoration (Ministry for the Environment, 2019).

Environmental Quality Well-Being Category

As expected, most ES/NCP in the material, non-material, and regulatory categories contribute to environmental quality (**Table 4**).

In summary, non-material ES/NCP, such as physical and psychological experiences, supporting identities, and learning and inspiration are relevant to six to nine well-being domains, including health status, time use, knowledge and skills, environmental quality, housing, and cultural identity. Regulating ES/NCP are also important to most well-being domains, with three or more ES/NCP relevant to health status, environmental quality, and cultural identity. Material ES/NCP are relevant to fewer well-being domains, contributing mainly to cultural identity, income, jobs, housing, and environmental quality.

Challenges and Opportunities

The aim of this research was to outline a systematic, structured and transparent process to identify and prioritize the key relationships between nature and well-being for decision-making purposes. The process was to aid the focusing of effort and targeting of decisions. While the points outlined below were notable insights drawn from our processes, we expect them to be relevant for similar processes run by others and in differing contexts.

Our process allows multiple viewpoints to be heard, creates transparency around how choices are made and provides a rationale for those choices. Because the process was designed to be participatory, there is co-production at each step (Steger et al., 2021). One main benefit was the conversation and debate generated between participants, as it was found to be as informative as the outcome of the process and valued by the participants. Discussion about the ES/NCP and well-being framing enabled people to think about the terminology and definitions needed to ensure a common language was understood by all participants. That step is essential, as

different interpretations can lead to wide variations in scoring. The prioritization process also prompted discussions about differing views on the importance of nature to different aspects of human well-being and helped ensure that a viewpoint was not inadvertently overlooked.

By using a participatory approach, we showed that rich discussions on the relationship between nature and well-being helps people understand the relationship from different perspectives and contexts (e.g., Fagerholm et al., 2020) and highlights the challenges of managing the environment when people's perspectives and expectations are diverse. Having a wide array of stakeholders from different backgrounds and interests can help ensure the range of views are heard in these types of prioritization processes, and for alternative worldviews to be shared. In our case, we lacked the bicultural representation of New Zealand as there were no Māori participants to share Māori knowledge and worldview. The diversity of views expressed by the other participants, however, highlighted a disparate range of perceptions and values put on the importance of ES/NCP depending on the social or cultural context (Cuni-Sanchez et al., 2019), or the individual's own background and personal relation to nature. As such, the results are heavily dependent on who is involved in the process, highlighting the need to carefully identify the participants based on an agreed set of criteria (e.g., social, cultural), thus ensuring a wide range of perspectives are included. While we tested our process during a workshop, other tools such as the Delphi process could also be used to help reach agreement in diverging opinions.

The scoring system forced a greater degree of consistency in judgements and highlighted those relationships where additional information or viewpoints were needed. Any ES/NCP–well-being relationship ranked as medium signaled more discussions/knowledge were needed to ascertain whether it should or should not be a priority. These prioritized relationships can also help determine where to focus future research and knowledge gathering to test the strength of the relationship between the ES/NCP and the well-being domain.

Observations and statements on the process from stakeholders at the workshop helped contextualize the prioritization outcomes (*see* **Supplementary Table S3** in Suppl. Mat. for a detailed example of the process including comments). The discussions with workshop participants highlighted the different ways in which the nature of the relationship between ES/NCP and a well-being domain was described, sometimes referring to timing (e.g. impact health temporarily) or feelings (e.g. influencing anxiety or fears). Perceived impact or dependency often differed with who was affected and the substitutability of ES/NCP. While the discussions on the ES/NCP–well-being domain relationships were focused on the current and very near future, some participants also noted that the scoring for impact and substitutability could change with time. For example, ethical and spiritual ES/NCP may be somewhat substitutable over time as attitudes, attributes/beliefs, and/or people's minds change. This highlighted the need to be explicit about what the scoring should or should not consider and the timeframe. The importance of different temporal aspects of these relationships is likely to differ, depending on where the prioritization is going to be used. It also highlights that these relationships may not be static and, for some uses, may require reassessment over time. One observation during the process was the need to separate potential versus actual importance for scoring. Some ES/NCP were included as part of the prioritization due to their importance for future risk. For instance, natural hazard regulation is important for the "safety and security" domain. While the impact has low spatial coverage (coastal zones and low-lying areas at risk of flooding), we decided to include this ES/NCP because of the likelihood of a future increase in natural hazards and scale of impact from changes in climate.

Different frameworks for nature or well-being resonate better with some stakeholders or participants than with others. The challenge is finding frameworks to which most people can relate, are relatively easy to understand, and can be applied to multiple contexts. For instance, the concept of ecosystem services has been criticized for its economics perspective, focusing on instrumental and intrinsic value from nature (Kadykalo et al., 2019). A Mātauranga Māori lens, however, argues that people not only benefit from the services provided by nature but are also part of the nature (Harmsworth and Awatere, 2013). Thus, a range of worldviews and frameworks/perspectives can be warranted to capture a fuller picture of the relationship between people and nature. For example, the IPBES framework articulates intrinsic, utilitarian, and relational values of nature to support their integration into policy and decision making (Pascual et al., 2017; Pascual et al., 2021). It also embraces pluralism and fosters the integration of multiple values, especially from indigenous people (Hill et al., 2021; Muradian and Gómez-Baggethun, 2021; Pascual et al., 2021). The NCP categories are intentionally fuzzy and fluid (Kadykalo et al., 2019), allowing them to be adapted for context-specific perspectives (Topp et al., 2021). While debates continue to disentangle the differences and commonalities between ES and NCP approaches (Kadykalo et al., 2019), our process does not intend to favor one classification over another, allowing flexibility for the intended use. Similarly, there are many well-being frameworks that could be used, such as the Maslow hierarchy of needs used in a New Zealand study (Roberts et al., 2015), the Human Development Index (United Nations Development Programme (UNDP), 1990), the Sustainable Development Goals (sdgs.un.org), and the OECD's Better Life Index (OECD, 2017). All were developed to measure the multiple dimensions of human well-being that are necessary for the betterment of a society and not just through economic output.

Application of the Process for Decision Making

The prioritization process proposed in this paper can be used for different purposes. The use of an ES/NCP concept allowed us to bridge the broader gap between people and nature, facilitating the development of chains of causation and enabling people to understand how nature underpins their everyday lives. Improving the understanding of linkages and challenges between nature and people's physical and spiritual needs helps to raise awareness for people or groups, incentivizing them to take action to improve nature and thus their well-being.

Recognizing the role of the environment on well-being for current and future generation is essential, and this is where our process can help identify where indicators (and data) are needed to monitor and report on these relationships. In New Zealand, for

example, there is a lack of data showing the consequences of degradation in the environment on the economy and society (Parliamentary Commissioner for the Environment, 2019). Equally, the New Zealand Treasury has developed the Living Standards Dashboard as a measurement tool to inform on cross-government policy priorities (New Zealand Treasury, 2019a). However, it is not clear how the natural capital indicators were chosen and how they connect to New Zealander's well-being. Our process can provide the first step towards an evidence-based approach to identity which indicator(s) should be developed or used to track natural capital and its influence on well-being.

At a policy level, identifying the important connections between ES/NCP and well-being domains can help target policy initiatives to achieve specific well-being outcomes. This enables regulatory or non-regulatory policies to target key components of nature while identifying potential trade-offs that may arise from policy signals or actions being undertaken. For instance, Gardiner and Huser (2017) explored the value of using an ecosystem services approach for policymaking in the Waikato region of New Zealand. Their pilot study highlighted the value of establishing the importance of ecosystem services for human well-being in integrating across a regional government's departments and teams that may have different outcome focuses. By framing the connections between biodiversity and human well-being, the International Union for Conservation of Nature highlighted the benefits of working with nature, emphasizing the economic and social benefits of nature-based solutions, to mitigate climate change while reducing biodiversity loss (Seddon et al., 2021). By considering all aspects of ES/NCP and the full range of well-being outcomes that are sought, our process could provide opportunities to help practitioners in narrowing down to the key relationships on which they should focus, and in implementing interventions or nature-based solutions that could provide multiple benefits.

An appropriately informed well-being framework is more likely to ensure effective and equitable targeting of public spending. Our process can be used by central government agencies to support sustainable investment decisions, raising the profile of investment into nature, and formalising the contribution of natural capital to well-being. For instance, the economic recovery from COVID-19 in 2020 for New Zealand necessitated rapid refocusing of investment decisions. Despite the urgency, it was important to make sure that decisions on short-term (economic) gain did not have unintended consequences or longer-term costs to nature and well-being. To assist with economic stimulus decisions, some of the broad-scale relationships between different ES/NCP and well-being domains identified using the process outlined in this paper were used as a "checklist" to assess decisions and track longer-term impacts (Ausseil et al., 2021). The rationale for considering nature was to avoid the depletion of nature, and the unintended consequences on our well-being (Alison Collins, pers. comm). Taking a step further, there were also opportunities to look at building resilience by including environmental impacts/improvements in decision-making processes. This would better preserve the choices available to future generations, particularly if green infrastructure approaches were used.

The first draft of the post-2020 global biodiversity framework from the Convention on Biological Diversity recognised in goal B that "Nature and its contributions to people are fully accounted and inform all relevant public and private decisions." Our process is a step forward to help analyse the key priorities in the relationship between nature and human well-being, thus enhancing the narratives around barriers and opportunities for change for these international commitments (IPBES, 2019), and providing a basis for monitoring progress.

CONCLUSION

Connecting nature to human well-being for effective policy decisions requires engagement processes and subsequent design and implementation of policies that can make a material difference to both the environment and people's well-being. We have described a process to enable better decision-making that ensures the relationship between nature and human well-being is understood and thus able to be protected into the future. The process was designed to assist decision makers in identifying the key nature–well-being relationships to focus their efforts, thereby reducing the cost and time to do the due diligence and justice to meaningfully embrace and act to enhance human well-being.

A structured and transparent process is more likely to ensure effective and equitable targeting of public spending; evidence-informed policies; and decisions that neither impact on, nor under-estimate, the contribution of a well-functioning environment to the economy, culture, and wider society. The inclusion of a diversity and plurality of values to inform decision making can help recognize and articulate the multiple views held for what a sustainable future would be. Indeed, multiple actors and representative stakeholders are needed to broaden the discussions and avoid the marginalization of some groups.

The outcomes from this prioritization process can be used for a variety of decision-making efforts. One possible next step to this process is the development of indicators for tracking changes in prioritized nature–well-being relationships. Indeed, a companion indicator design process is under development, fed by the outcomes in this paper and the supporting justification captured during workshop discussions. This indicator design process continues the participatory approach utilized in this paper to guide discussions for justifiable and fit-for-purpose ways of measuring and tracking nature–well-being relationships.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

A-GA, SG, PB, SL and AC wrote the manuscript. A-GA, AC and SG coordinated the study. A-GA, PB, and SG contributed to the analysis. SL provided review, writing, and editing input. All authors agreed to be accountable for the content of the work.

FUNDING

This research was supported by Manaaki Whenua – Landcare Research Strategic Science Investment Funding for Crown Research Institutes.

ACKNOWLEDGMENTS

The authors would like to acknowledge the workshop participants who generously gave their time to and critique of the process and to Geoff Kaine for his insightful comments on the manuscript. We thank the reviewers for their constructive feedback. We would also like to acknowledge the Office of the Prime Minister's Chief Science Advisor for hosting Anne-Gaelle Ausseil as a senior fellow for this project.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fenvs.2022.782229/full#supplementary-material

REFERENCES

Akinsete, E., Apostolaki, S., Chatzistamoulou, N., Koundouri, P., and Tsani, S. (2019). The Link between Ecosystem Services and Human Wellbeing in the Implementation of the European Water Framework Directive: Assessing Four River Basins in Europe. *Water* 11 (3), 508–520. doi:10.3390/w11030508

Ausseil, A. G. E., Collins, A., Greenhalgh, S., Booth, P., and Samarasinghe, O. (2021). *Environmental Stewardship and Well-Being"*. Lincoln, New Zealand: Manaaki Whenua – Landcare Research.

Bergeret, A., and Lavorel, S. (2022). Stakeholder Visions for Trajectories of Adaptation to Climate Change in the Drôme Catchment (French Alps). *Reg. Environ. Change* 22, 1876. doi:10.1007/s10113-022-01876-5

Biodiversity land and freshwater stakeholder Trust (2018). Report of the Biodiversity Collaborative Group. [Online]. Available at: http://www.biodiversitynz.org/uploads/1/0/7/9/107923093/final_online_-_biodiversity_group_report_1_oct_4pm.pdf (accessed August 30, 2021).

Brauman, K. A., Garibaldi, L. A., Polasky, S., Aumeeruddy-thomas, Y., Brancalion, P. H. S., DeClerck, F., et al. (2020). Global Trends in Nature's Contributions to People. *Proc. Natl. Acad. Sci. U S A.* 117 (51), 1–7. doi:10.1073/pnas.2010473117

Bruley, E., Locatelli, B., and Lavorel, S. (2021). Nature's Contributions to People: Co-producing Quality of Life from Multifunctional Landscapes. *Ecol. Soc.* 26 (1), 12. doi:10.5751/es-12031-26011

Ciftcioglu, G. C. (2017). Assessment of the Relationship between Ecosystem Services and Human Wellbeing in the Social-Ecological Landscapes of Lefke Region in North Cyprus. *Landscape Ecol.* 32 (4), 897–913. doi:10.1007/s10980-017-0494-y

Cradock-Henry, N. A., Greenhalgh, S., Brown, P., and Sinner, J. (2017). Factors Influencing Successful Collaboration for Freshwater Management in Aotearoa, New Zealand. *E&S* 22 (2), 220214. doi:10.5751/ES-09126-220214

Cruz-Garcia, G. S., Sachet, E., Blundo-Canto, G., Vanegas, M., and Quintero, M. (2017). To what Extent Have the Links between Ecosystem Services and Human Well-Being Been Researched in Africa, Asia, and Latin America? *Ecosystem Serv.* 25, 201–212. doi:10.1016/j.ecoser.2017.04.005

Cuni-Sanchez, A., Ngute, A. S. K., Sonké, B., Sainge, M. N., Burgess, N. D., Klein, J. A., et al. (2019). The Importance of Livelihood Strategy and Ethnicity in forest Ecosystem Services' Perceptions by Local Communities in north-western Cameroon. *Ecosystem Serv.* 40, 101000. doi:10.1016/j.ecoser.2019.101000

Czúcz, B., Arany, I., Potschin-Young, M., Bereczki, K., Kertész, M., Kiss, M., et al. (2018). Where Concepts Meet the Real World: A Systematic Review of Ecosystem Service Indicators and Their Classification Using CICES. *Ecosystem Serv.* 29, 145–157. doi:10.1016/j.ecoser.2017.11.018

DIA (2021). Three Waters Reform Programme. [Online]. Wellington, New Zealand: Department of Internal Affairs. Available at: https://www.dia.govt.nz/Three-Waters-Reform-Programme (accessed August 30, 2021).

Díaz, S., Pascual, U., Stenseke, M., Martín-López, B., Watson, R. T., Molnár, Z., et al. (2018). Assessing Nature's Contributions to People. *Science* 359, 270–272. doi:10.1126/science.aap8826

Fagerholm, N., Martín-López, B., Torralba, M., Oteros-Rozas, E., Lechner, A. M., Bieling, C., et al. (2020). Perceived Contributions of Multifunctional Landscapes to Human Well Being: Evidence from 13 European Sites. *People Nat.* 2 (1), 217–234. doi:10.1002/pan3.10067

Gardiner, D., and Huser, B. (2017). *Applying an Ecosystem Services Approach to Policy Development: Opportunities, Benefits and Recommended Approach for Waikato Regional Council"*. Hamilton, New Zealand: GMD Consultant report for Waikato Regional Council.

Garibaldi, L., Polasky, S., Zayas, C., Aumeeruddy-thomas, Y., Brancalion, P., Brauman, K., et al. (2019). Chapter 2: Status and Trends in Nature's Contributions to People (NCP). *IPBES Glob. Assess. Biodiversity Ecosystem Serv.*, 1. doi:10.5281/zenodo.3832035

Geijzendorffer, I. R., Cohen-Shacham, E., Cord, A. F., Cramer, W., Guerra, C., and Martín-López, B. (2017). Ecosystem Services in Global Sustainability Policies. *Environ. Sci. Pol.* 74, 40–48. doi:10.1016/j.envsci.2017.04.017

Government Inquiry into Havelock North Drinking Water (2017a). *Report of the havelock north Drinking Water Inquiry: Stage 1"*. Wellington, New Zealand: Department of Internal Affairs.

Government Inquiry into Havelock North Drinking Water (2017b). *Report of the havelock north Drinking Water Inquiry: Stage 2"*. Wellington, New Zealand: Department of Internal Affairs.

Greenhalgh, S., and Hart, G. (2015). Mainstreaming Ecosystem Services into Policy and Decision-Making: Lessons from New Zealand's Journey. *Int. J. Biodiversity Sci. Ecosystem Serv. Manage.* 11, 205–215. doi:10.1080/21513732.2015.1042523

Harmsworth, G. R., and Awatere, S. (2013). Indigenous Māori Knowledge and Perspectives of Ecosystems. *Ecosystem Serv. New Zealand – conditions Trends*, 274

Hikuroa, D. (2017). Mātauranga Māori-The Ūkaipō of Knowledge in New Zealand. *J. R. Soc. New Zealand* 47 (1), 5–10. doi:10.1080/03036758.2016.1252407

Hill, R., Díaz, S., Pascual, U., Stenseke, M., Molnár, Z., and Van Velden, J. (2021). Nature's Contributions to People: Weaving Plural Perspectives. *One Earth* 4, 910–915. doi:10.1016/j.oneear.2021.06.009

Huang, Q., Yin, D., He, C., Yan, J., Liu, Z., Meng, S., et al. (2020). Linking Ecosystem Services and Subjective Well-Being in Rapidly Urbanizing Watersheds: Insights from a Multilevel Linear Model. *Ecosystem Serv.* 43, 101106. doi:10.1016/j.ecoser.2020.101106

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (2018a). *Summary for Policymakers of the Regional Assessment Report on Biodiversity and Ecosystem Services for Asia and the Pacific of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services"*. Editors M. Karki, S. Senaratna Sellamuttu, S. Okayasu, W. Suzuki, L. A. Acosta, Y. Alhafedh, et al. (Bonn, Germany: IPBES Secretariat).

IPBES (2018b). *Summary for Policymakers of the Regional Assessment Report on Biodiversity and Ecosystem Services for Europe and Central Asia of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services"*. Editors M. Fischer, M. Rounsevell, A. Torre-Marin Rando, A. Mader, A. Church, M. Elbakidze, et al. (Bonn, Germany: IPBES Secretaria).

IPBES (2019). *Summary for Policymakers of the Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services"*. Editors S. Díaz, J. Settele, E. S. E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, et al. (Bonn, Germany: IPBES secretariat).

Jacobs, S., Martín-López, B., Barton, D. N., Dunford, R., Harrison, P. A., Kelemen, E., et al. (2018). The Means Determine the End - Pursuing Integrated Valuation in Practice. *Ecosystem Serv.* 29, 515–528. doi:10.1016/j.ecoser.2017.07.011

Johnson, J. A., Jones, S. K., Wood, S. L. R., Chaplin-Kramer, R., Hawthorne, P. L., Mulligan, M., et al. (2019). Mapping Ecosystem Services to Human Well Being:

a Toolkit to Support Integrated Landscape Management for the SDGs. *Ecol. Appl.* 29 (8), e01985. doi:10.1002/eap.1985

Kadykalo, A. N., López-Rodriguez, M. D., Ainscough, J., Droste, N., Ryu, H., Ávila-Flores, G., et al. (2019). Disentangling 'ecosystem Services' and 'nature's Contributions to People'. *Ecosyst. People* 15 (1), 269–287. doi:10.1080/26395916.2019.1669713

Keeler, B. L., Hamel, P., McPhearson, T., Hamann, M. H., Donahue, M. L., Meza Prado, K. A., et al. (2019). Social-ecological and Technological Factors Moderate the Value of Urban Nature. *Nat. Sustain.* 2 (1), 29–38. doi:10.1038/s41893-018-0202-1

Leviston, Z., Walker, I., Green, M., and Price, J. (2018). Linkages between Ecosystem Services and Human Wellbeing: A Nexus Webs Approach. *Ecol. Indicators* 93, 658–668. doi:10.1016/j.ecolind.2018.05.052

Maes, J., Liquete, C., Teller, A., Erhard, M., Paracchini, M. L., Barredo, J. I., et al. (2016). An Indicator Framework for Assessing Ecosystem Services in Support of the EU Biodiversity Strategy to 2020. *Ecosystem Serv.* 17, 14–23. doi:10.1016/j.ecoser.2015.10.023

Mandle, L., Shields-Estrada, A., Chaplin-kramer, R., Mitchell, M. G. E., Bremer, L. L., Gourevitch, J. D., et al. (2020). Increasing Decision Relevance of Ecosystem Service Science. *Nat. Sustain.* 4, 161–169. doi:10.1038/s41893-020-00625-y

Martín-López, B., Leister, I., Lorenzo Cruz, P., Palomo, I., Grêt-Regamey, A., Harrison, P. A., et al. (2019). Nature's Contributions to People in Mountains: A Review. *PLOS ONE* 14 (6), e0217847. doi:10.1371/journal.pone.0217847

Mastrángelo, M. E., Pérez-Harguindeguy, N., Enrico, L., Bennett, E., Lavorel, S., Cumming, G. S., et al. (2019). Key Knowledge Gaps to Achieve Global Sustainability Goals. *Nat. Sustain.* 2, 1115–1121. doi:10.1038/s41893-019-0412-1

Ministry for the Environment (2019). *Draft National Policy Statement for Indigenous Biodiversity*. Wellington, New Zealand. Available at: https://environment.govt.nz/assets/Publications/Files/draft-npsib.pdf.

Muradian, R., and Gómez-Baggethun, E. (2021). Beyond Ecosystem Services and Nature's Contributions: Is it Time to Leave Utilitarian Environmentalism behind? *Ecol. Econ.* 185, 107038. doi:10.1016/j.ecolecon.2021.107038

New Zealand Institute of Economic Research (NZIER) (2017). *The Economic Contribution of the Screen Industry*. Available at: https://www.nzfilm.co.nz/sites/default/files/2017-12/NZIER%20report%20the%20Economic%20Contribution%20of%20the%20Screen%20Industry%2022%20November%202017.pdf.

New Zealand Treasury (2019a). *Our Country, Our Future, Our People. The Living Standards Framework: Dashboard Update"*. Wellington, New Zealand: New Zealand Treasury. Available at: Living Standards Framework Dashboard Update - December 2019 (treasury.govt.nz).

New Zealand Treasury (2019b). *The Wellbeing Budget*. Wellington, New Zealand: New Zealand Treasury. Available at: The Wellbeing Budget 2019 (treasury.govt.nz).

Nilsson, M., Chisholm, E., Griggs, D., Howden-Chapman, P., McCollum, D., Messerli, P., et al. (2018). Mapping Interactions between the Sustainable Development Goals: Lessons Learned and Ways Forward. *Sustain. Sci.* 13, 1489–1503. doi:10.1007/s11625-018-0604-z

OECD (2017). *How's Life? 2017: Measuring Well-Being"*. Paris, France.

Parliamentary Commissioner for the Environment (2019). *Focusing Aotearoa New Zealand's Environmental Reporting System"*. Wellington. Available at: focusing-aotearoa-new-zealand-s-environmental-reporting-system.pdf (pce.parliament.nz).

Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., et al. (2017). Valuing Nature's Contributions to People: the IPBES Approach. *Curr. Opin. Environ. Sustainability* 26-27, 7–16. doi:10.1016/j.cosust.2016.12.006

Pascual, U., Adams, W. M., Díaz, S., Lele, S., Mace, G. M., and Turnhout, E. (2021). Biodiversity and the challenge of Pluralism. *Nat. Sustain.* 4, 567–572. doi:10.1038/s41893-021-00694-7

Pörtner, H. O., Scholes, R. J., Agard, J., Archer, E., Arneth, A., Bai, X., et al. (2021). "IPBES-IPCC Co-sponsored Workshop Report on Biodiversity and Climate Change," in *Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and Intergovernmental Panel on Climate Change (IPCC)*. doi:10.5281/zenodo.4782538

Ranganathan, J., and Lucas, N. (2008). A Guide for Decision Makers. *Control* 2, 1–96. doi:10.1371/journal.pone.0024378

Roberts, L., Brower, A., Kerr, G., Lambert, S., McWilliam, W., Moore, K., et al. (2015). *The Nature of Wellbeing: How Nature's Ecosystem Services Contribute to the Wellbeing of New Zealand and New Zealanders*. Wellington, New Zealand: Department of Conservation, 145.

Scottish Government (2019). *Wellbeing Economy Governments*. [Online]. Available at: https://www.gov.scot/groups/wellbeing-economy-governments-wego/ (Accessed August 30, 2021).

Seddon, N., Smith, A., Smith, P., Key, I., Chausson, A., Girardin, C., et al. (2021). Getting the Message Right on Nature-Based Solutions to Climate Change. *Glob. Change Biol.* 27 (8), 1518–1546. doi:10.1111/gcb.15513

statsNZ (2021). Tourism Satellite Account: Year Ended March 2021. Available at: https://www.stats.govt.nz/information-releases/tourism-satellite-account-year-ended-march-2021.

Steger, C., Klein, J. A., Reid, R. S., Lavorel, S., Tucker, C., Hopping, K. A., et al. (2021). Science with Society: Evidence-Based Guidance for Best Practices in Environmental Transdisciplinary Work. *Glob. Environ. Change* 68, 102240. doi:10.1016/j.gloenvcha.2021.102240

Stevens, H. R., Beggs, P. J., Graham, P. L., and Chang, H.-C. (2019). Hot and Bothered? Associations between Temperature and Crime in Australia. *Int. J. Biometeorol.* 63 (6), 747–762. doi:10.1007/s00484-019-01689-y

Topp, E. N., Loos, J., and Martín-López, B. (2021). Decision-making for Nature's Contributions to People in the Cape Floristic Region: the Role of Values, Rules and Knowledge. *Sustain. Sci.* doi:10.1007/s11625-020-00896-6

United Nations Development Programme (Undp) (1990). *Human Development Report 1990: Concept and Measurement of Human Development"*. New York.

World Resources Institute (WRI) (2012). *The Corporate Ecosystem Services Review: Guidelines for Identifying Business Risks and Opportunities Arising from Ecosystem Change Version 2.0"*. Washington (DC): World Resources Institute.

Zhang, J., Li, X., Bao, T., Li, Z., Liu, C., and Xu, Y. (2021). Linking Demographic Factors, Land Use, Ecosystem Services, and Human Well-Being: Insights from an Sandy Landscape, Uxin in Inner Mongolia, China. *Sustainability* 13 (9), 4847. doi:10.3390/su13094847

Zoderer, B. M., Tasser, E., Carver, S., and Tappeiner, U. (2019). Stakeholder Perspectives on Ecosystem Service Supply and Ecosystem Service Demand Bundles. *Ecosystem Serv.* 37, 100938. doi:10.1016/j.ecoser.2019.100938

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.