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To cite this article: Matthias Schröter, Esra Başak, Michael Christie, Andrew Church, Hans Keune, Elena Osipova, Elisa Oteros-Rozas, Stefanie Sievers-Glotzbach, Alexander P. E. van Oudenhoven, Patricia Balvanera, David González, Sander Jacobs, Zsolt Molnár, Unai Pascual & Berta Martín-López (2020) Indicators for relational values of nature's contributions to good quality of life: the IPBES approach for Europe and Central Asia, *Ecosystems and People*, 16:1, 50-69, DOI: [10.1080/26395916.2019.1703039](https://doi.org/10.1080/26395916.2019.1703039)

To link to this article: <https://doi.org/10.1080/26395916.2019.1703039>



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Published online: 10 Jan 2020.



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





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Indicators for relational values of nature's contributions to good quality of life: the IPBES approach for Europe and Central Asia

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ABSTRACT

Relational values are values of desirable relationships between people and nature and among people (through nature). We report on the approach to capture relational values of nature's contributions to people in the regional assessment for Europe and Central Asia of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). We present a framework considering indicators along four relational value dimensions about people's relationships with nature: security and sovereignty; health; equity and justice; and heritage, social identity and stewardship. The framework has been operationalized for three nature's contributions to people (NCP): regulation of freshwater quality and quantity, food and feed, and physical and psychological experiences derived from nature. We identify ways to empirically assess relational values of nature's contributions to people at regional and continental scales with social-ecological indicators and proxies, ranging from biophysical indicators to indicators that intersect socio-economic with biophysical data. We conclude that many of the identified indicators can be considered as useful proxies of relational values in a quantitative way. The analysis shows that relational values are essential to consider at the science-policy interface as they are an important set of values that people hold about nature and that go beyond instrumental relations.

ARTICLE HISTORY

Received 9 May 2019
Accepted 4 December 2019

EDITED BY

O'Farrell, Patrick

KEYWORDS

Nature's contributions to people; ecosystem services; biodiversity; human well-being; quality of life; human-nature relationship; environmental ethics; indigenous and local knowledge

1. Introduction

1.1. Relational values and their assessment within the IPBES regional assessment for Europe and central Asia

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) aims to integrate diverse conceptualisations of the values of nature, nature's contributions to people (NCP, Díaz et al. 2018) and good quality of life into policy decisions (Pascual et al. 2017a). From the development of its conceptual framework, IPBES has acknowledged the relevance of integrating and operationalizing *relational values* (RV) within its work programme including its assessments (Díaz et al. 2015; Pascual et al. 2017a; Chan et al. 2018). IPBES interprets RV as values that contribute to desirable relationships between people and nature, and

among people (through nature) (Pascual et al. 2017a; IPBES 2018). In a similar vein Chan et al. (2016) and Chan et al. (2018) approximate RV as being distinct from instrumental and intrinsic values, emphasizing those preferences, principles, and virtues associated with the relationships that people have with components of nature, i.e. when the relationships themselves matter to people, beyond a means to an end. Different dimensions of RV comprise eudaimonic values, which contribute to a meaningful life worth living in an Aristotelian sense (Chan et al. 2018). Thus, eudaimonic RV are associated with the values of nature as they contribute to reveal the importance of a meaningful life, including aspects of physical, mental and emotional health, security and livelihoods, cultural identity, heritage and stewardship, and perceptions of equity and sense of fairness and justice (Pascual et al. 2017a). Furthermore, RV can represent the

importance of the conditions to protect the life-supporting system, which allows people to define themselves and give sense to their existence (i.e. fundamental values) (Arias-Arévalo et al. 2018). Hence, fundamental RV represent, for example, the importance of nature because of its contribution to develop people's own identities (e.g. via culture, heritage and stewardship), health and security (Arias-Arévalo et al. 2018). Finally, RV also connect to core values about nature as related to (universal) moral values such as care, responsibility and stewardship (Pascual et al. 2017a; Chan et al. 2018; Himes and Muraca 2018).

In some cases, different dimensions of RV can be expressed at the same time in a particular context. For example, RV such as caring for the land can contribute to a meaningful life by supporting the quality of life dimension associated with promoting or taking care of one's cultural and historical heritage, identity and one's role as steward of nature. Caring for land can also lead to universal moral values about justice, when the responsibility of taking care of the land is related to core values of fairness, equity and justice. This is the case when, e.g. a farmer who has a sense of belonging to the land may take care of the land by not polluting it with agrochemicals and in this way, develops a sense of equity and justice towards other farmers since the use of agrochemicals can affect their lands. The responsibility towards the land and towards other farmers can be seen as two different dimensions associated with RV.

RV are considered a distinct type of value when compared with intrinsic values ('nature being valuable for its own sake') and instrumental values ('nature being a means to an end') (Chan et al. 2016; Himes and Muraca 2018). Pascual et al. (2017a) sketch a gradient between aspects of instrumental, relational, and intrinsic values and do not draw strict boundaries between such types of values. For example, people can value nature as it contributes to a good life by providing material NCP that increase the quality of life (instrumental values) or by supporting a meaningful life worth living (eudaimonic RV). One way to distinguish between instrumental and relational values is by looking at the substitutability of the thing being valued. While instrumental values reflect a means to an end (towards the quality of life), these means might be substitutable. Instead, RV reflect meaning-saturated relationships with nature (Chan et al. 2018). Such relationships meaningfully matter to people, and as such are not substitutable from the valuer's perspective (individually or collectively). This forms the essential basis of RV (Chan et al. 2018). RV can hence be considered as a third broad category of values that outside the space of instrumental and intrinsic values (Chan et al. 2016; Pascual et al. 2017a). In other words, instrumental, relational and intrinsic values provide an intuitive canvass of distinct values (Piccolo 2017) with

sometimes fuzzy boundaries between them (e.g. Arias-Arévalo et al. 2018).

Together, the conceptual contributions of Díaz et al. (2015) and Pascual et al. (2017a) have set the stage for the integration of RV into IPBES assessments as a distinct category of values that can be used for decision-making. In this paper, we report on the approach used in one of the four IPBES regional assessments, the Europe and Central Asia (ECA) assessment (IPBES 2018), to capture RV of and about nature and NCP (Martín-López et al. 2018). Instead of developing new knowledge, the ECA assessment has focused on currently available empirical findings and indicators. Notwithstanding limited existing research on RV in the ECA region, the IPBES ECA assessment report has spelt out diverse conceptualizations of values.

Here we seek to fill an important knowledge gap in the research of RV of NCP, that is, to identify social-ecological indicators (as proxies) that can be used to assess RV of NCP at regional and continental scales. Our aim here is to report on the process and the results from operationalizing RV of NCP in the IPBES ECA assessment. Indicators summarize, synthesise or aggregate data and information in a format that is understandable for decision-makers (Layke et al. 2012). Hence, indicators are expected to convey complex realities to specific decision contexts, and as such embody a way to transfer knowledge from science to policy. As is the case with large-scale assessments, indicators enable the monitoring and communication of trends, for instance in the quantity, quality and value of NCP, nature or good quality of life (Ash et al. 2010). In the context of IPBES, assessing NCP and their associated RV requires developing social-ecological indicators, either through bridging biophysical and socio-economic indicators (Olander et al. 2017), proxies or metrics that are based on multiple indicators. Also, indicators ideally need to inform on long-term trends, on progress towards achieving policy targets or aims (e.g. Aichi targets, Sustainable Development Goals), and need to be comparable across regions and different assessments. This poses particular challenges for indicators associated with RV, as they feature the interplay between biophysical and socio-economic information, e.g. the percentage of a population with access to drinking water (in contexts where there is natural availability of water) as an indicator of contextual notions of held values related to justice or equity.

We developed an analytical framework that considers multiple indicators along four RV dimensions about people's relationships with nature, including: (1) collective notions of security and sovereignty, (2) health towards a good quality of life, (3) contextual held values associated with equity and justice, and (4) aspects of natural heritage, social identity and

stewardship of the environment. These four dimensions are associated with the RV dimensions in the IPBES ECA assessment (Martín-López et al. 2018). These have been partly requested by the governments participating in IPBES and also been informed by the IPBES values and valuation guide (IPBES 2015). The analytical framework has been operationalized for three NCP of the 18 NCP categories defined in Díaz et al. (2018): regulation of freshwater quality and quantity¹ (as regulating NCP), food and feed (as material NCP), and physical and psychological experiences derived from nature (as non-material NCP related to recreation). We have selected these exemplary NCP as they have been associated with different RV dimensions in the ECA assessment (Martín-López et al. 2018), and since indicators (and proxies) and data were available for these three NCP. We subsequently discuss challenges and most evident knowledge gaps, and a road ahead also in light of the on-going IPBES values assessment.

1.2. The IPBES regional assessment for Europe and central Asia

Between 2015 and 2018, around 100 experts of the IPBES Regional Assessment for ECA have critically evaluated and synthesised existing knowledge on status and trends of nature and its NCP, the derived good quality of life, drivers of change, scenarios and governance options for the region. The ECA assessment was commissioned in

response to requests from 130 governments to IPBES (IPBES 2018). In March 2018, the sixth plenary of IPBES approved the Summary for Policy Makers and accepted the technical assessment report. The ECA region encompasses 54 countries in four subregions: Western, Central, and Eastern Europe, as well as Central Asia (Figure 1).

The ECA region includes countries with different geography and history, but also common properties. The ECA region shares many cultural-historical features reflected in similarities in land use, biodiversity and ecosystem services. Nevertheless, there is a high heterogeneity in natural and socio-cultural aspects. The ECA region ranges over the polar, temperate and subtropical climate zones. Large parts of ECA lie in the subarctic and humid continental climate zones, but most of the human population lives under oceanic, Mediterranean or continental climates. A large portion of ECA is highly fragmented in terms of geomorphology by mountain ranges and lake and sea coasts and major river systems, while most of Eastern Europe and Central Asia are lowlands or plateaus. Highly variable local conditions create a fine mosaic of land use and habitat types for most of Western and Central Europe, including diverse cultural landscapes. Large areas of sparsely inhabited land exist in Eastern Europe and in Central Asia where ecosystems are less modified by local human activity, but nevertheless, are affected by global change and natural resource extraction.



Figure 1. The Europe and Central Asia (ECA) region of the IPBES assessment.

Source: IPBES (2018).

¹For simplicity reasons, this category is merged from the two water-related NCP in Díaz et al. (2018), p. 6. Regulation of freshwater quantity, location and timing and 7. Regulation of freshwater and coastal water quality.

Further details and references for this basic description can be found in (IPBES 2018). The ECA assessment concludes that biodiversity in the region is in continuous strong decline (IPBES 2018). In recent years, national and international sustainability and conservation policies and actions have contributed to reversing some negative biodiversity trends. Across the region, NCP is unevenly experienced by people and communities. The IPBES ECA assessment also found that the ECA region is heavily telecoupled with the rest of the world in that it strongly depends on other world regions through the net import of renewable resources, having impacts on ecosystems

Box 1. Regulation of freshwater quantity and quality.

This combined NCP category involves the ecosystem's ability to: (i) regulate the flow and quantity of freshwater used for drinking, irrigation and industrial purposes, and (ii) the capacity of ecosystems to remove or break down excess nutrients and other pollutants in freshwater bodies.

Evidence from the IPBES ECA assessment indicates that water flow regulation, as measured through water retention, stream flow and base flow, shows mixed trends for ECA, with especially decreasing trends for this NCP in the European Union. Freshwater supply, indicated by renewable internal freshwater resources available per capita (regardless of the purpose), has generally decreased by 15% since the 1990s and up to 45% since the 1960s (FAO 2016). Trends of the actual use and abstraction of freshwater resources are mixed, with decreases in Western Europe and notable increases in the rest of the ECA region. In Western and Southern Europe, agriculture (39%) and energy (23%) account for more than half of the sub-regions' water use, with public water supply responsible for 27%. However, water abstraction by the energy sector is markedly higher in Eastern Europe (45%) and Central Asia. Areas suffering from severe droughts, mostly in Southern Europe and Central Asia are typified by extremely high water abstraction by agriculture. The IPBES ECA assessment also finds that regulation of water quality has declined throughout the ECA region, predominantly due to the conversion and loss of floodplains, wetlands and other important habitats (60%). Other biophysical indicators of water quality regulation included the ecological status of water bodies and the concentrations and removal rates of nitrogen and phosphorus.

Box 2. Food and feed.

The assessment found that overall food production from agriculture in the region increased by 56% between the 1960s and the 1990s. Since the 1990s the region has experienced a marked drive towards mechanization and intensification of fertile areas and an abandonment of mountainous and less productive areas (Caraveli 2000), that caused a decline of 33% in food production until 2014. Another indicator of intensification of land use in the agricultural system is the share of cultivated land per capita, which is currently decreasing in spite of the increases in the production of some key crops such as cereals, fruits, vegetables, and some processed crops such as olive oil and rapeseed oil. Since the early 2000s meat and eggs production, largely industrially fed with import-based compounds, is increasing in the region, mostly influenced by the growing production in Eastern Europe. Cattle represent the largest share of livestock animals in ECA. Abundance of sheep and goats, traditionally more associated with extensive and pastoralist management systems, is declining. Maize for biofuels and feed production have also seen rapid increases in the last three decades, with for example an increase of more than 50% in the production of industrial feeding compounds in the EU-28. Particularly in the Mediterranean basin, food sovereignty and health are largely influenced by these trends.

Box 3. Physical and psychological experience.

The physical and psychological experiences arising from interactions with nature are often linked to different forms of recreation (e.g. hiking and climbing), activities involving species, for example birdwatching, and extractive recreational pursuits such as hunting, mushroom gathering and fruit picking (Bell et al. 2007; Seeland and Staniszewski 2007; Schulp et al. 2014). Recreational fishing, birdwatching, water sports, whale-watching, and swimming are some of the most popular recreational activities based in marine and coastal systems (Beaumont et al. 2007; Ahtiainen et al. 2013). In 2016, 31% of the people surveyed by the Eurobarometer mentioned nature as a determinant factor for selecting tourist destinations (European Commission 2016). In the European Union 38% of the area has been identified as having high outdoor recreation potential (Paracchini et al. 2014), especially locations containing coastal and freshwater systems and broadleaved woodlands (Hornigold et al. 2016). Despite the importance of nature for leisure and tourism the capacity for nature-based recreation in ECA in recent decades has declined because of land-use change (Liquete et al. 2016; Pietilä and Fagerholm 2016). In urban areas green spaces provide valued recreational experiences, such as walking and outdoor sports (Baró et al. 2016; Smrekar et al. 2016). There are, however, uneven trends in the availability of urban green spaces with increases in Western Europe from 2000 to 2006 whereas in Central and Eastern Europe most cities experienced a decline in this period (Kabisch and Haase 2013).

and people in the rest of the world (Martín-López et al. 2018). We summarise the status and trends of the three selected NCP as assessed in the ECA assessment (Martín-López et al. 2018), on which our assessment of RV is based: regulation of freshwater quantity and quality (Box 1), food and feed (Box 2), and the physical and psychological experience derived from nature (Box 3). For a more detailed explanation of the status and trends of these NCP, see Martín-López et al. (2018).

2. Methods

2.1. Dimensions of relational values of nature's contributions to people's good quality of life

In this section, we conceptually elaborate the four dimensions of RV that have been operationalized in the IPBES ECA assessment: (1) security and sovereignty, (2) health, (3) equity and justice, and (4) heritage, identity and stewardship. Specifically, we present a framework (Figure 2) that conceptualises the meaning-saturated relationships that connect NCP with these four dimensions of people's good quality of life. These value dimensions span from tangible aspects, such as security of basic needs (food, water and energy) to intangible aspects, such as identity and stewardship. The selection of these dimensions covers the whole spectrum of essential aspects for the achievement of a fulfilled and meaningful human life (IPBES 2015), and thus are closely associated with our generalizable empirical interpretation of RV (including fundamental and eudaimonic RV). Note that we do not cover RV associated with individuals (as, for instance, notions of security, equity and justice); rather, we provide indicators

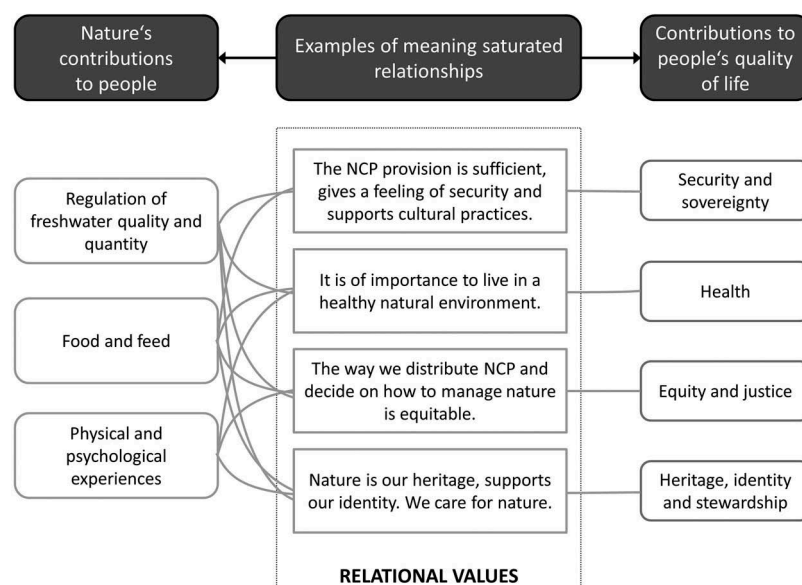


Figure 2. Framework of dimensions of relational values of Nature's Contributions to People (NCP) and their relations with different dimensions of people's quality of life that were operationalized in the IPBES regional report for Europe and Central Asia. Selected NCP have been chosen for this paper.

for collective notions of RV. This is because the IPBES ECA assessment was conducted at the regional scale and synthesised evidence across social groups, study sites, cases, and countries. It should be noted that due to the limited set of published empirical studies that use relevant indicators, the four RV dimensions for the three NCP are covered to different extents. For instance, we could not report on indicators for security and sovereignty for the NCP physical and psychological experiences. In addition, some of the indicators can be used in more than one of the four value and quality of life dimensions represented by Figure 2. For example, the indicator of access to drinking water can represent the importance of freshwater quality for health and security, conditions by which people develop their lives and achieve a fulfilled and meaningful human life. The choices in any assessment over how to use indicators in relation to value dimensions will depend on the context and data availability.

2.1.1. Security and sovereignty

The *meaning-saturated relationship* of food, water and energy security and sovereignty includes the political, social, spiritual and cultural ways in which food, water and energy are produced, transformed, traded and consumed by and for people. For example, pastoralists' intimate rela-

tions to their animals, the relevance of food in religious rituals and celebrations across cultures all over the world, or the ways in which food cultures define and represent people's identities, are some of the ways in which RV operate in relation to the material-non material gradient associated with NCP (Figure 2).

Water², food³ and energy⁴ security have been defined in different ways. The most widely used definitions (FAO 1996; UN 2010; UN-Water 2013) have in common the dimensions of availability (in a sufficient quantity), access (in physical and economic terms) and stability (uninterrupted availability). For water and food (as material NCP), the quality dimension is also a pillar in the definition of security (Norman et al. 2010; Ang et al. 2015; McNeill et al. 2017) and utilization is also widely acknowledged within the dimensions of security. All dimensions of security mediate the physical relation of people to food and the land providing it, and in doing so they do not only contribute to the quality of life via a sense of security, but also to health (Weiler et al. 2014). Via intangible interactions associated with cultural and emotional ties they also contribute to social identity, heritage and stewardship (Koochafkan and Altieri 2011). Cultural identity,

²Water security has been defined as 'the capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socioeconomic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability' (UN-Water, 2013).

³Food security is achieved 'when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO, 2014).

⁴Energy security has been defined as 'the access to clean, reliable and affordable energy services for cooking and heating, lighting, communications and productive uses' (UN, 2010) and by the IEA (2019) as 'the uninterrupted availability of energy sources at an affordable price'.

emotional aspects and power issues embedded in agrifood systems are also considered by the approach of ‘food sovereignty’⁵ (Patel 2009), which is understood as a condition for the full realization of the right to food (De Schutter 2014), hence incorporating also the issue of ‘justice’.

2.1.2. Health

The *meaning-saturated relationship* related to health builds on the importance of living within an environment that has the key natural elements, including NCP, crucial for human health (Figure 2). Health is defined as ‘a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’ (WHO 2014). While health is determined by a multitude of factors, nature and NCP are important factors (Barton and Grant 2006; Naeem et al. 2016). A diversity of nature-health interlinkages were conceptualised by the Millennium Ecosystem Assessment (MA, Millennium Ecosystem Assessment 2005) and in the World Health Organisation’s State of Knowledge (SoK) review (WHO and CBD 2015). These linkages and the contribution to a meaningful life through achieving a good health include nature related health benefits. Examples are the role of nature and NCP in contemporary and traditional medicine (Heinrich and Jäger 2015; Payyappallimana and Subramanian 2015), the development of new pharmaceuticals supported by bioprospecting and often based on lessons from traditional knowledge (Newman and Cragg 2016), food and nutrition security (Hillel and Rosenzweig 2008; Hodgkin and Hunter 2015) and the contribution of non-material psychological and physical experiences beneficial to health, e.g. the use of greenspace for psychological health (Clark et al. 2014).

2.1.3. Equity and justice

Here the *meaning-saturated relationship* between people and nature relating to equity and justice refers to the contextualized held values of equity and justice with respect to the distribution of NCP. This relationship has overlaps with other human-NCP relationships, as the distribution of food and water affects security and health, while the distribution and access to land might have an effect on human-nature connectedness and thus on identity, heritage and nature stewardship. Moreover, individual notions of what is equitable or just can affect, for instance, the way a farmer acts responsibly and takes stewardship for the land. Several aspects of equity and justice are associated with NCP and good quality of life (Schröter et al. 2017). We here refer to *justice* as fundamental moral rights and

obligations, while *equity* comparatively evaluates relationships, including access and control among different societal groups regarding NCP and nature. *Distributive equity and justice* concerns the sense of a fair allocation, among individuals, groups or stakeholders, of positive and negative NCP resulting from management decisions and resulting distributive effects on people’s good quality of life (Daw et al. 2011; McDermott et al. 2013).

2.1.4. Heritage, identity and stewardship

The *meaning-saturated relationship* of heritage, identity and stewardship refers to the ways in which nature contributes to the development and maintenance of a sense of individual and social identity, and stewardship of nature through both tangible and intangible heritage. Heritage in its broader sense refers to tangible places and objects and intangible aspects (e.g. languages, practices) passed on from one generation to another. Tangible and intangible heritage associated with nature and NCP helps to maintain cultural meanings and a sense of identity (Klinar and Geršič 2014). Nature contributes to heritage, identity and stewardship dimensions through providing opportunities for spiritual, aesthetic and recreational experiences, learning and inspiration, as well as for developing and maintaining indigenous and local knowledge. These experiences are linked to both material aspects of nature-related practices (e.g. hunting, fishing, etc.) and intangible ones, for example, myths, legends and religious practices associated with specific species and ecosystems (Daniel et al. 2012).

2.2. Synthesis approach

To find appropriate indicators of RV, we conducted a systematic literature search, followed by a critical synthesis of the search results. Hence, the aim was not to find or develop novel indicators, but rather commonly used ones. The search method involved search strings used to review the literature by the IPBES chapter authors. These search strings⁶ consisted of terms related to the specific NCP covered in this analysis as well as geographical search terms to cover the region and each of the countries in the ECA region. This search was performed between 2015 and 2017 using the Web of Science (WoS) and the information was extracted from the 25 most relevant (search filter in WoS) papers for each of the subregions in ECA. Information about each type of RV was searched for with the same method connected with Boolean operators for specific value terms. For example, the search string for NCP and RV associated with

⁵Expanding on food security, food sovereignty is defined as ‘the right of nations and peoples to control their own food systems, including their own markets, production modes, food cultures and environments’ (Wittman et al. 2010).

⁶For the whole set of search strings, see: https://www.ipbes.net/sites/default/files/eca_ch_2_appendix_2.1_protocol_of_the_systematic_review_used_for_chapter_2_of_the_eca_assessment.pdf.

contextual justice and equity was: ('ecosystem service*' OR biodiversity OR nature OR ecosystem OR 'natural capital' OR 'green infrastructure') AND (justice OR equity OR fair* OR 'access and benefit sharing' OR access OR distribution OR 'distributional justice' OR 'distributive justice' OR 'procedural justice' OR intergenerational OR intragenerational). In addition, the authors searched grey literature and intermediary assessment reports, which were subjected to two stages of peer-review of the assessment report in which additional information was added after expert consideration. Additional data on corresponding indicators were obtained from global and continental-scale databases (UNSTAT, FAOSTAT, EUROSTAT, World Bank). Overall, this search related to the generalising perspective of NCP as elaborated by Díaz et al. (2018), i.e. feasible for analytical purposes and striving for a universal applicability across contexts. Note that indicators and related information were considered appropriate for the ECA assessment if they i) inform on status and trends over time (long term), ii) inform on the outcome of a (policy) process or progress towards a target (e.g. SDG, Aichi), and iii) are compatible with or applicable to the other regional assessments of IPBES.

Moreover, we conducted a content analysis of the UNESCO document that resulted from the ECA (Indigenous Peoples and local communities) Dialogue Workshop in Paris (January 11th–13th 2016) and follow-up discussions with the selected Indigenous and Local Knowledge (ILK) holders and ILK experts (Roué and Molnár 2017). The content analysis of the narratives of the selected ILK holders, particularly herders, farmers and foresters, contributed to ascertain the RV of NCP

through qualitative data. This search related to the context-specific perspective of NCP as elaborated by Díaz et al. (2018). Nine chapters of Roué and Molnár (2017) were used for content analysis, which was conducted using the MAXQDA programme. The analysis included a reiterated review of the nine chapters that aimed at identifying how each NCP was described by the ILK holders and the reasons why they considered these NCP important.

3. Results

The assessment of the four dimensions of RV in Sections 3.1–3.4 identifies social-ecological indicators (or proxies) that can represent the importance of the three selected NCP for providing the conditions by which people develop their lives and define themselves, i.e. fundamental RV, and achieve a fulfilled and meaningful human life, i.e. eudaimonic RV. These are summarised in Table 1.

3.1. Security and sovereignty

3.1.1. Regulation of freshwater quantity and quality

Water security for the ECA region was mainly assessed through the indicators 'percentage of population with access to improved drinking water sources' (World Bank 2016) and 'freshwater withdrawal as percentage of total renewable water resources' (FAO 2016). These two indicators act as

Table 1. Social-ecological indicators and proxies that represent the importance of the three selected NCP from the lens of relational values.

	Security and sovereignty	Health	Equity and justice	Heritage, identity and stewardship
Regulation of freshwater quantity and quality	<ul style="list-style-type: none"> - Percentage of population with access to improved drinking water sources (<i>proxy</i>) - Freshwater withdrawal as percentage of total renewable water resources (<i>proxy</i>) 	<ul style="list-style-type: none"> - Quality of drinking water and natural water basins (<i>proxy</i>) - Percentage of population with access to improved drinking water sources (<i>proxy</i>) 	<ul style="list-style-type: none"> - Distribution of access to safe and adequate drinking water (regional differences) (<i>proxy</i>) - Freshwater withdrawal as percentage of total renewable water resources (intergenerational equity) (<i>proxy</i>) 	<ul style="list-style-type: none"> - Occurrence of cultural practices and rituals related to water bodies and waterscapes - Occurrence of traditional beliefs related with water
Food and feed	<ul style="list-style-type: none"> - Food availability: Average dietary energy supply adequacy; undernourishment (<i>proxies</i>) - Food stability: Per capita food production variability (<i>proxy</i>) - Food sovereignty: land grabbing rates (<i>proxy</i>) 	<ul style="list-style-type: none"> - Diversity of collected wild food (<i>proxy</i>) 	<ul style="list-style-type: none"> - Divergent regulation of rights to use non-timber forest products - Total land grabs as percentage of arable land (<i>proxy</i>) 	<ul style="list-style-type: none"> - Occurrence of cultural practices, traditional experiences or rituals related to wild food - Number of practices related with wild food in the List of the Intangible Cultural Heritage of Humanity
Physical and psychological recreational experiences	NA	<ul style="list-style-type: none"> - Access to recreational green space (<i>proxy</i>) 	<ul style="list-style-type: none"> - Distribution of access to urban green space (<i>proxy</i>) - Proportion of forests publicly accessible for recreational purposes 	<ul style="list-style-type: none"> - Occurrence of local traditions, products, identities that contribute to recreational experiences in nature - Level of contribution of recreational experiences in nature to local identity, sense of place and belonging

proxies of RV since we assume a positive relationship between the extent of the NCP of regulation of freshwater quantity and quality and securing a meaningful life of people in ECA. As noted above indicators can relate to more than one value dimension in keeping with the conceptual recognition that values can overlap. Access to safe and adequate water is an example of such an indicator since it can relate to water security and to health.

Throughout the region, water security has increased since the late 1980s (FAO 2016; Gain et al. 2016; World Bank 2016), despite increasing threats such as water pollution and reduced water availability. Safe drinking water is currently secured for 95% of the region's population, while freshwater extraction relative to available freshwater resources has decreased from 30% to 15%. Therefore, these indicators of regulation of freshwater quantity and quality suggest that nature has contributed to water security in the region, thereby supporting a meaningful life of people in ECA. In Western Europe and Central Europe, water security has remained stable since the late 1980s. Water scarcity and water stress in most of the Western and Central Europe have decreased since the 1990s, but remains threatened by overexploitation for agriculture and energy purposes, and climate change. Structural water stress was reported for around 20 river basins, such as the Danube and most of the Mediterranean region (Skoulidakis et al. 2017). Both in Eastern Europe and Central Asia, water security is increasing somewhat but remains unstable. Access to improved drinking water has increased to 95% and 85%, respectively. Sustainable freshwater extraction in Eastern Europe has increased by 10% and seems to have decreased in Central Asia (Alexander and West 2011). Karabulut et al. (2016) identified several Danube river sub-basins in Eastern Europe as being at risk of becoming water scarce. Climate change and excessive water abstraction especially pose a threat to Central Asia, which is considered to be facing water scarcity (Gain et al. 2016; UNEP and UNECE 2016).

3.1.2. Food and feed

Several proxies (e.g. food availability, accessibility, stability) can indicate how the NCP of food and feed contributes to food security and in doing so, supports a meaningful life of people in ECA. Overall, food security is ensured in the ECA region, though some dimensions show great differences across subregions (data from FAO (2017)). Food availability, for instance, is adequate, with an average dietary energy supply adequacy ranging from 137% in Western Europe to 121% in Central Asia. There was a decline during the last decade of the twentieth century in Central Asia, but since the early 2000s it has been increasing or stable. Food accessibility and

utilization varies between subregions. Since the 1990s, undernourishment has been very low in Central and Western Europe, while in Eastern Europe, it reached almost 45%. In Central Asia, undernourishment has fluctuated and currently still reaches 20%, while in Eastern Europe it has been reduced to 7%. Regarding food stability, per capita food production variability has followed differing trends within the region, with an increasing tendency of 45% on average in the region since 2010, particularly in Central Asia (75%) and Eastern Europe (64% and the highest variability), what might be considered a threat to food security.

Beyond food security, food sovereignty is threatened by land grabbing, i.e. large-scale control of extended tracts of land by large investment companies (van der Ploeg et al. 2015), frequently from abroad. The real magnitude of this phenomenon, which leads to crop production being intensified and oriented to distant markets other than local needs, is not captured by official statistics (TNI 2016) due to the lack of records of transactions between legal entities that often act through their subsidiaries or partner companies (Constantin et al. 2017). The only available data documented 51 cases occupying a total area of 4.4 million ha in ECA in 2012. Russia, Ukraine and Romania have been reported as the countries with the largest land-grabbed areas by European companies (GRAIN 2016).

ILK holders who use and control the land also acknowledge the security dimension of food and feed, value local 'wild' forages relative to cultivated fodders from markets. For example, a Sami herder acknowledged '*[Arboreal lichen] is a fantastic food for reindeer under catastrophic grazing conditions. There is no such feedstuff to buy with money. Even for money I don't think we would accept that they cut a forest full of arboreal lichen. There is no forage to place on level with arboreal lichen*' (Roturier et al. 2017).

3.2. Health

3.2.1. Regulation of freshwater quantity and quality

Both access to and the quality of water sources are crucial to human health and build the foundation for the relationship between people and nature regarding the importance to live in a healthy environment. The indicator 'access to safe and adequate water', which was also one of the two indicators for security and sovereignty, generally is increasing in the ECA region.

Water quality remains a major challenge, especially in Eastern Europe and Central Asia. In the Mediterranean region water quality is strongly affected by lower water flow regulation and water scarcity, and many European waterbodies remain affected by dissolved inorganic nutrients and pesticides (EEA 2015b). Water pollution in some Western and Central European countries has decreased, but in Eastern Europe and

Central Asia on-going water pollution remains a threat for the availability and quality of drinking water (UN-Water 2011). In addition, decreased water levels in natural reservoirs have led to increased water pollution and health threats in those regions, especially in the Aral Sea region and rural Tajikistan (Carpenter et al. 2006; UN-Water 2011). Despite a lack of systematic reviews of the positive or negative effects of waterbodies ('blue space'), they can have many types of influences on health (Völker and Kistemann 2011). Non-communicable diseases may be associated with contaminated water, whereas positive associations with mental health might be even stronger for blue than it might for green space (de Vries et al. 2016).

3.2.2. Food and feed

There is well-established general evidence regarding the contribution of biodiversity to food and nutrition security and nutrition diversity (Hillel and Rosenzweig 2008; Hodgkin and Hunter 2015). For ECA, data are limited to the cultural and economic significance of wild foods which indicates the role such food plays in dietary diversity (Łuczaj et al. 2013; Schulp et al. 2014), which in turn might affect human health. Schulp et al. (2014), for instance, identified 38 species of game, 27 species of mushrooms, and 81 species of vascular plants that are regularly hunted, collected and consumed in the European Union, with over 100 million European Union citizens consuming diverse forms of wild food each year. There is evidence that the activities of collecting and consuming wild foods in the European Union are also relevant to build meaningful relationships with nature in terms of a sense of place and a sense of belonging in nature Schulp et al. (2014).

Evidence also shows that dietary diversity may be associated with certain non-communicable disease risks, though this is also moderated by the effects of lifestyle and other socio-economic factors (Johnston et al. 2014; Hunter et al. 2015).

3.2.3. Physical and psychological experiences

The RV linked to the non-material NCP of physical and psychological experiences include impacts on mental and physical well-being arising from exposure to and experiential aspects of nature. The impacts of this NCP on human health can vary markedly geographically and amongst groups of people because the effects of biodiversity and NCP on human health are influenced by the characteristics of different types of communities and natural environments (Horwitz and Kretsch 2015; van den Berg et al. 2015). Indicators for access to green space suggest that there was an overall increase between 2000 and 2006 in urban green spaces in Western Europe but this was accompanied by a decline in cities in Eastern and Central Europe (Kabisch and Haase 2013). In the EU access to green recreational spaces was also found to reduce

differences in mental well-being between groups of people (Mitchell et al. 2015) but other research shows that a wide range of other cultural, social, and economic factors also influences the strength and nature of the linkages between greenspace and health (Clark et al. 2014). In addition, recreational experiences in nature that contribute to local traditions, products and identities show varying patterns of change. The collection of wild products such as fruits, nuts, mushrooms, berries and truffles is more prevalent in Western Europe than Central and Eastern Europe but the diversity of wild plants collected has declined in both Western and Central Europe (Reyes-García et al. 2015). At the same time the revival of 'traditional' cuisines has maintained the use of certain wild edible plants (Schulp et al. 2014). The effect on mental health of physical and psychological experiences linked to nature is also clearly acknowledged by ILK-holders, such as herders: 'For me, this means relaxation. I have time to watch the wildlife, game and birds' (Kis et al. 2017).

3.3. Equity and justice

3.3.1. Regulation of freshwater quantity and quality

Distributive equity and justice as contextualized held values refer to the distribution of NCP across ECA, within subregions and between different social groups (intragenerational) and between generations (intergenerational). Strong regional differences of access to sufficient and clean drinking water, water flow and water quality regulation were noted in the assessment. In addition, unsustainable water resources exploitation will affect the water availability of future generations and therefore their ability to achieve a meaningful life (Falloon and Betts 2010; EEA 2015a).

Regions in Europe with high water flow regulation are characterized by large areas of natural vegetation or less intensive agriculture (Stürck et al. 2014), whereas river basins and areas with densely populated cities and intensive agriculture are currently water stressed. The same counts for areas with poor water quality, which is furthermore affected by upstream land-use intensification and the excessive nutrient use. Furthermore, the northern part of West and Central Europe showed higher or more stable water flow regulation as compared to the south, i.e. most Mediterranean countries as well as Austria and Germany (Stahl et al. 2012; Vidal-Abarca Gutiérrez and Suárez Alonso 2013; Skoulidakis et al. 2017).

The access to safe and adequate drinking and irrigation water is substantially lower in Eastern Europe and Central Asia, with notable difference within Central Asia too. Fifteen percent of people in Central Asia and 5% in Eastern Europe lack access to safe drinking water, compared to less than 1% in

Western and Central Europe. Climate change and unsustainable water use make the former more vulnerable (FLERMONECA 2015; Karabulut et al. 2016). Furthermore, high upstream water abstraction and uneven distribution have continued to threaten water security in Central Asia (Abdolvand et al. 2015; Conrad et al. 2016). The health of children in Central Asia is disproportionately threatened due to a lack of access to safe drinking water, especially in the Aral Sea region and rural Tajikistan (Carpenter et al. 2006). This demonstrates the overlap between different dimensions of RV: equity as a held value concerns security and health. Finally, the overall decrease of freshwater availability and largely increasing trends of freshwater extraction indicate consequences for future generations and thus matters for intergenerational equity.

3.3.2. Food and feed

With respect to food and feed, the IPBES ECA assessment notes the differential access of people to non-timber forest products as an indicator for distributive equity associated with access to NCP. Access to forests is regulated differently across the region, allowing free access of everyone to forests (freedom to roam, or 'everyman's right') in the Nordic countries and in some other countries (e.g. Germany, Austria, Czech Republic, Hungary) (Bauer et al. 2004) or access through community-based governance as commons (Guadilla-Sáez et al. 2017). This enables different social groups to develop held values of justice and equity by collecting food in forests without payment, and hence not excluding people based on lack of ability to pay. In other countries permission or payment of charges can apply in private forests (e.g. in

Croatia, Cyprus, France, UK, Turkey) (Bauer et al. 2004), which could potentially exclude social groups who cannot afford the charges.

3.3.3. Physical and psychological experiences

The IPBES ECA report found a case-based indication of uneven distribution of recreation opportunities across social groups. For instance, UK protected areas are actively used by older people and men (privileged social groups), and less so by minorities (Booth et al. 2010). A similar unequal pattern has been observed in access to green space in European cities that provide opportunities for recreation. It has been found that residential areas with specific ethnic groups (Comber et al. 2008) or a high proportion of immigrants (Kabisch and Haase 2014) have a lower share of urban green space, leading to unequal distribution of the possibility to recreate. Unequal access to green space has also been found across regions in Europe, with cities in northern, western and central parts offering more opportunities to recreate than cities in the south (Kabisch et al. 2016). Comparable to the access to forests for the collection of non-timber forest products, the right to enter forests for recreational purposes is unevenly distributed across ECA. While high proportions of forests (98–100%) are publicly accessible for recreation in Scandinavia, the Baltic states and other Central European countries with high forest covers (e.g. Bosnia and Herzegovina, Slovenia and Serbia), considerably lower levels of public access to forests are reported for some Western European countries (UK: 46%, France: 25%) (Forest Europe 2015).



Figure 3. Hidrellez rituals continue actively in the Northern Aegean Kaz Mountains of Turkey where the Turkmen settlers wash their face before the break of dawn in order to receive health and bounty of the river waters. Photo © Solmaz Karabaşa.

3.4. Heritage, identity and stewardship

3.4.1. Regulation of freshwater quantity and quality

Freshwater is among one of the most significant natural elements that intricately ties humans with nature based on specific belief and knowledge systems. IPBES ECA assessment has demonstrated that many traditional knowledge systems in ECA depict ecosystems fully alive (Berkes et al. 1998) where water elements help providing meaning and interpreting the world and humans' place in it (Verschuuren 2006). For example, an active ritual throughout the Turkic world continues celebrating the awakening of nature on Hidrellez day with rites that are dependent on water (Walker and Uysal 1973) (Figure 3). Hızır prophet is revered and associated in the folk mind with fertility, with the annual renewal of vegetation, and with the seasonal life cycle – all of which are dependent on water. These ceremonies generally take place in nature, near sources of water, or near tombs and shrines. In rituals before sunrise on that day, Turks construct, in their gardens, models of the things they wish for most such as good health, or write their wishes on pieces of paper which are then either released into rivers and other waterbodies or hung on trees. Other pre-dawn rituals include washing one's self in streams and collecting morning dew believed to have healing properties.

Throughout the ECA region, ILK evidence also supports the importance of freshwater quantity and quality regulation. A local forester in Western Ukraine is sensitive to the changes of acorn production of pedunculate oaks due to climate change effects on freshwater. He states: *'The trees are old and I can almost say that they are not fruiting. And until there was no such drought it was possible to collect acorns. But now, since there is this big drought, what the tree fruits falls down is almost entirely wormy.'* (Demeter 2017). In the boreal region, a Sami reindeer herder expresses their need to adapt to varying water abundance on the ground: *'Maybe it starts to snow in mid November, so we get 10–20 cm of snow. Then comes a thaw weather that melts the snow cover so there's only water left. In the meantime, the ground has frozen by the end of October. So the ground doesn't let through the water anymore: it pools on the ground instead, especially in dry, lichen-rich pine forests. And soon it's icing [on top of the lichen]. It can be better where you have thicker humus where the ground lets through the water.'* (Roturier et al. 2017).

3.4.2. Food and feed

With regards to food and feed, the RV perspective of heritage, identity and stewardship was demonstrated in

the IPBES ECA assessment through references to cultural practices that enhance identity and preserve ILK. Many recreational activities related to food, such as mushroom collecting and berry picking are part of culture and tradition in many Western and Central European countries (de Aragón et al. 2011; Schulp et al. 2014; Hansen and Malmaeus 2016). The current revival of practices linked to 'traditional' cuisine observed in many countries has helped preserve these traditions and their RV (Schulp et al. 2014; Reyes-García et al. 2015). Traditions and rites related to food also form an important part of intangible heritage in the ECA region. Out of 130 elements of intangible heritage from countries in ECA currently inscribed on the List of Intangible Cultural Heritage (UNESCO 2003), 53 are directly linked to nature and many of those are associated with traditional practices of collecting food from wild sources and traditions and rituals linked to food preparation.

Finally, the narratives of ILK-holders also showed the importance of feed in terms of stewardship and identity: *'We live 100% on grass./The way I see it, if there's no livestock, then I don't exist either. No money, no family/I see myself as a herder, so it's very important for a calf to reach the right weight as soon as possible, without fodder, only eating grass and drinking its mother's milk. That's a source of pride to me, that's why I see myself as a herder.'* (Molnár et al. 2017).

3.4.3. Physical and psychological experiences

In ECA, the values of cultural heritage, identity and stewardship are partly linked to how outdoor spaces provide opportunities for leisure, tourism, learning and knowledge acquisition. For example, in rural areas of Western Europe, local traditions, products, identities and knowledges contribute to the growth and development of tourism and recreation activities (Parrotta and Agnoletti 2007; Fernández-Giménez and Fillat Estaque 2012). In urban areas of Western and Central Europe, recreation and leisure are often identified by residents as the most important benefits derived from urban green spaces partly because of the emotional attachment that people develop to particular spaces (Bolund and Hunhammar 1999; Casado-Arzuaga et al. 2013; Mocior and Kruse 2016). Stewardship related to green spaces and ecosystems can be enhanced in locations where outdoor learning provides additional value for learners and teachers in terms of awareness raising and knowledge acquisition (Mocior and Kruse 2016). The importance of physical and psychological experiences to contribute to local identity, sense of place and belonging is strongly expressed by ILK holders, particularly herders: *'This is like home, you can't tell it. It has to be felt. This is the single sentence you can say. You don't have to add anything else. In springtime when you*

go out and smell the fresh air, it cannot be told, the feeling of how wonderful it is' or 'I lived in a farmstead since I was a kid, livestock and nature for me are one and the same.' (Kis et al. 2017).

4. Discussion

In this paper, we aimed to explore evidence of, and indicators for various dimensions of RV (see Table 1), as they connect to people's meaningful lives, that are in turn connected to three different NCP in the ECA region: Regulation of freshwater quantity and quality (a regulating NCP), Food and feed (a material NCP), and Physical and psychological recreational experiences (a non-material NCP). For each NCP, we considered social-ecological indicators (and proxies) associated with four dimensions of RV as they relate to people's good quality of life: security and sovereignty, health, equity and justice, and heritage, identity and stewardship. We first discuss the linkages between different dimensions of RV, and where RV fit in the gradient between instrumental values and intrinsic values (Section 4.1). We then summarise and reflect upon the identified indicators that may be used to evidence RV of NCP (Section 4.2). We discuss how the inclusion of ILK has contributed to the assessment (Section 4.3) and highlight telecoupling as an emerging issue in the assessment of RV (Section 4.4). Finally, we explore the implications of our findings for incorporating RV for the science-policy interface and future IPBES assessments (Section 4.5).

4.1. Relationships between different dimensions of relational values

In this paper, we have defined RV as the '*values that contribute to desirable relationships, such as those among people and between people and nature*' (Pascual et al. 2017a; IPBES 2018, p. 817). However, there is some debate in the academic literature as to whether RV should be considered as a discrete value category that lies between instrumental and intrinsic (Himes and Muraca 2018), or whether it sits along a fuzzy gradient between purely utilitarian/instrumental and biocentric/intrinsic values (Pascual et al. 2017a). In our analysis, we find that it is often not possible to depict clear boundaries between instrumental, relational and intrinsic values. Food, for instance, has instrumental aspects of mere survival, and hence a strong instrumental dimension. However, food is culturally crucially important and the way it is produced and used connects people to their land and culture (IAASTD 2009; Hill et al. 2019). Another example is a physical and psychological experience. This has instrumental dimensions if people

go for a walk with the purpose of feeling healthier, but it also has relational dimensions since experiencing nature physically and psychologically contributes to a meaningful life, i.e. eudaimonic RV, and allows people to define and develop themselves as human beings through such experiences, i.e. fundamental RV. In addition, if physical and psychological experience involves contemplation of nature then it may also connect to intrinsic values (Callicott 2006). Based on this observation, we concur with the argument of Pascual et al. (2017a) that there exists a continuum or gradient from instrumental to relational to intrinsic values.

Our findings suggest strong overlaps and synergies between different value dimensions, especially security and sovereignty, health, and equity and justice. Both water and food security go beyond the issue of security, as they involve access to sufficient amounts of water and food that should also meet quality standards and cultural adequacy. Not meeting these requirements has profound consequences for public health and cultural identity. As a result of the overlaps and synergies, some indicators proved informative on multiple value dimensions. Although this might not be desirable in the light of 'double-counting' and avoiding overlap, it can be considered useful for the context of large-scale assessments, considering the ease with which progress towards targets can be monitored and data can become available.

4.2. Social-ecological indicators for relational values in Europe and Central Asia

Our study identifies ways to empirically measure the importance of RV across four dimensions (security and sovereignty, health, equity and justice, and heritage, identity and stewardship) and associated to three key NCP. Considering the context of the IPBES assessments, the findings needed to be based on readily available information (state of the art rather than newly developed and synthesized). Also, the indicators needed to inform on status and long-term trends of RV as well as other criteria, which naturally limit the number of social-ecological (place-based) indicators.

We argue that RV are an important component of human-nature relationships and NCP, and therefore these values should be taken into account in policy decisions. However, we also note that there is significant variability in terms of the current availability of evidence on RV of NCP in ECA. Particularly, evidence of RV in Central Asia is largely missing. Evidence of RV in ECA was collected using searches of a mix of academic and grey literatures, as well as sources of ILK. One of the difficulties encountered was that the term 'relational

values' is relatively new, and therefore other search terms relating more broadly to the RV concepts were used including terms associated with nature and ecosystem services, as well as terms related to the four assessed dimensions of RV.

In our assessment, we identified social-ecological indicators and proxies, ranging from biophysical indicators (e.g. quality of drinking water) to indicators that intersect socio-economic with biophysical data (e.g. access to urban green space or extent to which free use of non-timber forest products is allowed). This variability in indicators was particularly evident given the diversity of cultural backgrounds across ECA and the different NCP considered in this study. We note that different data sources are required to evidence the different indicators of RV, for example, FAO data, survey data, or collections of rites and practices. Significant data gaps are apparent, in particular on the distribution of and access to different NCP, concrete health-related indicators specifically for the region, or records of rituals, practices and traditional experiences concerning nature and NCP. As such, we did not identify a definitive suite of indicators that could be applicable across the whole ECA region and across NCP but certain useful indicators are set out in Table 1 above.

A major question is to what extent the social-ecological indicators selected for the ECA assessment indicate a direct or indirect connection with RV. Some of these indicators, we argue, are straightforward and can shed light on meaning-saturated (direct) relationships in a quantitative way. For example, the number of cultural practices and rituals related to wild food that are considered in the List of the Intangible Cultural Heritage of Humanity (Table 1) is an indicator that clearly shows the importance of the material NCP of food through the lenses of RV since it illustrates how cultural identity can be reinforced through active experiences with wild food in nature. Other indicators are associated with RV more indirectly and as such, they are considered proxies in Table 1. For instance, access to safe and adequate drinking water (Table 1) purveys a picture about distributional equity (in terms of regional differences), the importance of living in a healthy natural environment, and the related security to fulfil needs for drinking water. The same holds for access to urban green space (Table 1), which can be distributed unequally across groups, hence portrays an equity relationship, and can have differentiated effects on health, while portraying the importance of living in a healthy natural environment. Such indicators, however, are not able to directly reveal that and how people value such relationships actively. For proofing such relationships, place-based research is needed. For example, by conducting social surveys Arias-Arévalo et al. (2017) found several RV in the

narratives about the importance of the Otún river watershed (Colombia) for people. Similarly, Klain et al. (2017) conducted social surveys in Costa Rica and the United States to unravel why people conserve nature. Gould et al. (2019) found five long-standing Hawaiian RV, i.e. righteousness and balance; spirituality, care; right and responsibility; and love and connection – after reviewing the body of information regarding traditional knowledge about relationships between humans, spiritual entities and nature.

It is important to note that an increase of access to safe and adequate drinking water does not necessarily imply that people in ECA have increasingly developed relationships with nature or have increasingly found nature meaningful since the contribution of this NCP to water security also depends on anthropogenic assets (e.g. technology, investments) (Palomo et al. 2016). In fact, given the co-production of this NCP by natural and anthropogenic capitals (Palomo et al. 2016), it is difficult to tease out the RV underpinning the importance of this NCP for people in ECA at the continental scale. Food security is also increasingly depending on anthropogenic assets (e.g. agrochemicals, technology, investments), which indeed might have jeopardized the construction and preservation of meaningful relationships between people, nature and the land. The indicator hence only provides evidence on how the co-production of food and feed by nature and anthropogenic assets (Díaz et al. 2015) supports food security in the ECA region. Thus, when NCP are co-produced by technology, alternative indicators need to be developed that reflect upon relative natural contributions. Large-scale data for such indicators is, however, largely lacking.

Other indicators which were used to assess RV and related quality of life across a large region can rather be considered as proxies for RV (Table 1). For instance, the proportion of forest accessible for recreational purposes can indicate how evenly the access to forests is distributed among countries, being an indicator for equity and justice, but says little, for instance, about the actual use of forest by different groups and how that use fosters meaningful relationships with forests. Therefore, the proportion of forest accessible for recreational purposes can be considered a proxy for RV (Table 1). The list of indicators and proxies for RV is hence a first step and not a comprehensive list. In this sense, future place-based research that seeks to elicit and uncover RV is essential for developing a more complete and comprehensive list of indicators.

4.3. Inclusion of indigenous and local knowledge to assess relational values

A novel contribution of the IPBES conceptual framework is that it explicitly considers the contribution of ILK for the assessment of NCP (Díaz et al. 2018) and

for their valuation (Pascual et al. 2017a). The ECA assessment did not fully succeed in accomplishing such inclusion because of the limited representation of ILK-holders in the Dialogue Workshop in Paris (January 11th-13th 2016) (Roué and Molnár 2017). Yet, the participation of ILK holders who practice ILK in their everyday lives was relatively high, and therefore this dialogue and the resulting report (Roué and Molnár 2017) offer a rich picture of the importance of nature and NCP for farmers, shepherds, herders, foresters and Sami people in Europe. However, the RV uncovered through ILK in this paper are not comprehensive and do not represent the RV expressed by other Indigenous Peoples and local communities in ECA. The methodological approach that includes the ILK Dialogues and an extensive ILK literature review guaranteed the methodological soundness of this approach (Tengö et al. 2017; Hill et al. 2019). Hence, this approach is one of the first to apply the context-specific perspective in addition to the generalizing perspective, as outlined by Díaz et al. (2018).

It has been recently argued that RV have the potential to include ILK and the perspectives of Indigenous Peoples and local communities in environmental management (Sheremata 2018). Likewise, this research shows that ILK can be a reliable source to uncover RV, interlinkages between RV and overlaps between RV (bundles of RV dimensions) and intrinsic and instrumental values. For example, the narrative by Hungarian herders about the importance of grass for their livestock shows the synergies between the RV of security (*'We live 100% on grass./The way I see it, if there's no livestock, then I don't exist either. No money, no family'*), identity and stewardship (*'I see myself as a herder, so it's very important for a calf to reach the right weight as soon as possible, without fodder, only eating grass and drinking its mother's milk. That's a source of pride to me, that's why I see myself as a herder'*). This narrative also shows that although herders consider the notion of care with regards of plant species in the grasslands (*'I took water and watered it [the plant, *Asclepias syriaca*], goat doesn't eat it'*), their relation with these plants is, however, intertwined with an utilitarian approach and thus with instrumental values (*'I know them [pasture plant species] as long as they are good for me, I am into it [= learning/knowning them] because I am interested'*) (Molnár et al. 2017). This result is consistent with the findings from Arias-Arévalo et al. (2018) and Sheremata (2018), who found that although Indigenous Peoples and local communities expressed the importance of nature in instrumental terms, instrumental values coexist with multiple RV. In the same fashion, the act of using certain local, e.g. ethnoveterinary practices has been shown to be tightly linked with the maintenance of transhumant herding practices, cultural identity and therefore generational turnover (Oteros-

Rozas et al. 2013). The nuances of ILK narratives also support recent findings regarding RV. For example, the notion of care as a RV that leads to the expression of other RV, such as identity and stewardship (Jax et al. 2018; West et al. 2018).

4.4. Telecoupling as an emerging issue for the assessment of relational values

Telecoupling, i.e. the intricate linkage of regions through, e.g. interregional flows of NCP (Schröter et al. 2018) has been identified as an emerging issue in the assessment of RV in the IPBES ECA assessment. One of the clearest examples of telecoupling is global food trade, which has implications for RV related with equity. The distribution of benefits and costs of production and consumption is not evenly allocated among regions and social groups (Martínez-Alier 2002; Jax et al. 2013), but rather global distribution of consumption and production patterns place environmental burdens on distant regions (Pascual et al. 2017b) and thus affect global intragenerational equity. For instance, the global trade of soy for animal feed in Europe implies land-use change and intensification associated with production in Latin America and is happening at the cost of natural habitats and rural and indigenous peoples. These are displaced from their customary territories and their connection with nature, sense of place and identity are eroded (Wolford 2008; Leguizamón 2016). Local communities in producing countries of goods like soy for animal feed in the global South are therefore often losers while consumers in the global North often are winners (e.g. Leguizamón 2016). In the agrifood system, these distributional injustices tighten through the effects of land grabbing (Rulli et al. 2013). In Europe, land grabbing, promoted in order to consolidate intensive agriculture, occurs mostly in the Eastern and Central countries, particularly in Hungary and Romania, in some of the most fertile agricultural lands and water sources for irrigation (Antonelli et al. 2015; Constantin et al. 2017). This practice frequently excludes social groups in the respective countries from acquiring benefits from agriculture and experiencing the RV derived from their lands: it not only jeopardizes the dimension of food security and sovereignty by controlling the land, but it also impacts the dimension of identity, heritage and stewardship, by accelerating the decline of farmers' place attachment, the sense of belonging, the local and traditional knowledge (Hartel et al. 2018; Martín-López et al. 2019), the social and demographic evolution of communities, the local economies and traditional livelihood activities as well as governance on the right to food (Borras et al. 2011; Schoneveld 2014).

4.5. Outlook for IPBES work on values and work at the science-policy interface

Indicators are devices which communicate knowledge and information to governance and decision-making processes. Creating a balance between credibility, salience, legitimacy and feasibility of such indicators is a task that can only be fulfilled in dialogue between the information demand from decision-makers and the knowledge overview from the diverse scientific disciplines involved (van Oudenhoven et al. 2018). The indicators presented here and summarised in Table 1 are the result of such a science-policy dialogue and are used as proxies for RV in the ECA region. This process, however, had some clear limitations. For instance, the aim of IPBES to assess nature, NCP and quality of life still suffers from a historical bias towards the natural sciences and a limited involvement of social sciences and humanities (Vadrot et al. 2016). Although the IPBES assessments have impressively broadened the biodiversity assessment community, the initial recruitment was still drawn mainly from the pool of natural scientists available through the biodiversity national focal points and science-policy networks. Another major factor influencing valuation outcomes is the disciplinary bias: the choice of valuation method (Harrison et al. 2018) heavily determines the outcomes (Jacobs et al. 2018). Deeper inclusion of socio-economic and ILK expertise in all elements of the IPBES work programme will provide a richer picture of potential indicators concerning RV associated with nature and NCP. The ongoing Values Assessment of IPBES aims to address this social-science deficit. Ideally, the diverse socio-economic effects of (changes in) nature and its contributions are inventoried first and in full diversity, upon which diverse disciplines and knowledgeable actors concerning these impacts would be representatively engaged. The on-going Values Assessment of IPBES will furthermore conceptualize values and assess valuation methods.

There is a strong need to close data gaps and further operationalize RV. The operationalization of a framework to assess RV of NCP to support the science-policy interface can be fostered by developing a strategy to coordinate the monitoring of how these values change over space and through time and how they can be best framed to inform policy design. The identification of Essential Variables, that is the minimum set of dimensions that can be feasibly and coherently monitored, has been already quite useful for the identification of Essential Climate Variables (Bojinski et al. 2014), Essential Ocean Variables (Miloslavich et al. 2018), Essential Biodiversity Variables (Pereira et al. 2013), and Sustainable Development Goal Variables (Reyers et al. 2017). Such an approach can certainly contribute to enhance

the coordination of current efforts and mainstream findings on RV for a range of users. In this work, we already identified four dimensions of RV, with respective indicators. The effort presented here can constitute the first step towards identifying an initial set of Essential Variables for Relational Values of Nature's Contributions to People.

5. Conclusion

The notion of RV is currently developed and further conceptualised as one of the multiple ways in which NCP can be valued as contributing to people's good quality of life. Although earlier large-scale assessments may not have explicitly focussed on RV of biodiversity and ecosystems, some of the human-nature relationships associated with RV are apparent. For example, the Millennium Ecosystem Assessment (www.millenniumassessment.org/) included case studies of recreational, cultural, spiritual and other values that contribute to the MA's five constituents of human well-being: basic materials for life, health, security of resources, social relationships and freedom of choice. Similarly, the reports of The Economics of Ecosystems and Biodiversity (TEEB) initiative (www.teebweb.org) provided data on non-instrumental values that have links to RV. However, these assessments do not provide a comprehensive analysis of RV as these assessments were undertaken before the concept of RV was coined in 2016 (Chan et al. 2016); instead these assessments tended to conflate these values with instrumental values because of their anthropocentric nature. IPBES is taking major steps to advance knowledge and understanding on RV. The IPBES ECA assessment has spelled out a first set of social-ecological indicators (and proxies) associated with RV as they contribute to a meaningful life of people. These indicators might be used and further developed by future national ecosystem assessments, IPBES assessments and the IPBES knowledge and data Task Force (<https://www.ipbes.net/knowledge-data>).

From the assessment of these values across a large and culturally different regions, such as ECA, we conclude that many of the identified indicators can be considered as useful proxies since they portray an idea about these values in a quantitative way that goes beyond conceptualisations of RV. However, large data gaps remain for all four dimensions of RV considered. We consider it important to acknowledge RV at the science-policy interface and in decision-making as they are an essential set of values that people hold about their environment and that go beyond instrumental relations.

Acknowledgments

We acknowledge all lead and contributing authors as well as reviewers of the Chapter 2 of the Regional Assessment for

Europe and Central Asia of IPBES for inspiring discussions. We thank three anonymous reviewers for their feedback, which has helped to improve an earlier version of the paper.

Disclosure statement

No potential conflict of interest was reported by the authors.

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