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1

PLANETARY WELL-BEING[1]

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Introduction[2]

Human activities dominate Earth: Less than one-quarter of the land area remains free from significant direct human impact, and by 2050 this area is projected to shrink to <10% (Watson *et al.*, 2016; the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), 2018). Nearly three-quarters of freshwater areas and over half of marine areas are exploited for food production (Díaz *et al.*, 2019; IPBES, 2019). The biomass of wild mammals has fallen by 82% since prehistory (Bar-On, Phillips and Milo, 2018), and it is projected that by 2050 humans will have eliminated 38–46% of all biodiversity (measured as mean species abundance) from the planet (van der Esch *et al.*, 2017; IPBES, 2018).

Human actions threaten to cause irreversible changes in the Earth system, with critical safety limits (planetary boundaries) exceeded for biosphere integrity, biochemical flows, climate change, and land system change (Rockström *et al.*, 2009; Steffen *et al.*, 2015a; O'Neill *et al.*, 2018; IPCC, 2019). Crossing such boundaries may lead to irreversible changes in the Earth system (Steffen *et al.*, 2015a; O'Neill *et al.*, 2018). The scale of these pressures has evoked a proposal for labelling the current geological epoch the Anthropocene, an era where humans shape the geosphere and biosphere evolution (*e.g.*, Crutzen and Stoermer, 2000; Dryzek and Pickering, 2018). The negative anthropogenic impact on the Earth system has thus reached a point where the future of human societies and the flourishing of life, in general, are threatened. On the other hand, attributing the aforementioned negative impacts on the whole of humanity, "Anthropos", is overgeneralizing: It dismisses that only a fraction of the humanity is historically responsible for most of the environmental harm and that the extent of harmful impacts varies significantly depending on the particular processes of production and consumption (Malm and

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Hornborg, 2014). According to the historical graphs, these developments have "been almost entirely driven by a small fraction of the human population, those in developed countries" (Steffen *et al.*, 2015b).

Global inequalities among humanity are stark regarding who receives the benefits of environmentally damaging actions and who has to bear their detrimental impacts. Around the world, nations' top 10% of earners capture 37–61% of national income; globally, the share of the top 10% of global income is between 53% and 60% depending on the method of measurement (Alvaredo *et al.*, 2018). The costs of ecosystem degradation and climate change, on the other hand, hurt the well-being of at least 3.2 billion less affluent people (IPBES, 2018; UN Environment, 2019). Retaining the present standard of living in the wealthiest countries necessitates structures that maintain globally unequal, exploitative labour division, and ecological exchange (Hornborg, 1998; Newsome *et al.*, 2015). Transformative changes to social, economic, and technological systems are increasingly called for to change the course towards a more sustainable future in both environmental and social terms (*e.g.*, Díaz *et al.*, 2019; Kohler *et al.*, 2019; Willemen *et al.*, 2020).

The above described environmental and social problems have generated a broad spectrum of discourses and action, from the sustainable development framework and goals (United Nations (UN), 2015; World Commission on Environment and Development (WCED), 1987) to the foundations of social justice (Nussbaum and Sen, 1993) (for key frameworks, see the Supplementary Material in Kortetmäki *et al*., 2021). From the ecological viewpoint especially, a serious challenge is that a majority of the frameworks focus on the human perspective and consider nonhuman well-being important only to the extent it contributes to human well-being (*e.g.*, Dryzek, 2005, p. 157). Solely human-focused ethos of many conceptualizations of sustainability is typical of Western science, contrary to some other knowledge systems (for example, some forms of Indigenous and non-Western knowledge) that emphasize balance and collaboration with nature (Díaz *et al.*, 2015).

Another challenge with the existing frameworks is that they seldom focus on the systems and processes that support life, well-being, and biodiversity at different spatial scales. Although sustainability studies have recognized the interconnectedness of the social, economic, and ecological aspects of life, and the importance of studying processes as taking place in complex socio-ecological systems (Ostrom, 2009), the mainstreaming of such thinking to well-being studies has been slower. Lack of a systems-oriented and multiscalar outlook can result in a fragmentary view of the problems and their solutions. Many frameworks aim to overcome either anthropocentrism or the lack of systemic and multiscalar outlook, but few attempt both and do that with the viewpoint of well-being. For example, the widely used notion of ecosystem services is focused on the instrumental values of nonhuman nature to humanity, which reduces nonhuman nature into capital and has even been suggested to be the "Trojan Horse" of anthropocentrism within the community of conservation (Washington, 2020). In Supplementary Material in Kortetmäki *et al.* (2021), we list the widely acknowledged concepts that address the ecological crisis, sustainable

well-being or the environmental impacts of human actions, and we shortly describe how these notions differ from the concept that we propose in this paper.

The need to conceptualize well-being in a way that is non-anthropocentric and encourages a systems-oriented, multi-scalar outlook, raises a fundamental question: What is well-being? In human psychology, the focus is traditionally on subjective, experienced well-being: Persons with subjectively high well-being are satisfied with life, experience positive feelings, are able to fulfil personal aspirations, have favourable relations, and are in good mental health (Keyes, 2005; Kokko *et al.*, 2013). The subjective accounts of well-being have also been criticized from the environmental sustainability view-point: If experienced well-being depends on the fulfilment of seemingly limitless human desires and wants (instead of limited needs) with manifold direct and indirect material impacts, this poses unsustainably high material criteria for well-being (Gough, 2015). To address this problem, ecopsychology (as well as the ecosocial approach to well-being, see the Supplementary Material in Kortetmäki *et al.*, 2021) argues that human beings are simply a part of nature (Winter and Koger, 2004). From this perspective, nature and humanity are ineradicably linked and high levels of well-being can only be achieved through the experiential realization of nature connectedness and exposure to nonhuman nature (Roszak, Gomes and Kanner, 1995; Mayer and Frantz, 2004; Brymer, Cuddihy and Sharma-Brymer, 2010). Especially from the viewpoint of social justice as an equal opportunity to achieve well-being, nearby nature which anybody can access is important. In spite of that, focus on subjective well-being is problematic from the viewpoint of social justice and equality even when the ecological inter-connectedness is incorporated. Underprivileged people can adapt to their circumstances (demonstrating "malleable preferences") and may be unable to articulate their experiences of lower well-being and satisfaction of life, whereas minor losses of the privileged groups can get overemphasized (Nussbaum and Sen, 1993; Nussbaum, 2011).

In social sciences, consequently, well-being is often approached nonsubjectively and understood to depend on the satisfaction of basic human needs, such as the need for material subsistence, protection, affection, understanding, and autonomy, which contribute to physical and mental health, and to the abilities for social participation (*e.g.*, Doyal and Gough, 1984; Rice, 2013; Gough, 2017; see also Nussbaum and Sen, 1993). The argument is that these universal human needs persist through cultures and time, even while the strategies and means to satisfying the needs, and thresholds for adequate needs satisfaction, can change (Gough, 2017). Needs-based approaches thereby conceptualize well-being in a way that is more suitable (than subjective experiences of well-being) for public policy planning and implementation.

Needs-based, objective accounts of well-being are also used in the context of nonhumans, since studying their experienced well-being is challenging (Wemelsfelder, 1997). This newer strand of literature alleviates the anthropocentric orientation of the well-being discourse by acknowledging that it is not only humans who

can gain or lose well-being. Most of the literature on nonhuman well-being focuses on nonhuman animals and maintains that they have species-typical physical and behavioural needs, the satisfaction of which is crucial for their well-being (*e.g.*, Broom, 1991; Bartussek, 1999; Singer, 2002; Nussbaum, 2006). Nevertheless, the concept of well-being (also referred to as thriving or flourishing) has been applied to other organisms, too: Populations, species or lineages, and even ecosystems. Ecosystem well-being, for example, has been defined as the functional integrity of an ecosystem and its capacity to retain its typical functionings and characteristics (Schlosberg, 2007; Kortetmäki, 2017; see also Prescott-Allen, 2001), including succession and adaptation. The well-being of species or lineages is addressed via regenerative capacities that are related to functional integrity: To be well, species must be able to maintain self-sustaining capacities and to adapt to environmental changes (Kortetmäki, 2018).

In sum, the theoretical and conceptual research literature on well-being has expanded much. It has advanced from disconnected and subjective accounts to interconnected ecopsychological and ecosocial views, to objective and needs-based conceptualizations that help to address well-being from the social equality and public policy-related aspects, and finally also to the well-being beyond humans. Nevertheless, the contributions typically focus on one level or aspect at a time, be it the human–nonhuman connections, sentient animals, or collective nonhuman entities. The challenge of connecting different levels and domains has remained insufficiently addressed. Although the conflicts between the well-being of different organisms have been acknowledged and reflected upon (*e.g.*, Nussbaum, 2006; Schlosberg, 2007 for the predator–prey relations), these reflections have also received criticism (*e.g.*, Cripps, 2010; Hailwood, 2012), and interactions between well-being at different levels are articulated mainly in parentheses,[3] lacking the multiscalar approach. Contributions cannot be easily integrated, as the criticism has pointed out.

We propose a new concept, *planetary well-being*, to address the above discussed need for a non-anthropocentric, systemic conceptualization of well-being that takes into account the multiple scales of interaction. Planetary well-being acknowledges the value of both human and nonhuman well-being for their own sake (intrinsic value): The moral right for both humans and nonhumans to exist, to have their needs satisfied, and to realize their typical characteristics and capacities. The needs of organisms—both human and nonhuman—are interconnected so that the satisfaction of the needs of various entities creates both synergies and conflicts. Hence, the concept transcends the level of individual organisms and focuses on the integrity of Earth system and ecosystem processes underlying the well-being of all forms of life. It also serves as a framework that ties together ecological and social equality considerations. As a concept, planetary well-being facilitates scientific and political discussions by using the same vocabulary to address the impacts of human activities on the well-being of human and nonhuman nature.

To derive and propose a non-anthropocentric concept means that we openly commit to certain normative views on moral considerability. Morally considerable

beings and collectives have moral value for their own sake (inherent or intrinsic value), regardless of whether they have instrumental value for humans. Consequently, the well-being of morally considerable entities matters for their own sake. We adopt a pluralist or multicriterial approach to moral valuation; it grounds the moral considerability of entities on several criteria (Warren, 1997). The pluralist valuing grants moral considerability to human and nonhuman individuals but extends the sphere of moral considerability beyond them: Species or lineages and ecosystems that can be well or flourish and have self-regulative capacities (*e.g.*, Rolston, 1985, 2002; Schlosberg, 2007) are also morally considerable (hereafter, the term "living entities" denotes this diverse ensemble of morally considerable individuals and non-individual entities). While our normative viewpoint may not be shared by all, we believe that responding to ecological crisis adequately requires adopting a non-anthropocentric normative approach where nonhuman nature is valued also for its own sake, not only due to its importance for human prosperity.

Conceptualization of planetary well-being

We ground the concept of planetary well-being in accounts that link well-being with the satisfaction of basic needs as they are perceived from a neutral, nonsubjective viewpoint. As described above, the needs-based accounts of well-being have been previously applied to human well-being (Doyal and Gough, 1984; Max-Neef, 1991; Rice, 2013; Gough, 2015, 2017), animal well-being (*e.g.*, Broom, 1991; Bartussek, 1999; Singer, 2002; Nussbaum, 2006) and the well-being of populations and ecosystems (*e.g.*, Schlosberg, 2007; Kortetmäki, 2017). Yet, the overall diversity and number of different needs of various life forms prevents the integration of those views easily into a singular calculus of well-being—or at least renders the possible results hardly applicable in practice. Therefore, instead of focusing on needs themselves, we propose a focus on the systems and processes that are necessary for the satisfaction of the needs of diverse life forms on Earth. The focus on life-supporting systems and processes enables the integration of human and nonhuman well-being into a single framework.

A systems-oriented approach (Bunge, 2003, 2004) allows conceptualizing well-being at a general level (see Table 1.1). We utilize this approach to define planetary well-being in a way that links well-being across levels of biological hierarchies, from organisms (including humans) and populations and lineages to ecosystems—these all can be considered as *systems*—and to Earth system and ecosystem processes. In general, life on Earth can be understood as a set of interlinked, interdependent systems, and well-being at any level as the integrity of that particular system (be it an individual organism, population, or ecosystem). Crucially, the functional integrity of any system (*i.e.*, its well-being) is dependent on the satisfaction of its needs. Need satisfiers are usually products of, or comprise, interactions between other systems. In other words, the well-being of any particular system depends on inputs provided by other systems.

TABLE 1.1 The generic systems-oriented conceptual framework for well-being

System	A system is an entity that is comprised of its components, that can be impacted by the environment, has characteristic relations and interactions between its components, and has system-specific characteristics and capacities that stem from the system processes.
Critical system processes	System processes are recurring interactions between system components. Interactions require inputs to function. Critical system processes are those without which the system cannot continue its existence and realize its system-specific characteristics and capacities.
Needs and need satisfiers	Needs are conditions of dependence on inputs (need satisfiers). Needs must be satisfied for the critical system processes to function.
Well-being	Well-being is the functional integrity of the system, or in other words, the integrity of the critical system processes, that allows the system to continue its existence and realize its system-specific characteristics and capacities.

The conceptualization of well-being as the functional integrity of a system could, in principle, be applied also to human artefacts (like motors), or to socially constructed systems (like economic systems). However, as we do not consider such entities or systems to have moral considerability (value of their own that does not depend on their value for humans), the well-being of artefacts and socially constructed systems falls outside the scope of this manuscript.

The consideration of life on Earth as comprised of interlinked and interacting systems directs attention to how the needs and well-being of different species and ecosystems are connected. For example, the needs of organisms have evolved over their evolutionary history in the context of the ecosystems they inhabit. All organisms participate in many interactions. Some of the interactions are critical for their well-being (such as feeding), while others may be detrimental and even lethal for them (like being fed upon), yet critical for the well-being of some other organism(s). Interactions take place in ecosystems that in turn are dependent on the functioning of other, larger-scale processes (such as climatic processes that affect temperatures and rainfall). Ecosystems further interact with other ecosystems; the examples of teleconnections between ecosystems include precipitation in terrestrial areas, which in large part depends on evapotranspiration in distant forested areas (van der Ent *et al.*, 2010) and transport of energy and nutrients from marine to terrestrial ecosystems by migratory fish (Cederholm *et al.*, 1999).

We define planetary well-being as a state in which the integrity of Earth system and ecosystem processes remains unimpaired to a degree that lineages can persist to the future as parts of ecosystems, and organisms (including humans) can realize their typical characteristics and capacities (see Table 1.2). Planetary well-being puts the emphasis on the integrity of Earth system processes (such as the global climate and biogeochemical cycles of elements) and ecosystem-level processes

(such as succession and pollination) instead of organismal well-being, because at the organismal level life is rife with conflicts such as predator–prey relations, and consequently not all organisms can "be well" all the time. Death and senescence are also normal life processes although they may demonstrate the lack of organismal well-being. However, the integrity of Earth system and ecosystem processes is fundamental for the survival and evolutionary potential of species and lineages—and for the existence and well-being of organisms and ecosystems they inhabit. We intend planetary well-being as a concept to promote respectful ways of cohabiting Earth with all forms of life so that both humans and nonhumans can achieve well-being in all parts of the world.

By the integrity of Earth system and ecosystem processes, we refer to the integrity of those flows of energy and matter on Earth and biotic interactions in ecosystems that are critical for the satisfaction of the needs of various organisms, populations, and communities.[4] These processes are manifold, and while there is a reasonable understanding about several important processes, such as nutrient cycles or pollination, it would be foolhardy to assume that all important processes are known inside out. For example, the ozone layer depletion following the emission of chlorofluorocarbons came as a surprise to the scientific community (Rowland, 2006). Thus, all actions that significantly impact the flows of energy and matter are a serious concern for planetary well-being, be it by resource use such as the human appropriation of 38% of the net primary production on Earth (Running, 2012), or by the release of nutrients, greenhouse gases, or other chemicals with possibly

TABLE 1.2 Key concepts of planetary well-being

Organismal (human and nonhuman) well-being	Organismal well-being is a state where an organism can realize its typical characteristics and capacities.
Organismal needs and need satisfiers	Organismal needs are conditions of dependence on inputs (need satisfiers). Needs must be satisfied for an organism to realize its typical characteristics and capacities. Needs depend on the evolutionary history of the lineage an organism belongs to.
Lineages, species, populations	A group of organisms with a shared genetic ancestry that is distinct from other such groups constitutes a lineage. For sexually reproducing organisms, species and populations constitute lineages at global and local scales, respectively.
Ecosystems	Ecosystems are communities of organisms that interact with each other and the abiotic environment.
Earth system and ecosystem processes	Processes relating to the flows of energy and matter on Earth and to biotic interactions in ecosystems.
Planetary well-being	Planetary well-being is a state in which the integrity of Earth system and ecosystem processes remains unimpaired to a degree that lineages can persist to the future as parts of ecosystems, and organisms (human and nonhuman) can realize their typical characteristics and capacities.

unknown effects. Similarly, excessive interference with natural ecosystems (by, for example, the destruction of natural habitats or overharvesting of natural populations) is likely to harm planetary well-being by impacting the integrity of crucial processes.

While we (as the research community) have an incomplete understanding of specific processes, we also have limited knowledge about interactions between and among the Earth's geophysical systems, ecosystems, and human-created systems (*e.g.*, Reid *et al.*, 2010; Liu *et al.*, 2015, 2018). Many of these interactions are likely to magnify each other: The risks of causing irreversible changes to the Earth system are higher in studies that consider interactions between systems or processes (*e.g.*, Lade *et al.*, 2019). Given that there are profound uncertainties regarding the consequences of human interference with the Earth system and ecosystem processes, abstinence from potential harm even in the absence of the *proof of harm*—the precautionary principle (*e.g.*, Cameron and Abouchar, 1991)—is often a safer strategy to avoid worsening global environmental problems.

The definition of planetary well-being underscores the persistence of lineages (*e.g.*, species and populations) as parts of ecosystems for both instrumental and normative reasons. As discussed above, the processes contributing to the satisfaction of the needs of various living systems are not fully understood. However, it is possible to monitor the status of populations and species, and this gives a good indication of whether the needs of lineages and organisms within them can be adequately satisfied. For example, if population sizes show unusual persistent declines, this usually indicates a failure of some critical process(es) relating to need satisfaction (of also individual organisms). The viability of species and populations thus indicates the integrity of the critical, but sometimes intractable, processes that underpin well-being at all levels.

As a non-anthropocentric and systemic concept, planetary well-being aligns with views that consider the survival of lineages to be an end in itself (Rolston, 1985). The present human exploitation of and interference with ecosystems harm vast numbers of other species and populations, with the estimated number of species considered to be at risk of extinction being up to 1 million (IPBES, 2019). However, humans also have needs that have to be satisfied for human well-being. The satisfaction of some of these needs—like the need for adequate nutrition—is practically impossible without some interference with ecosystems and, consequently, lineages. From the planetary well-being point of view, the level of human interference with ecosystems must not compromise the ability of other species and lineages to persist in these ecosystems to the future (*i.e.*, it must not put them at the risk of extinction). The importance of lineages has significant impacts on the consideration of, for example, the impacts of human-managed food system activities. Achieving planetary well-being necessitates that human basic needs are satisfied in a way that does not compromise the capacity for nonhuman entities to achieve well-being. An important step in this direction is to prioritize the satisfaction of basic human needs over the satisfaction of desires and wants that have a negative impact on nonhuman nature.

Putting the concept to use

Planetary well-being is not purported to simply replace the existing concepts, many of which are valuable in their particular domains of application. However, by integrating the systemic, process-oriented view and the concept of well-being with the needed ethical transformation away from anthropocentrism, planetary well-being provides a fruitful analytical and discursive lens for many domains of addressing—thinking about, researching, and acting upon—the ecological crisis. In academia, it has the potential to advance research on transformational changes (sustainability transition) and advance sustainability sciences by encouraging the non-anthropocentric framing of future research questions (*cf.*, Kates *et al.*, 2001). Outside academia, the notion of planetary well-being contributes to discussing and acting upon the ecological crisis at several levels: In addressing the trade-offs between different needs and desires, in setting targets and measures for decision-making, and in bridging divergent worldviews. We reflect upon these next in more detail.

Reconciling human needs with planetary well-being

The idea of needs and need satisfiers is integral to the concept of planetary well-being. While the satisfaction of needs is necessary for the well-being of any system, the relationship between the needs and need satisfiers is contingent: Needs can often be satisfied in various ways. When it comes to securing the satisfaction of the needs of nonhuman nature, the human action mainly concerns safeguarding or not harming the Earth system and ecosystem processes as far as possible. Active measures are often unnecessary; the well-being of "wild" nonhuman nature is often best served by "deconstructing the impediments to nature's own capabilities [or capacities] to fully and continually function" (Schlosberg, 2007, p. 150). Domesticated animals and ecosystems (gardens, for example) on the other hand depend on human provision for their continued existence. While we do not discuss the status of domesticated nature (that raises distinct normative questions) here, we note that many domesticated animals are not able to realize their characteristics and capacities, and ecosystem modification (*e.g.*, building a garden) may interfere with ecosystem processes that are critical for the satisfaction of the needs of wild nonhuman nature.

When it comes to the satisfaction of human needs, it is necessary to reflect upon what the quality of life—as associated with well-being—entails, especially regarding the consumption of material goods (IPBES, 2019). Humans are complex social beings and different scientific fields provide different accounts of human well-being with varying emphasis. However, when the question is how societies can organize and operate in ways that best support human well-being, it is necessary to approach well-being in a way that is institutionally applicable and meaningful to governance and policymaking. This directs attention to the needs-based, nonsubjective conceptions of human well-being. They are grounded on the assumption that all humans, like all organisms, have certain universal basic needs that have

to be satisfied in order to avoid harm and have a good life including the ability to act fully in life: The satisfaction of needs is a necessary (though not necessarily sufficient) condition for well-being. Although the articulation of the needs varies between different authors (*e.g.*, Doyal and Gough, 1984; Max-Neef, 1991; Rice, 2013; Gough, 2017) and some accounts emphasize the capabilities to achieve various functionings that contribute to needs satisfaction over the actual outcome of needs satisfaction (Nussbaum and Sen, 1993; Nussbaum, 2011), they all have as key elements the need for physical and mental health, for relationships, and for autonomy in action and thought. Satisfaction of these key elements may require, for example, adequate nutrition, safety, and at least some kind of health care and education. When approached from a human perspective, planetary well-being is a state in which the organization of human systems simultaneously allows human needs to be met, and the impact on Earth and ecosystem processes is limited so that lineages can persist to the future as parts of ecosystems and organisms can realize their typical characteristics and capacities.

Needs-based approaches to human well-being have several features that are relevant to discussions about sustainability (Gough, 2017). First, many human needs are objective: Regardless of subjective experiences, it is empirically verifiable that, for example, malnourishment or the lack of caring relationships causes serious harm to individuals (this is not to deny that needs are still subjectively interpreted at the individual level). Second, human needs are plural: They include material, social, and psychological aspects. Third, human needs are non-substitutable: It is not possible to satisfy, for example, a need for healthy nutrition with more education. Fourth, human needs are in principle satiable: It is possible to identify a level of needs satisfaction that would suffice for adequate well-being. However, in consumerist societies, being able to "live without shame" requires a level of consumption that matches—or exceeds—the consumption of others, which drives ever-increasing consumption. Yet, at the societal level, this does not lead to increasing social well-being but to fragmentation and anomie (Jackson, 2017, p. 124). Fifth, needs are substantially universal and apply to people in different places and at different times although the ways of satisfying them vary in different times and cultures: Even the objective and universal needs are not "absolute" but involve relative, context-specific aspects. The precise level where a need is satisfied may vary across individuals and contexts (consider the differentiated needs for nutrition or, for example, belongingness); and some space of choice for needs satisfaction and actual doings in one's individual life are required for freedom (Nussbaum and Sen, 1993). The conception of universal needs and average requirements for their satisfaction at individual level, nevertheless, provides a useful tool for guiding and evaluating societal activities in directions that support human well-being. This gives a foundation for considering the well-being of both present and future generations in such arenas.

The idea of satiable human needs means that good, fulfilling, and dignified life can be achieved with limited consumption sufficient to meet the material needs,

together with the satisfaction of non-material needs like significant primary relationships, leisure, and social participation (Max-Neef, 1991; Gough, 2017). Acknowledged, the levels of subjectively experienced well-being in such scenarios of reduced material consumption are not well known although similar changes have historically occurred in societies, especially during the post-war periods. Suggestions for achieving well-being with significantly lesser material consumption, however, are difficult. They are in stark contrast with consumerist and materialistic societies, where ever-increasing production and consumption fuel the dynamics of the economy, where well-being is understood as the realization of insatiable human preferences, and where the good life is understood as the rising material standard of living. Planetary well-being does not require the reduction of well-being but calls for reducing the consumption of material goods that are not relevant to human needs or that directly harm well-being. Global and regional equality considerations necessitate a focus on the satisfaction of both material and non-material needs of all, instead of increased (assumed) well-being for the already privileged. There are successful examples of participatory well-being workshops that utilize the needs-based approach to human well-being and help communities critically discuss what is needed for well-being, what is not, and what are the obstacles to achieving well-being in ecologically less harmful ways in the societies (*e.g.*, Guillen-Royo, Guardiola and Garcia-Quero, 2017). We suggest that planetary well-being could be put into use in citizen deliberation and policy-making arenas in similar ways, which would produce the benefit of expanding the well-being considerations beyond humans.

It is also important to note that human material needs can be satisfied in many ways (by different need satisfiers), with significantly differing impacts on planetary well-being. This directs attention to the processes of production. One relevant example that has received much research attention is the human need for protein, which can be satisfied in various ways that differ in their impacts on planetary well-being. When there are multiple ways of fulfilling human needs, those with the least harmful impacts on planetary well-being and the most beneficial impacts on needs satisfaction globally, between and within human communities, should be prioritized to move towards planetary well-being. Simultaneously, it should be kept in mind that the best need satisfiers may be different in different locations and societies and should hence remain open to community-level reflections and some level of individual freedom of choice (*cf.*, Nussbaum and Sen, 1993) because of the importance of autonomy for human well-being. Understanding and propping up the factors that promote pro-environmental behaviour (including lower material consumption) at individual levels is also crucial. Related behaviour patterns are influenced by, for example, institutional, economic, social, emotional, motivational, value, attitude, and awareness factors (Kollmuss and Agyeman, 2002). The multiscalar view of processes calls for attending to the dynamics between different levels, such as the impact of global processes on the needs satisfaction, and preferences within different communities, from the viewpoint of planetary well-being.

Measures and targets for decision-making

The fact that more than 25% of the 134,425 assessed species are threatened with extinction (The International Union for Conservation of Nature (IUCN), 2021) manifests the lack of well-being of nonhuman life on Earth today. Improving planetary well-being necessitates halting or transforming the harmful human activities and fostering actions to restore the integrity of Earth system and ecosystem processes that have been impaired by past actions. Ecological remediation, rehabilitation, and restoration advance this aim at local levels (Gann *et al.*, 2019). Data about the national and regional drivers of extinction threats can be a valuable source of information to identify those human practices (such as livestock farming and ranching, logging and wood harvesting, and the release of effluents) that are most damaging to planetary well-being at regional and national scales, and to justify urgent changes in these actions. This information about the direct drivers of extinction threat is available in the national/regional IUCN Red Lists although the coverage is not yet global. Information from the IUCN Red Lists also helps to identify those ecosystems and processes that require the most urgent protection and restoration actions to improve the viability of threatened species and populations.

From Red Lists, it is also possible to construct indices that can be used as surrogate measures for regional and global states and trends in planetary well-being, at least as far as nonhuman nature is concerned. As we have pointed out earlier, the status of populations and species can serve as a good indicator for the integrity of processes that are critical for the satisfaction of the needs of various living systems. The Red List Index (RLI) calculates the average threat status of the set of species included in the index. RLI takes values between 0 (all species extinct) and 1 (all species in the "Least Concern" category). As we define planetary well-being also in terms of the persistence of lineages to the future (see Table 1.2), RLIs for well-chosen sets of species at regional and global scales could be used to measure the status of planetary well-being at different scales (however, extinction threats due to nonhuman causes, such as volcanic eruptions and natural diseases, should not count negatively to the score of planetary well-being). Regional and global RLI values approaching 1 could also serve as intuitive, specific, and measurable targets for efforts to stop and reverse current declines in biodiversity, like the UNFCCC target of limiting global warming to 1.5 °C.

Progress towards planetary well-being ultimately depends on the ability of human societies to organize the systems for satisfying human needs so that they do not compromise the integrity of Earth system and ecosystem processes. Societal goals and targets, and the indicators of progress, should thus be aligned with the aim of maintaining and restoring the integrity of the processes that are constitutive for planetary well-being while providing for the satisfaction of human needs. The first step in this direction could be the adoption of indicators that emphasize sufficiency and the meeting of basic material, social and psychological needs while depreciating environmentally and socially harmful development (see *e.g.*, Rogers *et al.*, 2012; Hickel, 2020).

Bridging divergent worldviews

We believe that planetary well-being could enrich the conceptual toolbox to foster transformation to a world that promotes well-being more equally by unifying systems-thinking and both human and nonhuman well-being to a single, intuitively appealing concept. Unlike many related concepts, planetary well-being avoids anthropocentrism and allows for discussions onhuman and nonhuman well-being in a common framework. The emphasis on well-being as the satisfaction of basic needs helps draw attention to the plight of underprivileged human communities and socio-economic groups and to the literally existential plight of nonhuman nature.

The concept speaks to different scientific disciplines, which we have tested during the process of writing this work, and it is approachable to different domains in the public sector, at different levels, as well as to civil society and private sector actors whose cooperation is required for solving the ecological crisis. The concept of planetary well-being does not aim to replace previous conceptual frameworks everywhere but, rather, to supplement them by providing a multiscalar and non-anthropocentric approach to discussing the pressing questions of environmental and social challenges. Planetary well-being—the opportunity for both humans and nonhumans to have their needs satisfied now and in the future—can, and should, become the ultimate goal of human activities and cooperation.

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Notes

1 Originally published as an article (including Supplementary Material): Kortetmäki *et al.* (2021).

2 JYU.Wisdom community: This paper is a result of a collective effort and intense transdisciplinary discussions by the JYU.Wisdom community. All authors contributed to the work significantly and are listed in alphabetical order, except for the first three and the last author, who are together considered as the shared first author.

3 For example, Schlosberg (2007, p. 148) notes: "It is simply not possible to talk about the flourishing of individual animals without reference to the environment in which this flourishing is to occur. Systems are living entities with their own integrity; atomizing nature into isolated animals devalues a form of life, and the way that this form of life flourishes". He acknowledges how the integrity of larger systems contributes to the functioning of individuals and proposes it meaningful to talk about flourishing at both levels. However, in Schlosberg's account, it seems that individuals are after all "subjugated" to the functioning integrity of the larger system; moreover, he does not clarify which non-individual systems can flourish (be well) except for doubting that species may not be able to have well-being (see Kortetmäki, 2018), which is a problematic potential exclusion. Moreover, the theoretical and unidisciplinary nature of Schlosberg's work lacks the explanation what he means by systems and the way in which their flourishing is interconnected, which he (2007, p. 157) leaves to be the task of interdisciplinary work—which we are doing now.

4 It is possible to suggest and think about the well-being of the Earth system as a whole, understood as a stable geophysical state of the system (and potentially some other conditions). There are two reasons we do not address this further. First, high planetary well-being would also imply the well-being of the Earth system because the Earth system comprises Earth's interacting processes the integrity of which is constitutive to planetary well-being. Second, the normative viewpoint that we have adopted here would not in any case attach inherent value to the well-being of the Earth system. It is too unclear what it would mean for the Earth system to "realise its system-specific characteristics and capacities" (part of the definition of well-being used in this work, see Table 1.1). Consequently, we consider that the potential well-being of the Earth system as a stable geophysical state is sufficiently covered by planetary well-being.)

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