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Occupation Mediates Ecosystem Services with Human Well-Being

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The 2005 Millennium Ecosystem Assessment linked ecosystem services, the benefits people obtain from ecosystems, directly with four constituents of human well-being: security, basic material for good life, health, and freedom of choice and action. No explicit model of the role of human activity in the transformation of ecosystem services into well-being was, however, developed by the Assessment and the connective relations between ecosystem services and human well-being remain poorly understood. The authors of this paper argue that the concept of "occupation" is a crucial addition to understanding these connective relations. It is proposed that human well-being, human activity, and ecosystem services are mediated by, *i.e.*, connected through the medium of, occupational performance. Some implications of this proposal for the study of the human dimensions of global environmental change are briefly discussed.

Keywords: Ecosystem services, Human activity, Occupation, Well-being, Global environmental change, Millennium Ecosystem Assessment

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At the beginning of the 21st century, humanity is faced with an unprecedented yet rapidly growing crisis of how to build globally sustainable patterns of economic development that maintain human health and well-being. Responses to this crisis must acknowledge that human health and well-being are central to the problem of sustainability (McMichael, 2009), measured as "the production of human well-being... per unit of extraction from or imposition upon nature" (Paehlke, 2005, p. 36). Human health, well-being, and quality of life rely closely on the availability and health of ecosystem services, which can be defined as "the benefits people obtain from ecosystems" (Millennium Ecosystem Assessment, 2005, p. v). These include "provisioning services" such as food, water, timber and medicines; "regulating services" that control climate, disease, floods and water; "cultural services" that furnish aesthetic, spiritual, educational and recreational benefits; and "supporting services" such as photosynthesis, pollination and soil formation (Millennium Ecosystem Assessment, 2005; see also Chivian & Bernstein, 2008).

The Millennium Ecosystem Assessment (2005), an international body coordinated by the United Nations Environment Programme, made an important contribution by linking ecosystem services directly with four constituents of human well-being: security, basic material for good life, health, and freedom of choice and action. The Millennium Ecosystem Assessment did not, however, develop an explicit model of the role of human activity in the transformation of ecosystem services

into well-being; such activities are viewed instrumentally as direct and indirect 'drivers of change'. The connective relations between ecosystem services and human well-being remain poorly understood (Carpenter et al., 2006; Raudsepp-Hearne et al., 2010). We argue here that the concept of occupation, in the sense used in occupational science, is a crucial addition to understanding these connective relations. Specifically, we propose that human well-being, human activity, and ecosystem services are connected through occupational performance. We then discuss some possible methodological implications of this proposal and conclude that the concept of occupation is an important addition to current debates on sustainable growth.

Human Activity as Occupation

Humanity faces the growing irony that 'human activities' are both the cause and solution to our current crisis. It is widely accepted that human activities are major contributing factors in global climate change, biodiversity losses, and ecosystem degradation (Foley et al., 2005; Pachauri & Reisinger, 2007; Vitousek, Mooney, Lubchenco, & Melillo, 1997; Wackernagel et al., 2002). At the same time, changes in everyday human activities are proposed as essential components of a response to global environmental change (Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009; Ikiugu, 2008; Stern, 2000). Human activity is also thought to be an important factor promoting resilience in social-ecological systems (Blaikie & Brookfield, 1987; Davidson-Hunt & Berkes, 2003). Yet, while all the human sciences deal with human activity in some way, scientists have not yet reached a shared framework for understanding this concept. The term human activity has become widely used in environmental fields as the most encompassing designation; other terms that are frequently employed in the environmental literature include 'human impacts' and 'human dimensions'. These latter terms have the advantage of making explicit the idea of human causality (Meyer, 2009), but none of these are analytical categories normally used in the social sciences. These sciences dissect human activity as it relates to the environment into areas of specific expertise such as culture, behavior, class, religion and gender (e.g., Crate & Nuttall, 2009; Masika, 2002; Swim et al., 2009). However, if a conceptual framework was available in which the connections among human activity, ecosystem services, and human well-being were clear, our responses to the current crisis of sustainability would be more effective.

The Millennium Ecosystem Assessment (2005) identified five "indirect drivers of change" that connect ecosystem services with human well-being: demographic, economic, sociopolitical, science and technology, and cultural and religious. Existing research on human activity in the social sciences tends to focus on one or more of these factors and to approach activity as a phenomenon embedded in nested social units such as the individual, family, culture, nation, and world system (Dietz, Rosa, & York, 2010). This nested approach is essential to an integrated model of health (Kaplan, Everson, & Lynch, 2000; Loring & Gerlach, 2009), but in practice human activity is negotiated, chosen and performed by individuals as integrated action or 'doing'. Because it is explicitly linked both to health and well-being *and* to environmental contexts, a useful way of perceiving this 'doing' is through the concept of occupation, as used in occupational science. In that field, occupations represent "engagement or participation in a recognizable everyday life endeavor" (Christiansen & Townsend, 2010, p. 420). Another commonly used definition is "chunks of culturally and personally meaningful activity in which humans engage that can be named in the lexicon of our culture" (Clark et al., 1991, p. 301),[1] "chunking" being a term employed in cognitive science to refer to the way the human mind processes complex sets of information. For occupational science, occupations are seen as the level of human activity that has potentially the most meaning and purpose for the individual and occupational performance is thought to be linked with health, well-being and social participation, meeting deep physiological, psychological and social needs for humans to organize and occupy

their time (Meyer, 1922; Pierce, 2003; Piškur, Kinébanian, & Josephsson, 2002; Wilcock, 2006).

We propose that this concept of occupation provides a way to understand how human activity links ecosystem services with human well-being. Not all of the links between ecosystem services and well-being require the medium of occupational performance. Some basic physiological processes such as breathing, for example, cannot necessarily be counted as occupations, although such physiological processes are central to satisfactory occupational performance. E. O. Wilson's (1984) biophilia hypothesis similarly suggested that some cultural services may derive value through largely unconscious instinct. In the majority of cases, however, the link between ecosystem services and human well-being is mediated through occupational performance. Even biophilia type effects usually occur when a person is engaged in a particular occupation—such as walking through a forest or reading on a beach, even though those effects may be incidental to the performance of that occupation. Furthermore, few if any human occupations would be possible without a range of basic ecosystem services. Just reading this article, for example, requires numerous such services including light from the sun, fossil fuels or candle wax.

Figure 1 provides a simplified version of this linking process between ecosystem services and well-being. Three points need to be emphasized here. Firstly, while occupations are chosen and performed by individuals, human capabilities for occupation are influenced by a wide range of social, cultural and ecological factors. Secondly, although Figure 1 retains the color and width of the arrows found in the original Millennium

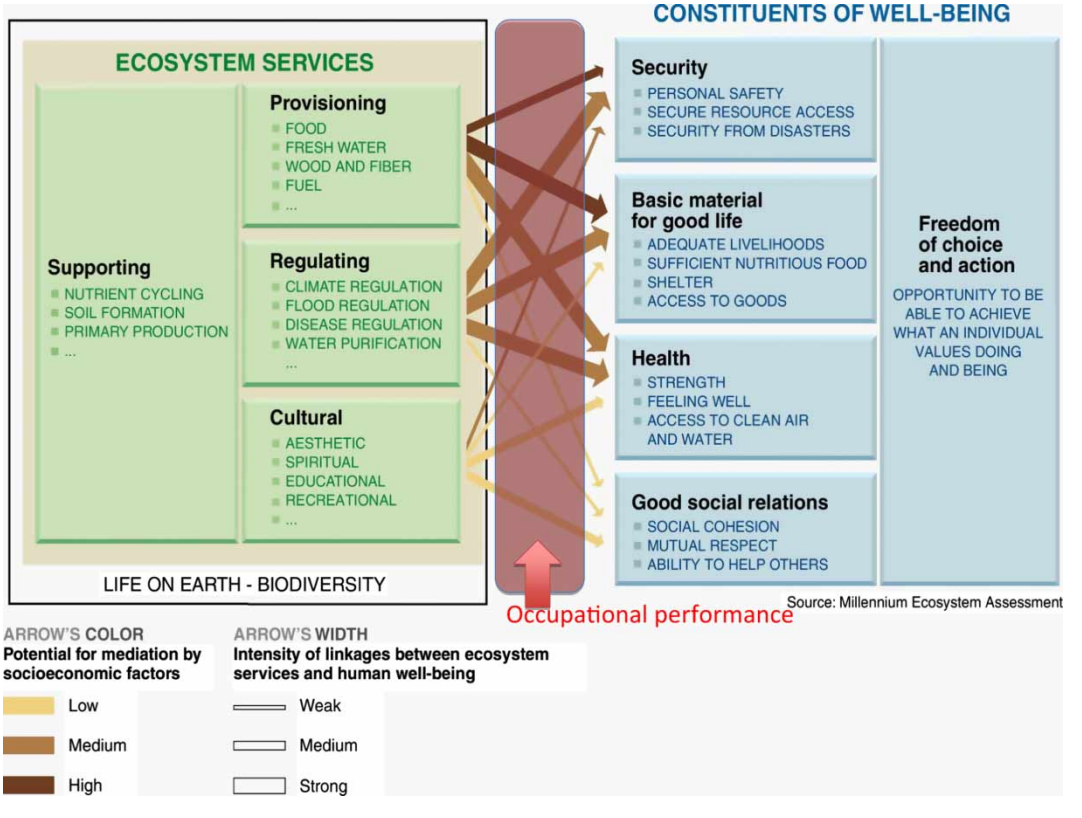

Figure 1: Occupation Forms a Mediating Link Between Ecosystem Services and Human Well-being. Adapted from the Millennium Ecosystem Assessment (2005). Used with permission of the World Resources Institute.

Ecosystem Assessment diagram, in reality occupational performance further complicates this relationship. The intensity of the linkage between ecosystem services and well-being, for example, is strongly influenced by personal experiences of occupational performance. Similarly, mediation by socioeconomic factors works through occupational performance. Finally, although this relationship is not shown in Figure 1, as humans exist within linked social-ecological systems (Berkes & Folke, 1998), the forms of occupational performance adopted by individuals and groups have direct and indirect influences, both positive or negative, back on the natural environment (Ikiugu, 2008).

Ecosystem services are "services that natural ecosystems supply to the human enterprise" (Mooney & Ehrlich, 1997, p. 17). These services are modeled as flows within a framework of complex, *linked* social-ecological systems (Berkes & Folke, 1998; Liu et al., 2007). This means that humans are not seen as separate from, or in opposition to, the environment, but as parts of one complex system that links or couples both social and ecological elements. Our Figure 1, therefore, differs fundamentally from what Iwama (2005) argued had been a dominant assumption in occupational therapy (and by extension occupational science), *i.e.*, that the "Western" approach to occupation is based on "the primacy of the individual as agent of change in relation to the environment" (p. 134) and thus that the individual attempts to "control" the environment through occupation (p. 132). The relationship in Figure 1 is, in fact, one of mutual interaction between occupation and ecosystem services and between occupation and well-being.

Although humans cannot control nature, there is no doubt that they currently *dominate* most global ecosystems (Haberl et al., 2007; Vitousek et al., 1997). Scientists increasingly refer to the present geological era as the "Anthropocene" to denote the extent of human domination of ecosystems (Crutzen, 2002; Steffen, Crutzen & McNeill, 2007). If human activities did *not* impact the environment there would be no such thing as anthropogenic environmental change. Exactly what role occupation plays in such inputs is a topic for further research, but Wilcock (2010, p. 111) has already suggested that it *does* play a role, arguing "that it is the occupations of people that have, in large part, altered environments and that this trend continues without thought of ecological change or the health and well-being of future generations." This human alteration of environments has, in the majority of cases, involved the simplification and homogenization of landscapes and biodiversity (Chapin et al., 2000). The extent to which this process has been associated with a substantial decline in the diversity of human occupations is a question for future research.

Discussion

We have argued that viewing human activity as occupation is an important addition to analyzing the relationships between ecosystem services and human well-being. Such a perspective may serve to shift the emphasis within occupational science toward further consideration of the ecological contexts of occupational performance, but in this discussion we want to examine some of the implications *beyond* occupational science. At a time of unprecedented need for deeper knowledge of human-environment interactions (Cornell, Costanza, Sörlin, & van der Leeuw, 2010), what do we actually gain in analytical understanding by seeing the relationship between ecosystem services and well-being in terms of occupation? Is the concept of occupation useful outside of occupational science for the broader study of the human dimensions of environmental change?

Such questions are not easy and there are few clear answers from within occupational science. Despite a holistic view of health and a strong commitment to social issues, both occupational science and occupational therapy have so far paid little attention to the natural environment (Aoyama, 2009). Wilcock (1998) was the first to make explicit links between occupation and ecological sustainability, but this topic has been discussed by only a few other writers and it must be acknowledged that

occupational science does not currently have an extensive body of research in this area. However, a number of recent publications (Hudson & Aoyama, 2008; Ikiugu, 2008; Pereira, 2008, 2009) and projects such as the Occupational Therapy Sustainable Practice Network (http://sustainablehealthcare.org.uk/occupational-therapy-sustainable-practice-network-ot-susnet), the Project Miquel Martí i Pol at the Universitat de Vic in Catalonia (Algado, 2011), and the Human Activity and Sustainability Group (http://hasg.jp) show that there is a new interest in these issues. Wilcock (2010) has recently issued a clear call to arms for occupational therapy, which we believe is just as relevant to occupational science:

> With a concern for the ecosystem and sustainable resources, occupational therapists could become advocates for and advisers of the occupations suited to individuals to meet their needs yet to sustain resources and the ecology. The way forward is to be part of the economic and ecological debate, with the occupation for health needs at the forefront of the agenda. It is a different role, but it is the practice of occupational therapy at the global level. (p. 119)

We support Wilcock's vision and in this discussion we briefly examine four areas where an occupational perspective may be useful in improving understanding of the relations between ecosystem services, sustainability, and human well-being. Firstly, a focus on occupation provides useful methods to study the detailed interrelationships between the natural environment, daily life, and well-being. Secondly, it provides a means to gain a deeper understanding of why people choose, or do not choose, certain occupations and thus of the contradiction that humans often do things that are harmful to the environment and therefore ultimately to their own well-being. Thirdly, the concept of occupation may help in behavioral interventions in environmental adaptation and mitigation. Finally, occupation is, we suggest, an important addition to concepts of 'real growth' (Speth, 2008) that attempt to balance economic development with human and ecological well-being. The preliminary discussion here should be seen as a rough roadmap for future work. We agree with Stern (2000) that "to understand any specific environmentally significant behavior requires empirical analysis" (p. 415) and we hope that such analysis will soon be forthcoming within occupational science.

Methodological contributions

A focus on occupation could provide new methods to study the relationships between ecosystem services, daily life, and well-being. Such work is already being conducted by anthropologists and other scholars who, for example, have examined the effects of climate change on daily activities in indigenous communities in the Arctic (Ford, Pearce, Duerden, Furgal, & Smit, 2010; Furgal & Seguin, 2006; Nickels et al., 2002). This research could, however, gain further insights from occupational analyses that (1) examine apparently mundane aspects of daily life that other researchers often overlook; and (2) then attempt to incorporate those aspects into a broader understanding of occupational behaviors and meanings.

An excellent example is provided by Blakeney and Marshall's (2009) occupational study of the effects of water pollution on daily life in the Appalachian coalfields. While Blakeney and Marshall used traditional ethnographic methods borrowed from anthropology, such as interviews and participant observation, their focus on everyday occupations represents a significant difference from similar studies, such as that by Marino, White, Schweitzer, Chambers and Wisniewski (2009) on rural Alaskan water usage, and results in a type of detail that is rarely found in anthropological studies. Here we are suggesting that an occupational perspective is an important addition to, not a replacement for, existing approaches.

Occupation as individual agency

As noted above, the Millennium Ecosystem Assessment and most existing studies of human activity as it relates to environmental change, analytically separate out factors such as demography

and economy and then try to determine how such factors may connect together. The occupational approach, in contrast, begins with the assumption that an individual endeavors to operationalize a set of actions that are perceived to be positive (however defined) for that person and then attempts to separate out the factors that lead to the individual's occupational choices. The occupational perspective differs from other approaches to human activity in emphasizing individually adaptive, holistic task structures that are situated within social contexts that privilege humanistic values of meaning, justice, and well-being.

Several occupational scientists have criticized this focus on the individual. For example, Iwama (2005, 2006) insisted that the emphasis on the autonomous individual is a Western idea that is not necessarily shared by Japanese and other 'Eastern' societies. Dickie, Cutchin and Humphry (2006) have also argued that a transactional approach provides a more realistic view of human activity-in-environment. We do not deny that occupational choices and performances are strongly influenced by an enormous range of complex factors including ecosystem viability, cultural context, world-view, and social interactions with other people. The individual and collective levels of human activity/occupation are invariably entwined (Adger, Lorenzoni, & O'Brien, 2009a, p. 10). What is important about the concept of occupation, however, is that it provides the opportunity to analyze activity at the individual level in a way that other approaches do not. Again, this is not a replacement to existing approaches but rather an addition that needs further discussion.

Occupations and interventions

The concept of occupation may also help in behavioral interventions in climate change mitigation and adaptation. In the climate change context, mitigation refers to actions and policies designed to prevent or reduce the effects of climate change before it occurs, whereas adaptation is usually used to mean changes that humans are forced to make after climate change is already apparent. The relevance of an occupational perspective to such attempts is immediately suggested by therapeutic uses of occupation: "It is through occupation that people realize aspirations, satisfy needs, *and change or cope with the environment*" (Wilcock, 2010, p. 111, emphasis added). Both mitigation and adaptation involve a complex range of policy and governance factors; neither phenomenon can be fully explained by occupation, but we argue that this concept is nevertheless one important factor in understanding how humans attempt to mitigate and adapt to climate change.

If people attempt to structure their lives around personally meaningful occupations, then more attention needs to be paid to this level of human activity in mitigation strategies. People are more likely to voluntarily change their daily activities into more sustainable forms if those changes also support their occupational needs. For example, Dietz et al. (2009) argued that even simple household actions can provide a 'behavioral wedge' to reduce carbon emissions, but found extreme variation in the potential plasticity of change in those actions. Dietz et al.'s estimates of behavioral plasticity range from 90 to 15%. An occupational perspective may help explain this difference: for example, one-off tasks such as home weatherization and equipment upgrades are often more easily implemented than changes to individually meaningful occupations (either routine or symbolic) such as cooking or driving—although it needs to be emphasized that the importance of these latter activities varies depending on the individual. Dietz et al. (2009) argued that the most effective household emission reduction interventions combine multiple approaches and targets, and the incorporation of an occupational focus would be a useful addition.

Changing human behavior to more environmentally sustainable forms is a crucial yet enormously difficult task. Existing research in this area typically tests the rate of adoption of specific pro-environmental behaviors, but occupation emphasizes a broader view of health and well-being as part of an individual's set of occupations

over his or her life course. For this reason, occupational approaches such as those mentioned below could be effective elements in effective interventions. In a small pilot study of graduate students in the US, it was demonstrated that occupation-based interventions are potentially effective in guiding interventions to respond to global environmental change (Ikiugu & McCollister, 2009) and there is a clear need for further such studies. Recent research has found that when climate change is presented as an issue relevant to public health, it becomes much more compelling to members of the general public (Maibach, Nisbet, Baldwin, Akerlof, & Diao, 2010). Furthermore, Haines et al. (2009) argued that participation in climate change mitigation strategies often has direct health benefits through, for example, reductions in indoor pollution and consumption of animal fats and increased physical exercise through walking and cycling.

Previous successes in occupation-based approaches to community health, including those beyond traditional clinical settings (Frank, Murphy, Kitching, Garfield, & McDarment, 2008; Kronenberg, Algado, & Pollard, 2005; Kronenberg, Pollard, & Sakellariou, 2011; Scaffa, Reitz, & Pizzi, 2010), suggest that the addition of an occupational focus to climate change mitigation strategies might be effective. The labor- and time-intensive interventions typically used by occupational therapy may seem impractical in promoting environmentally significant behavior on a global scale, but relevant cost-benefit analyses have yet to be conducted and a small-scale occupational health promotion project in California found that such interventions could be extremely cost effective (Hay et al., 2002).

Building adaptive capacity has also been identified as a key research and policy need in the face of climate change (Adger, Lorenzoni, & O'Brien, 2009b; Grambsch & Menne, 2003), and occupational therapy could make important contributions in this endeavor because of its expertise in re-building adaptive capacity in people's daily lives (Ikiugu, 2007). At the outset, however, it has to be accepted that adaptation to climate change involves significant differences from the "adaptation" to disability or illness that occupational therapists usually deal with. These differences are nicely illustrated by Blijlevens (2010, p. 73) in her mistaken claims that (1) humans will easily be able to adapt to new conditions (for example, by gardening "with drought-resistant plants"); (2) that "the impact of climate change is not likely to be instantaneous" and thus that "older adults will be able to adapt to the changes within their physical environment in a gradual manner"; and (3) that "people are more likely to experience occupational deprivation as a result of . . . government initiatives" rather than from the effects of climate change. Firstly, while occupational therapy's optimistic approach to 'making the best of adversity' is not to be lightly dismissed, it has to be recognized that there are real limits to adaptation to climate change precisely because humans exist in and ultimately rely on the planet's ecosystems (Peterson, 2009).

Blijlevens' example of gardening in the desert might or might not work as occupational therapy, but the ecological conditions implied in this example raise profound questions about the viability of basic ecosystem services such as water and food under such a climatic regime. Secondly, Blijlevens is right that climate change will not happen "over a weekend" (p. 73), but this is because *it is already happening*. Here it is important to distinguish the phenomenon of climate change from its actual impacts, which will often be sudden and unexpected. Gardiner (2004) noted that the whole concept of climate change adaptation involves adapting to "sudden unpredictable large scale impacts which descend at random on particular individuals, communities, regions and industries and visit them with pure irrecoverable costs" (p. 574).

Furthermore, older adults—together with children (Hudson, in press)—are two of the groups most vulnerable to climate change impacts, with older adults perhaps *least* likely to be able to adapt to such change in a gradual manner (Wolf, Lorenzoni, Few, Abrahamson, & Raine, 2009). Finally, governments are currently characterized

by "massive inertia" in the face of climate change (Adger et al., 2009a, p. 6) and there is no empirical evidence to suggest that occupational deprivation will be greater as a result of government initiatives rather than the actual effects of climate change.

Occupation, growth and well-being

How can we change our economy into one that supports real health, well-being and happiness? It is clear that this cannot be achieved through current patterns of capitalist consumption, patterns that have failed to produce increases in happiness, life satisfaction and social health in recent decades (McKibben, 2007; Speth, 2008). This essential failure of the modern economy to support human well-being was realized ninety years ago by psychiatrist Adolf Meyer (1922/1977):

> Our industrialism has created the false, because one sided, idea of success in *production* to the point of overproduction, bringing with it a kind of nausea to the worker and a delirium of the trader living on advertisement and salesmanship, instead of sound economics of a fair and sane distribution of the goods of this world according to need, and an education of the public as to where and how to find the best and worthiest. (p. 642, original emphasis)

Meyer's prescient comments have been more than realized in the manifold expansion of the "delirium of the trader" in recent decades (cf. Steffen et al., 2007). A near sacred assumption of both occupational science and occupational therapy has been that occupations support well-being, but we might extend Hammell's (2009) recent critique of this assumption by asking if this is still the case when many contemporary occupations in the industrialized world over-exploit ecosystem services and thus weaken the very capability of ecosystems to support our well-being? Occupations can certainly support human well-being, but many human occupations are now impacting the planet to such an extent that they are reducing the ability of ecosystem services to support well-being.

'Balance' is perhaps an overused word in the environmental literature, but present "economic activity and its enormous forward momentum can be accurately characterized as 'out of control' environmentally" (Speth, 2008, p. 52). Does this mean that many of our occupations are also out of control? What is a sustainable balance between individual occupations and the maintenance of ecosystem services? Again these are not questions that are easily answered, but we argue that there is a need for occupational science to discuss them further. At present it is certainly the case that many occupations are performed in a way that is consistent with the economic practice of designating environmental costs as 'externalities' that ignore long-term sustainability.

Conclusions and Future Directions

We have argued that occupational performance connects or *mediates* the relationship between ecosystem services and human well-being described by the Millennium Ecosystem Assessment (2005). At a time of rapidly increasing research on questions of the environment, sustainability and human well-being, we further argued that this occupational perspective is an important addition to analyzing the relationships between ecosystem services and human well-being. There are many ways to problematize global environmental change, but the need for a greater understanding of the relationships between ecosystem services, human occupation, human well-being, and sustainability seems central to the predicament we face. In order to understand these relationships, humanity first needs a deeper appreciation of the interactive aspects of these four elements. Well-being, for example, has to be understood as a multifaceted phenomenon that is influenced by syndemic interactions with both social and natural environments (Singer, 2009). The study of human activity also requires broader and more integrative approaches than exist at present. Occupational science, with its emphasis on holistic health and adaptability, brings an invaluable perspective to these needs.

As noted by Adolf Meyer in the 1920s, occupations are by their very nature linked with psychosocial resilience (Christiansen, 2007) and are probably also linked to the resilience of social-ecological systems (Aoyama & Hudson, 2011). Because the occupational perspective emphasizes empowerment, it has proven particularly successful in increasing understanding and ability to help disempowered and minority peoples, through its demonstration that human activity is a combination of individual choices and social and political aspirations to occupational justice (Kronenberg et al., 2005; Kronenberg et al., 2011; Watson & Swartz, 2004). The concept of occupation will not by itself transform environmental policy but, because it foregrounds the question of how everyday activities relate to health, well-being, social justice, and sustainability, it is a concept that has considerable potential to contribute to an integrated science of human activity as it relates to ecosystem services and environmental change.

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End Note

1. The "our" in this definition is, of course, problematic and should be replaced by something like "in the lexicon of the culture concerned."

REFERENCES

Adger, W. N., Lorenzoni, I., & O'Brein, K. L. (2009a). Adaptation now. In W. N. Adger, I. Lorenzoni, & K. L. O'Brien (Eds.), *Adapting to climate change: Thresholds, values, governance* (pp. 1–22). Cambridge: Cambridge University Press.

Adger, W. N., Lorenzoni, I., & O'Brein, K. L. (Eds.). (2009b). *Adapting to climate change: Thresholds, values, governance*. Cambridge: Cambridge University Press.

Algado, S. S. (2011). Universities and the global change: Inclusive communities, gardening, and citizenship. In F. Kronenberg, N. Pollard, & D. Sakellariou (Eds.), *Occupational therapies without borders: Towards an ecology of occupation-based practices* (Vol. 2, pp. 357–365). Edinburgh: Elsevier/Churchill Livingstone. doi 10.1016/B978-0-7020-3103-8.00047-X

Aoyama, M. (2009, September). *The natural environment and human health in occupational therapy and occupational science*. Paper presented at the conference Medical Anthropology at the Intersections: Celebrating 50 Years of Interdisciplinarity, Yale University, New Haven, CT.

Aoyama, M., & Hudson, M. J. (2011, March). *Resilience and the occupational cycle of indigenous Ainu people in northern Japan: Perspectives from occupational science*. Paper presented at the conference Resilience 2011, Arizona State University, Tempe, AZ.

Berkes, F., & Folke, C. (Eds.). (1998). *Linking social and ecological systems: Management practices and social mechanisms for building resilience*. Cambridge: Cambridge University Press.

Blaikie, P., & Brookfield, H. C. (1987). *Land degradation and society*. London: Methuen.

Blakeney, A., & Marshall, A. (2009). Water quality, health, and human occupations. *American Journal of Occupational Therapy*, *63*, 46–57.

Blijlevens, H. (2010). The climate change debate: Another perspective. *Australian Occupational Therapy Journal*, 57, 73–74. doi: 10.1111/j.1440-1630.2009.00846.x

Carpenter, S. R., DeFries, R., Dietz, T., Mooney, H. A., Polasky, S., Reid, W. V., & Scholes, R. J. (2006). Millennium ecosystem assessment: Research needs. *Science*, *314*, 257–258. doi: 10.1126/science.1131946

Chapin, F. S., Zaveleta, E. S., Eviner, E. S., Naylor, R. L., Vitousek, P. M., Reynolds, H. L. . . . Diaz, S. (2000). Consequences of changing biodiversity. *Nature*, *405*, 234–242. doi:10.1038/35012241

Chivian, E., & Bernstein, A. (Eds.). (2008). *Sustaining life: How human health depends on biodiversity*. Oxford: Oxford University Press.

Christiansen, C. H. (2007). Adolf Meyer revisited: Connections between lifestyles, resilience and illness. *Journal of Occupational Science*, *14*, 63–76.

Christiansen, C. H., & Townsend, E. A. (2010). *Introduction to occupation: The art and science of living* (2nd ed.). Upper Saddle River, NJ: Pearson Education.

Clark, F. A., Parham, D., Carlson, M. E., Frank, G., Jackson, J., Pierce, D., & . . . Zemke, R. (1991). Occupational science: Academic innovation in the service of occupational therapy's future. *American Journal of Occupational Therapy*, *45*, 300–310.

Cornell, S., Costanza, R., Sörlin, S., & van der Leeuw, S. (2010). Developing a systematic "science of the past" to create our future. *Global Environmental Change*, *20*, 426–427. doi:10.1016/j.gloenvcha.2010.01.005

Crate, S. A., & Nuttall, M. (Eds.). (2009). *Anthropology and climate change: From encounters to actions*. Walnut Creek, CA: Left Coast Press.

Crutzen, P. J. (2002). Geology of mankind. *Nature*, *415*, 23. doi:10.1038/415023a

Davidson-Hunt, I. J., & Berkes, F. (2003). Nature and society through the lens of resilience: Toward a human-in-ecosystem perspective. In F. Berkes, J. Colding, & C. Folke (Eds.), *Navigating social-ecological systems: Building resilience for complexity and change* (pp. 53–82). Cambridge: Cambridge University Press.

Dickie, V., Cutchin, M. P., & Humphry, R. (2006). Occupation as transactional experience: A critique of individualism in occupational science. *Journal of Occupational Science*, *13*, 83–93.

Dietz, T., Gardner, G. T., Gilligan, J., Stern, P. C., & Vandenbergh, M. P. (2009). Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. *Proceedings of the National Academy of Sciences, USA*, *106*, 18452–18456. Doi: 10.1073/pnas.0908738106

Dietz, T., Rosa, E. A., & York, R. (2010). Human driving forces of global change: Dominant perspectives. In E. A. Rosa, A. Diekmann, T. Dietz, & C. Jaeger (Eds.), *Human footprints on the global environment: Threats to sustainability* (pp. 83–134). Cambridge, MA: MIT Press.

Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R. . . . Snyder, P. K. (2005). Global consequences of land use. *Science*, *309*, 570–574. doi: 10.1126/science.1111772

Ford, J. D., Pearce, T., Duerden, F., Furgal, C., & Smit, B. (2010). Climate change policy responses for Canada's Inuit population: The importance of and opportunities for adaptation. *Global Environmental Change*, *20*, 177–191. doi: 10.1016/j.gloenvcha.2009.10.008

Frank, G., Murphy, S., Kitching, H. J., Garfield, Sr., D. M., & McDarment, N. (2008). The Tule River tribal history project: Evaluating a California tribal government's collaboration with anthropology and occupational therapy to preserve indigenous history and promote tribal goals. *Human Organization*, *67*, 430–442.

Furgal, C., & Seguin, J. (2006). Climate change, health, and vulnerability in Canadian northern Aboriginal communities. *Environmental Health Perspectives*, *114*, 1964–1970. doi: 10.1289/ehp.8433

Gardiner, S. M. (2004). Ethics and global climate change. *Ethics*, *114*, 555–600.

Grambsch, A., & Menne, B. (2003). Adaptation and adaptive capacity in the public health context.

In A. J. McMichael, D. H. Campbell-Lendrum, C. F. Corvalan, K. L. Ebi, & A. K. Githeko (Eds.), *Climate change and health: Risks and responses* (pp. 220–236). Geneva: World Health Organization.

Haberl, H., Erb, K. H., Krausmann, F., Gaube, V., Bondeau, A., Plutzar, C. . . . Fischer-Kowalski, M. (2007). Quantifying and mapping the human appropriation of net primary production in earth's terrestrial ecosystems. *Proceedings of the National Academy of Sciences, USA*, *104*, 12942–12947. doi: 10.1073/pnas.0704243104

Haines, A., McMichael, A. J., Smith, K. R., Roberts, I., Woodcock, J., Markandya, A. . . . Wilkinson, P. (2009). Public health benefits of strategies to reduce greenhouse-gas emissions: Overview and implications for policy makers. *The Lancet*, *374*(9707), 2104–2114. doi:10.1016/S0140-6736(09)61759-1

Hammell, K. W. (2009). Sacred texts: A sceptical exploration of the assumptions underpinning theories of occupation. *Canadian Journal of Occupational Therapy*, *76*, 6–13.

Hay, J., LaBree, L., Luo, R., Clark, F., Carlson, M., Mandel, D. . . . Azen, S. P. (2002). Cost-effectiveness of preventive occupational therapy for independent-living older adults. *Journal of the American Geriatric Society*, *50*, 1381–1388. doi: 10.1046/j.1532-5415.2002.50359.x

Hudson, M. J. (in press). Kodomo to chikyū kikō hendō [Children and global climate change]. In S. Kagawa (Ed.), *Kodomogaku no susume* [An introduction to children's studies]. Saga: Saga Shinbunsha (in Japanese).

Hudson, M. J., & Aoyama, M. (2008). Occupational therapy and the current ecological crisis. *British Journal of Occupational Therapy*, *71*, 545–548.

Ikiugu, M. N. (2007). *Psychosocial conceptual practice models in occupational therapy: Building adaptive capacity*. St. Louis: Mosby Elsevier.

Ikiugu, M. N. (2008). *Occupational science in the service of Gaia: An essay describing a possible contribution of occupational scientists to the solution of prevailing global problems*. Baltimore: Publish America.

Ikiugu, M. N., & McCollister, L. (2009, September). *The effectiveness of MIOT: An occupation-based framework for individual empowerment in facilitating occupational performance change to help resolve global issues of concern to humanity*. Paper presented at the conference Medical Anthropology at the Intersections: Celebrating 50 Years of Interdisciplinarity, Yale University, New Haven, CT.

Iwama, M. K. (2005). Situated meaning: An issue of culture, inclusion, and occupational therapy. In F. Kronenberg, S. S. Algado, & N. Pollard (Eds.), *Occupational therapy without borders: Learning from the spirit of survivors* (pp. 127–139). Edinburgh: Elsevier/Churchill Livingstone.

Iwama, M. K. (2006). *The kawa model: Culturally relevant occupational therapy*. Edinburgh: Elsevier/Churchill Livingstone.

Kaplan, G. A., Everson, S. A., & Lynch, J. W. (2000). The contribution of social and behavioral research to an understanding of the distribution of disease: A multilevel approach. In B. D. Smedley & S. L. Syme (Eds.), *Promoting health: Intervention strategies from social and behavioral research* (pp. 37–80). Washington, DC: National Academies Press.

Kronenberg, F., Algado, S. S., & Pollard, N. (Eds.). (2005). *Occupational therapy without borders: Learning from the spirit of survivors*. Edinburgh: Elsevier/Churchill Livingstone.

Kronenberg, F., Pollard, N., & Sakellariou, D. (Eds.). (2011). *Occupational therapies without borders: Towards an ecology of occupation based practices* (Vol. 2). Edinburgh: Elsevier/Churchill Livingstone.

Liu, J., Dietz, T., Carpenter, S. R., Folke, C., Alberti, M., Redman, C. L. . . . Provencher, W.(2007). Coupled human and natural systems. *Ambio*, *36*, 639–649. doi: 10.1579/0044-7447(2007)36[639:CHANS]2.0.CO;2

Loring, P. A., & Gerlach, S. C. (2009). Food, culture, and human health in Alaska: An integrative health approach to food security. *Environmental Science and Policy*, *12*, 466–478. doi:10.1016/j.envsci.2008.10.006

Maibach, E. W., Nisbet, M., Baldwin, P., Akerlof, K., & Diao, G.-Q. (2010). Reframing climate change as a public health issue: An exploratory

study of public reactions. *BMC Public Health*, *10*, 299. doi: 10.1186/1471-2458-10-299

Marino, E., White, D., Schweitzer, P., Chambers, M., & Wisniewski, J. (2009). Drinking water in northwestern Alaska: Using or not using centralized water systems in rural communities. *Arctic*, *62*, 75–82.

Masika, R. (Ed.). (2002). *Gender, development and climate change*. Oxford: Oxfam.

McKibben, B. (2007). *Deep economy: The wealth of communities and the durable future*. New York: Times Books.

McMichael, A. J. (2009). Human population health: Sentinel criterion of environmental sustainability. *Current Opinion in Environmental Sustainability*, *1*, 101–106. Doi: 10.1016/j.cosust.2009.07.001

Meyer, A. (1922). The philosophy of occupational therapy. *Archives of Occupational Therapy*, *1*, 1–10. Reprinted in *American Journal of Occupational Therapy, 31*, 639–642.

Meyer, W. B. (2009). Human impacts. In D. J. Cuff & A. S. Goudie (Eds.), *The Oxford companion to global change* (pp. 333–338). Oxford: Oxford University Press.

Millennium Ecosystem Assessment. (2005). *Ecosystems and human well-being: Synthesis*. Washington, DC: Island Press.

Mooney, H. A., & Ehrlich, P. A. (1997). Ecosystem services: A fragmentary history. In G. C. Daily (Ed.), *Nature's services: Societal dependence on natural ecosystems* (pp. 11–19). Washington, DC: Island Press.

Nickels, S., Furgal, C., Castleden, J., Moss-Davies, P., Buell, M., Armstrong, B. . . . Fonger, R. (2002). Putting the humanface on climate change through community workshops. In I. Krupnik & D. Jolly (Eds.), *The earth is faster now: Indigenous observations of arctic environmental change* (pp. 301–333). Fairbanks: Arctic Research Consortium of the United States.

Pachauri, R. K., & Reisinger, A. (Eds.). (2007). *Climate change 2007: Synthesis report. Contribution of working groups I, II and III to the fourth assessment report of the Intergovernmental Panel on Climate Change*. Geneva: IPCC.

Paehlke, R. (2005). Sustainability as a bridging concept. *Conservation Biology*, *19*, 36–38. doi: 10.1111/j.1523-1739.2005.00426.x

Pereira, R. B. (2008). Population health needs beyond ratifying the Kyoto Protocol: A look from occupational deprivation. *Rural and Remote Health* (Online), *8*, 927.

Pereira, R. B. (2009). The climate change debate: Ageing and the impacts on participating in meaningful occupations. *Australian Occupational Therapy Journal*, *56*, 365–366. doi: 10.1111/j.1440-1630.2009.00792.x

Peterson, G. (2009). Ecological limits of adaptation to climate change. In W. N. Adger, I. Lorenzoni, & K. L. O'Brien (Eds.), *Adapting to climate change: Thresholds, values, governance* (pp. 25–41). Cambridge: Cambridge University Press.

Pierce, D. E. (2003). *Occupation by design: Building therapeutic power*. Philadelphia: F. A. Davis.

Piškur, B., Kinebanian, A., & Josephsson, S. (2002). Occupation and well-being: A study of some Slovenian people's experiences of engagement in occupation in relation to well-being. *Scandinavian Journal of Occupational Therapy*, *9*, 63–70.

Raudsepp-Hearne, C., Peterson, G. D. Tengō, M., Bennett, E. M., Holland, T., Benessaiah, K. . . . Pfeifer, L. (2010). Untangling the environmentalist's paradox: Why is human well-being increasing as ecosystem services degrade? *BioScience*, *60*, 576–589. doi: 10.1525/bio.2010.60.8.4

ScaffaM. E., ReitzS. M., & Pizzi, M. A. (Eds.). (2010). *Occupational therapy in the promotion of health and wellness*. Philadelphia: F. A. Davis.

Singer, M. (2009). *Introduction to syndemics: A critical systems approach to public and community health*. San Francisco: Jossey-Bass.

Speth, J. G. (2008). *The bridge at the edge of the world: Capitalism, the environment, and crossing from crisis to sustainability*. New Haven, CT: Yale University Press.

Steffen, W., Crutzen, P. J., & McNeill, J. R. (2007). The anthropocene: Are humans now overwhelming the great forces of nature? *Ambio*, *36*, 614–621. doi: 10.1579/0044-7447(2007)36[614:TAAHNO]2.0.CO;2

Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, *56*, 407–424.

Swim, J., Clayton, S., Doherty, T., Gifford, R., Howard, G., Reser, J. . . . Weber, E. (2009). *Psychology and global climate change: Addressing a multi-faceted phenomenon and set of challenges*. Washington, DC: American Psychological Association.

Vitousek, P. M., Mooney, H. A., Lubchenco, J., & Melillo, J. M. (1997). Human domination of the earth's ecosystems. *Science*, *277*, 494–499. doi: 10.1126/science.277.5325.494

Wackernagel, M., Schulz, N. B., Deumling, D., Linares, A. C., Jenkins, M., Kapos, V. . . . Randers, J. (2002). Tracking the ecological overshoot of the human economy. *Proceedings of the National Academy of Sciences USA*, 99, 9266–9271. doi: 10.1073/pnas.142033699

Watson, R., & Swartz, L. (Eds.). (2004). *Transformation through occupation*. London: Whurr.

Wilcock, A. A. (1998). *An occupational perspective of health*. Thorofare, NJ: Slack.

Wilcock, A. A. (2006). *An occupational perspective of health* (2nd ed). Thorofare, NJ: Slack.

Wilcock, A. A. (2010). Population health: An occupational rationale. In M. E. Scaffa, S. M. Reitz, & M. A. Pizzi (Eds.), *Occupational therapy in the promotion of health and wellness* (pp. 110–121). Philadelphia: F. A. Davis.

Wilson, E. O. (1984). *Biophilia*. Cambridge, MA: Harvard University Press.

Wolf, J., Lorenzoni, I., Few, R., Abrahamson, V., & Raine, R. (2009). Conceptual and practical barriers to adaptation: Vulnerability and responses to heat waves in the UK. In W. N. Adger, I. Lorenzoni, & K. L. O'Brien (Eds.), *Adapting to climate change: Thresholds, values, governance* (pp. 181–196). Cambridge: Cambridge University Press.